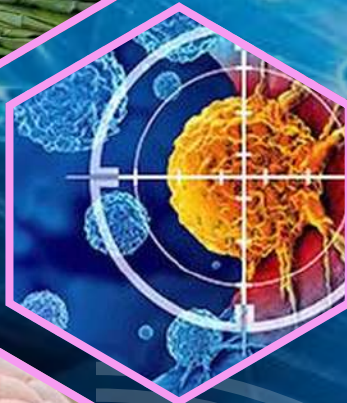


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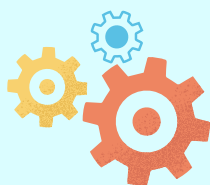
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BITS Pilani Hyderabad researchers develop graphene electrode for improved supercapacitor performance

The work was carried out by scientists at the MEMS, Microfluidics and Nanoelectronics (MMNE) Lab and published recently in the journal Surfaces and Interfaces

Researchers at the BITS Pilani Hyderabad Campus have developed a graphene-based electrode that could significantly enhance the performance and lifespan of supercapacitors—an emerging energy storage technology widely used in portable electronics, wearable devices, and microelectronic systems.

The research was conducted at the MEMS, Microfluidics and Nanoelectronics (MMNE) Lab and recently published in the journal Surfaces and Interfaces. The study focuses on phosphorus-doped laser-induced graphene (PLIG), an advanced material engineered to improve the efficiency of supercapacitors while remaining cost-effective and scalable for large-scale manufacturing.

Unlike conventional batteries, supercapacitors can store and release energy much more rapidly, making them highly promising for next-generation electronic systems. However, existing laser-induced graphene materials have been limited by relatively low energy storage capacity. To overcome this challenge, the research team introduced phosphorus atoms into the graphene structure, enhancing both electrical conductivity and electrochemical performance.

The fabrication process involved combining liquid polyimide with phosphoric acid, coating the mixture onto filter paper, and exposing it to a blue diode laser.

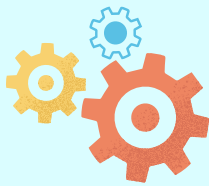
The laser transformed the carbon-rich material into a porous graphene network without the need for expensive fabrication methods such as chemical vapour deposition or lithography.

According to the researchers, the newly developed electrode demonstrated conductivity nearly eight times greater than that of conventional laser-induced graphene. The study also reported high specific capacitance and approximately 98% capacitance retention after 6,000 charge-discharge cycles, highlighting the material's exceptional long-term stability.

Sanket Goel, Head of the Center for Research Excellence in Semiconductor Technologies at BITS Pilani and the corresponding author of the study, said the research demonstrates how controlled phosphorus doping can substantially improve graphene performance while preserving scalability for practical applications. Lead author Sowmya Sree Palavai added that the team's primary objective was to develop a process suitable for real-world energy storage devices.

The researchers believe the technology could have wide-ranging applications in wearable electronics, flexible energy storage systems, on-chip power devices, and other high-power electronic technologies.

Source: <https://www.thehindu.com/sci-tech/science/bits-pilani-hyderabad-researchers-develop-graphene-electrode-for-improved-supercapacitor-performance/article70997258.ece>
<https://www.thehindu.com>



SCIENCE & TECHNOLOGY

CCMB Scientists Discover Rare Gene Variant Behind Red Hair in Indian Girl

Scientists at the CSIR-Centre for Cellular and Molecular Biology (CCMB), Hyderabad, have uncovered a rare genetic mutation responsible for red hair in a five-year-old Indian girl, providing new insights into India's rich genetic diversity.

Red hair is extremely uncommon in India, where black hair is the norm. The study began when researchers observed a young girl with red hair on her scalp, eyebrows, and body, while her eyes remained dark. This unusual combination prompted a detailed genetic investigation.

Using genome sequencing, the team identified a rare variant of the MC1R gene, a key gene that regulates pigmentation. MC1R determines whether the body produces eumelanin, which gives dark brown or black coloration, or pheomelanin, which produces red and yellow shades.

