

DREAM

2047

DECEMBER 2020 / Vol. 23 / No. 3 / ₹ 20

<p>1 NO POVERTY</p> 	<p>2 ZERO HUNGER</p> 	<p>3 GOOD HEALTH AND WELL-BEING</p> 	<p>4 QUALITY EDUCATION</p> 	<p>5 GENDER EQUALITY</p> 
<p>6 CLEAN WATER AND SANITATION</p> 	<p>7 AFFORDABLE AND CLEAN ENERGY</p> 	<p>8 DECENT WORK AND ECONOMIC GROWTH</p> 	<p>9 INDUSTRY, INNOVATION AND INFRASTRUCTURE</p> 	<p>10 REDUCED INEQUALITIES</p> 
<p>11 SUSTAINABLE CITIES AND COMMUNITIES</p> 	<p>UN SUSTAINABLE DEVELOPMENT GOALS: THE SCIENCE CONNECTION</p>			<p>12 RESPONSIBLE CONSUMPTION AND PRODUCTION</p> 
<p>13 CLIMATE ACTION</p> 	<p>14 LIFE BELOW WATER</p> 	<p>15 LIFE ON LAND</p> 	<p>16 PEACE AND JUSTICE</p> 	<p>17 PARTNERSHIPS FOR THE GOALS</p> 

VACCINE DEVELOPMENT:
TRIALS, APPROVAL AND
ETHICAL ISSUES

PHOTONS TO PHYTANS:
WORLD CREATION IN
RAMCHARITMANAS

WHY DON'T BATS
GET SICK FROM VIRUSES
THEY CARRY?

Editor-in-Chief:

Nakul Parashar

Editor:

Nimish Kapoor

Production:Pradeep Kumar
Bipro Kumar Sen
Amitesh Banerjee**Expert member:**Biman Basu
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

Bye-bye 2020 - A very different year!

THE YEAR

2020 applied brakes that were hard and unprecedented. The entire humanity was taken by surprise, shaken, and still remains very uncertain. COVID-19 carries 2019 in its name, but the effect of it was felt all over the globe in 2020. Everything needing physical presence got affected. School classes, university lectures, public gatherings, travel, hospitality, functions and events, fairs and exhibitions and a lot more just did not happen for a long time during the year. Life seemed to have reached a standstill.

Amidst all this, there was one thing that was galloping much faster than what you and I as a human being can imagine. It's about the efforts to save humanity. At present, more than two dozen top laboratories of the world have been up and running round the clock to find a vaccine against COVID-19. Science pundits have forecasted that we might be getting closer to the vaccine - late 2020 or early 2021.

Anxious as we are, the next question that hits us is a date that we look forward to with regards to this vaccine-in-making. However, the flip side is that the role of a science communicator has become more challenging and demanding ever since the COVID hit the globe. Media has remained replete with statistics and multitude of developments in the domain of COVID-19. Presenting the nitty-gritty of research happening within the four walls of laboratories needs to be made simple, lucid, and understandable to the masses. Mass communication, especially in the case of science and technology, requires high turnaround time, efficiency, correctness, and user-friendliness.

The present-day requirement is no exception. Well, whatever be it, it's just wait-and-watch for the moment. Whilst we come

towards the end of the year, one thing that all of us would remember about the year is how soon we all did acclimatise to the new normal.

Most of us who found ourselves agnostic to the technological changes, accepted them rather than embraced them quickly. Teachers for that matter, especially science school-teachers, who had put in their life teaching on the blackboards and whiteboards, explaining scientific theories and drawing complex chemical and biological diagrams, quickly invented the new ways to impart education. Placing a transparent glass sheet with a mobile phone atop it with its camera on, and in turn, connected to a net-connected laptop is one of the many examples that I have personally witnessed.

Economy from the in-person to non-in-person started to pick up pace. The sale of personal computers, hand-held devices, and subscription to net-connectivity saw a historical rise, worldwide. Similarly, the dependence on public transport also saw a major shift resulting in the increased retail sale of automobiles. Computer programs such as Zoom, MS Teams, Cisco, GoToMeeting and many more came up in the while quickly, to assist the world to stay connected. A robust supply chain with online sales and distribution spread its tentacles to the countryside as well. Work-from-home, a concept that most of the corporates in the west have been adopting for past two decades, gradually became a permanent and a global norm.

Despite all this, humanity has stood steadfast, learning by 2020 to ensure that we bid it like we have said bye-bye to other years of our lives so far. Yes, but a bit differently!

Email: nakul.parashar@vigyanprasar.gov.in

RECENT DEVELOPMENTS IN SCIENCE AND TECHNOLOGY

MOON HAS MORE WATER THAN PREVIOUSLY THOUGHT

A recent announcement by NASA about finding water on Moon's sunlit surface for the first time comes more than a decade after the first discovery of water on Moon by India's Chandrayaan-1. On 14 November 2008, the Moon Impact Probe (MIP) on-board the Chandrayaan-1 orbiter was released from a height of 100 km and struck the Shackleton Crater near the lunar south pole. When it hit the ground, the MIP ejected the lunar soil (called regolith) off the ground, spectroscopic analysis of which revealed the presence of water.

Now, in two separate studies published in the journal *Nature Astronomy* on 26 October 2020, scientists have reported findings with potentially huge implications for sustaining humans on the Moon in the future. One study reports detection of water on the Moon's sunlit surface for the first time; the other estimates that the Moon's dark, shadowy regions, which potentially contain ice, are more widespread than thought. The observations were made by NASA's Stratospheric Observatory for Infrared Astronomy, or SOFIA, telescope and Lunar Reconnaissance Orbiter.

The observations using SOFIA were made in late August 2018 by a team led by Casey Honniball, a NASA Postdoctoral Program fellow at the agency's Goddard Space Flight Centre and a researcher at the University of Hawaii at Manoa.

In the other study, using high-resolution imagery from NASA's Lunar Reconnaissance Orbiter, a team led



NASA's Stratospheric Observatory for Infrared Astronomy, SOFIA, carrying a 2.7-metre telescope, with open telescope doors.

by University of Colorado Boulder planetary scientist Paul Hayne mapped the distribution of smaller craters, which he calls 'micro cold traps', and areas of rough ground and calculated that approximately 40,000 square kilometres of the lunar surface (about 15% of Moon's total surface area) has the capacity to trap water. Water ice has

been found on Moon before, in the coldest, darkest regions at the north and south poles. But the new finding suggests that water may be present across more of the lunar surface, beyond areas that are frigid and permanently in shadow.

Water is not only a marker of potential life but also a precious resource in deep space. For astronauts landing on Moon, water is necessary not only to sustain life but also for purposes such as generating rocket fuel. NASA plans to send a man and a woman to Moon in 2024 under its Artemis project, and hopes to establish a "sustainable human presence" there by the end of the decade.

NASA also plans to send a golf cart-size rover to the lunar surface in late 2023 to study the origin and distribution of water.

NEW HUMAN SALIVARY GLANDS DISCOVERED

The salivary glands in mammals are glands that produce and release saliva through a system of ducts. Salivary glands collectively churn out more than a litre of saliva each day, which is deeply associated with health or the functions of our body, including teeth and gums. Saliva has various functions including chemical digestion and cleaning the mouth. It lubricates the mouth, making it easier to speak and

swallow. It ferries the tasty chemicals in food to the microscopic cells that can sense them. It even comes imbued with crude healing powers, waging war against germs and speeding the closure of wounds.

Any modern anatomy book shows just three major types of salivary glands in humans: one set near the ears, another below the jaw, and another under the tongue – known as parotid, submandibular, and sublingual salivary glands, respectively. Recently, in a surprising discovery, a group of scientists from The Netherlands has stumbled upon a fourth pair of salivary

Continued to page 18 →

Digital platform for COVID vaccine delivery and monitoring is making ready in consultation with all the stakeholders

On 20 November, 2020 Prime Minister, Shri Narendra Modi, reviewed the preparedness of COVID-19 vaccine delivery, distribution and administration. He appreciated the efforts of innovators, scientists, academicians and pharma companies in their efforts to develop vaccines and has directed that every effort should be made to facilitate the research, development and manufacturing of the vaccine.



