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CCMB scientists identify metabolism as new target for antifungal therapies

Fungal infections are among the most underestimated health threats worldwide, contributing to rising hospitalizations and deaths. Beyond human health, fungi also devastate crops, reduce yields, and worsen food insecurity — creating a dual crisis for both public health and agriculture.

Now, researchers at the CSIR–Centre for Cellular and Molecular Biology (CCMB) in Hyderabad have uncovered a significant insight into how fungi become dangerous in the first place. Their findings point to a promising new pathway for developing antifungal therapies by targeting fungal metabolism rather than only gene networks.

Fungi can exist in two forms

Led by scientist Sriram Varahan, the study reveals that a fungus's ability to switch shapes — a key factor in its infectiousness — is driven not only by genetic signals but also by its internal energy-generating processes. Fungi can exist in two major forms: a small, oval yeast form and a larger filamentous form.

How yeast travels to transform into filamentous form

The yeast form travels through the host environment searching for a niche to anchor. Once it finds one, it transforms into filaments, allowing it to invade tissues aggressively. Inside the human body, fungi encounter nutrient scarcity, temperature shifts, and competing microbes. These stresses typically trigger their transformation into the filamentous form, which is much harder for both immune cells and medicines to eliminate.



The yeast and filament form of Fungi

A key link needed for fungal invasion

While earlier studies have focused heavily on genes that control these shape changes, the CCMB research highlights metabolism as a critical, previously overlooked driver. “We uncovered what can be described as a hidden biological short circuit,” said Mr. Varahan. “We found a direct link between glycolysis — the process of breaking down sugars — and the production of sulfur-containing amino acids needed for fungal invasion.”

Why fungi need sugars?

When fungi rapidly consume sugars, they generate the sulfur-based amino acids required to initiate invasive filament formation. The team tested what happens when sugar breakdown is slowed. In these conditions, the fungi remained trapped in their harmless yeast form and could not transition into the disease-causing state. However, when sulfur-containing amino acids were added externally, the fungi quickly regained their invasive ability.

The researchers studied a *Candida albicans* strain lacking a key enzyme for sugar breakdown and found it to be “metabolically crippled.” It struggled to change shape, was easily destroyed by immune cells, and caused only mild disease in mouse models.

‘Achilles’ heel’ of fungal pathogens

These findings suggest that interfering with fungal metabolism may be the ‘Achilles’ heel’ of fungal pathogens. Mr. Varahan notes that with drug-resistant fungal infections on the rise, targeting metabolism could lead to safer, more effective antifungal therapies— benefiting both human health and agricultural security.

Source: <https://www.thehindu.com/sci-tech/science/ccmb-scientists-identify-metabolism-as-new-target-for-antifungal-therapies/article70603285.ece>

Dated: February 09, 2026, <https://www.thehindu.com>



(From left) Siddhi Gupta, Dhrumi Shah, Sriram Varahan and Sudharsan M



SCIENCE & TECHNOLOGY

IIT-Delhi, Germany team makes device to sort current by ‘handedness’

If some engineering challenges can be overcome, the technology could lead to low-power computing and new forms of magnetic memory



False-coloured SEM image of the microstructured device of PdGa made using focused-ion beam techniques, showing the three-arm geometry. The scale bar is 10 μm .

In a new study published in *Nature*, scientists from IIT Delhi and Germany have demonstrated a device that can separate electrons based on their “handedness” without the use of powerful magnetic fields. This marks an important step towards chiral electronics, which could eventually enable low-power electronic devices.

Just as the human left hand is a mirror image of the right and cannot be perfectly superimposed, electrons in certain complex materials called topological semimetals can also possess a left- or right-handed chirality. This chirality refers to a specific quantum state of an electron moving through a crystal.

However, these special electrons are typically mixed with “standard” electrons that lack chirality. Detecting and separating them has traditionally required strong magnetic fields or precise chemical doping, making the technology impractical for everyday applications. The researchers overcame this challenge by exploiting the quantum geometry of a palladium gallium (PdGa) crystal.

“The single homochiral crystal made by Claudia’s group was crucial for the study,” said Stuart Parkin, managing director at the Max Planck Institute of Microstructure Physics and a co-author of the study, referring to the work of fellow author Claudia Felser.