Researchers found that the girl carried two copies of a rare mutation known as c.872C>A—one inherited from each parent. Although both parents had normal dark hair, they each carried a single copy of the mutation. This inheritance pattern, known as autosomal recessive inheritance, caused the MC1R protein to function improperly, resulting in the child's red hair.

Led by senior scientist K. Thangaraj, the team expanded their research to understand how common such variations might be across India. They analyzed genetic data from more than 11,000 individuals representing 91 populations, using information from the GenomeIndia Consortium and additional laboratory samples.

The study identified 21 novel or ultra-rare MC1R variants, highlighting a greater level of genetic diversity than previously recognized. Laboratory experiments and studies using zebrafish models confirmed that several of these variants affect gene function and influence pigmentation patterns.

However, scientists stress that skin color is controlled by multiple genes, including SLC24A5 gene and SLC45A2 gene, and cannot be explained by MC1R alone.



The study was prompted by a striking case of a five-year-old Indian girl with red hair on her scalp, eyebrows and body, while retaining dark eyes — an extremely rare phenotype. Photo: Facebook/@CCMBnews

According to the researchers, India's wide spectrum of skin tones reflects a complex history of migration, genetic mixing, environmental adaptation, and social practices such as endogamy. The findings not only improve understanding of human genetic diversity but also have medical significance, as certain MC1R variants are linked to an increased risk of skin cancers, including Melanoma.

The study highlights how rare genetic variations can reveal important clues about ancestry, pigmentation, and human health in India's diverse population.

Researchers also examined another MC1R variant, c.-226A>T (rs3212363), which is associated with lighter skin pigmentation. Its frequency varies significantly across India. The variant is common among the Bodh population of Ladakh but occurs less frequently among Dravidian tribal groups in southern India. Northern and northeastern populations, which generally have lighter skin tones, show higher frequencies of this variant.

Source: <https://www.thehindu.com/sci-tech/science/ccmb-scientists-identify-rare-gene-behind-indian-girls-red-hair/article71036811.ece>
<https://www.thehindu.com>



ENVIRONMENT

Two New Apps Launched to Identify and Record Indian Butterflies



Mythily Ramesh of Next Wealth, which supported the project with Krushnamegh Kunte and Nature's Ark co-founders Kannan A. S and Poornima Kannan

To improve the collection of reliable biodiversity data in India, evolutionary biologist Dr. Krushnamegh Kunte and Nature's Ark have launched two Android applications: iButterfly Explorer and iBiodiversity Count. Designed specifically for Indian butterflies, the apps aim to support both citizen scientists and researchers in documenting and understanding butterfly diversity.

Dr. Kunte, a biodiversity scientist at the National Centre for Biological Sciences and founder of the Butterflies of India website, believes that accurate data is essential for understanding the true impact of climate change and human activities on biodiversity. While many people feel butterfly numbers have declined over the years, he emphasizes that scientific conclusions require solid, long-term evidence.

The iButterfly Explorer app uses artificial intelligence to identify Indian butterfly species from photographs. Users can take a photo, upload one from their gallery, or share an image directly from platforms such as WhatsApp. The AI model was trained using data from the Butterflies of India website, which contains observations that have been reviewed by experienced butterfly experts. According to Nature's Ark co-founder Kannan AS, this curated dataset has enabled the app to achieve an identification accuracy of over 90%.

Beyond species identification, the app provides detailed information about each butterfly, including its physical characteristics, caterpillar stage, host plants, and geographic distribution. This educational feature makes the app valuable not only for butterfly enthusiasts and researchers but also for teachers and students interested in learning about nature.

The second app, iBiodiversity Count, focuses on recording and organizing field observations. It allows users to document butterfly sightings in real time, creating digital checklists that can be used for long-term monitoring. The app currently supports butterfly observations but may eventually expand to include other groups such as moths, dragonflies, and damselflies.

A major goal of the project is to generate high-quality biodiversity data that can support scientific research. Researchers interested in analyzing butterfly populations over time can request access to the collected data. Unlike some existing platforms, the team also aims to ensure that contributors receive proper recognition for the observations they submit.

Kunte notes that on many citizen-science platforms, data can be freely downloaded without acknowledging the individuals who collected it. By promoting contributor recognition, the project hopes to encourage greater public participation in biodiversity monitoring.