Five vaccines are in advanced stages of development in India, out of which 4 are in Phase II/III and one is in Phase-I/II. Countries such as Bangladesh, Myanmar, Qatar, Bhutan, Switzerland, Bahrain, Austria and South Korea have shown keen interest in partnering for vaccine development of Indian vaccines and use thereof.

In an effort to administer the vaccine at the first available opportunity, database of healthcare and frontline workers, augmentation of cold chains and procurement of syringes, needles, etc. are in advanced stages of preparation. The vaccination supply chain is being enhanced and non-vaccine supplies are being escalated. Medical and nursing students and faculty will be involved in training and implementation of the vaccination programme.

National Expert Group on Vaccine Administration for COVID-19 (NEGVAC) in consultation with State Governments and all relevant stakeholders have accelerated the implementation of vaccination of priority groups in first phase.

The digital platform for vaccine administration and distribution is prepared and test runs are underway in

partnership with the State- and District-level stakeholders. The Prime Minister reviewed the aspects of emergency use authorisation and for manufacture and procurement of medicine. The Government has provided assistance of Rs. 900 crore under COVID Suraksha Mission to support Research & Development of COVID-19 vaccination. The Prime Minister directed that a time-bound plan be laid out for speedy regulatory clearances and timely procurement for early rollout of the vaccination drive.

The meeting was attended by Principal Secretary to PM, Cabinet Secretary, Member (Health) NITI Aayog, Principal Scientific Advisor, Secretary Health, DG ICMR, officers of PMO, and Secretaries of related Departments of Government of India.

Home Minister inaugurates mobile COVID-19 RT-PCR Lab jointly developed by SpiceHealth & ICMR

On November 23, the Union Home Minister, Shri Amit Shah, inaugurated a mobile COVID-19 RT-PCR Lab at the Indian Council of Medical Research (ICMR) in New Delhi, jointly launched by SpiceHealth and ICMR. The Union Health and Family Welfare Minister, Dr Harsh Vardhan, also participated in the inauguration function. The Secretary DHR and Director General of the ICMR, Dr Balram Bhargava, the Chairman and Managing Director of SpiceJet, Shri Ajay Singh and the CEO of SpiceHealth, Ms. Avani Singh also took part in the inauguration ceremony.

This testing lab and more such labs which are planned to be set up shall help in adding more capacity to COVID-19 testing. The lab is accredited by NABL and approved by the ICMR. RT-PCR tests are most decisive and crucial for COVID-19 testing. These tests will cost Rs. 499 and the cost of testing will be borne by the ICMR. The people of Delhi will not have to bear any cost. The test report would be available within 6 to 8 hours from the time of sample collection compared to the average 24



to 48 hours taken by similar test reports. SpiceHealth has signed a Memorandum of Understanding with the ICMR for setting up testing facilities (laboratories) and collection centres across the country. To begin with, the first testing facility has been set up in Delhi. More such testing facilities will come up in different parts of the National Capital over the coming days. It is planned to set up 10 labs in the first phase. At the outset, each lab would be able to test up to 1,000 samples per day and testing would slowly be ramped up to 3,000 samples per day per lab.

CSIR-SERC licenses makeshift hospital's technology to L&T

CSIR's Chennai-based constituent Laboratory Structural Engineering Research Centre (SERC) has signed an agreement for licensing of technology – Portable lightweight foldable module for makeshift hospitals and other needs (PoliTal-M) with Larsen & Toubro Limited (L&T), Mumbai. The agreement was signed in the presence of Dr Shekhar C Mande, Director General, CSIR, Prof. Santosh Kapuria, Director, CSIR-SERC, and Shri M V Satish, Whole-time Director and Senior Executive Vice President, L&T.

PoliTal-M is a lightweight foldable modular unit for fast deployment in the critical need of shelters, which can be transported and erected quickly using a crane and two-three manpower. The total weight of the unit is around one ton and it can be folded and transported easily. The module can be fabricated in the factory with simple fabrication utilizing standard steel sections welded.



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



COVER STORY

NAKUL PARASHAR



**UN SUSTAINABLE
DEVELOPMENT
GOALS:
THE SCIENCE
CONNECTION**



COVID-19 has shaken the entire world. As we enter December 2020, it still continues. Despite all possible efforts being made the world over by researchers, there is still no clear respite in sight. Science pundits continue to forecast the arrival of a vaccine in early 2021. Researchers are working day and night to get the vaccine—a part of their responsibility towards society, isn't it? However, the show must go on and humanity has to thrive.

For humanity and nature around to sustain, it is important that factors that affect it are taken into full consideration and are duly reviewed with a structured approach. Structured approach! Yes, with a completely planned strategy where areas are duly identified, targets are set and progress parameters put in place with a robust mechanism to measure them. All of this has to be well-thought-out, duly-oiled, and properly executed and managed. The scope of work obviously is humongous. Similarly, the time-frame to execute has to be well thought of as well because unprecedented events like COVID-19 leave behind a long-lasting impact on the progress of such Herculean tasks. At the global level, who else other than the United Nations could do this? This is how came up the famous United Nations Sustainable Development Group or the UNSDG.

At the global level, the UNSDG serves as a high-level forum for joint policy formation and decision-making. It guides, supports, tracks and oversees the coordination of development operations in 162 countries and territories to achieve the 2030 Agenda, addressing key challenges that transcend country borders such as health and environment.

Meticulously articulated as a part of the post-2015 development agenda, the first 15 goals came up during 25-27 September 2015, in New York at a high-level plenary meeting of the General Assembly. These were thus named as the UNSDGs. The mission was to have a blueprint to achieve a better and more sustainable future for all by 2030. With 2030 in sight, it is also known as Agenda 2030—a global appeal to end poverty, protect the world, and a committed effort that everyone lives in a peaceful and prosperous environment by 2030. With a

vow to leave no-one behind, member nations came forward to ensure that this Agenda 2030 is taken on top priority.

Although it all began with 15 goals, as deliberations increased, two more goals got added in March 2017 thereby taking it to 17 that we see today (see box).

Indeed, each of these goals is targeted at the fundamental issues related to humanity. Thus, before we jump to analyse how science and technology would play an important role in helping the people involved in achieving these goals and monitoring their progress, it is critical to know how its execution and review process and progress is quantified.

When we magnify a UNSDG goal, we find that each of them has approximately a dozen targets associated with it. With every target, we find that there are about four indicators linked with it. These indicators help in quantifying the progress of the goals. This clearly indicates how the entire process is planned scientifically and monitored through statistical means, thus making it fully quantifiable.

Besides planning, reviewing, and monitoring the progress of this goal, science and technology has an important role in the execution of work related to each and every goal. According to scientists and technocrats, several solutions are either ready or need to be customised to fit the required framework associated with the progress of each goal. The application of S&T tools to aggregate data, analyse the big data, and production means and strategies is one of the many ways that S&T plays an important role in improving various standards associated with these critical-to-humanity goals. Besides, the application of interdisciplinary research results has a great role to play in this mix as well. It is heartening to see that a number of leading universities around the globe have realised the importance of UN SDGs and encouraged related research using scientific means.

Another major aspect of UN SDGs is the progress of its implementation, which requires a complete intervention of a structured and scientific approach. A yearly report about the progress of the implementation of the UN SDGs is prepared and made public every year. The progress of UN SDG in 2020 has been affected by the COVID-19 pandemic. With complete information easily available with all possible data analytics, the UN and its agencies and participating nations, the yearly reports indicate the amount of work and approaches being applied to meet the goals and targets, duly measured through the indicators.

