

SCIENCE AND TECHNOLOGY PULSE

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Strengthening State Science Councils for India's Innovation Future

The roadmap will open new R&D co-creation channels between industries and academia, fostering state-level innovation clusters. It will also promote investment partnerships to boost the scalability of technologies across sectors, including biotech, space, and clean energy.

Union Minister Dr. Jitendra Singh launched NITI Aayog's Roadmap to strengthen State Science and Technology Councils, aiming to align regional innovation with India's vision of Viksit Bharat@2047. The initiative emphasises public-private partnerships, calls for industry-linked R&D, and promotes early-stage commercialisation. Dr. Singh highlighted the ANRF as a pivotal platform for academia-industry collaboration and underscored India's rising global S&T standing, including a 56% rise in patent filings and major strides like Chandrayaan-3 and gene therapy trials. The roadmap seeks to empower states as innovation hubs while aligning with national economic and scientific goals.

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you can expect
updates from:

Government Initiatives

Emerging Technologies

Health and Medicine

Environmental Science

Food and Agriculture

Space Exploration



Fueling India's Innovation Engine: INR 1 Lakh Crore RDI Scheme to Boost Private R&D

The scheme offers concessional finance and equity support for R&D-intensive industries in deep-tech, critical technologies, and strategic manufacturing. It helps scale innovation-led startups and private enterprises by reducing capital risk and improving tech adoption.

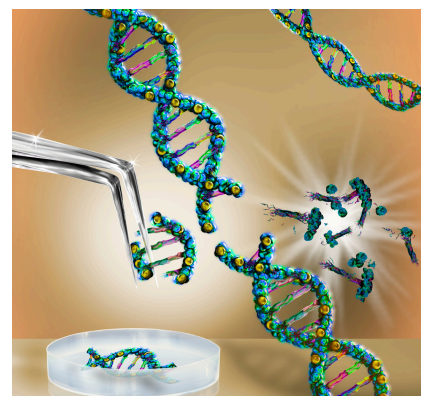
The Union Cabinet, led by PM Modi, has approved the INR 1 lakh crore Research Development and Innovation (RDI) Scheme to enhance private sector investment in strategic and sunrise sectors. The scheme offers long-term, low or zero-interest loans and equity support through a two-tiered fund model managed by the ANRF, with DST as the nodal agency. It aims to fund high-TRL projects, technology acquisition, and create a Deep-Tech Fund of Funds. An Empowered Group of Secretaries will oversee implementation and sectoral priorities. This move seeks to address financing gaps and make India self-reliant and globally competitive as part of the Viskit Bharat @2047 vision.



India Develops Scalable Solar-Driven System for Green Hydrogen Production

This innovation can power energy-intensive sectors such as chemicals, fertilisers, steel, & mobility by enabling on-site, fossil-free hydrogen generation. Industries seeking decarbonisation pathways now have a viable technology for clean fuel production powered entirely by sunlight.