Inside this crystal, electrons behave like waves as they move through the lattice, which restricts their possible energy and momentum. These constraints form what is known as the band structure — essentially the “road” an electron travels on. In ordinary copper wiring, this road is flat and straight, so applying a voltage pushes electrons in a straight line. In PdGa, however, the road is twisted, causing electrons to drift sideways even when moving forward. The direction of this drift depends on the electron’s handedness.

The team fabricated a small three-armed device and passed an electric current through it. Beyond a certain threshold, PdGa’s quantum geometry forced left-handed electrons into one arm and right-handed electrons into another.

“Using quantum geometry as a functional element, rather than an external magnetic field, was key to achieving the valve functionality,” Dr. Parkin said. “It allowed us to design a unique device geometry and demonstrate control over currents with opposite electronic chirality.”

Several challenges remain, including the need for ion beams to fabricate the device and ultra-low temperatures for operation, which currently limit practical applications. If these obstacles can be overcome, the technology could pave the way for low-power computing and new forms of magnetic memory.

Source: <https://www.thehindu.com/sci-tech/science/iit-delhi-germany-team-makes-device-to-sort-current-by-handedness/article70609625.ece>

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



Environment

Study maps future glacial lakes

A team of researchers from IIT Guwahati flags 493 high-risk sites in the Eastern Himalayas



A team of researchers from the Indian Institute of Technology Guwahati (IIT-G) has developed a new method to identify where glacial lakes are likely to form in the Himalayas, offering a significant advance in disaster preparedness for mountain regions facing rapid climate change.

The study focuses on the Eastern Himalayas, which has recorded the highest frequency of glacial lake outburst floods (GLOFs) across the mountain range. These sudden and destructive floods occur when natural dams holding back glacial lakes collapse, releasing massive volumes of water, debris, and sediment downstream.

The findings have been published in the journal *Scientific Reports*. The paper is co-authored by Ajay Dashora of IIT-G's Department of Civil Engineering, along with his research scholar Anushka Vashistha and Afroz Ahmad Shah of the University of Brunei Darussalam.

GLOFs have caused extensive loss of life and damage to infrastructure in the past, affecting roads, bridges, hydropower projects, and agricultural land. The most recent major disaster occurred in October 2023 in Sikkim, where 94 people were killed, 1,835 houses were damaged, 2,563 people were displaced, and a 1,200-megawatt dam was swept away.

According to the researchers, both the number and size of glacial lakes are increasing as glaciers retreat more rapidly due to rising temperatures, heightening risks for downstream communities. Unlike earlier studies that relied primarily on climate data to assess glacial lake hazards, this research adopts a different approach by placing geomorphology—the physical shape and structure of the land—at the centre of prediction.

The study examines how specific landforms influence meltwater accumulation, including cirques (bowl-shaped depressions carved by glaciers), U-shaped valleys, meltwater channels, retreating glacier fronts, and nearby lakes. Together, these features determine whether a landscape can trap water long enough for a glacial lake to form.

Using high-resolution satellite imagery and digital elevation models, the researchers analysed more than 12,000 grid locations across the Eastern Himalayas. Machine learning techniques were then applied to estimate the probability of glacial lake formation at each site.

Among the tested models, a Bayesian neural network produced the most reliable results. Unlike conventional models, it not only predicts where lakes are likely to form but also quantifies uncertainty in the predictions—an important advantage in remote mountain regions where field data are scarce and terrain conditions vary sharply.

The resulting probability maps highlight zones with a high likelihood of future lake formation, many of which coincide with areas of active glacier retreat and gentle slopes that favour water accumulation. Several of these zones lie upstream of existing settlements and infrastructure, underscoring the potential risk.

“By pinpointing high-risk areas, the framework can guide early-warning systems for GLOFs, help plan safer locations for roads, hydropower projects and settlements, and support long-term water resource management,” Prof. Dashora said.

“Beyond hazard management, the method can also help us understand how water systems may evolve as glaciers continue to retreat. Importantly, the framework is adaptable to other glaciated mountain regions worldwide, making it a valuable tool for climate-resilient planning and disaster-risk reduction globally,” he added.