The development of these apps builds on more than 16 years of work by the Butterflies of India initiative, which has created one of the country's most reliable butterfly databases. The team is now expanding its efforts with two additional applications—iMoth Explorer and iOdonata Explorer—expected to be released later this year.

Together, these tools aim to make biodiversity exploration more accessible while generating valuable scientific data. By helping people identify species, record observations, and learn about the natural world, the apps encourage greater awareness and appreciation of India's rich biodiversity.

Source: <https://www.thehindu.com/life-and-style/two-new-apps-to-identify-and-record-indian-butterflies-launched/article71140435.ece>
<https://www.thehindu.com/>



Environment

Pushing for environmental protection, social organisation distributes eco-friendly green leaf plates, saplings in Lucknow

Lucknow-based social organisation on May 12 distributed over 45,000 eco-friendly green leaf plates and 5,000 saplings/plants at various locations in the city

A Lucknow-based social organisation, Panchtatva, launched a major environmental awareness campaign on May 12, 2026, promoting sustainable development and ecological conservation during the occasion of Bada Mangal. Led by environmental activist Shipra Pathak, the initiative focused on reducing plastic waste and encouraging tree plantation across the city.

Volunteers of the organisation distributed more than 45,000 eco-friendly leaf plates and 5,000 saplings at various Bhandaras (community meal events) organised across Lucknow. Beginning early in the morning, teams spread out to different parts of the city, replacing plastic plates with biodegradable alternatives and spreading awareness about environmental protection.

At several major locations, including Burlington Crossing, devotees were gifted saplings as sacred offerings. Speaking during the campaign, Ms. Pathak urged people to treat the plants not merely as saplings, but as “Prasad” blessed by Lord Hanuman. She highlighted that every tree planted today would help provide clean air for future generations and maintain ecological balance.

She encouraged citizens to pledge to plant at least five saplings and ensure their proper care. According to her, the campaign’s purpose was not limited to distribution alone, but also aimed at developing a deeper sense of respect and responsibility toward nature among people.

The initiative also received support from several social and voluntary organisations, strengthening the broader movement for environmental conservation. Organisers estimated that the use of nearly 8,000 plastic plates was prevented during the event, significantly reducing plastic waste and promoting eco-friendly practices through religious celebrations.

Senior Rashtriya Swayamsevak Sangh activist Krishna Gopal also participated in the campaign and distributed leaf plates and saplings. He stated that environmental conservation is one of the greatest needs of the present time and praised the effort to combine religious festivities with nature protection, calling it a positive step for society.

Source: <https://www.thehindu.com/sci-tech/energy-and-environment/lucknows-panchtatva-distributes-45000-eco-friendly-plates-and-5000-saplings/article70970554.ece>
<https://www.thehindu.com/>



How do volcanoes affect the earth's atmosphere?



Volcanoes significantly affect Earth's atmosphere by releasing vast amounts of gases and particles during eruptions. When a volcano erupts, it sends sulphur dioxide high into the atmosphere, where the gas reacts with water vapour to form aerosols. These aerosols scatter sunlight, so a major eruption can cool Earth's surface for several years. Large eruptions also produce huge clouds of ash and dust that temporarily block sunlight near the eruption site, although most of the ash settles back to the ground within a few weeks.

Volcanic eruptions also release carbon dioxide. Although modern human activities emit far more carbon dioxide than volcanoes, volcanic activity throughout Earth's history has contributed to long-term climate warming. In addition, volcanoes emit compounds that can lead to acid rain and damage the protective ozone layer. Overall, volcanic eruptions have continuously shaped Earth's climate and atmospheric conditions.

Recently, researchers used satellites to study the 2022 Hunga Tonga–Hunga Ha'apai eruption in the South Pacific. They discovered that the eruption released enormous amounts of methane into the stratosphere. There, volcanic ash triggered chemical reactions that converted the methane into formaldehyde. Scientists believe this discovery could help develop new methods to slow global warming, since methane is a highly potent greenhouse gas.

