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What are bio-based chemicals and enzymes?

How is India positioned with respect to scaling bio-based chemicals and enzymes?

What are bio-based chemicals and enzymes?

Bio-based chemicals are industrial chemicals derived from renewable biological feedstocks such as sugarcane, corn, starch, and agricultural residues. They are typically produced through fermentation or enzymatic processes. Examples include organic acids (such as lactic acid), bio-alcohols, solvents, surfactants, and intermediates used in plastics, cosmetics, and pharmaceuticals.

Enzymes are biological catalysts that accelerate chemical reactions. They are widely used across sectors including detergents, food processing, pharmaceuticals, textiles, pulp and paper, and increasingly in advanced biomanufacturing. Because enzymes often operate at lower temperatures and pressures than conventional chemical catalysts, they can significantly reduce energy consumption and emissions.

Why does India need bio-based chemicals and enzymes?

India possesses strong fundamentals for scaling bio-based chemicals and enzymes. It has a large agricultural base that can supply feedstocks, deep expertise in fermentation built through its pharmaceutical and vaccine industries, and a rapidly expanding manufacturing sector.

Expanding domestic production in this space could:

- Reduce dependence on imported petrochemicals
- Create new value-added markets for agricultural produce
- Strengthen rural incomes
- Position India as a competitive global supplier of sustainable industrial inputs

For instance, India imported approximately \$479.8 million worth of acetic acid in 2023, highlighting the potential for import substitution through domestic bio-based alternatives.

Where does India stand today?

India has identified bio-based chemicals and enzymes as priority areas under the Department of Biotechnology's BioE3 policy.

In bio-based chemicals:

- Praj Industries and Godrej Industries are key players.
- Godavari Biorefineries is advancing ethanol-based, bio-derived chemicals.
- Jubilant Ingrevia produces acetyl intermediates such as acetic anhydride and ethyl acetate.
- Emerging firms like StringBio are developing novel microbial platforms to produce value-added chemicals.
- The Indian enzymes market is relatively consolidated, with the top players accounting for more than 75% of market share. Major companies include:
 - Novozymes India
 - DuPont
 - DSM
 - Advanced Enzyme Technologies
 - BASF SE
 - Ultreze Enzymes Private Limited



What are other countries doing?

Several major economies are strategically supporting bio-based chemicals and enzyme industries:

- The European Union's Bioeconomy Strategy and Action Plan integrates bio-based chemicals into its circular economy and climate goals, linking industrial transformation with waste reduction and sustainable growth.
- In the United States, the USDA BioPreferred Program mandates federal procurement preference for certified bio-based products, including chemicals and enzymes, thereby creating early-stage demand.
- China's bioeconomy development plans explicitly prioritize high-value bio-based chemicals and enzyme technologies as strategic sectors.
- In Japan, priority projects supported by METI and NARO integrate research in bio-based chemicals with manufacturing readiness and commercialization pathways.

What are the risks and challenges?

Despite strong potential, several challenges remain:

1. Cost competitiveness

Bio-based chemicals often face higher production costs compared to petrochemical alternatives, particularly at early stages of scale-up. This cost differential can discourage private investment.

2. Feedstock reliability and infrastructure

Large-scale production requires reliable access to feedstocks and supporting logistics infrastructure. Variability in agricultural supply chains can pose risks.

3. Market adoption barriers

Downstream manufacturers may hesitate to switch to bio-based inputs unless performance, compatibility, and pricing are comparable to existing petrochemical products.

What can enable scale?

Scaling shared biomanufacturing infrastructure — such as biofoundries, pilot plants, and demonstration facilities under the BioE3 framework — can reduce capital risks for emerging firms.

In addition, clear standards, certification mechanisms, and targeted public procurement policies can help create early demand, build investor confidence, and accelerate commercialization.

Source: <https://www.thehindu.com/sci-tech/science/what-are-bio-based-chemicals-and-enzymes-explained/article70636267.ece>

Dated: February 17, <https://www.thehindu.com>



SCIENCE & TECHNOLOGY

The holy trinity of cancer care: biochemistry, microbiology and pathology

Biochemistry, microbiology and pathology are the eyes that see the unseen world of cancer care, quietly doing the heavy lifting behind the scenes. In today's world of precision medicine and personalised care, they play a critical role



The Role of Biochemistry

Cancer begins at the genetic and molecular level, triggering biochemical changes that eventually develop into detectable disease. Onco-biochemistry measures tumour markers, enzymes, hormones and metabolites in blood and body fluids to aid diagnosis, assess prognosis and monitor treatment response.