The study also challenges the assumption that climate alone determines glacial lake formation. While temperature controls meltwater supply, the research shows that landforms largely dictate where that water ultimately accumulates.

Source: <https://www.thehindu.com/sci-tech/energy-and-environment/study-maps-future-glacial-lakes/article70556752.ece>

Dated: February 05, 2026, <https://www.thehindu.com/>



AGRICULTURE

Microbial limits to phosphorus availability uncovered in karst farmlands of southern China



A research team led by Prof. Wang Kelin from the Institute of Subtropical Agriculture of the Chinese Academy of Sciences has uncovered microbial mechanisms that limit phosphorus (P) cycling in farmland soils, showing that high-intensity farming increases phosphorus limitation. The findings, based on regional-scale sampling in a karst region of southern China, were published in *Agriculture, Ecosystems and Environment* on January 13.

Phosphorus deficiency in soil is a global challenge for agriculture. Soil microbes play a crucial role in mobilizing this essential nutrient and making it available to crops. However, common farming practices may disrupt this delicate system. The impact of agricultural activities on microbial communities and their ability to alleviate phosphorus shortages remains poorly understood.

To address this, the researchers examined four typical farmland types along a gradient of low to high agricultural disturbance in the region's two main soil types—calcareous and red soils: pasture, sugarcane fields, rice paddies, and maize croplands.

They found that high-intensity farming, characterized by frequent tillage and heavy inputs of fertilizers and pesticides, increased the abundance of microbial genes associated with phosphorus starvation. At the same time, it reduced the abundance of key genes involved in phosphorus solubilization and transport, limiting its availability to crops.

The study also showed that alkaline calcareous soils naturally host a higher abundance and diversity of phosphorus-cycling microbes and their functional genes than acidic red soils. This is largely because their near-neutral pH provides a more favorable environment for microbial activity.

In contrast, acidic red soils exhibited a strong coupling between microbial species diversity and functional diversity related to phosphorus cycling. However, in the more favorable calcareous soils, this relationship was decoupled. In other words, higher species diversity did not necessarily translate into greater functional diversity, indicating that simply having more microbial species does not guarantee improved phosphorus cycling.

“We found that high-intensity farming weakens the functional capacity of soil microbes involved in phosphorus cycling. This appears to be a core reason behind phosphorus limitation in agricultural soils,” said Prof. Zhao Jie, the corresponding author of the study. “These findings provide a scientific basis for developing more sustainable strategies to manage this essential nutrient.”

Source: <https://phys.org/news/2026-02-microbial-limits-phosphorus-availability-uncovered.html>
Dated: February 9, 2026, <https://phys.org>



AGRICULTURE

Why is rice such a water-intensive crop?



Many rice-growing systems deliberately flood the fields and most of the water is lost to the air or to the ground. Farmers often maintain shallow flooding to stabilise some nutrient dynamics. In many paddies, water also moves sideways or down the soil unless the field is rich in clay or well sealed. Flooding is an easy way to meet these goals but also expands the exposed water surface, so the total water demand rises.

Second, the plant needs CO₂ inside the leaf for photosynthesis. CO₂ enters primarily through open stomata, but the same open pores also allow water vapour to leave. Third, rice is a C₃ plant, and C₃ photosynthesis is less water-efficient in hot or dry conditions than C₄ (e.g. maize). In C₃ plants, the main CO₂-fixing enzyme sometimes reacts with oxygen instead of CO₂. To keep photosynthesis going, C₃ leaves often need to keep stomata open enough to sustain internal CO₂ levels, which increases transpiration.

Finally, flooded soils are oxygen-poor because oxygen diffuses slowly through water. Most crops' roots struggle in these conditions. Rice is tolerant, however, because it develops air-filled channels that move oxygen from the shoots to the roots.