Source: <https://www.thehindu.com/sci-tech/science/how-do-volcanoes-affect-the-earths-atmosphere/article70972577.ece>
<https://www.thehindu.com/>



AGRICULTURE



Improving efficiency of fertilizer use in India

The more fertilizers we use, the more they deplete the soil's organic matter and its holding capacity for water and nutrients, threatening crop yields and pushing farmers to add more fertilizers

India's growing dependence on fertilizers has created serious economic, environmental, and agricultural concerns. Rising global fuel and fertilizer prices, especially due to the ongoing conflict in West Asia, highlight the need for India to improve fertilizer-use efficiency and reduce import dependence. Although India produces around 80% of its urea domestically, the industry still relies heavily on imported fuel. The country is even more dependent on imports for phosphatic fertilizers because it lacks sufficient rock phosphate reserves.

Fertilizers are essential for food security, but their inefficient use has led to massive waste. Despite annual subsidies of nearly ₹2 lakh crore, much of the fertilizer applied is lost through air and water pollution rather than contributing to crop growth. Excessive and imbalanced fertilizer use damages soil fertility, pollutes ecosystems, reduces biodiversity, and contributes to climate change. It also lowers soil organic matter, forcing farmers to use even more fertilizers to maintain yields, creating a harmful "fertilizer trap."

Government measures such as nutrient-based subsidies and neem-coated urea have had limited impact. Organic alternatives like manure, compost, biochar, pulses, and leguminous crops could significantly reduce fertilizer dependence, but these are no longer central to Indian farming systems.

Policy distortions have worsened the problem. Although Minimum Support Prices (MSPs) are announced for many crops, government procurement mainly supports rice, wheat, and sugarcane. Farmers therefore prefer these crops, which consume over two-thirds of India's urea. This has weakened traditional pulse-cereal crop rotations that naturally restore soil nitrogen. India now produces excess rice and sugarcane, much of which is exported or used for bioethanol production, increasing pressure on land, water, and fertilizers.

Promoting pulse-based farming is crucial. Pulses and legumes naturally fix atmospheric nitrogen and require little or no urea. They are also ideal for rain-fed regions and can help tackle India's widespread protein deficiency. However, pulse cultivation has stagnated, forcing the country to import nearly 20% of its demand.

India must encourage crop diversification, improve implementation of pulse-promotion schemes, and expand the use of organic inputs such as manure and compost. Research shows that up to half the recommended fertilizer dose can be replaced with organic alternatives without reducing yields. Investments in crop varieties with higher nutrient-use efficiency can further reduce fertilizer demand.

Sustainable farming practices, better policy coordination, and efficient fertilizer use are essential for ensuring India's long-term food security, environmental protection, and reduced dependence on costly imports.

Source: <https://www.thehindu.com/opinion/op-ed/improving-efficiency-of-fertilizer-use-in-india/article70995382.ece>



AGRICULTURE

Nitrogen-Fixing Genes Offer Hope for Reducing Fertilizer Dependence



Most major crops, including wheat and corn, rely heavily on costly nitrogen fertilizers to grow successfully. Scientists are now exploring a more natural solution: using bacteria to help these crops obtain nitrogen directly from the atmosphere, similar to how peas and beans survive through partnerships with nitrogen-fixing microbes.

Researchers at Washington State University (WSU) have made an important breakthrough in this field by successfully transferring nitrogen-fixing genes from one type of bacteria to another. Their findings could eventually help engineers create bacteria capable of supplying nitrogen to cereal crops, reducing dependence on chemical fertilizers.

The study focused on rhizobia, bacteria naturally able to convert atmospheric nitrogen into a form plants can use. Scientists identified a large group of genes, known as a “symbiosis island,” responsible for both nitrogen fixation and the ability to live within plant roots. Using a newly developed genetic tool, the researchers transferred this gene cluster into bacteria that previously lacked these abilities.

“This research highlights the importance of finding sustainable ways to provide nitrogen to crops,” said Stephanie Porter, associate professor of biological sciences at WSU Vancouver. According to Porter, the team successfully converted ordinary bacteria into nitrogen-harvesting strains in a single step.