In eradicating poverty, planning infrastructure, bringing in innovation, better health, and above all, bringing in overall parity requires scientists, technocrats, economists, social scientists, and many more domain experts together to work on these issues. With several publications on this topic, we kickstart a series of articles on UN SDG from the January 2021 issue of Dream 2047, trying to cover two or more goals in each issue of it.

Here, as an introduction to UN SDG, we are sharing all the 17 sustainable development goals (SDGs) to transform our world.

GOAL I: NO POVERTY

There are five targets for this goal to be achieved by 2030:

- 1. Eradicate extreme poverty for all people everywhere, currently measured as people living on less than Rupees 100 a day.
- 2. Reduce at least by half the proportion of men, women and children of all ages living in poverty in all its dimensions according to national definitions.
- 3. Implement nationally appropriate social protection systems and measures for all, including floors, and by 2030 achieve substantial coverage of the poor and the vulnerable.
- 4. Ensure that all men and women, in particular the poor and the vulnerable, have equal rights to economic resources, as well as access to basic services, ownership and control over land and other forms of property, inheritance, natural resources, appropriate new technology and financial services, including microfinance.
- 5. Build the resilience of the poor and those in vulnerable situations and reduce their exposure and vulnerability to climate-related extreme events and other economic, social and environmental shocks and disasters.

GOAL II: ZERO HUNGER

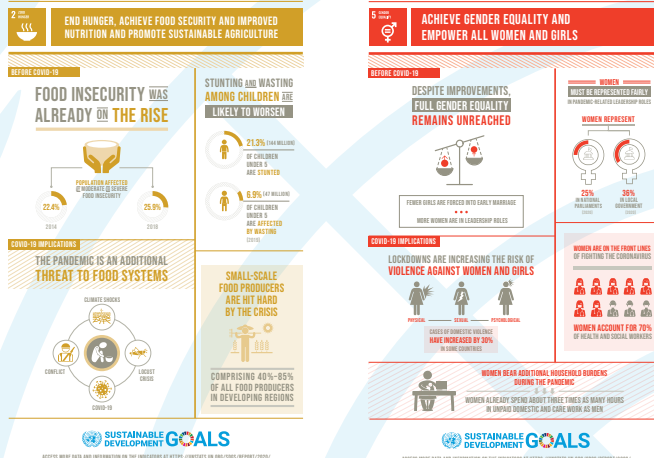
There are five targets for this goal to be achieved by 2030:

- 1. End hunger and ensure access by all people, in particular the poor and people in vulnerable situations, including infants, to safe, nutritious and sufficient food all year round.
- 2. End all forms of malnutrition, including achieving, by 2025, the internationally agreed targets on stunting and wasting in children under 5 years of age, and address the nutritional needs of adolescent girls, pregnant and lactating women and older persons.
- 3. Double the agricultural productivity and incomes of small-scale food producers, in particular women, indigenous peoples, family farmers, pastoralists and fishers, including through secure and equal access to land, other productive resources and inputs, knowledge, financial services, markets and opportunities for value addition and non-farm employment.
- 4. Ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality.
- 5. Maintain the genetic diversity of seeds, cultivated plants and farmed and domesticated animals and their related wild species, including through soundly managed and diversified seed and plant banks at the national, regional and international levels, and promote access to and fair and equitable sharing of benefits arising from the utilisation of genetic resources and associated traditional knowledge, as internationally agreed.

GOAL III: GOOD HEALTH AND WELL-BEING

There are nine targets for this goal to be achieved by 2030:

- 1. Reduce the global maternal mortality ratio to less than 70 per 100,000 live births.
- 2. End preventable deaths of new-borns and children under 5 years of age, with all countries aiming to reduce neonatal mortality to at least as low as 12 per 1,000 live births and under 5 mortality to at least as low as 25 per 1,000 live births.
- 3. End the epidemics of AIDS, tuberculosis, malaria and neglected tropical diseases and combat hepatitis, water-borne diseases and other communicable diseases.
- 4. Reduce by one-third, premature mortality from non-communicable diseases through prevention and treatment and promote mental health and well-being.



- 1. Strengthen the prevention and treatment of substance abuse, including narcotic drug abuse and harmful use of alcohol.
- 2. Halve the number of global deaths and injuries from road traffic accidents.
- 3. Ensure universal access to sexual and reproductive health-care services, including for family planning, information and education, and the integration of reproductive health into national strategies and programmes.
- 4. Achieve universal health coverage, including financial risk protection, access to quality essential health-care services and access to safe, effective, quality and affordable essential medicines and vaccines for all.
- 5. Substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination.

GOAL IV: QUALITY EDUCATION

There are seven targets for this goal to be achieved by 2030:

- 1. Ensure that all girls and boys complete free, equitable and quality primary and secondary education leading to relevant and effective learning outcomes.
- 2. Ensure that all girls and boys have access to quality early childhood development, care and pre primary education so that they are ready for primary education.
- 3. Ensure equal access for all women and men to affordable and quality technical, vocational and tertiary education, including university.
- 4. Substantially increase the number of youth and adults who have relevant skills, including technical and vocational skills, for employment, decent jobs and entrepreneurship.
- 5. Eliminate gender disparities in education and ensure equal access to all levels of education and vocational training for the vulnerable, including persons with disabilities, indigenous peoples and children in vulnerable situations.
- 6. Ensure that all youth and a substantial proportion of adults, both men and women, achieve literacy and numeracy.
- 7. Ensure that all learners acquire the knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship and appreciation of cultural diversity and of culture's contribution to sustainable development.

GOAL V: GENDER EQUALITY

There are six targets for this goal to be achieved by 2030:

- 1. End all forms of discrimination against all women and girls everywhere.
- 2. Eliminate all forms of violence against all women and girls in the public and private spheres, including trafficking and sexual and other types of exploitation.
- 3. Eliminate all harmful practices, such as child, early and forced marriage and



female genital mutilation.

- Recognise and value unpaid care and domestic work through the provision of public services, infrastructure and social protection policies and the promotion of shared responsibility within the household and the family as nationally appropriate.
- Ensure women's full and effective participation and equal opportunities for leadership at all levels of decision-making in political, economic and public life.
- Ensure universal access to sexual and reproductive health and reproductive rights as agreed in accordance with the Programme of Action of the International Conference on Population and Development and the Beijing Platform for Action and the outcome documents of their review conferences.

GOAL VI: CLEAN WATER & SANITATION

There are six targets for this goal to be achieved by 2030:

- Achieve universal and equitable access to safe and affordable drinking water for all.
- Achieve access to adequate and equitable sanitation and hygiene for all and end open defaecation, paying special attention to the needs of women and girls and those in vulnerable situations.
- Improve water quality by reducing pollution, eliminating dumping and minimising release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally.
- Substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity.
- Implement integrated water resources management at all levels, including through trans-boundary cooperation as appropriate.
- Protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes.

GOAL VII: AFFORDABLE AND CLEAN ENERGY

There are three targets for this goal to be achieved by 2030:

- Ensure universal access to affordable, reliable and modern energy services.
- Increase substantially the share of renewable energy in the global energy mix.
- Double the global rate of improvement in energy efficiency.

GOAL VIII: DECENT WORK & ECONOMIC GROWTH

There are ten targets for this goal to be achieved by 2030:

- Sustain per capita economic growth in accordance with national circumstances and, in particular, at least 7 per cent gross domestic product growth per annum in the least developed countries.
- Achieve higher levels of economic productivity through diversification, technological upgrading and innovation, including through a focus on high-value added and labour-intensive sectors.
- Promote development-oriented policies that support productive activities, decent job creation, entrepreneurship, creativity and innovation, and encourage the formalisation and growth of micro-, small-and medium-sized enterprises, including through access to financial services.
- Improve progressively, through 2030, global resource efficiency in consumption and production and endeavour to decouple economic growth from environmental degradation, in accordance with the 10 Year Framework of Programmes on Sustainable Consumption and Production, with developed countries taking the lead.
- Achieve full and productive employment and decent work for all women and men, including for young people and persons with disabilities, and equal pay for work of equal value.
- Substantially reduce the proportion of youth not in employment, education or training.