Source: <https://www.thehindu.com/sci-tech/science/why-is-rice-such-a-water-intensive-crop/article70521356.ece>

Dated: January 21, 2026, <https://www.thehindu.com>



HEALTH

Endometriosis care needs a comprehensive approach

ICMR's EndoCare India's multidisciplinary approach can introduce a standardised screening guideline for frontline healthcare workers and health providers in primary care settings to recognise symptoms and refer patients to higher health facilities in a timely manner

The launch of a multidisciplinary care model, EndoCare India, by the Indian Council of Medical Research (ICMR) marks a significant step towards improving the treatment and management of endometriosis in India's public healthcare system. This integrated model seeks to address the complex medical, psychological, and social needs of patients across different life stages, from adolescence to menopause. It helps bridge long-standing gaps in care for an estimated 40 million Indian women and girls, many of whom suffer silently from this debilitating condition.

Endometriosis occurs when endometrial-like tissue grows outside the uterus, leading to inflammation, cysts, and adhesions. These changes cause severe pelvic pain, infertility, and bowel and bladder problems, disrupting daily life, work, and relationships. Women often endure symptoms in silence due to low awareness and the normalisation of menstrual pain. Misinformation, along with the widespread belief that period pain is “normal”, contributes to significant diagnostic delays, medical dismissal, and psychological distress. In India, cultural stigma further compounds the problem, with many women delaying care until symptoms become unbearable.

A stakeholder consultation titled “Tackling endometriosis together to improve women's lives”, organised by the George Institute for Global Health in February last year, highlighted the profound impact of helplessness, anxiety, and depression among affected women and their partners. Drawing on qualitative findings from patient interviews across India, the consultation revealed how untreated endometriosis undermines economic productivity—women miss work, face career setbacks, and struggle with family planning. These insights informed a policy brief by the George Institute, which called for comprehensive strategies to address endometriosis holistically through policy reforms, better access to care, increased research funding, and enhanced public education campaigns. This approach aligns with global calls, including those from the World Health Organization, to recognise endometriosis as a chronic disease requiring urgent public health action. Early diagnosis and timely referral to specialised care can significantly improve quality of life, especially since symptoms often go undiagnosed for seven to ten years.



EndoCare India's multidisciplinary approach brings together gynaecologists, pain specialists, psychologists, and fertility experts under one roof, and is designed for scalability within the public sector. Piloted at select ICMR sites, the model has the potential to reduce infertility—affecting 30–50% of cases—and alleviate mental health burdens through holistic care. However, the development of standardised screening guidelines for frontline healthcare workers in primary care settings is essential to enable early recognition of symptoms and timely referral to higher facilities, thereby reducing delays in diagnosis and treatment.

The model's success will ultimately depend on effective implementation. States such as Maharashtra and Tamil Nadu, with strong public health systems, could lead the rollout by training frontline health workers and primary care providers through structured modules on symptom recognition. Digital tools, including ICMR's telehealth platforms, could further link primary health centres with EndoCare hubs, ensuring continuity of care and follow-up, particularly for rural patients.

Public health response

While the introduction of EndoCare India is a step in the right direction, it must be complemented by greater recognition of endometriosis as a major public health concern. This includes dedicated resources for research, community-level awareness campaigns, and the development of robust screening and referral systems. The National Health Mission could integrate endometriosis into RMNCH+A programmes, support awareness through ASHA-led outreach and school curricula, and prioritise research on cost-effective diagnostics such as ultrasound protocols. Behavioural and social interventions will also be critical in addressing stigma and empowering women to seek timely care.

Source: <https://www.thehindu.com/opinion/op-ed/endometriosis-care-needs-a-comprehensive-approach/article70612718.ece>

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



HEALTH

Busting dangerous first aid myths about epileptic seizures

Millions of Indians live with epilepsy. During a seizure, what they need most is not control, but care. It is crucial to be aware of what should and should not be done when someone near you is experiencing a seizure

Across India, many people recognise the scene when someone has a seizure: a person suddenly collapses, the body stiffens, limbs jerk, and breathing sounds strange or unfamiliar. Panic spreads instantly. People rush in, shouting instructions, grabbing arms, forcing mouths open, and pushing in old keys, metal objects, or even cloth.

For the person having a seizure, this is a moment of complete vulnerability. Consciousness fades, control is lost, and when awareness slowly returns it is often to pain, confusion, injuries — and the memory of being restrained by strangers. Much of this suffering is not caused by epilepsy itself, but by dangerous first-aid myths that remain deeply rooted in society.

