



SCIENCE AND TECHNOLOGY PULSE

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India and Germany Expand High-Tech Ties in AI, Quantum, Clean Energy, and Biotech

This partnership will greatly benefit industries in biotechnology, clean energy, AI, quantum tech, electric mobility, and space-tech, offering new avenues for joint ventures, research commercialization, and market access. Indian and German companies can co-develop next-generation solutions, leverage academic expertise, and tap into each other's growing innovation ecosystems. This also opens new growth opportunities for agri-biotech, pharma, EV manufacturing, and tech startups seeking international scale.

In a high-level bilateral meeting between Dr. Jitendra Singh and Bavaria's Minister-President Markus Söder, India and Germany reaffirmed their strong and long-standing cooperation in Science, Technology and Innovation (STI), with plans to deepen collaboration in key areas like Artificial Intelligence, Quantum Technologies, Clean Energy, Biotechnology, Green Hydrogen, and Electric Mobility. The Indo-German 2+2 collaboration model—pairing academia with industry—was hailed as a strategic step for co-development and commercialization. Dr. Singh highlighted India's leadership in biotech with over 3,000 startups and the recent BIOe3 policy focused on Energy, Economy, and Employment. He noted that India now ranks 3rd globally in startups and unicorns, with over 50,000 Indian students studying in Germany, mostly in STEM fields, a number that has tripled in the past seven years.

**In this newsletter
you can expect
updates from:**

Government Initiatives

Health and Medicine

Emerging Technologies

Environmental Science

Space Exploration

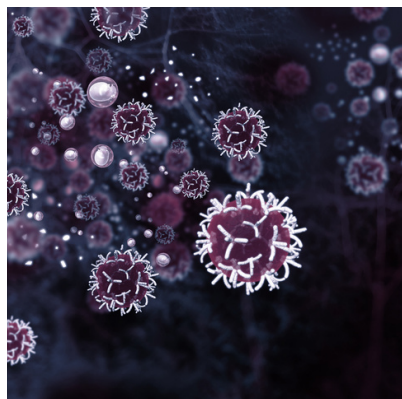
Food and Agriculture



India-Italy Ink Science and Tech Pact to Drive Industrial Innovation in AI, Biotech, and Clean Energy

This partnership opens vast opportunities for industries in biotech, digital health, AI, green energy, and deeptech sectors. Startups and SMEs in agro-biotech, healthcare, renewables, and Industry 4.0 will gain from joint R&D, funding, and global market access. It also boosts cross-border innovation and tech transfer, enhancing India's role in global industrial value chains.

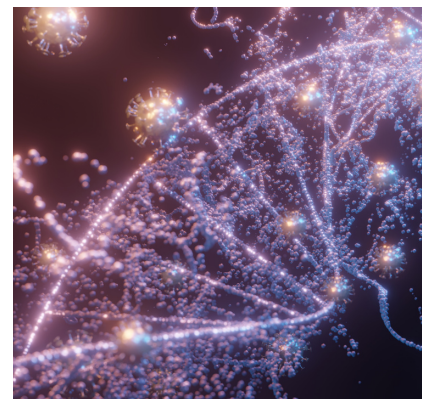
India and Italy signed a key MoU to strengthen Science and Technology ties, launching a Joint Executive Programme (2025–2027) with 10 collaborative research projects and 10 mobility proposals. The pact supports the India-Italy Strategic Action Plan (2025–2029) and focuses on AI, Quantum Tech, Biotech, and Clean Energy. India highlighted its advancements in DNA-based vaccines, gene therapy, Nafithromycin, and initiatives like the Aroma Mission and Swamitva Yojana. Both nations agreed to boost cooperation in renewable energy, ocean research, heritage tech, and promote academic-industry links, especially involving SMEs and startups.



Nanomagnetic Cancer Therapy: A Cost-Effective Thermal Approach with Cobalt Chromite Nanoparticles

This advancement benefits biomedical and nanomedicine industries by enabling targeted, minimally invasive cancer therapies. Pharma and device firms can explore cost-effective treatments and magnetic hyperthermia tools.