- Take immediate and effective measures to eradicate forced labour, end modern slavery and human trafficking and secure the prohibition and elimination of the worst forms of child labour, including recruitment and use of child soldiers, and by 2025 end child labour in all its forms.
- Protect labour rights and promote safe and secure working environments for all workers, including migrant workers, in particular women migrants, and those in precarious employment.
- Devise and implement policies to promote sustainable tourism that creates jobs and promotes local culture and products.
- Strengthen the capacity of domestic financial institutions to encourage and expand access to banking, insurance and financial services for all.

GOAL IX: INDUSTRY, INNOVATION & INFRASTRUCTURE

There are five targets for this goal to be achieved by 2030:

- Develop quality, reliable, sustainable and resilient infrastructure, including regional and trans-border infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all.
- Promote inclusive and sustainable industrialisation and, by 2030, significantly raise industry's share of employment and gross domestic product, in line with national circumstances, and double its share in least developed countries.
- Increase the access of small-scale industrial and other enterprises, in particular in developing countries, to financial services, including affordable credit, and their integration into value chains and markets.
- Upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities.
- Enhance scientific research, upgrade the technological capabilities of industrial sectors in all countries, in particular developing countries, including, by 2030, encouraging innovation and substantially increasing the number of research and development workers per 1 million people and public and private research and development spending.

GOAL X: REDUCED INEQUALITIES

There are seven targets for this goal to be achieved by 2030:

- Progressively achieve and sustain income growth of the bottom 40 per cent of the population at a rate higher than the national average.
- Empower and promote the social, economic and political inclusion of all, irrespective of age, sex, disability, race, ethnicity, origin, religion or economic or other status.
- Ensure equal opportunity and reduce inequalities of outcome, including by eliminating discriminatory laws, policies and practices and promoting appropriate legislation, policies and action in this regard.
- Adopt policies, especially fiscal, wage and social protection policies, and progressively achieve greater equality.
- Improve the regulation and monitoring of global financial markets and institutions and strengthen the implementation of such regulations.
- Ensure enhanced representation and voice for developing countries in decision-making in global international economic and financial institutions in order to deliver more effective, credible, accountable and legitimate institutions.
- Facilitate orderly, safe, regular and responsible migration and mobility of people, including through the implementation of planned and well-managed migration policies.

GOAL XI: SUSTAINABLE CITIES & COMMUNITIES

There are seven targets for this goal to be achieved by 2030:

- Ensure access for all to adequate, safe and affordable housing and basic services and upgrade slums.

- Provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons.
- Enhance inclusive and sustainable urbanisation and capacity for participatory, integrated and sustainable human settlement planning and management in all countries.
- Strengthen efforts to protect and safeguard the world's cultural and natural heritage.
- Significantly reduce the number of deaths and the number of people affected and substantially decrease the direct economic losses relative to global gross domestic product caused by disasters, including water-related disasters, with a focus on protecting the poor and people in vulnerable situations.
- Reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management.
- Provide universal access to safe, inclusive and accessible, green and public spaces, in particular, for women and children, older persons and persons with disabilities.

GOAL XII: RESPONSIBLE CONSUMPTION & PRODUCTION

There are eight targets for this goal to be achieved by 2030:

- Achieve sustainable management and efficient use of natural resources.
- Halve per-capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses.
- Implement the 10 Year Framework of Programmes on Sustainable Consumption and Production Patterns, all countries taking action, with developed countries taking the lead, taking into account the development and capabilities of developing countries.
- Achieve the environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce their release to air, water and soil in order to minimise their adverse impacts on human health and the environment.
- Substantially reduce waste generation through prevention, reduction, recycling and reuse.
- Encourage companies, especially large and transnational companies, to adopt sustainable practices and to integrate sustainability information into their reporting.
- Promote public procurement practices that are sustainable, in accordance with national policies and priorities.
- Ensure that people everywhere have the relevant information and awareness for sustainable development and lifestyles in harmony with nature.

GOAL XIII: CLIMATE ACTION

There are three targets for this goal to be achieved by 2030:

- Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries.
- Integrate climate change measures into national policies, strategies and planning.
- Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning.

GOAL XIV: LIFE BELOW WATER

There are seven targets for this goal to be achieved by 2030:

- Prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution.
- Sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including by strengthening their resilience, and take



CLIMATE ACTION: WHY IT MATTERS

What's the goal here?

Taking urgent action to tackle climate change and its impacts.

Why?

The climate crisis continues unabated as the global community shies away from the full commitment required for its reversal. 2010-2019 was warmest decade ever recorded, bringing with it massive wildfires, hurricanes, droughts, floods

and other climate disasters across continents.

How are people being affected by climate change?

Climate change is affecting every country in the world. It is disrupting national economies and affecting lives and livelihoods, especially for the most vulnerable.

Weather patterns are changing, sea levels are rising, and weather events are becoming more extreme.

13 CLIMATE ACTION



To limit global warming to 1.5C, as called for in the Paris Agreement, greenhouse gas emissions must begin falling by **7.6%** each year starting in 2020

action for their restoration in order to achieve healthy and productive oceans.

- Minimise and address the impacts of ocean acidification, including through enhanced scientific cooperation at all levels.
- Effectively regulate harvesting and end overfishing, illegal, unreported and unregulated fishing and destructive fishing practices and implement science-based management plans, in order to restore fish stocks in the shortest time feasible, at least to levels that can produce maximum sustainable yield as determined by their biological characteristics.
- Conserve at least 10 per cent of coastal and marine areas, consistent with national and international law and based on the best available scientific information.
- Prohibit certain forms of fisheries subsidies which contribute to overcapacity and overfishing, eliminate subsidies that contribute to illegal, unreported and unregulated fishing and refrain from introducing new such subsidies, recognising that appropriate and effective special and differential treatment for developing and least developed countries should be an integral part of the World Trade Organization fisheries subsidies negotiation.
- Increase the economic benefits to small island developing States and least developed countries from the sustainable use of marine resources, including through sustainable management of fisheries, aquaculture and tourism.

GOAL XV: LIFE ON LAND

There are five targets for this goal to be achieved by 2030:

- Ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreements.
- Promote the implementation of sustainable management of all types of forests, halt deforestation, restore degraded forests and substantially increase afforestation and reforestation globally.
- Combat desertification, restore degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve a land



degradation-neutral world.

- Ensure the conservation of mountain ecosystems, including their biodiversity, in order to enhance their capacity to provide benefits that are essential for sustainable development.
- Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species.
- Promote fair and equitable sharing of the benefits arising from the utilisation of genetic resources and promote appropriate access to such resources, as internationally agreed.
- Take urgent action to end poaching and trafficking of protected species of flora and fauna and address both demand and supply of illegal wildlife products.
- Introduce measures to prevent the introduction and significantly reduce the impact of invasive alien species on land and water ecosystems and control or eradicate the priority species.
- Integrate ecosystem and biodiversity values into national and local planning, development processes, poverty reduction strategies and accounts.

GOAL XVI: PEACE, JUSTICE & STRONG INSTITUTIONS

There are ten targets for this goal to be achieved by 2030:

- Significantly reduce all forms of violence and related death rates everywhere.
- End abuse, exploitation, trafficking and all forms of violence against and torture of children.
- Promote the rule of law at the national and international levels and ensure equal access to justice for all.
- Significantly reduce illicit financial and arms flows, strengthen the recovery and return of stolen assets and combat all forms of organized crime.
- Substantially reduce corruption and bribery in all their forms.
- Develop effective, accountable and transparent institutions at all levels.
- Ensure responsive, inclusive, participatory and representative decision-making at all levels.
- Broaden and strengthen the participation of developing countries in the institutions of global governance.
- Provide legal identity for all, including birth registration.
- Ensure public access to information and protect fundamental freedoms, in accordance with national legislation and international agreements.