Epilepsy is a neurological condition. An epileptic seizure is caused by abnormal electrical activity in the brain — it is a medical event. It does not require force, fear, or crowd control. It requires calm, protection, and dignity.

Myth 1: Holding the person down prevents injury

The belief: Many people think restraining a person during a seizure will stop them from hurting themselves. Arms and legs are pinned down, and the body is held firmly to the ground in an attempt to “control” the situation.

The reality: Seizure movements are involuntary and cannot be stopped by force. Restraining the body often causes torn muscles, dislocated shoulders, fractures, and even spinal injuries. When consciousness returns, the person wakes up not only exhausted, but injured and in pain. Protection means clearing the surrounding space — not controlling the body.

Myth 2: Something must be put in the mouth

The belief: A deeply ingrained fear exists that the person will “swallow their tongue”. As a result, spoons, cloth, keys, or even fingers are pushed into the mouth.

The reality: The tongue cannot be swallowed. What can happen instead is broken teeth, jaw injuries, choking, or severe bites to helpers. Tongue-biting, although distressing to witness, is usually minor and heals naturally. No object should ever be placed in the mouth during a seizure. Forcing items inside can cause serious oral and dental injuries and, in severe cases, airway obstruction. The correct action is to gently turn the person onto their side so saliva or vomit can drain out, reducing the risk of choking.



Myth 3: The seizure will not stop without intervention

The belief: Many people fear that unless they act, the seizure will continue endlessly. They believe water must be poured or restraint increased to stop the shaking.

The reality: Most seizures last one to two minutes and stop on their own. Interference does not shorten them. What truly matters is observing and timing the seizure, and calling for medical help if it lasts longer than five minutes or repeats without recovery in between.

Why these myths are dangerous

In India, epilepsy continues to carry stigma and is widely misunderstood. Many families hide the diagnosis, and basic first-aid knowledge is limited. Myths are passed down with good intentions — but intentions do not prevent harm.

When a person regains consciousness after a seizure, they are often confused, weak, and deeply embarrassed. Being restrained or surrounded by panic adds emotional trauma to physical injury and exhaustion. Dignity is often the first casualty.

What actually helps

Correct seizure first aid is simple, quiet, and respectful:

- Stay calm and stay with the person
- Move harmful objects away
- Place something soft under the head
- Time the seizure
- Do not restrain movements
- Do not put anything in the mouth
-

Once the movements stop, gently turn the person onto their side and allow them to rest.

Hospitals frequently treat people with epilepsy for injuries caused not by seizures, but by incorrect first aid — broken teeth, dislocated joints, and deep bruises. Families often carry guilt, wishing they had known better. These injuries are preventable. The fear that causes them does not have to exist.

Source: <https://www.thehindu.com/sci-tech/health/busting-dangerous-first-aid-myths-about-epileptic-seizures/article70602951.ece>

Dated: February 09, 2026, <https://www.thehindu.com/>



S&T COOPERATION FOR GLOBAL SOUTH

Türkiye's Contribution to UNFSSC Strengthens UNOSSC-UN Technology Bank Innovation Partnership for LDCs



A new contribution from the Government of Türkiye to the United Nations Fund for South-South Cooperation (UNFSSC) is accelerating science, technology, and innovation in Least Developed Countries while also enabling closer collaboration between the United Nations Office for South-South Cooperation (UNOSSC) and the UN Technology Bank for the Least Developed Countries.

This collaboration reflects the spirit of UN80, highlighting how South-South and triangular cooperation can deliver practical, forward-looking solutions through partnership, complementarity and collective action. By bringing together institutions of the United Nations system with Southern-led leadership and expertise, the initiative demonstrates how South-South cooperation is responding to today's global challenges while advancing a more inclusive and effective multilateral system.

Türkiye's contribution enables UNOSSC to deepen its partnership with the UN Technology Bank in a manner that is both strategic and complementary, leveraging the respective mandates and comparative advantages of the two entities. Building on strong institutional alignment, the collaboration aims to promote innovation-led South-South and triangular cooperation. This offers a practical pathway to address persistent development challenges faced by LDCs, including structural vulnerabilities, limited technological capacity, and uneven access to innovation ecosystems.