Scientists from the Institute of Advanced Study in Science and Technology (IASST), in collaboration with NIT Nagaland, have developed an efficient magnetic system using nanocrystalline cobalt chromite magnetic nanoparticles doped with Gadolinium (Gd), synthesized via chemical co-precipitation. These nanoparticles can generate controlled heat under an alternating magnetic field to raise the temperature of tumor cells to around 46°C, leading to cell death—a process known as magnetic hyperthermia. Unlike traditional cancer treatments, this method offers fewer side effects, better targeting, and potentially lower costs. The research was recently published in *Nanoscale Advances*, Royal Society of Chemistry.



Novel Epigenetic Therapy Offers New Hope for Autism and Intellectual Disability Patients

This finding offers biopharma opportunities to develop targeted epigenetic therapies for neurodevelopmental disorders. Biotech and pharma companies can innovate with nanosphere-based drug delivery and shift from symptom management to phenotype correction in ASD and ID treatments.

Researchers at JNCASR, led by Tapas K Kundu and James Clement, identified a promising therapy for Autism Spectrum Disorder (ASD) and Intellectual Disability (ID) by targeting impaired histone acetylation in mice with Syngap1 gene mutations. Using glucose-derived nanospheres (CSP) to deliver TTK21, an activator of the p300/KAT3B enzyme, they restored brain function, learning, and memory, even in late-stage brain development. This study, published in *Aging Cell*, demonstrates the potential for reversing cognitive deficits in ASD and ID.



Scientists Unveil New Fiber Classification for Tailored Health Benefits

This research enables nutraceutical and food tech industries to develop targeted health products using specific fiber properties. It supports innovation in functional foods and supplements tailored to digestive and metabolic needs for health-conscious consumers.

RMIT University researchers have developed a more precise model for classifying dietary fibers, moving beyond the traditional soluble and insoluble categories. Their new framework, based on five key features—backbone structure, water-holding capacity, structural charge, fiber matrix, and fermentation rate—helps target specific health outcomes such as digestive health, weight management, and blood sugar control. The study found that fibers interact with the gut microbiome in diverse ways, and by tailoring fiber intake to these characteristics, consumers and health professionals can achieve better health results. The framework has already sparked interest from dietitians, clinicians, and food technologists, highlighting a global fiber deficiency issue where average fiber intake in the U.S. and Europe falls far short of recommended levels. This new model aims to guide more personalized and effective dietary advice and product development.



QNu Labs Unveils QShield: India's Advanced Platform for Quantum-Safe Cybersecurity

This platform offers quantum-safe security for banking, telecom, defense, cloud, and critical infrastructure sectors, ensuring protection against next-gen cyber threats. It helps industries stay compliant with global encryption standards and lead in quantum-resilient innovation.

On World Quantum Day, Bengaluru-based startup QNu Labs, supported by the Department of Science and Technology under the National Quantum Mission, launched QShield—the world's first unified platform for seamless cryptography management across cloud, on-premises, and hybrid environments. QShield integrates key innovations like Armos, Tropos, QHSM, and NIST-compliant Post-Quantum Cryptography to protect sensitive data at rest and in transit. It includes services such as Qosmos, QConnect, QVerse, QSFS, and QVault, ensuring enterprise-level protection and future-proofing systems against quantum threats.

Optical Tweezer Electrophoresis Offers New Precision in Tracking Adsorption for Industrial Applications

This technique enables industries like pharmaceuticals, water purification, and cosmetics to optimize adsorption processes in real-time, enhancing product precision and efficiency. It also paves the way for advanced surface treatments in coatings and emulsions through smarter charge-transfer control.

Researchers at the Raman Research Institute, supported by the Department of Science and Technology, have used a technique called optical tweezer electrophoresis to study how tiny clay particles (Laponite nanoplatelets) stick to larger Latex spheres at the single-particle level and in real-time. This technique tracks changes in electrical charge as particles interact under a focused laser and electric field, offering a fast data rate of 30,000 measurements/second. The study revealed how factors like clay concentration and salt additives influence adsorption rates, and identified non-electrostatic dispersion as the key force driving early-stage particle adhesion. Electron microscopy (cryo-FESEM) confirmed the findings, showing actual clay deposits on microsphere surfaces. These insights, published in *Soft Matter*, offer a deeper understanding of how clay particles attach to surfaces and how this process can be tuned.