Markers such as PSA, CA-125 and CEA help detect prostate, ovarian and colon cancers, sometimes before symptoms appear. Tests like LDH, Beta-2 microglobulin and protein electrophoresis help assess cancer burden and diagnose conditions such as multiple myeloma. Falling marker levels often indicate treatment success even before scans show improvement.

Advanced assays detect minimal residual disease and early relapse. Biochemistry also ensures safe drug dosing, monitors liver and kidney function, and identifies life-threatening complications such as tumour lysis syndrome and hypercalcaemia. In high-risk treatments like bone marrow transplant, it provides continuous monitoring of recovery and metabolic balance.

What Microbiology Does

About 20% of cancers are linked to infections. Viruses such as HPV, hepatitis B and C, Epstein-Barr virus, and HTLV-1, as well as bacteria like *Helicobacter pylori*, are known cancer causes. Early detection and treatment of these infections can help prevent cancer.

Cancer therapy weakens immunity, making patients vulnerable to serious infections. Microbiologists use advanced systems to rapidly detect pathogens and guide targeted antimicrobial treatment. Early and accurate diagnosis supports rational antibiotic use, prevents resistance and improves patient survival.

How Pathology Works

Pathologists answer the crucial question: "Is it cancer?" By examining biopsies under the microscope, they determine the type, grade and stage of cancer. Modern oncopathology combines microscopy with molecular techniques such as immunohistochemistry, flow cytometry and genetic testing to precisely characterise tumours.

Molecular profiling is central to personalised cancer treatment, guiding targeted therapy and immunotherapy. Pathologists also detect precancerous lesions, provide intraoperative (frozen section) guidance during surgery and monitor treatment response, remission and relapse.

Biochemistry, microbiology and pathology are the unseen pillars of cancer care — enabling early detection, precise treatment and long-term monitoring, and ultimately improving survival and hope.

Source: <https://www.thehindu.com/sci-tech/health/the-holy-trinity-of-cancer-care-biochemistry-microbiology-and-pathology/article70591070.ece>

Dated: February 06, 2026, <https://www.thehindu.com>



ENVIRONMENT



Climate change is draining colour from nature, from greener seas to browning forests and whitening coral reefs. As habitats become warmer and more polluted, insects and birds are shifting pigmentation, changing the way they adapt to their surroundings, the way they tolerate heat, and even how successfully they mate

The colours of the natural world are fading. Over the past two decades, more than half of the oceans have turned greener, forests are browning early, and many plants and animals are changing colour in response to climate change. Rising temperatures, habitat loss, pollution, and deforestation are driving what scientists call “ecological discolouration”.

Colour plays a vital role in survival. It helps animals escape predators, attract mates, and regulate body temperature. But environmental stress is altering these functions. A study in *Biodiversity and Conservation* found that deforestation in the Amazon has led to duller butterflies, with the brightest species disappearing from disturbed areas. Less colourful butterflies survive better because they camouflage more easily in degraded habitats.

Similar changes were seen during the Industrial Revolution, when soot-darkened trees favoured darker peppered moths. Today, global warming is producing the opposite effect. Many species are becoming lighter as their bodies produce less melanin, the pigment responsible for dark colours. A 2024 study in *Ecology and Evolution* reported that insects such as ladybirds and dragonflies in the northern hemisphere are turning lighter due to frequent heatwaves, which helps them avoid overheating.

Climate rules also explain these shifts. Bogert’s rule suggests animals in warmer regions tend to be lighter, while Gloger’s rule links darker colours to humid environments. In Europe, milder winters have increased the dominance of brown tawny owls, whose darker feathers offer better UV protection.

Urbanisation is another factor. A study of bird species in China found city birds were darker and duller, possibly due to pollution and heavy metals binding with melanin. Plants are also changing: urban vegetation produces fewer carotenoids, pigments that attract pollinators, and flowers are altering UV pigments, potentially reducing reproductive success.

One of the most striking examples is coral bleaching. In 2025, mass bleaching was reported in Indian waters including Lakshadweep and the Andaman and Nicobar Islands. Heat-stressed corals expel their algae and turn white, weakening entire reef ecosystems. Algal blooms are also making oceans greener and reducing oxygen levels, harming marine life.