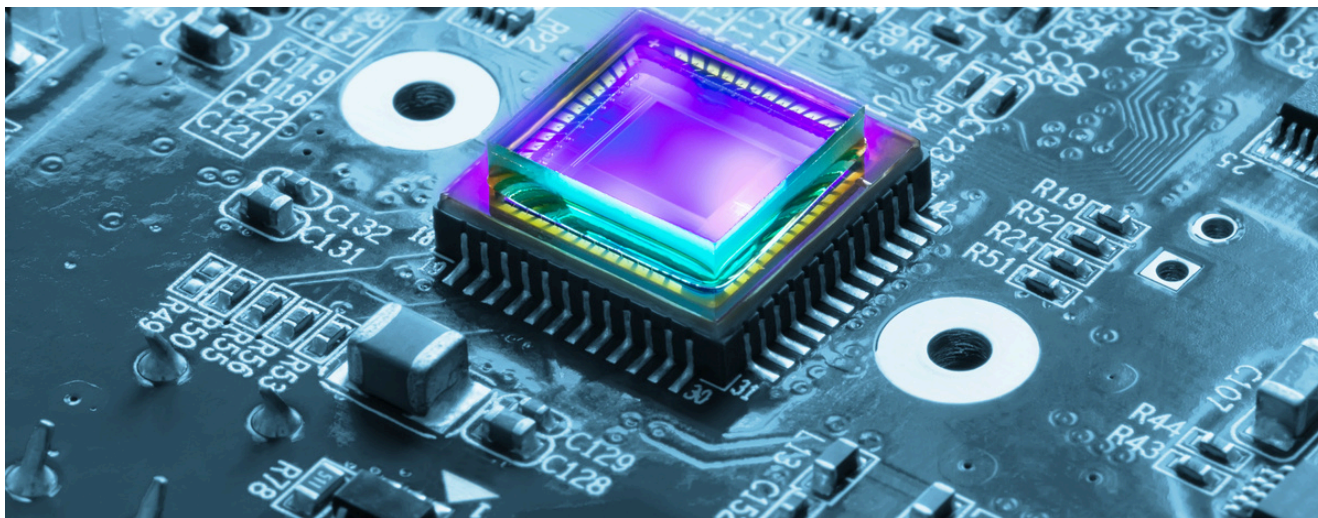
Scientists at CeNS, Bengaluru, have developed a cost-effective, scalable device that produces green hydrogen using only solar energy and earth-abundant materials, without fossil fuels. The silicon-based photoanode, engineered with a layered n-i-p heterojunction structure (TiO₂, intrinsic Si, and NiO), enables efficient light absorption, charge transport, and low recombination losses. Fabricated via magnetron sputtering, an industry-ready method, the device achieved 600 mV surface photovoltage and maintained 96% efficiency over 10 hours in alkaline conditions. It also performed successfully at a larger scale, proving potential for mass deployment. Published in the Journal of Materials Chemistry A, this development could revolutionise access to clean energy.



Smart CRISPR Tool Gives Crops Timely Defense Against Heat and Disease

This CRISPR-based stress-responsive gene switch can help the agri-biotech and seed industries develop climate-resilient, disease-tolerant crop varieties, reducing yield losses from heat and pathogens. It enables precision breeding and smart agriculture solutions tailored for changing environmental conditions.

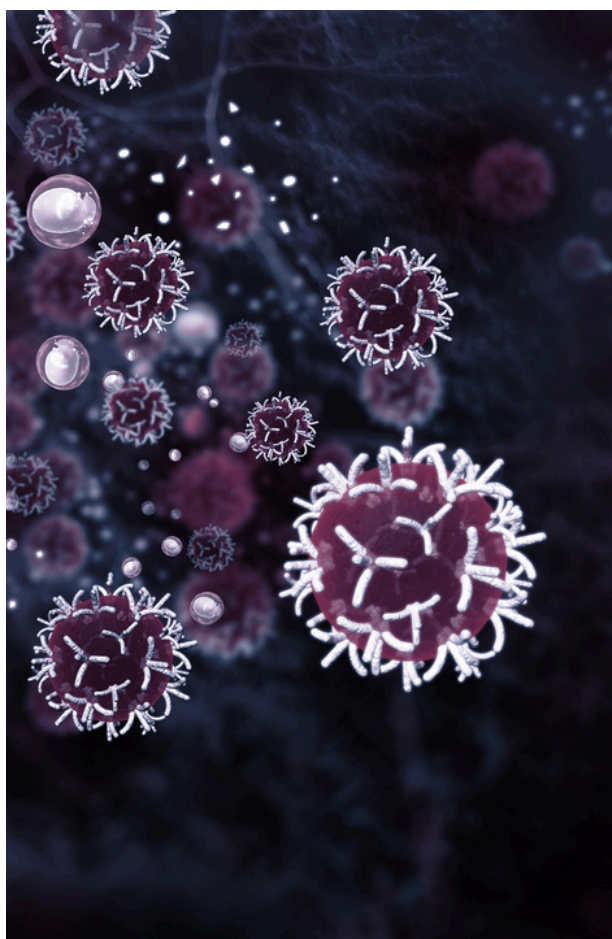
Researchers at the Bose Institute have developed a novel CRISPR-based gene regulation system that helps plants respond smartly to heat and pathogen stress. Unlike traditional CRISPR that cuts DNA, this tool uses a modified dCas9 "switch" controlled by a tomato-derived TM domain, which activates only under stress. Tested in tomatoes, potatoes, and tobacco, the system successfully activated key defense genes (CBP60g, SARD1) against bacterial infection and heat-responsive genes (NAC2, HSFA6b), helping plants retain water and stay green. Published in the International Journal of Biological Macromolecules, the study opens new avenues for crop resilience under climate stress.