In an increasingly complex global environment, strengthening science, technology and innovation capacities in LDCs is critical to accelerating sustainable development, enhancing resilience, and supporting progress toward the 2030 Agenda and the Doha Programme of Action.

South-South and triangular cooperation offer important opportunities to mobilize context-appropriate technologies, applied expertise and peer learning from across the Global South, complementing traditional development approaches.

The UNOSSC-UN Technology Bank collaboration will focus on shared knowledge and capacity development through targeted analytical reviews, knowledge products, policy dialogues, and innovation-focused capacity-building initiatives to respond to country-driven priorities. Through joint efforts, the partnership seeks to elevate evidence-based insights, highlight practical innovation solutions, and strengthen platforms for exchange among policymakers, practitioners and development partners – helping connect LDC demand with relevant technology and innovation expertise.

As host country of the UN Technology Bank and a longstanding champion of South-South and triangular cooperation, Türkiye continues to demonstrate leadership in promoting innovation-driven development solutions for LDCs. This contribution provides a foundation for expanded collaboration, increased visibility of Southern-led innovation, and the development of scalable initiatives that can attract broader partnerships and resources over time.

Source: <https://unsouthsouth.org/2026/01/30/turkiyes-contribution-to-unfssc-strengthens-unossc-un-technology-bank-innovation-partnership-for-ldcs/>

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



OTHERS

WHY DOES THWAITES GLACIER MATTER?

Thwaites glacier is a large glacier in West Antarctica, about the size of a large country. Scientists have often called it the “Doomsday Glacier” in the media. It is one of the most important places on the earth for those trying to understand how sea levels will rise in future.

The glacier sits on land that slopes downward as you go further inland, dipping below sea level. This is important: warm ocean water is known to flow under the glacier’s floating edge, i.e. its ice shelf, and melt it from below. As a result, the ice shelf acts like a brace, like a doorstep, that slows the glacier’s flow into the ocean. As the ice shelf becomes thinner or breaks in places, the glacier speeds up and loses more ice.

Scientists’ studies have revealed that the glacier is already changing: it has been becoming thinner, retreating, and contributing to sea-level rise. If Thwaites were to collapse completely over a long period, it could cause global sea levels to rise by around half a meter.

Thwaites is also holding back ice nearby in the West Antarctic Ice Sheet. If it weakens beyond a point, other glaciers may lose ice faster as well, further increasing sea-level rise. Higher sea levels will cause coasts to flood more easily, worsen erosion, increase storm surges, and threaten cities, low-lying islands, and ports. While Thwaites is far from most lived areas, how it changes will affect people worldwide.

Source: <https://www.thehindu.com/sci-tech/science/why-does-thwaites-glacier-matter/article70607073.ece>
Dated: February 08, 2026 , <https://www.thehindu.com/>



What is quantum computing?

They say that computers can perform tasks beyond the abilities of human beings. But what if I told you that there has been a method under development where problems that are beyond the skillset of classical computers can be solved? Let's dive in!



The quantum computer

It's time to introduce the star of this article! The quantum computer is quite different from the regular computer you would use at home, the office, or in a school computer lab. It is a device that utilises quantum mechanics (a field of physics where the behaviour of matter and energy is described and studied at the atomic and sub-atomic levels) to solve complex problems and perform computations faster than a traditional computer. Theoretical physicist Richard Feynman was credited as one of the first scientists to introduce the idea of combining computers with quantum mechanics to ensure efficient computer simulations (creation of digital models and equations to mimic real-world scenarios). Unlike regular computers that use bits, or binary digits, quantum computers operate through the manipulation of qubits.

What are qubits?

Qubits serve as the main contrast between quantum computers and regular computers. A qubit is a two-state fundamental unit of quantum computing. In traditional computers, bits are used for storing and processing data, but have a binary state, only being able to exist as either a zero or a one. Qubits, however, are different, as they can exist as both a zero and a one at the same time! This additionally means that qubits can help the quantum computer accomplish many tasks at once at much higher speeds. Think of it this way: there are two workers, one wearing red and the other wearing blue. In a 'bit', only one of the two workers (either red or blue) can work on a provided task at a time. But in a quantum bit, both workers can work on the task at the same time!