Despite these trends, recovery is possible. Regenerated forests in the Amazon have seen a return of colourful butterflies, and experts say regulating coastal development and improving water quality can reduce coral bleaching. Protecting habitats may yet help restore the world’s natural colours.

Source: <https://www.thehindu.com/sci-tech/energy-and-environment/global-warming-pollution-are-stripping-vibrant-colours-from-nature/article70614888.ece>

Dated: February 11, 2026, <https://www.thehindu.com/>



New dragonfly species discovered in Kerala, named *Lyriothemis keralensis*



Although the species has been known to be found in Kerala since 2013, it had remained misidentified for over a decade as Lyriothemis acigastra, a species previously thought to be restricted to northeast India

Researchers have discovered a new species of dragonfly from Kerala and named it *Lyriothemis keralensis*, in recognition of the State's exceptional biodiversity. The species was recorded from Varapetty near Kothamangalam in Ernakulam district, where it inhabits vegetated pools and irrigation canals within well-shaded pineapple and rubber plantations.

The study was conducted by Dattaprasad Sawant of the Indian Foundation for Butterflies, Bengaluru; A. Vivek Chandran of the Department of Wildlife Science, College of Forestry, Kerala Agricultural University; Renjith Jacob Mathews of the Society for Odonate Studies, Kerala; and Krushnamegh Kunte of the National Centre for Biological Science, Bengaluru. The findings were published in the International Journal of Odonatology.

According to Dr. Chandran, the newly described dragonfly is seasonally visible only during the southwest monsoon, from late May to the end of August. During the remaining months of the year, the species is believed to persist in its aquatic larval stage, surviving in the network of canals and pools within shaded plantation landscapes.

He said *Lyriothemis keralensis* is a small dragonfly with distinct sexual dimorphism. The males are bright blood-red with black markings, making them visually striking, while the females are bulkier and yellow with black markings.

Although the species has been known to occur in Kerala since 2013, it remained misidentified for over a decade as *Lyriothemis acigastra*, a species previously thought to be restricted to northeast India. The researchers confirmed its distinct identity through detailed microscopic examinations and comparisons with museum specimens, which revealed clear differences, including a more slender abdomen and distinctly shaped anal appendages and genitalia.

Dr. Chandran and his colleagues also highlighted conservation concerns, noting that most populations of the species occur outside the protected area network. They stressed the importance of careful land-use practices, especially in plantation-dominated landscapes, to ensure the long-term survival of the species.

Source: <https://www.thehindu.com/sci-tech/energy-and-environment/new-dragonfly-species-discovered-in-kerala-named-lyriothemis-keralensis/article70610007.ece>

Dated: February 10, 2026, <https://www.thehindu.com/>



AGRICULTURE

Eight agri experts among 2026 Padma award winners

While some are celebrated academicians who have helmed India's premier universities, others are grassroots innovators



The list also includes IIT-Madras director and SHAKTI microprocessor developer V. Kamakoti.

On the eve of the 77th Republic Day, President Droupadi Murmu announced 131 Padma awards, honouring distinguished service across fields ranging from art and social work to science and medicine. The list, released by the Ministry of Home Affairs, includes five Padma Vibhushan, 13 Padma Bhushan and 113 Padma Shri awardees.

Eight of the laureates have been recognised for their contributions to agriculture, animal husbandry and crop sciences. The honourees range from eminent academicians who have led India's premier agricultural institutions to grassroots innovators transforming farming practices on the ground.

Ashok Kumar Singh, a plant geneticist and former Director of the Indian Agricultural Research Institute, is best known for developing high-yielding Basmati rice varieties. His work integrates molecular breeding with conventional techniques to enhance grain quality and disease resistance.

Gopalji Trivedi, former Vice-Chancellor of Dr. Rajendra Prasad Central Agricultural University, played a key role in strengthening agricultural education in Bihar and promoted technology-driven solutions tailored to the State's diverse agro-climatic zones.

K. Ramasamy, who served as Vice-Chancellor of Tamil Nadu Agricultural University, helped modernise agricultural education in Tamil Nadu and contributed to national policy through committees of the Indian Council of Agricultural Research and the University Grants Commission.