New Compact Sensor Enables Real-Time Monitoring of Toxic SO₂ in Industrial Environment

This portable SO₂ sensor can significantly benefit chemical, petroleum, mining, and manufacturing industries by enabling low-cost, real-time monitoring of toxic emissions, ensuring regulatory compliance and enhancing worker safety. Its compact design also supports installation in confined or mobile industrial environments for continuous environmental risk management.

Scientists from the Centre for Nano and Soft Matter Sciences (CeNS), Bengaluru, have developed a compact, low-cost sensor capable of detecting sulfur dioxide (SO₂) a harmful gas linked to respiratory illnesses at extremely low concentrations of just 320 ppb. Made by combining nickel oxide (NiO) and neodymium nickelate (NdNiO₃), the sensor uses a threshold-based visual alert system (green, yellow, red) for real-time monitoring, eliminating the need for complex equipment or scientific expertise. This portable device, tested and validated by a team led by Dr. S. Angappane and published in *Small*, offers a sensitive, scalable solution for tracking air pollution in urban, industrial, and enclosed environments.



Room-Temperature Nano-Cup Synthesis Offers Scalable Cancer Heat Therapy Solution

This enables the biotech and oncology pharmaceutical industries to develop safer, scalable, and more cost-effective photothermal cancer therapies. It also opens new avenues for advanced biomedical device manufacturers in targeted diagnostics and Surface-Enhanced Raman Spectroscopy (SERS) based biosensing technologies.

Researchers from INST Mohali, ACTREC Tata Memorial Centre, and IIT Bombay have developed a simplified, one-step method to create PEGylated nano-cups (semi-shells) for effective cancer treatment using photothermal therapy (PTT). Unlike traditional multi-step toxic methods, this uses a biocompatible ZIF-8 framework, ascorbic acid as a mild reducing agent, and no harsh chemicals. These gold-based nano-cups absorb near-infrared light, ideal for PTT, and exhibit enhanced blood compatibility, cryo-stability, and shelf life. The technique showed success in ablating metastatic breast tumors in mice, increasing survival and reducing tumor relapse. Future work includes their use in chemo-PTT and optical biosensing.

Poison to Potential: Assam Scientists Explore Toxic Plants for Future Drug Discovery

This work opens up new avenues for drug formulation, offering scope for innovation in the phytopharmaceutical, biotech, and wellness sectors. By harnessing validated plant toxins, industries can create novel, high-value therapeutic products for unmet medical needs.

Researchers at the Institute of Advanced Study in Science and Technology (IASST), Guwahati, have identified 70 traditionally used poisonous plant species with significant medicinal potential. These plants, rich in phytochemicals used by indigenous cultures to treat ailments like jaundice, skin diseases, and fevers, are being re-examined using modern pharmacological tools. The study, led by Prof. Ashis K. Mukherjee and published in *Toxicon: X*, highlights how toxic compounds, once properly isolated and modified, could lead to effective new drugs. With rigorous testing and scientific validation, these naturally occurring toxins may hold the key to treating diseases with limited or no current therapies.