The key components from quantum mechanics that are incorporated into these qubits (or quantum bits) are superposition and entanglement.

Quantum superposition states that the qubit can exist as both a zero and a one, and can represent many values at the same time, making computing much quicker and more vast.

Quantum entanglement, on the other hand, is when two or more qubits become linked so that one cannot exist independently of the other. If one is measured, the other's information is instantly known. Think of it as two light bulbs being connected to the same switch. If you were to look at one bulb and turn on the switch, you wouldn't have to look to know that the other has turned on as well. This allows qubits to work in a unified manner and solve complex problems more quickly and efficiently.

Applications

When quantum computing began to slowly shift from being a theoretical concept to an experiment, there were many fields that saw its benefits. Within finance, studies have explored the potential of quantum computing to aid in portfolio optimisation (the process by which the best combination of assets is selected for an investment that ensures the highest returns) through the Quantum Approximate Optimization Algorithm (QAOA), which can be used to find near-optimal solutions for problems where the options are finite. This also leads to better decisions being made in businesses, alongside risk analysis and fraud detection.



Leafy chemistry: What happens when a leaf changes colour in autumn?

If you've visited Kashmir or Himachal Pradesh during the fall, you must have seen this vibrant fall foliage. Leaves of orange, yellow, red, gold, and every other colour near it. It's not just a beautiful sight, it is a part of the life cycle of a tree. Let's explore.



For a moment, close your eyes and imagine yourself in the fall season. A cold, chilly wind brushes against your face, and leaves dance gracefully as they fall from the trees. What's the first thing you notice about them? That they change colour before they fall. But how does this happen?

The science behind it

Trees that shed their leaves annually are called deciduous trees. These trees usually have large, broad leaves that change colour with the seasons. For most of the year, these leaves appear green because of a pigment called chlorophyll. As you may have learned in school, chlorophyll plays a vital role in photosynthesis: it absorbs sunlight and helps convert it into energy, which is then turned into sugars that nourish the tree. During spring and summer, chlorophyll is produced continuously, while other pigments remain present in much smaller amounts.

As the seasons change and temperatures drop, days become shorter and trees receive less sunlight. As a result, chlorophyll production slows down and the existing chlorophyll begins to break down. This allows other pigments to become more visible, marking the tree's preparation for winter.



Fallen chinar tree leaves float on the waters of Tehunte Kul, a tributary of Dal Lake, during an autumn day in Srinagar, Wednesday, 19, November 2025. Fall in Kashmir, locally known as "Harud", transforms the valley into a vibrant canvas of red, orange, and yellow hues.

Eventually, the flow of nutrients to the leaves is cut off. The leaves fall to the ground, where they decompose and enrich the soil, supporting the next life cycle.

Chemicals and colours

So why do leaves display so many different colours? This happens because of various pigments in the leaves and how they react to sunlight. Yellow and orange shades come from pigments called carotenoids, which are present throughout the year but are usually masked by chlorophyll. Red and purplish-brown colours come from anthocyanins, which are produced in higher amounts in autumn. Healthy trees often show brighter red colours because higher sugar levels promote anthocyanin production.

Trees stressed by drought, disease, or poor soil conditions may lose their leaves earlier, leaving them bare before the peak autumn colours appear.

Hotspots of change

These dramatic colour changes are most commonly seen in temperate regions, which lie in the middle latitudes of the Earth and experience moderate climates with four distinct seasons. Mount Mansfield in Vermont, USA, is famous for its vivid reds and golds. Lake Tahoe in the USA and Agawa Canyon in Canada showcase golden aspens and maples in mid-October. Other notable hotspots include the Douro Valley in Portugal, the red maples of Nara and Kyoto in Japan, and the chinar trees around Dal Lake in Kashmir.

Leaves changing colour is not just a beautiful sight—it is a natural response to seasonal change and a vital survival strategy. Autumn's colours are nature's way of preparing for renewal.

Source: <https://www.thehindu.com/children/leafy-chemistry-what-happens-when-a-leaf-changes-colour-in-autumn/article7055944.ece>

Dated: February 03, 2026, <https://www.thehindu.com/>