Prem Lal Gautam, Chancellor of Dr. Rajendra Prasad Central Agricultural University and former Deputy Director General (Crop Science) at ICAR, is credited with developing over a dozen improved crop varieties, including wheat and foxtail millet.

Jogesh Deuri, Director of Sericulture for the Bodoland Territorial Council, has advanced 'Eri' silk farming in Assam — a form of non-violent silk production — while modernising traditional rearing methods to create livelihoods for rural youth and tribal communities in Kokrajhar district.

From Maharashtra, Shrirang Devaba Lad has been recognised for his service to agriculture, representing progressive farmers who drive innovation at the field level.

Two awards in this category were conferred posthumously. Rama Reddy Mamidi, founder of the Co-operative Development Foundation, championed the Mulukanoor model, empowering rural communities in Telangana through democratically managed dairy and credit cooperatives. Raghupat Singh was honoured for his grassroots contributions to agriculture in Uttar Pradesh.

Beyond agriculture, the Science and Engineering category features a distinguished group of innovators. A. E. Muthunayagam was a key architect of the Indian Space Research Organisation's liquid propulsion systems. Former Defence Research and Development Organisation scientist Chandramouli Gaddamanugu led the development of the Akash missile system for over three decades. Juzer Vasi of Indian Institute of Technology Bombay was recognised for his work in solar photovoltaics.

The list also includes V. Kamakoti, Director of Indian Institute of Technology Madras and a key contributor to the SHAKTI microprocessor initiative; Kumarasamy Thangaraj of the CSIR-Centre for Cellular and Molecular Biology, noted for his work in population genetics; and Praveen Kumar of Indian Institute of Technology Mandi, who develops AI-based early-warning systems for landslides in the Himalaya. Also honoured is Krishnamurty Balasubramanian for his contributions to materials science at the Nonferrous Materials Technology Development Centre.

The sole woman in the Science and Engineering category, Shubha V. Iyengar, has been recognised for her work at the intersection of chemistry, materials science and aeronautical engineering.

Source: <https://www.thehindu.com/sci-tech/agriculture/eight-agri-experts-among-2026-padma-award-winners/article70549855.ece>

Dated: January 25, 2026, <https://www.thehindu.com/>



AGRICULTURE

New rootstocks promise faster, higher apple yields for Kashmir farms

Despite having one of the largest areas under apple cultivation in India, productivity in the Kashmir Valley remains far below that of developed apple-growing regions



Dr. Raja, a scientist at the Fruit Science Division of ICAR-Central Institute of Temperate Horticulture, has developed two innovative technologies for apple rootstock multiplication and feathering. These are licensed to 25 nurseries and adopted by over 100 orchardists nationwide.

Rootstock — the root and lower stem onto which a desired apple variety is grafted — determines tree size, early fruiting, and resistance to pests and diseases such as root rot and woolly aphid. High-density orchards rely on clonal rootstocks propagated from cuttings to ensure uniformity. Dwarf types such as M9 apple rootstock, MM106 apple rootstock and MM111 apple rootstock can raise productivity up to 40 tonnes per hectare and begin yielding within 2–4 years. They reduce tree height, improve fruit colour and uniformity, and increase yield efficiency, while lowering labour and pruning costs.

As winters warm and snowfall declines in Kashmir, dwarf clonal rootstocks help trees cope with erratic rainfall, heat stress and soil-borne diseases. However, high costs and limited availability of quality planting material remain barriers. Under schemes like the Mission for Integrated Development of Horticulture, around 836 hectares in Jammu & Kashmir have shifted to high-density plantations. Farmers require training in pruning, canopy management, fertigation and pest control, as mismanagement sharply reduces productivity.