Glacier Retreat Linked to Future Volcanic Risk: New Climate-Volcano Study Raises Global Concerns

This research provides critical inputs for risk assessment models used by the insurance, infrastructure, and energy sectors operating in glacier-influenced volcanic zones. It also aids geospatial and climate analytics companies in improving forecasting tools that inform operational decisions and long-term investment planning.

A study presented at the Goldschmidt Conference 2025 reveals that melting glaciers could trigger more frequent and explosive volcanic eruptions in regions like the Andes and potentially Antarctica. Researchers from the University of Wisconsin-Madison analysed six volcanoes in southern Chile using argon dating and crystal chemistry, finding that thick glacial ice during the last ice age suppressed eruptions and allowed magma to build up underground. As glaciers retreated, pressure was released, leading to sudden, violent eruptions. This study, based on historical eruption patterns, warns that current climate-induced glacier melt may activate dormant volcanoes globally, creating a feedback loop that could worsen climate change.



Climate's Silent Toll: Bigger Crops, Shrinking Nutrition

This research enables the seed, agri-biotech, and food manufacturing industries to develop climate-resilient crop varieties with enhanced nutrient retention. It also helps the health-tech and functional food sectors tailor fortified products that address micronutrient loss linked to climate-driven agricultural shifts.

New research from Liverpool John Moores University shows that rising CO₂ and temperature levels linked to climate change can reduce the nutritional value of leafy vegetables like kale, rocket, and spinach. While crops may grow faster and larger, their levels of key minerals like calcium, antioxidants, and proteins decline, especially under combined CO₂ and heat stress. Using tools like high-performance liquid chromatography and X-ray fluorescence, the study highlights the risk of more calorie-dense but nutrient-poor diets, which could worsen non-communicable diseases such as diabetes and nutrient deficiencies, particularly in vulnerable regions.



Black Coffee, Better Life: Study Reveals Sweeteners May Undermine Health Perks

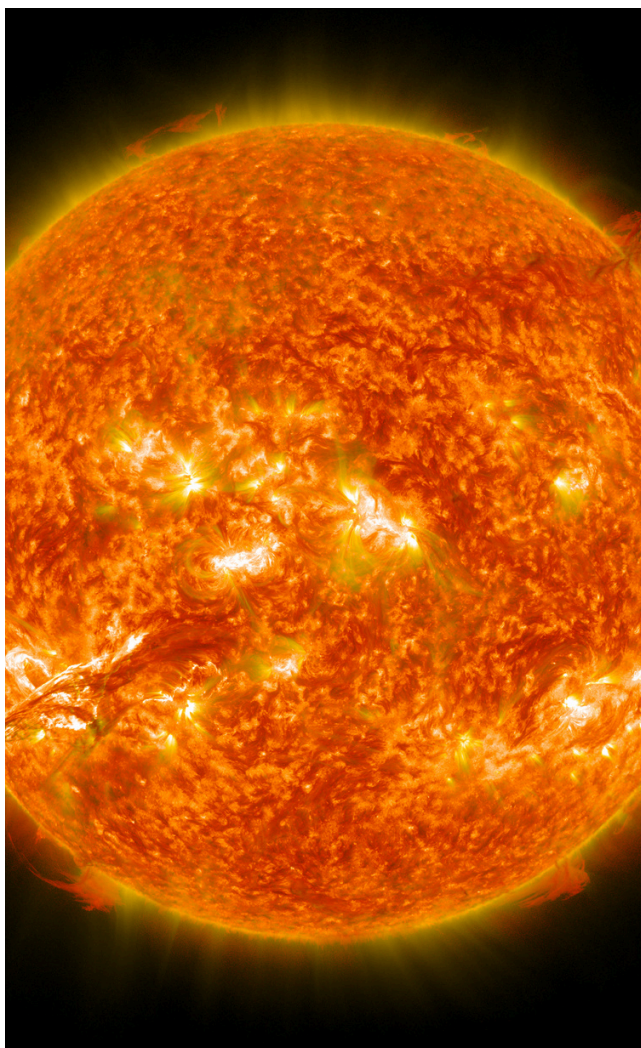
The findings offer a competitive edge to the coffee, functional beverage, and nutraceutical industries by enabling the development of health-oriented, low-sugar coffee products backed by scientific evidence. This can drive consumer trust, support clean-label marketing, and expand offerings in the growing health and wellness beverage segment.