Published in *Current Biology*, the research represents more than a decade of work studying endosymbiosis—a process in which microbes and host organisms evolve to live together closely for mutual benefit. These relationships play a major role in ecosystems, supporting processes such as nitrogen fixation in plants and photosynthesis in coral reefs.

The research team, led by postdoctoral scholar Angeliqua Montoya, tested millions of combinations between bacteria and plant cells. Although bacterial mating is normally difficult, their new genetic method significantly improved success rates. Many bacterial strains were successfully transformed, especially those genetically similar to nitrogen-fixing species.

Surprisingly, most new partnerships between bacteria and plants were either beneficial or harmless. This challenges the common belief that newly formed symbiotic relationships begin as harmful interactions before becoming cooperative over time.

The scientists now aim to identify which genes and genetic variations are most important for successful nitrogen fixation. Understanding these factors could help researchers improve the process and apply it to a wider range of crops.

“Our study can encourage further research into transferring nitrogen-fixing genes into new bacterial strains,” Montoya explained. “This will help us understand what makes these relationships successful and how they can be improved.”

The long-term goal is to introduce nitrogen-fixing bacteria into major food crops such as corn, wheat, and soybeans. If successful, this technology could reduce fertilizer costs, lower environmental pollution, and help farmers cope with rising fertilizer shortages worldwide.

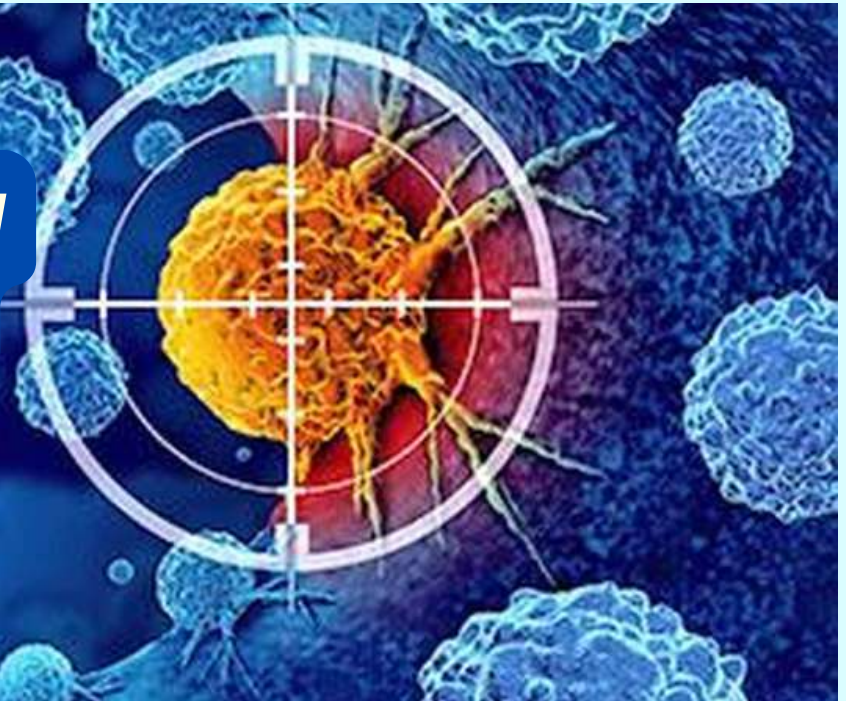
Porter believes the approach has enormous agricultural potential. “We can continue improving these bacterial conversions to help crops naturally access the nitrogen they need,” she said.

This breakthrough marks an important step toward sustainable agriculture, offering the possibility of healthier crops and reduced dependence on synthetic fertilizers in the future.

Source: <https://phys.org/news/2026-05-nitrogen-genes-bacterial-strains-path.html>
<https://phys.org/>



Cancer Immunotherapy May Alter the Brain's Protective Barrier



Researchers have found that PD-1 inhibitors, a common form of cancer immunotherapy, may weaken the blood-brain barrier (BBB) — the protective layer that controls what enters the brain. The study, led by scientists at Technion – Israel Institute of Technology and published in *Cancer Discovery*, suggests this effect is driven by a protein called DKK1.

The BBB normally blocks many cancer drugs from reaching brain tumors. While immunotherapy can activate immune cells that cross into the brain and attack cancer, researchers discovered that anti-PD-1 therapy may also make the barrier more permeable.