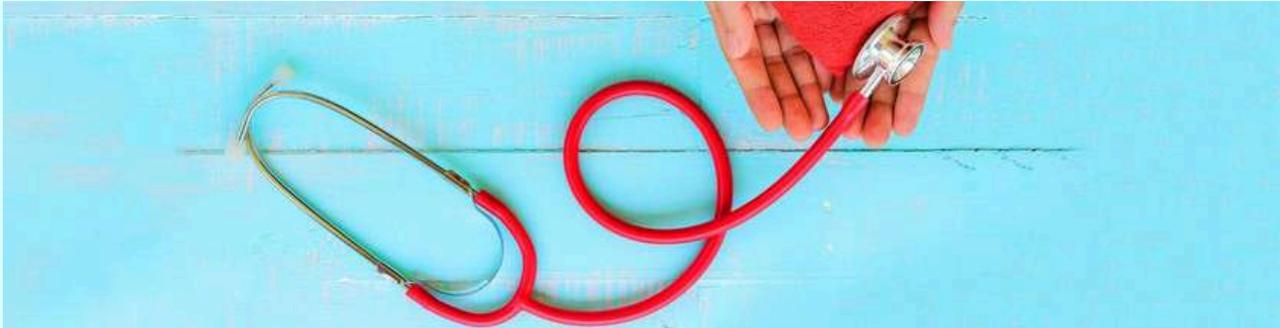
ICAR-CITH is also developing indigenous, climate-resilient rootstocks suited to Himalayan conditions, which may soon expand apple cultivation into marginal areas. Farmers are already seeing results. Tantray Manzoor of Anantnag converted part of his orchard to high-density planting with M9 rootstock, reducing fruiting time from nearly 10 years to two and quadrupling yields. Though initial investment is high, improved fruit quality and better market returns have made the system economically rewarding.

Source: <https://www.thehindu.com/sci-tech/agriculture/new-rootstocks-promise-faster-higher-apple-yields-for-kashmir-farms/article70623688.ece>

Dated: February 12, 2026, <https://www.thehindu.com>



HEALTH



Physical inactivity behind 13 per cent of heart failure cases among diabetics in India: Study

The analysis combined population-based cohort studies and national surveys with risk estimates from large international meta-analyses (analysis of multiple studies) and global physical activity surveillance systems

Over 13 percent of heart failure cases among people living with diabetes in India may be linked to physical inactivity, according to a large global study.

The findings, published in the Journal of Sport and Health Science, also indicate that 9.6 percent of coronary heart disease cases and 9.4 percent of cardiovascular complications among Indians with diabetes could be attributed to insufficient physical activity.

Globally, researchers found that one in ten cases of macrovascular (large blood vessel) complications and diabetic retinopathy in people with diabetes are associated with physical inactivity.

“Diabetes complications are often viewed as inevitable consequences of the disease. Our findings challenge that assumption by showing that a meaningful proportion of these complications could be prevented through achievable increases in physical activity,” said lead author Jayne Feter of the School of Medicine at Universidade Federal do Rio Grande do Sul.

The World Health Organization recommends at least 150 minutes of moderate-to-vigorous physical activity per week. For the study, researchers analysed data from more than 2.3 million adults with diabetes across multiple world regions, including South Asia.

The analysis found that physical inactivity accounted for more than 10 percent of strokes, 9.7 percent of diabetic retinopathy cases, 7.3 percent of heart failure cases, and roughly 5 to 7 percent of cardiovascular and coronary heart disease cases among people with diabetes worldwide.

Women and individuals with lower levels of education consistently experienced a higher proportion of complications linked to physical inactivity, highlighting significant social inequalities, the researchers noted.

India is home to more than a quarter of the world’s people with diabetes, according to a 2024 study published in The Lancet. Long-term high blood sugar can damage blood vessels and nerves throughout the body, leading to serious complications.

Treating these complications consumes an increasing share of healthcare budgets, particularly in regions where health systems are already under strain.

“This study reframes physical activity as a core component of preventing diabetes-related complications,” Feter said. “Encouraging physical activity among people with diabetes could reduce hospitalisations, disability, and healthcare costs, while improving quality of life.”

The researchers combined data from population-based cohort studies and national surveys with risk estimates from large international meta-analyses and global physical activity surveillance systems.

“Integrating physical activity promotion into routine diabetes care and national strategies for noncommunicable diseases is no longer optional,” said co-author Natan Feter of the Department of Biological Sciences at the University of Southern California. “Policies must reflect local realities and explicitly address social and gender inequalities.”

Source: <https://www.thehindu.com/sci-tech/health/physical-inactivity-behind-13-per-cent-of-heart-failure-cases-among-diabetics-in-india-study/article70646674.ece>

Dated: February 18, 2026, <https://www.thehindu.com/>



NIMHANS study demonstrates promise in intranasal therapy for Parkinson's disease

This is not just a proposed hope for Parkinson's patients, we have successfully demonstrated in a pre-clinical rat model that this strategy works, says Indrani Datta, professor at the Department of Biophysics at NIMHANS



Researchers at NIMHANS, Bengaluru have reported encouraging results from a pre-clinical study in which a non-invasive, intranasally delivered therapy improved motor and biological markers associated with Parkinson's disease in rats.