A new study from Tufts University's Friedman School, based on data from 46,000 U.S. adults over 20 years, found that drinking 1-2 cups of black or lightly sweetened caffeinated coffee daily can lower the risk of all-cause mortality by 14-17%, especially from cardiovascular disease. The health benefits were linked to low or no added sugar (under 2.5g) and saturated fat (under 1g), while heavily sweetened or creamy coffees did not show the same protective effect. The findings, published in *The Journal of Nutrition*, reinforce that coffee's bioactive compounds may support heart health, if not diluted by excessive additives. However, benefits declined with intake beyond three cups per day and were not observed in decaf coffee.

Decoding the Brain's Sugar Switch: New Target Emerges in Alzheimer's Fight

This opens up new possibilities for the pharmaceutical, nutraceutical, and neurotech sectors to develop metabolic-based therapeutics that target glycogen regulation. Biotech firms working on dementia and neurodegeneration can explore as precision therapies for Alzheimer's and frontotemporal dementia. These insights also present fresh formulation strategies for age-related brain health supplements.

A new study from the Buck Institute, published in *Nature Metabolism*, reveals that neurons in Alzheimer's disease models accumulate glycogen, impairing the brain's ability to manage oxidative stress. Researchers found that restoring the function of the enzyme glycogen phosphorylase (GlyP) helped break down glycogen, rerouting the sugars into protective metabolic pathways that reduce tau-related damage and prolong neuron health. Tested in both fly models and human neurons, the findings show that dietary restriction and drugs like 8-Br-cAMP can mimic this protective effect. The results also offer a possible explanation for the success of GLP-1 drugs in dementia prevention by tapping into this sugar-clearing mechanism.



Tiny Solar Plasma Loops Unveil Hidden Clues to Magnetic Energy Bursts

The research advances models of magnetised plasma behavior, which can support the aerospace, satellite, and clean energy industries in designing more resilient electronic systems, energy storage solutions, and high-temperature materials for solar or space applications. The data also strengthen space weather forecasting tools that safeguard communication, navigation, and power infrastructure globally.

Researchers from the Indian Institute of Astrophysics, in collaboration with NASA, BBSO, and MPS, have discovered tiny, fast-evolving plasma loops just 3,000-4,000 km long and under 100 km wide in the Sun's lower atmosphere. Detected using multi-wavelength data from high-resolution telescopes, these loops exhibit intense non-thermal activity and plasma temperatures exceeding several million degrees, indicating magnetic reconnection events. The findings, published in *The Astrophysical Journal*, show that these miniature features could be key to understanding how the Sun stores and explosively releases magnetic energy, particularly via jets and small-scale solar filaments. Observed for the first time in H-alpha wavelengths, these loops reveal dynamic plasma activity within the dense chromosphere.



Private Spaceflight Boosts Global R&D: NASA Hosts Axiom Mission 4 at ISS

This mission expands opportunities for aerospace, biotech, and materials science industries to test and validate innovations in microgravity. It strengthens international commercial space partnerships, accelerating the development of low-Earth orbit R&D hubs and space-based services for future markets.

NASA has launched its fourth all-private astronaut mission to the International Space Station (ISS) with Axiom Mission 4, carried by a SpaceX Dragon spacecraft. The mission includes astronauts from India (ISRO's Shubhanshu Shukla), Poland, and Hungary, marking their return to space after over four decades. Led by former NASA astronaut Peggy Whitson, the crew will conduct joint science experiments, STEM demonstrations, and commercial research over a two-week stay. The mission stems from U.S. collaboration with international agencies like ISRO and ESA and strengthens public-private space efforts in low Earth orbit.

Thank you for reading!

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