In experiments on mice with breast tumors, scientists observed weaker blood vessel support cells, damaged barrier proteins, and increased immune-cell entry into the brain after anti-PD-1 treatment. The mice also developed more brain metastases, indicating that a “leaky” BBB may allow cancer cells easier access to the brain.

Lead researcher Abhilash Deo explained that cancer treatments can sometimes trigger unintended changes in healthy cells, creating conditions that may support cancer spread. Importantly, this effect appeared specific to anti-PD-1 therapy and was not seen with other immune checkpoint inhibitors.

The team identified DKK1 as a key mediator. Plasma from treated mice caused BBB leakage in untreated animals, and removing DKK1 reduced the effect. Patient data supported these findings: lung cancer patients receiving anti-PD-1 therapy showed greater brain spread on MRI scans, while higher DKK1 levels were linked to faster disease progression and poorer treatment response.

Doctors say these findings may explain why immunotherapy responses differ widely in patients with brain metastases. According to Nirmal Raut, some patients respond well, while others develop new brain lesions despite improvement elsewhere in the body. The brain’s immune environment appears to behave differently from organs such as the lung or liver.

The discovery also highlights a possible advantage. Since many chemotherapy drugs cannot cross the BBB, temporarily opening it could improve drug delivery to the brain. Researchers found that combining anti-PD-1 therapy with cisplatin chemotherapy increased drug accumulation in the brain and improved survival in mice.

Experts caution that the effect may be double-edged: while BBB opening could help deliver treatment, it might also allow circulating cancer cells to enter the brain. Researchers believe DKK1 could become a useful biomarker for identifying patients at higher risk of brain metastases during immunotherapy.

Scientists stress that larger human studies are needed before these findings can influence routine cancer treatment.

Source: <https://www.thehindu.com/sci-tech/science/cancer-immunotherapy-may-reshape-brains-barrier-to-metastasis/article70969178.ece>
<https://www.thehindu.com/>



HEALTH

Climate Change Linked to Rise in Antibiotic Resistance in Salmonella

The result suggests that environmental changes can speed up how bacteria adapt to antibiotics

A study published in The Lancet Planetary Health has revealed that 82% of the countries examined experienced an increase in antibiotic resistance genes (ARGs) in Salmonella, an enteric bacterium responsible for food poisoning and typhoid fever. The strongest climate-related increases were observed in the Middle East and North Africa, followed by South Asia and Sub-Saharan Africa.

Bacteria develop antibiotic, or antimicrobial, resistance when they become resistant to the drugs designed to eliminate them. Researchers, including scientists from the Chinese Academy of Sciences, found that antimicrobial resistance (AMR) does not rise uniformly with increasing temperatures. Instead, the abundance of resistance genes changes in a more complex manner over time, influenced by both temperature and rainfall patterns.

The findings suggest that environmental changes can accelerate the rate at which bacteria adapt to antibiotics. The researchers analyzed more than 480,000 Salmonella genome samples collected from 139 countries and regions between 1940 and 2023. Their analysis showed that the global average abundance of antibiotic resistance genes in Salmonella increased by 38% during the study period.

“Climate change is associated with a 10% global rise in the abundance of Salmonella ARGs, with increases observed in 82 out of 100 countries,” the authors wrote.

Previous studies have already highlighted the connection between climate change and antibiotic resistance, suggesting that rising temperatures and more frequent extreme weather events may increase the spread of infectious diseases and, consequently, the use of antibiotics and antimicrobials.

The study also modelled how antibiotic resistance genes in Salmonella could evolve by 2100 under different climate-emission scenarios. The results indicated that if countries achieve low-emission climate targets and strengthen responsible antibiotic-use practices, resistance gene levels could be 24% lower compared to the highest-emission scenario.

The authors emphasized the importance of incorporating climate change into global efforts to monitor and combat AMR. They added that stronger climate action, responsible antibiotic use, and improved disease surveillance across humans, animals, and the environment will be critical in limiting the future spread of antimicrobial resistance.