GOAL XVII: PARTNERSHIP FOR THE GOALS

There are five targets for this goal to be achieved by 2030:

- Strengthen domestic resource mobilisation, including through international support to developing countries, to improve domestic capacity for tax and other revenue collection.
- Developed countries to implement fully their official development assistance commitments, including the commitment by many developed countries to achieve the target of 0.7 per cent of gross national income for official

development assistance (ODA/GNI) to developing countries and 0.15 to 0.20 per cent of ODA/GNI to least developed countries; ODA providers are encouraged to consider setting a target to provide at least 0.20 per cent of ODA/GNI to least developed countries.

- Mobilise additional financial resources for developing countries from multiple sources.
- Assist developing countries in attaining long-term debt sustainability through coordinated policies aimed at fostering debt financing, debt relief and debt restructuring, as appropriate, and address the external debt of highly indebted poor countries to reduce debt distress.
- Adopt and implement investment promotion regimes for least developed countries.
- Enhance North-South, South-South and triangular regional and international cooperation on and access to science, technology and innovation and enhance knowledge-sharing on mutually agreed terms, including through improved coordination among existing mechanisms, in particular at the United Nations level, and through a global technology facilitation mechanism.
- Promote the development, transfer, dissemination and diffusion of environmentally sound technologies to developing countries on favourable terms, including on concessional and preferential terms, as mutually agreed.
- Fully operationalise the technology bank and science, technology and innovation capacity-building mechanism for least developed countries by 2017 and enhance the use of enabling technology, in particular information and communications technology.
- Enhance international support for implementing effective and targeted capacity-building in developing countries to support national plans to implement all the Sustainable Development Goals, including through north-south, South-South and triangular cooperation.
- Promote a universal, rules-based, open, non discriminatory and equitable multilateral trading system under the World Trade Organization, including through the conclusion of negotiations under its Doha Development Agenda.
- Significantly increase the exports of developing countries, in particular with a view to doubling the least developed countries' share of global exports by 2020.
- Realise timely implementation of duty-free and quota-free market access on a lasting basis for all least developed countries, consistent with World Trade Organization decisions, including by ensuring that preferential rules of origin applicable to imports from least developed countries are transparent and simple, and contribute to facilitating market access.

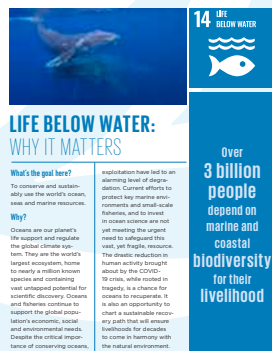
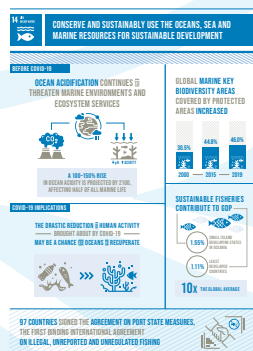
- Enhance global macroeconomic stability, including through policy coordination and policy coherence.
- Enhance policy coherence for sustainable development.
- Respect each country's policy space and leadership to establish and implement policies for poverty eradication and sustainable development.
- Enhance the Global Partnership for Sustainable Development, complemented by multi-stakeholder partnerships that mobilise and share knowledge, expertise, technology and financial resources, to support the achievement of the Sustainable Development Goals in all countries, in particular developing countries.
- Encourage and promote effective public, public-private and civil society partnerships, building on the experience and resourcing strategies of partnerships.

- Enhance capacity-building support to developing countries, including for least developed countries and small island developing States, to increase significantly the availability of high-quality, timely and reliable data disaggregated by income, gender, age, race, ethnicity, migratory status, disability, geographic location and other characteristics relevant in national contexts.
- Build on existing initiatives to develop measurements of progress on sustainable development that complement gross domestic product, and support statistical capacity-building in developing countries.

Image Courtesy: UN SDG

Dr Nakul Parashar is Director, Vigyan Prasara and also a science writer and communicator.

Email: nakul.parashar@viganprasar.gov.in



VACCINE DEVELOPMENT: Trials, Approval and Ethical Issues

Vaccine development, testing and regulation are a tedious and complex process, often lasting several years. Vaccine research also involves strict ethical norms.

In today's world vaccination is the cheapest and easiest method of protection against potentially lethal infections. Back in 1796, English doctor Edward Jenner used cowpox blood serum to generate immunity to smallpox. In the late 1800s, Louis Pasteur showed that microbes cause several infectious diseases. Later, Pasteur developed the process of laboratory-created vaccines using microbes.

Vaccine development, testing and regulation are a tedious and complex process, often lasting several years and involving combined efforts of public and private institutions. The World Health Organization (WHO) provides essential guidance to respective National Regulatory Agencies (NRAs), vaccine manufacturers, scientific investigators and clinicians involved with the clinical assessment of candidate vaccines (WHO Technical Report Series No. 850, Annexure 3, 1995).

The vaccine Research and development (R&D) activities for new vaccines involve mainly three stages: developmental, granting of license and post-licensure surveillance. The initial developmental stage consists of two phases: pre-clinical R&D and clinical R&D. WHO manual on 'Immunisation in Practice' describes the basic standards of vaccine storage, transportation, suitable injection techniques for vaccine delivery, and safety of injections.

Vaccines versus drugs

Vaccines are essentially preventive agents and not curative. Vaccines stimulate a person's immune system to produce immunity to a specific disease and protect the person from that disease. Vaccines are mostly specific to a particular microbe (virus or bacteria) and helps in tuning the recipient's immune system against it. Following immunisation, vaccines elicit a controlled and very specific immune response and create cellular memory of immune cells to protect the person from future infection by the same infectious agent. In most cases, vaccination is required once in a life-time and may involve booster doses in some diseases like tetanus, polio, etc. Vaccines are generally administered orally, through nasal spray or injection and do not require to be metabolized.

On the contrary, prescribed medicines or drugs are chemical, herbal or biological products often used as curative agents and/or protective agents. Unlike vaccines, drugs are frequently prescribed following diagnosis of a disease and may require to be administered several times for complete cure. Drugs are composed of active ingredients which in most cases may be chemically synthesised (like paracetamol), natural (like penicillin), and biological/biologics (monoclonal antibodies such as rituximab). Unlike vaccines, drugs essentially require to get metabolised and absorbed to become

active inside the body. After metabolism and action on specific substrate, drugs get cleared from the person's body through excretion (urine and/or stool).

Vaccine testing and the approval process

The Centres for Chronic Disease Control and Prevention (CDC), USA has categorised the various stages in the development of a vaccine, such as initial investigative stage, pre-clinical stage, clinical development, regulatory review and approval, manufacturing, and quality control surveillance.

The 'pre-clinical assessment stage' of a vaccine candidate is an initial testing phase that lays the foundation of subsequent clinical trials. In pre-clinical stage testing, laboratory-based molecular techniques are used, followed by animal trials. In this phase, either a novel vaccine or a new combination of vaccines is evaluated. The immunisation of animals with candidate vaccine preparations and the resulting immunogenicity data derived from these animal models provide valuable data to select the product doses, schedules and routes of administration which are evaluated further in clinical trials. Immunogenicity is defined as the "capacity of a vaccine to induce antibody mediated and/or cell-mediated immunity and/or immunological memory" (WHO Expert Committee on Biological Standardisation, 2001, Annex. 1).