Parkinson's disease is characterised by the gradual loss of dopamine-producing neurons in a midbrain structure called the substantia nigra, leading to tremors, rigidity and slowing of movement. Existing treatments largely address symptoms and do not arrest progression.

Funded by the Indian Council of Medical Research (ICMR) and the Department of Science and Technology, the study has been published in the journal *Stem Cell Research and Therapy*. It was led by Indrani Datta, professor at the department of biophysics at NIMHANS, along with doctoral researchers Kallolika Mondal and Rituparna Ghanty, in collaboration with the department of neuropathology.

"This is not just a proposed hope for Parkinson's patients, we have successfully demonstrated in a pre-clinical rat model that this strategy works," Dr. Datta told *The Hindu*. "What makes this particularly exciting is that we have shown, for the first time, that these exosomes can trigger the brain to generate new dopaminergic neurons in the midbrain structure, the very region that degenerates in the disease," Dr. Datta said.

What is Parkinson's disease?

- Parkinson disease (PD) is a brain condition that causes problems with movement, mental health, sleep, pain and other health issues.
- PD gets worse over time. There is no cure, but therapies and medicines can reduce symptoms. Common symptoms include tremors, painful muscle contractions and difficulty speaking.
- Parkinson disease results in high rates of disability and the need for care. Many people with PD also develop dementia.
- The disease usually occurs in older people, but younger people can also be affected. Men are affected more often than women.
- The cause of PD is unknown but people with a family history of the disease have a higher risk. Exposure to air pollution, pesticides and solvents may increase risk.

Source:

<https://www.thehindu.com/news/national/karnatak/nimhans-study-demonstrates-promise-in-intranasal-therapy-for-parkinsons-disease/article70638839.ece>

Dated: February 18, 2026, <https://www.thehindu.com/>

How the therapy works

The team used small extracellular vesicles, or exosomes, derived from dental pulp stem cells. These particles can cross the blood-brain barrier and carry therapeutic molecules to injured regions. "Think of exosomes as intelligent courier packages. They can cross the blood-brain barrier and deposit on to damaged or inflamed areas, like a GPS-guided delivery system," said Ms. Mondal, first author of the study.

The vesicles were loaded with phloroglucinol, a natural antioxidant, and administered intranasally. "The intranasal route provides a direct highway from the nose to the brain. This bypasses the digestive system and helps the cargo reach the midbrain intact," she said.

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Safety and next steps

The researchers did not observe significant accumulation of the vesicles in peripheral organs during the study period. "We found no build-up in the lungs or liver over four weeks," Dr. Datta said. However, the team underlined that several stages of work remain before human testing.

Dr. Datta said four broad areas require attention. These include detailed toxicology and safety assessments such as dose escalation, long-term biodistribution, immunogenicity and tumour risk in at least two animal species. Studies must also test the therapy after the onset of motor symptoms, reflecting real-world clinical scenarios.



S&T COOPERATION FOR GLOBAL SOUTH

Solidarity in Action: Cross-Regional Dialogue Key Messages and Recommendations



Regional integration and cooperation have been vital to the growth and development of countries and regions. At a time of global uncertainty and economic fragmentation, they are even more crucial for mobilizing collective action to accelerate progress on the Sustainable Development Goals (SDGs).

Persistent development challenges, combined with geopolitical and economic fragmentation, financial distress, and instability, are affecting regions in distinct ways – shaping national SDG progress and regional prospects alike.

In this context, regional integration and cooperation are essential not only for the growth of countries and regions, but also for addressing cross-border challenges and securing a peaceful and sustainable global future.

South-South and triangular cooperation, long viewed as complements to traditional North-South development cooperation, are increasingly recognized as crucial pillars of the action and support that countries of the Global South require to grow, build resilience, and achieve their development priorities. These cooperation modalities channel development solutions anchored in the experience of the Global South; enable collaborations in which partners accompany one another's development journeys; and deliver support that ensures contextual specificity and mutual benefit, without imposing burdens.