Source: <https://www.thehindu.com/sci-tech/health/climate-change-linked-with-rise-in-antibiotic-resistance-genes-in-salmonella-analysis/article71028606.ece>
<https://www.thehindu.com/>



HEALTH

CHRONIC STRESS AND SLEEP DEPRIVATION: HIDDEN RISK FACTORS FOR SILENT ARRHYTHMIAS

Heart disease is often associated with dramatic symptoms such as severe chest pain, breathlessness, or sudden collapse. However, some heart conditions develop quietly and remain undetected for years. One such condition is arrhythmia—an abnormal heart rhythm that can have serious consequences if left untreated.

Arrhythmia occurs when the heart beats too fast, too slowly, or irregularly due to disturbances in its electrical system. While some rhythm abnormalities are harmless, others can increase the risk of heart failure, stroke, or even sudden cardiac arrest.

One of the most common forms of arrhythmia is atrial fibrillation (AFib), in which the heart's upper chambers beat irregularly and inefficiently. AFib significantly increases the risk of stroke because irregular heartbeats can lead to blood clot formation, which may travel to the brain. Ventricular arrhythmias are even more dangerous, as they can result in sudden cardiac death. Despite these risks, many people remain unaware that they have the condition.

What makes arrhythmia particularly concerning is that its symptoms are often mild, intermittent, and easily mistaken for stress, anxiety, or fatigue. Common warning signs include occasional palpitations, skipped heartbeats, dizziness, unexplained tiredness, disturbed sleep, and brief episodes of breathlessness. Because these symptoms come and go, many people ignore them or attribute them to a busy lifestyle.

Diagnosis can also be challenging. An abnormal heart rhythm may last only a few minutes or hours before returning to normal. As a result, routine tests such as an ECG may appear normal if performed after the episode has passed, leading to delayed diagnosis.

Traditionally, arrhythmias were considered a condition of older adults. However, they are increasingly being diagnosed in younger individuals with no significant structural heart disease. Modern urban lifestyles have created a perfect environment for rhythm disorders. Chronic stress, long working hours, physical inactivity, smoking, excessive alcohol consumption, and unhealthy eating habits can all affect the heart's electrical stability.



Sleep deprivation is another major contributor, especially among younger adults. Poor sleep disrupts the autonomic nervous system, which plays a vital role in regulating heart rate and rhythm. Persistent lack of sleep can therefore increase the likelihood of developing arrhythmias.

Other risk factors include ageing, high blood pressure, diabetes, obesity, and thyroid disorders. As stress levels rise and populations age, arrhythmias are becoming a growing public health concern.

Awareness is essential because symptoms are often subtle. Wearable devices such as smartwatches can sometimes detect irregular heart rhythms during daily activities and serve as useful screening tools. However, they are not diagnostic devices and may occasionally produce false alarms. If a wearable device detects an irregular rhythm, a medical evaluation should be sought promptly.

Maintaining a healthy lifestyle, managing stress, prioritizing quality sleep, and paying attention to unusual symptoms can help reduce the risk of arrhythmias. Early detection and timely medical care remain the most effective ways to prevent serious complications and protect long-term heart health.

Source: <https://www.thehindu.com/sci-tech/health/chronic-stress-and-lack-of-sleep-are-risk-factors-for-silent-arrhythmias-what-you-should-know/article71047367.ece>
<https://www.thehindu.com/>



OTHERS

How scientists are using ‘DNA maps’ to expose pangolin trafficking hubs

‘International seizures in China seem to have originated both from outside and within the country, with evidence of a network from northeastern India around Arunachal Pradesh and Assam ... feeding Yunnan’

Pangolins are among the world’s most trafficked mammals, even as habitat loss pushes them closer to extinction. Conservationists have long struggled to trace seized pangolin scales back to their source because the DNA in trafficked materials is often badly degraded.

A new study published in PLOS Biology on May 7 offers a major breakthrough. An international team of researchers used advanced genetic sequencing to map trafficking routes for the three most-traded pangolin species: the white-bellied, Sunda, and Chinese pangolins.