The next stage - 'clinical development'

- is a three-phase process comprising of Phases I to III. Phase I clinical studies, also referred as human trial, involves the first administration of a candidate vaccine to humans in small numbers (like 20 to 100 volunteers), to test the properties of a vaccine (Does this vaccine seem to work?), safety (Is this vaccine safe?), tolerability (Are there any serious side effects?), and clinical laboratory and pharmacological parameters (How is the size of the dose related to side effects?). Phase II studies engage several hundreds to thousands of subjects from the target or at-risk population at several places to obtain primary evidences on a vaccine's ability to produce its desired effect in protecting against the disease/infection in the target population (How are the volunteer's immune system responding to the vaccine candidate?) and general safety (What are the most common short-term side effects in the subjects?). The Phase III clinical trials involve thousands of volunteers to assess the protective efficacy (Is the vaccine safe and effective?), safety profile (What are the most common side effects?). Further, it is important to measure the vaccine's effectiveness

by comparing the persons who got the vaccine and those who did not. An application by the manufactures based on the vaccine's clinical development data for a market authorisation is submitted to the concerned NRA in that particular country. Following approval by regulatory authorities, potent vaccine becomes available in the national or international market. After the grant of license, vaccines may also undergo Phase IV formal studies, referred as post-marketing studies or post-marketing surveillance (PMS).

National Vaccine Policy (India)

Following the recommendation of National Technical Advisory Group on Immunisation (NTAGI), The National Vaccine Policy Document (India) was developed in 2011. This Document defines the broad issues of strengthening the R&D of vaccines, introduction of new vaccines under the Universal Immunization Program (UIP), operational efficiency of UIP, and implementation and monitoring. It also addresses issues related to vaccine security and vaccination programs of National Health Policy in India.

Ethical considerations

Strict ethical norms are associated with vaccine research as it involves sacrifice, experimental harm, pain and discomfort of a large number of laboratory animals and risking health of human subjects. Mammalian model animals such as rats, mice, rabbits, pigs, calves, cattle, sheep, monkeys, and horses are frequently used for vaccine research to assess: (i) vaccine safety, (ii) protection against the disease/infection, (iii) limiting clinical symptoms, (iv) critical function of immune system, (v) magnitude of immune response, (vi) routes of administration, and (vii) which immune components are induced. Major objective of ethical considerations for clinical trials include rationale of the trial, selection of participants, limiting biasness, health outcome, participant's consent, confidentiality, medical care and clinical follow-up. Respective "Institutional Ethics Committees" (IEC) and Indian Council of Medical Research (ICMR) oversee the strict ethical compliance as per the guidelines issued by ICMR, New Delhi.

Current perspective

More than 20 billion vaccine doses are produced globally every year, of which nearly 3 billion doses are produced in India. Under the current COVID-19 pandemic, 143 candidate vaccines are under pre-clinical evaluation and 33 are undergoing clinical trials (WHO Report as of 28 August). Two Indian vaccines namely, Covaxin (inactivated whole virus) by Bharat Biotech and ZyCoV-D (DNA plasmid vaccine) by Cadila Healthcare Ltd are under Phase I clinical trial. Serum Institute of India in collaboration with Codagenix, USA developed another candidate vaccine which is still under pre-clinical trial.

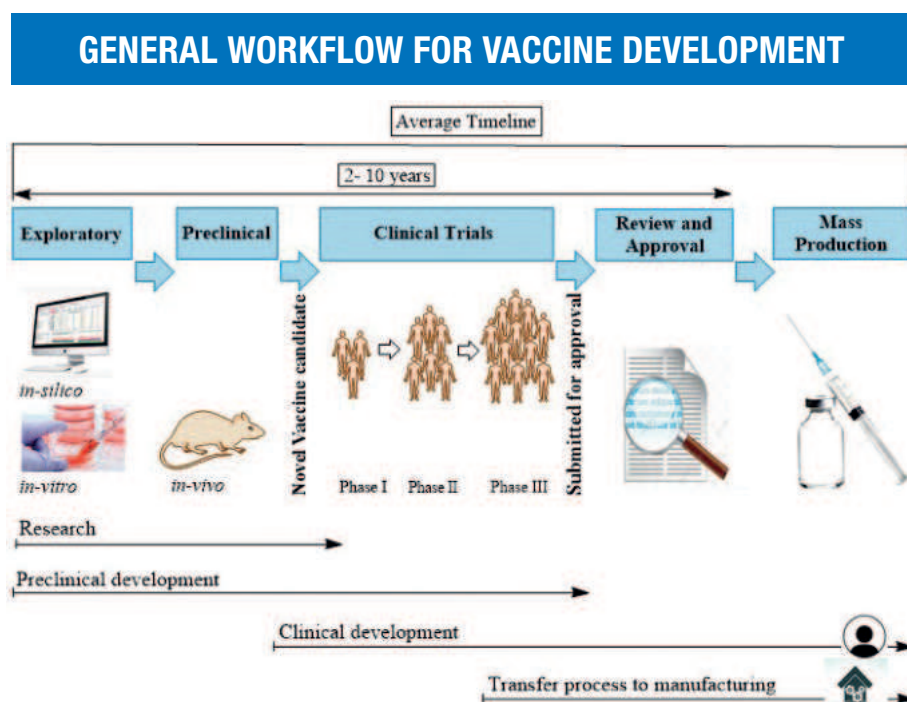


Image Adapted From: GAO Analysis of GAO-20-215SP, FDA, HHS, and Pharmaceutical Research and Manufacturers of America (PhRMA) Documentation (GAO-20-583SP)

Dr Neetu Bhattacharya is Assistant Professor, Department of Zoology, Dayal Singh College, University of Delhi, Delhi.

Email: neetu13feb@yahoo.co.in.

Dr Sabyasachi Senapati is Assistant Professor, Department of Human Genetics & Molecular Medicine, Central University of Punjab, Bathinda.

Email: s.senapati@cup.edu.in

PHOTONS TO PHYTANS: World Creation in Ramcharitmanas

In the early 16th century Goswami Tulsidas Ji in his Shri Ramcharitmanas incorporated all the four aspects of human life-worldly riches, religious merits, enjoyment and liberation based on the reasoned exposition of Jnana and Vijnan.

In this article five important words have been 'decoded' which enables narration of genesis of nature and living beings by photons emanating from the Sun. They are BGWAN, BGWANA, BGWANU, MAYA and MAYADHEESH.

BGWAN comprises of B-Bhumi-earth; G-Gagan-ether; W-Wau-air; A-Agni-fire; and N-Neer-water. These are generated and regulated by BGWAN'U' (Five components and Urja or energy). Their combined effort yields the formation of BGWAN'A'-Aawaran, the cover-based structure; body of an atom to living body. The process of bond formation etc. with the help of energy is called MAYA and the controller of this MAYA is MAYADHEESH—the Sun; who releases photons for all the worldly affairs.

Goswami Tulsidas, in his scripture, Ramcharitmanas offered some simple notions for the wellbeing of the humanity. He emphasized that the lives of saints were dedicated entirely for the wellbeing of the world when he says,

Sant Saralchit Jagat hit jani subhau sanehu

[Study of Manas would benefit the world, its living as well as its non-living

forms.] Goswamiji clarified that he has not written the script; rather he has collected the essence of all the scripts written on the topic and put them at one place. For this he writes,

Aagam Nigam Puran Sant Sab Chhaho Shastra Sab Granthan Ko ras

Generally, Ramcharitmanas is treated as a religious scripture as the issues described in it at a great length are religious in nature. However, if it mentions 'religion' it says,

Iti Dharyati So Dharma

This means, religion is what the body contains. Its ingredients form the matter and also conduct its behaviour. Thus, the question is, among these ingredients which one forms the living animates and the inanimate? What are the components that make up living beings? This has been described by the following doha,

Jad Chetan Jag Jiv Jat Sakal Ram Mai Jani

The world, including its inanimates, animates and matters with consciousness are composed of a uniform component—which is universally present is "Rama". What is "Rama"? Tulsidas says,

Ram Sacchidanand Dinesa

This means that Rama is in the form of the Sun. This is universally true, conscious and full of bliss.

If Rama is the form of Sun, then what are the attributes of the Sun? What are the duties of the Sun? What is its mechanism of action? In short it can be

said that the Sun consistently emanates light. It is always in a form of action.

Based on all known evidences it can be firmly said that Sun bears the heat itself and enlightens the whole world. In describing the kind of light this is, Tulsidas says,

Sahaj Prakash Roop Bhagwana; Nahi tahn puni vigyana Bihana

Lord Rama is not only panchbhoot.