Air Quality Alert: Study Reveals Toxicity Spike Beyond 70 $\mu\text{g}/\text{m}^3$ PM_{2.5} in Kolkata

Waste management, air filtration, and environmental monitoring industries can use this toxicity threshold to develop precision air quality sensors, smart filters, and urban waste handling systems. Additionally, urban planning and construction sectors can benefit by aligning pollution control measures with these new toxicity indicators, ensuring both compliance and better public health outcomes.

A recent study led by Prof. Abhijit Chatterjee from Bose Institute reveals that PM_{2.5} toxicity in Kolkata significantly increases once pollution levels cross 70 $\mu\text{g}/\text{m}^3$, marking this as a new "toxicity standard" for the city. The study, published in *Science of The Total Environment*, found a non-linear jump in oxidative potential (OP)—linked to respiratory stress—between 70 $\mu\text{g}/\text{m}^3$ and 130 $\mu\text{g}/\text{m}^3$, beyond which toxicity plateaus. Using source apportionment models, the team identified biomass and solid waste burning as the major contributors to the increased toxicity, despite the progress under India's National Clean Air Programme (NCAP). Their findings have already influenced stricter local action in Kolkata, leading to noticeable air quality improvement in winter 2024–25.





Black Hole ‘Ansky’ Awakens: New Insights into Quasiperiodic Eruptions and X-ray Flares

These insights can aid space and satellite industries in enhancing telescope design and cosmic modeling tools. Energy and materials sectors may also apply high-energy process knowledge to innovate in extreme environment technologies and advanced energy systems.

A black hole at the center of galaxy SDSS1335+0728, about 300 million light-years away in Virgo, has unexpectedly entered an active phase after decades of dormancy, emitting powerful X-ray bursts every 4.5 days. First observed in 2019, this rare quasiperiodic eruption (QPE) challenges current models, with bursts far more intense and longer-lasting than typical QPEs. NASA's Swift, Chandra, and ESA's XMM-Newton telescopes are monitoring the activity, which may be caused by shocks in the accretion disc or a small object disturbing the black hole's material, offering a unique real-time look into black hole behavior.



Martian Dust Poses Health Risks: A Call for Preventative Measures for Future Astronauts

Aerospace and environmental tech industries can develop advanced filtration systems and simulate Martian conditions for testing protective gear. Healthcare firms may innovate targeted treatments for space-related thyroid and respiratory issues.

New research from the University of Colorado Boulder warns that Martian dust could pose serious health risks to astronauts on long-term missions to the planet. The study, published in *GeoHealth*, reveals that Martian dust contains harmful compounds such as silicates, arsenic, beryllium, and perchlorates. These particles, often as small as 3 micrometers, can enter the lungs and bloodstream, leading to chronic respiratory issues, thyroid disease, and silicosis. Martian dust storms and dust accumulation could further increase astronauts' exposure, making it critical to develop dust-repelling technologies and health solutions like iodine supplements to protect future explorers. With the Mars mission potentially lasting up to 18 months, proactive measures are necessary to mitigate health risks.



Smart Spray Tech Cuts Pesticide Waste, Boosts Crop Efficiency

Agrochemical and agri-tech industries can adopt this low-waste application method to boost pesticide and nutrient efficiency while cutting input costs. It enables chemical manufacturers and farm equipment makers to co-develop sustainable, high-value farming solutions.

MIT researchers and AgZen, a spinoff company, have developed a cost-effective spray system that helps pesticide and fertilizer droplets stick better to plant leaves, reducing chemical runoff and saving up to 50% on pesticide use. Using a thin oil-based coating—sometimes made from surfactants or adjuvants already used by farmers—the technology enhances droplet "stickiness" up to 100 times, even on water-repellent leaf surfaces. Field tests across 920,000 acres are planned for 2025, with proven success in doubling product retention on crops like kale and soybeans. The system works with existing nozzles and requires only a minor equipment upgrade. The innovation has already attracted \$10 million in funding and promises to significantly improve chemical efficiency in agriculture while reducing environmental damage.

Thank you for reading!

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