To overcome poor DNA quality, the researchers focused on 671 specific points in the pangolin genome that vary between populations. Using 122 museum specimens, they filled major geographic gaps in regions where pangolins have become extremely rare. Combined with hundreds of recent samples, the team created a large genetic database covering all eight pangolin species.

The researchers describe the database as a “genetic map” that can help authorities identify the origin of trafficked pangolins with high accuracy. This could allow enforcement agencies to target poaching hotspots more effectively.

The study also revealed that local and international pangolin trafficking networks are closely connected. Previously, experts often treated domestic and export markets as separate problems. However, the data showed that areas supplying pangolins to local markets frequently overlap with those feeding international smuggling networks. On average, pangolins involved in domestic trade were moved about 454 km from their source.

The researchers identified three major international trafficking hotspots: southwestern Cameroon for white-bellied pangolins, southwestern Borneo for Sunda pangolins, and regions around Myanmar for Chinese pangolins.

According to the study, traffickers often gather scales from several nearby pangolin populations before shipping them abroad, mainly to consumers in China and Vietnam. The findings also suggest a trafficking network linking northeastern India — including Arunachal Pradesh and Assam, and possibly Bhutan — to Yunnan in China, which may further supply Guangdong.

The team said this is the first population genomics study to jointly examine the three most heavily traded pangolin species at such a large geographic scale. Earlier research had focused only on individual species or limited regions.

Illegal wildlife trafficking is a multibillion-dollar global crime. Between 2015 and 2021 alone, authorities recorded more than 1.4 lakh seizures involving plant and animal species worldwide. Yet enforcement agencies have often lacked the tools to trace wildlife products back to their source. Researchers believe this new genetic mapping approach could become a powerful weapon against pangolin trafficking and help protect one of the planet’s most endangered mammals.

Source: <https://www.thehindu.com/sci-tech/energy-and-environment/how-scientists-are-using-dna-maps-to-expose-pangolin-trafficking-hubs/article70988109.ece>, <https://www.thehindu.com/>



OTHERS

Sperm whale 'clicks' have complex patterns similar to human speech

Researchers have revealed that sperm whales, which communicate using clicking sounds, also vary the sounds in ways that resemble how humans use vowels

Sperm whales communicate using short click sequences called codas, long thought to function like a simple “Morse code” based only on timing and rhythm. However, a recent study published in *Proceedings of the Royal Society B* reveals that these vocalisations are far more complex and may share surprising similarities with human speech.

Traditionally, scientists classified codas by the number of clicks and the pauses between them. For example, some codas contain evenly spaced clicks, while others combine pauses with rapid bursts. Different whale groups use distinct coda patterns, suggesting that these communication systems are partly learned rather than entirely instinctive.

Researchers from the University of California, Berkeley, discovered an additional layer of complexity by analysing the acoustic structure of individual clicks. They found that clicks fall into two categories based on their frequency patterns: one with a single dominant frequency and another with two. Similar to human vowel sounds, the researchers labelled these click types “a” and “i.” Importantly, the same coda pattern can be produced using either click type, showing that sperm whales control not only timing but also the quality of the sounds they make.

The study uncovered even more variation. “A” codas are generally longer than “i” codas, and the “i” category itself includes both short and long forms. Such differences resemble how vowel length can affect meaning in human language. Researchers also observed individual differences between whales: some consistently produced longer codas than others, almost like vocal accents.

Another intriguing finding was that one coda can influence the next. Occasionally, the first click of a coda differs from the rest, especially when whales switch between coda types. This suggests that codas are connected rather than isolated signals, much like how sounds in human speech can affect neighbouring sounds.

Scientists say these findings point to parallels between sperm whale communication and human phonology — the system that organises speech sounds. While researchers caution against calling it a true language, the study suggests whale communication is built from multiple interacting features, making it far more sophisticated than previously believed.

Exactly what these codas mean remains unknown. Researchers still do not know whether different patterns correspond to specific messages or situations. Nevertheless, the discovery highlights the remarkable complexity of sperm whale social communication and opens new possibilities for understanding how these animals share information within their groups.

Source: <https://www.thehindu.com/sci-tech/science/sperm-whale-clicks-have-complex-patterns-similar-to-human-speech/article70982438.ece>
<https://www.thehindu.com/>