Hiranyachh Bhrata Sahit Madhu Kaitabh Balwan

Jehi Mare Soie Awtaraiu Kripa Sindhu Bhagwan

He is covered by a capsule which gives a shape called the body - "Bhagwana". This Bhagwana is fortified with energy that runs the body.

Dharam Dhurien Bhanukul Bhanu Raja Ram Subas Bhagwanu

It means this energy is an amalgamation of panchbhoot and energy (Urja) that mobilizes the 'form' of energy, the bhagwana-body. Here, Bhagwana has been explained.

This energy is the basis of Dharm, which gives attributes to the matter. As Lord Rama was born in the family of the Sun (i.e., 'Bhanu kul'), he held the central position in the solar system. Thus it is called Bhanukul Bhanu-Sun of the solar system and the 'King with his own governance'. He himself is the driving force of life "Jeevan ka Jeev" or energy for running the body and metabolism.

All the five components, Earth,

Ether (sky), Air, Fire and Water are cumulatively called “BGWAN” and the basis of all the five components is an independent energy “BGWANU”, which helps in running the body, “Bgwan” which is the encapsulated body of “Bgwana”.

Bgwan is encircled by a cover (envelope) called “Bgwana”. The simplest, unique and inevitable unit of the body “Bgwana” is solar energy “Photon”. Photon is the bundle of energy which is continuously released by the Sun and it synthesizes every matter in this world. Since its release from the Sun does not depend on anything, the Sun is called “Swabas Bhagwanu”. Release of Photons is a continuous process which ensures continuous presence of light and marks the absence of night. This results in continuance of a single day. When there is no occurrence of night, there is no ‘second day’. This continuous process of creation through energy is known as “Maya” and centre of “Maya” is Photon (Mayadheesh).

Therefore, this science was initially defined as a complete package of the knowledge of generation, maintenance, and dissolution through fire. The processes ran through “Raj-Sat-Tam”. Rajo Guna is the force which attracts and binds two or more atoms together, while Sato Guna is the force that maintains the binding. Tamo Guna is the force that breaks the molecules and as a consequence of which new molecules are formed or liberated. All these functions do occur and are driven by the same force. This reveals that the whole world is constituted by the same unique force of energy (Photon) and the process continues unequivocally.

We should understand that Rama Bhagwana's are infinite, and it is known that infinite number of animals, plants and living beings are there in this world. Infinite Photons emanate from the Sun and they continuously react with matters differently. Thus, the consequent impact is also different. The attributes are also infinite and their products are countless. The same energy therefore leads to infinite number of reactions continuously. The product of these reactions has a body. The attributes and unique qualities of

these products are also countless and this proves that the whole world is made up of one common form of energy. Tulsidas ji justifies this phenomenon by saying,

*Jagat Prakashyay Prakashak Ramu,
Mayadheesh Gyan Gun Dhamu*

The world is lightened and enlightened by Lord Rama only. He is the sole centre of knowledge, attributes, and he is the master of all physical and chemical reactions taking place in the world. He is the basis of all the attributes. All the reactions and changes occur due to Photons. Thus, it is called ‘Lord of happenings’ and on this basis, it is said that there is no difference between formless and formed structures.

*Agunahi Sagunahi Nahi Kachhu Bheda
Bari Beech Jimi Gawahi Veda*

There is no difference between water and the water that is flowing (stream) as described in the Vedas, which may have some form or can be formless. For example, water and ice are not different objects; rather they are at different stages of existence. This variation is also based on quantum of potential and kinetic energy. Thus, there is no difference in inanimate and animate objects. For example, when water is inside a living body it is live, and once it is out of the body it becomes a non-living entity. When the temperature is below zero degrees Celsius, water becomes ice and above 100 degrees Celsius, it turns into vapour. It has the power of transformation at various stages. Also, it vitalizes the power of conduction in living being and provides mobility to life. The difference in potential and kinetic energy in stagnated and flowing water in streams yields hydroelectricity as well. When light bundles/energy bundles/Photons are emitted from the Sun as solar rays and fall on any matter, their inherent electromagnetic force gets changed or altered, because some of the energy is absorbed by the matter depending on



its absorption capacity. While some of it is refracted and reflected, the absorbed energy causes creation or destruction in the matter. Water, upon receiving solar energy and atmospheric air, evaporates to form cloud and consequently rain. Rain water in turn helps in the formation of matter, which is inanimate and it also supports living beings. However, in the living being this energy/force conducts metabolism which has been expressed in the following lines,

Soi Jal Aanal Anil Sandhata

Hoi Jalad Jag Jeevan Daata

The bundle of energy is characterless/attribute less, formless, invisible and inborn. It gets converted with the ‘Bhagkta’ or other material that demands/absorbs/captures and attains the attribute and forms as per its characteristics. This energy alone is distributed throughout in all varieties of inanimate and animate objects in various forms. Panchbhootas Bhagwana having Earth, Ether, Air, Fire, and water encapsulates various forms.

The type of encapsulation defines the organism like human and plants etc. It also formulates the body of the living beings and performs the functions to the capacity of the body it attains. This specificity rests with all the creatures which have their own characteristics.

In this world, solar energy is transformed into chemical energy from which all the life forms receive energy for their sustenance. This cycle of energy running from life to matter and vice versa is called bio-geo-chemical cycle. This phenomenon of conversion of light energy into living body and creation of other worldly form through chemical reactions (maya) known as Photons to Phytans, the body of a living beings and forms, is called journey of energy defining the world dendrogram (vasudhaiva kutumbakam). Evolutionary trend of all from one entity or oneness of the world is attained in a fraction of second.

*Lav Nimesh mah bhuan nikaya,
Rachai jasu anushashan maya.*

Prof. S.P. Gautam is former Vice-Chancellor,
Rani Durgavati Vishwavidyalaya, Jabalpur.

Email: spgautam1956@gmail.com



Why don't bats get sick from viruses they carry?

Bats are important for our environment. They are the only mammals with the ability to fly. Due to interference of humans in the cycle of nature there has been an increase in the cases of zoonotic diseases in the world in recent times.

While having a conversation with the teachers on COVID-19 a question sprung up: Why don't bats get ill though they carry the virus? Though bats harbour viruses in their body, why are they not affected by it and instead, spread it to humans? How have the bats managed to save themselves from viruses?

It is true that bats are hosts to dangerous viruses and are considered notorious for spreading Ebola, Marburg, Nipah and severe respiratory problem-causing coronavirus. Maybe for this reason, there is almost universal hatred

and disregard for bats among people.

However, bats are important for our environment. They are the only mammals with the ability to fly. There are approximately 1,300 species of bats in the world, which account for nearly 20% of the mammalian population. Bats play an important role in pollination of flowers as well as dispersion of seeds.

Bats are natural hosts to viruses and both stay together without harming each other. We are aware of the fact that SARS-CoV-2 virus, which is responsible for COVID-19, reached another mammal called pangolins from the bats and from

whom humans were infected and right before our eyes, this disease started engulfing the entire world.

For a long time, researchers were baffled by the fact that bats are not infected by the viruses which are known to spread epidemic in humans. Researcher Peng Zou, who works at Wuhan Institute of Virology in China and her team, isolated a strain of SARS coronavirus in 2003 which was responsible for infecting more than 8,000 people and killing nearly 800 people.

The process of diseases being passed from animals to humans is known as 'zoonosis' and the diseases that are spread by animals are referred to as 'zoonotic'. Bats are natural hosts to coronaviruses, but due to interference of humans in the cycle of nature there has been an increase in the cases of zoonotic diseases in the world in recent times. COVID-19 is one of the latest examples of this.

Bats are carriers of viruses but they themselves are not affected by them. The reason is, due to evolutionary adaptations bats were able to make certain changes in their immunity system. It is interesting to note that this adaptation in immunity system was not to counter the infection caused by virus but to tackle the DNA which might stray into their cytoplasm.