UNOSSC, Regional Commissions New York Office (RCNYO), and the Emerging Development Partners (EDP) Network convened a cross-regional dialogue on regional integration and cooperation on 28 October 2026.

Source: <https://unsouthsouth.org/2026/01/30/solidarity-in-action-cross-regional-dialogue-key-messages-and-recommendations/>

Dated: January 30, 2026, <https://unsouthsouth.org>



OTHERS

WHAT IS 'SNOWBALL EARTH'?

In the Cryogenian Period (720-635 million years ago), some scientists believe the earth went through through episodes when ice covered even the tropical latitudes, and the world was called 'snowball earth'. If the oceans were mostly frozen, it was also believed that the usual interactions between the ocean, atmosphere, sunlight, and climate patterns would have been greatly weakened.

A new study in Earth and Planetary Science Letters has reported evidence that shorter climate cycles still operated during at least one phase of this snowball earth. The authors analysed 2,640 thin layers of sediment in the Port Askaig Formation on the Garvellach Islands in Scotland. They argued that the layers are annual varves, meaning each year produced a light, coarser layer from the runoff water, followed by a dark, finer layer when the melting stopped.

Then they measured how thick each yearly couplet was. This thickness record revealed climate cycles matching well-known solar cycles: roughly 9-11 years (the sunspot cycle) and about 60-150 years (which is the slower Gleissberg cycle that periodically suppresses sunspots). The data also showed a variability of two to five years, similar to modern climate swings like the El Nino.

The team also simulated the climate of snowball earth with different amounts of sea ice and again found signs of a two to three year variability.

In sum, even when the earth was a giant snow-covered ball, the climate may have 'pulsed' on timescales of years to centuries instead of staying still.

Source: <https://www.thehindu.com/sci-tech/science/what-is-snowball-earth/article70642498.ece>
Dated: February 17, 2026, <https://www.thehindu.com/>



OTHERS

Why do so many flowers have five petals?



In the flower bud, new organs begin as small bumps on a ring of tissue, and the petal number is equal to the number of slots this tissue lays down in a whorl.

Many flowers are indeed pentamerous — but across flowering plants as a whole, the petal number varies widely. Monocots often have flower parts in threes. Eudicots have four or five. Many species also have fused petals, others have several petals, and yet others lack them altogether.

In the flower bud, new organs begin as small bumps on a ring of tissue, and the eventual number is equal to the number of slots this tissue lays down in a whorl, given its size and shape and the organs' spacing needs.

Early in the evolution of angiosperms, different major clades 'opted' for different numbers of slots. The monocots typically evolved three slots per whorl. The eudicots opted for four to five per whorl.

Importantly, the plant's genes don't control the exact number; instead they only control the dynamics of growth. For example, if the meristem — i.e. the population of undifferentiated cells that develop into new tissues per the plant's needs — is bigger, more organs form with more parts. If an organ develops sooner, it will have more time to initiate its parts, leading to more of them. And so on.

Source: <https://www.thehindu.com/sci-tech/science/why-do-so-many-flowers-have-five-petals/article70675008.ece>

Dated: February 25, 2026, <https://www.thehindu.com/>



OTHERS

Why do shrubs like hibiscus flower/fruit profusely only on the sunlit side?



Shrubs and trees often flower and fruit more on the sunlit side because the planet's energy budget on that side is different.

Sunlit leaves capture more usable light so they photosynthesise more and make more sugars and starch. Buds and young fruits need that carbon supply to form and grow. On the shaded side, on the other hand, the leaves make less carbon so the buds stay vegetative, the flowers abort more often, and small fruits drop more easily.

Well-lit leaves also produce stronger 'signals' that encourage the buds nearby to make flowers. Likewise, the plant interprets the way shade changes the quality of light — especially the balance between red to far-red light — as crowding and tries to extend shoots and leaves so that they get more light, over its own reproduction.

Temperature helps this process but isn't the full picture. It warms buds and increases the speed of development, yet also dries leaves and raises the planet's demand for water. If the plant can't supply enough water, it closes its stomata and the rate of photosynthesis drops.

Pruning to let more light into the canopy often reduces one-sided flowering.

Source: <https://www.thehindu.com/sci-tech/science/why-do-shrubs-like-hibiscus-flowerfruit-profusely-only-on-the-sunlit-side/article70644520.ece>

Dated: February 19, 2026, <https://www.thehindu.com/>