In eukaryotic cells, DNA is confined in the nucleus and generally don't cross and move to the cytoplasm. The cytoplasm of a healthy cell is free from DNA. If any virus infects a cell, then the first line of our immune system gets into action which identifies and then kills it. The DNA present in the virus is identified by proteins called interferons, which then acts on it.

When any virus tries to infect a cell then to counter it a gene called STING (STimulator of INterferon Gene) triggers interferon immune system (interferons are group of signalling proteins causing nearby cells to heighten their anti-viral defences) which helps to remove the virus. These interferons are found in all animals and are the first line defence mechanism.

The first line defence mechanism is known as the innate immune response

consisting of physical, chemical and cellular defences against pathogens. The main purpose of the innate immune response is to immediately prevent the spread and movement of foreign pathogens throughout the body. Found in all multicellular organisms as the first step towards defence, the innate immune system develops along with the growth of the animal. Therefore, it would be fair to say that it is the most prominent and primary defence of any organism. Indeed, it has evolved to protect the host from a variety of toxins and infectious things, including bacteria, fungi, viruses, and parasites.

The important function of the STING is to initiate a response as soon as it finds a DNA in cytoplasm so that it could be destroyed. While studying the genomics of two species of bats, a new clue emerged. The STING showed the strongest evidence of positive selection in the evolution of bats. In fact, the STING triggers the formation of interferon proteins and plays an important role in combating infection at the primary level in vertebrates.

Researchers have been speculating about why the virus does not have detrimental effect in bats. They first thought that bats would have innate immunity. This means that interferon

will be killing the virus. But after studying the genome and other studies, it was found that mutations in the STING result in formation of less interferons. Since the formation of interferon is low, the virus's first line of defence mechanism has created a compromise between bats and viruses where both have started living together peacefully.

In comparison to terrestrial mammals, bats are creatures with an amazing ability to fly. Studying the genome of bats revealed that about 88 million years ago, when the ancestors of bats first started flying in the sky, there was a sudden change in the genes that detected and responded to DNA damage. Bats require a lot of energy to fly. This means that

Bats require a lot of energy to fly. This means that bats have a faster metabolic rate. It has been observed that the metabolic rate of bats is twice that of squirrels and mice. The high metabolic rate during flying destroys the DNA within the nucleus, raising the possibility of its own DNA fragments leaking into the cytoplasm.

bats have a faster metabolic rate. It has been observed that the metabolic rate of bats is twice that of squirrels and mice. The high metabolic rate during flying destroys the DNA within the nucleus, raising the possibility of its own DNA fragments leaking into the cytoplasm. Although the DNA leaked is its own, the STING would produce interferons against it and if this were to happen, bats would have a flying problem. The immune system of the bats would have to continuously produce interferons.

Mutation in the STING found in bats resulted in the formation of small amounts of interferons. One of the noticeable things is that interferons are formed in the first-line defense response during virus infection in the vertebrate immune system. These interferons destroy those strayed DNA.

Researchers found that there is only one amino acid difference in the STING of bats and other vertebrates, including humans. The amino acid called 'serine' is not found in the STING of bat, while it is found in other vertebrates. Due to this difference, interferon is made in small quantities in bats. Actually, the disappearance of serine is the only major factor in the STING of bats. This is the mutation due to which interferon is rarely produced in bats.

In a series of experiments, researchers have isolated the STING from Rufous horseshoe bat (*Rhinolophus sinicus*) in the laboratory and found that the presence of serine reduces the formation of interferons. If serine amino acid is added to the STING of the bats, the level of interferon production increases. It was also observed that if serine is removed from the human STING, there is a drastic reduction in the formation of interferons.

Overall, the STING-interferon pathway is of a rare variety in bats. This arrangement allows them to live together with viruses along the lines of "we are together".

(Translated by Jitesh Shelke)



Pangolin

The author is a science writer and also associated with Azim Premji Foundation, Khargone, Madhya Pradesh.

Email: kr.sharma@azimpremjifoundation.org

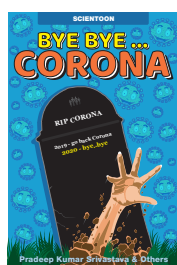
'Bye Bye Corona' released by UP Governor



'Bye Corona', written by 'scientoonist' Dr Pradeep Srivastava, former Senior Principal Scientist at CSIR-Central Drug Research Institute (CDRI), Lucknow, was released in a function held at Raj Bhawan, Lucknow, by Smt. Anandiben Patel, Governor, Uttar Pradesh on 29 October, 2020. The book is published by Vigyan Prasar.

Cartoons are most effective in communicating serious messages. They not only tickle us but are also capable of delivering tough messages in a simple, subtle and riveting manner. A 'scientoon' is a cartoon communication based on science. Scientoons are meant to inform and sensitize people to science and scientific concepts in an intelligible and interesting way. World's first scientoon book entitled "Bye

The 220-pages book contains comprehensive information on novel coronavirus pandemic, its symptoms and its prevention through precautions.



The Book offers a perspective insight into the intricacies of the deadly pandemic without scaring the reader.

It is further planned to make a 3D version of this book, as to facilitate its multi lingual adaptation across India and abroad.

are ideal for a wide range of consumer and industrial applications. Despite their many advantages, however, plastics suffer from the big disadvantage of being non-biodegradable which makes them remain in the environment almost indefinitely, creating serious environmental problems. One of the major factors driving plastic pollution is the lack of a cost-effective way to recycle it. Instead, it is simply discarded.

It is estimated that currently, our planet is burdened with almost 8.3 billion tonnes of plastic waste which is creating havoc with our environment. The only way to tackle this problem is to find ways to turn this waste into useful products economically.

Chemical recycling has emerged as a promising technology to add value to waste plastics. Plastics can be gasified into hydrogen and carbon monoxide (synthesis gas) as a feedstock for fuel production.

Recently, a research team led by Fan Zhang of the University of California, USA, has developed an innovative catalytic process in which two chemical reactions—hydrogenolysis and aromatisation—are combined. They have produced long-chain alkylaromatic hydrocarbons by treating low-molecular-weight polyethylene waste with a commonly used heterogeneous catalyst, platinum (Pt) nanoparticles dispersed on an alumina (Al₂O₃) support. The research has been published in the journal Science on 23 October 2020.

According to the researchers, a delicate balance between the two catalytic reactions must be maintained to avoid the unnecessary production of less valuable gases, such as methane, ethane, and propane, as well as carbon (coke) deposits that may lead to catalyst deactivation. Fine-tuning was realised by opting for a moderate reaction temperature (280°C), because higher reaction temperatures (e.g., 330°C) led to production of gases and volatile hydrocarbons.

← Continued from page 3

glands that has gone unnoticed by doctors after centuries of medical research—a pair of salivary glands hidden away in our skulls where the nasal cavity and the throat meet. The discovery was made by Matthijs H. Valstar, a surgeon in the department of head and neck oncology and surgery at The Netherlands Cancer Institute. He and his team first came across the unknown glands during a scan designed to look for tumorous growths. The study has been published in the journal Radiotherapy and Oncology on 23 September 2020.

According to the researchers, the glands had remained unknown because they do not show up in conventional methods of medical imaging like ultrasound, CT scans or MRI. According to the researchers, radiotherapy used for cancer treatment can cause damage to the newly discovered glands and



Diagrammatic representation of the new salivary glands discovered in humans (blue arrow)

leave lasting complications. However, according to scientists, for most patients, it should technically be possible to avoid delivering radiation to this newly discovered location of the salivary gland system in the same way doctors try to spare known glands. The next step is to find out how these new glands can be best spared and in which patients.

TURNING PLASTIC WASTE INTO USEFUL PRODUCTS

Plastics is the term commonly used to describe a wide range of synthetic or semi-synthetic materials that are used in a huge and growing range of applications. Plastics are extremely versatile materials and

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