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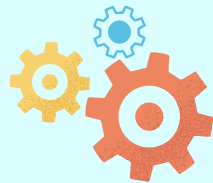


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SCIENCE & TECHNOLOGY

Jammu CSIR lab finds cannabis plant compound has antibiotic effects

The study revealed tetrahydrocannabinol obtained from cannabis could fight methicillin-resistant *Staphylococcus aureus*

Cannabis has the potential to make a dent in India's fight against the escalating threat of antibiotic resistance.

Scientists at CSIR-Indian Institute of Integrative Medicine (IIIM), Jammu, have found that phytocannabinoids, a class of compounds found in the cannabis plant, possess some hitherto unexplored antibiotic properties.



Cannabis being grown in controlled conditions in CSIR-IIIM Jammu.

Antimicrobial resistance (AMR) is a major health concern worldwide. It refers to when bacteria, viruses, fungi, and parasites no longer respond to medicines used to treat them.

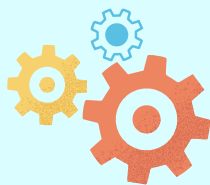
According to Sanghapal D. Sawant, a senior principal scientist at the CSIR-National Chemical Laboratory (NCL), Pune, bacteria have developed certain sophisticated 'shields' over many decades to resist the effects of antibiotic medications.

These include the formation of biofilms – thin sheets of bacterial colonies that are more resistant to antibiotics than when separated – and cellular mechanisms called efflux pumps that flush drugs out from cells. The resulting AMR increases the risk of disease spread, severe illness, and death.

What is India's AMR burden?

According to one estimate, India reported 2.97 lakh deaths in 2019 that could be attributed to AMR and 10.42 lakh others that could be associated with AMR. Reports have also flagged the overuse of antibiotics in India, their misuse in animal husbandry, and poor waste disposal for engendering AMR and potentially rendering India the "AMR capital of the world".

Source: <https://www.thehindu.com/sci-tech/science/csir-iiim-jammu-tetrahydrocannabinol-antibiotic-effects-explained/article67729896.ece>



Scientists create green sustainable fuel from whisky distilling waste

Scientists have used the wastewater from a whisky distillery to create green hydrogen, a sustainable fuel.



Sudhagar Pitchaimuthu (left) and PhD student Michael Walsh with a sample of whisky distillery wastewater

This really should not be taken for an excuse to drink more but researchers at the Heriot-Watt University in Edinburgh used wastewater from the whisky distilling industry to produce green hydrogen, which is a type of sustainable fuel.

They did this by developing a new nanoscale material — a particle is about one-10,000th the diameter of a human hair. This allowed distillery wastewater to replace fresh water in the green hydrogen production process. This nanoparticle is called nickel selenide and it treats the wastewater. This produced similar or slightly higher quantities of green hydrogen compared to fresh water, according to the university.

“It takes 9 kg of water to produce every 1 kg of green hydrogen. Meanwhile, every 1 litre of malt whisky production creates about 10 litres of residue. To help protect the planet, we need to reduce our use of fresh water and other natural resources. So our research focused on how to use this distillery wastewater for green hydrogen production with a simple process that removes waste materials present in the water,” said Sudhagar Pitchaimuthu, co-author of a paper published in the journal *Sustainable Energy & Fuels*, in a press statement.

Unlike fossil fuels, hydrogen does not emit carbon when it burns. Green hydrogen refers to the fuel generated using renewable energy. Green hydrogen is typically produced using electrolysis using electricity from renewable sources like wind or solar. This process produces hydrogen by splitting water molecules into hydrogen and oxygen.

Usually, devices that perform electrolysis or electrolyzers only work with fresh water. The added substances in wastewater usually makes them fail. But the researchers claim they were able to overcome this with the use of the nanoparticle.

Source: <https://indianexpress.com/article/technology/science/scientists-whisky-wastewater-green-hydrogen-9102103/>

Scientists claim this soil-powered fuel cell can ‘run forever’

This fuel cell generates power with the help of microbes in the soil and can potentially be used in green infrastructure and precision agriculture applications.



The 3D-printed top of the microbial fuel cell sticking out of the soil. (Northwestern University)

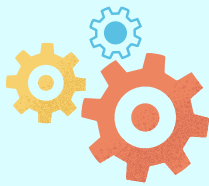
A team led by Northwestern University in Illinois have developed a new fuel cell they claim can harvest energy from microbes living in the soil.

The fuel is around the size of a book and can potentially be used to fuel underground sensors used in green infrastructure and precision agriculture. It could become a sustainable, renewable alternative to batteries that use toxic and flammable chemicals which could leak into the ground when used in the soil. Also, the materials used to manufacture batteries come through conflict-affected supply chains and contribute to electronic waste.

The researchers tested the new fuel cell by using it to power sensors that detect touch and measure soil moisture and published the results in *Proceedings of the Association for Computing Machinery on Interactive, Mobile, Wearable and Ubiquitous Technologies*. The former capability can be used for tracking passing animals. The researchers also added a tiny antenna to the soil-powered sensor to transmit data to a nearby base station by reflecting existing radio frequency signals

“The number of devices in the Internet of Things (IoT) is constantly growing. If we imagine a future with trillions of these devices, we cannot build every one of them out of lithium, heavy metals and toxins that are dangerous to the environment. We need to find alternatives that can provide low amounts of energy to power a decentralized network of devices. In a search for solutions, we looked to soil microbial fuel cells, which use special microbes to break down soil and use that low amount of energy to power sensors. As long as there is organic carbon in the soil for the microbes to break down, the fuel cell can potentially last forever,” said Northwestern alumnus Bill Yen, who led the work, in a press statement.

Source: <https://indianexpress.com/article/technology/science/soil-powered-fuel-cell-run-forever-9113100/>



JNCASR scientists develop brain-like computing with industry compatible nitride semiconductors

They used scandium nitride (ScN) to develop a device mimicking a synapse that controls the signal transmission as well as remembers the signal



A file photo of Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR) in Bengaluru. Apart from JNCASR, researchers from the University of Sydney also participated in this study.

A team of scientists from the Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR) have used scandium nitride (ScN) and Complementary Metal-Oxide-Semiconductor (CMOS) compatibility to develop brain-like computing.

This invention can provide a new material for stable, CMOS-compatible optoelectronic synaptic functionalities at a relatively lower energy cost and also potential to be translated into an industrial product.

According to the Department of Science and Technology, the JNCASR team led by Dhemahi Rao who were working on nitride-based materials used their background for developing hardware for neuromorphic computing. They used ScN to develop a device mimicking a synapse that controls the signal transmission as well as remembers the signal.

“The JNCASR team demonstrates an artificial optoelectronic synapse with ScN thin films that can mimic synaptic functionalities like short-term memory, long-term memory, the transition from short-term to long-term memory, learning–forgetting, frequency selective optical filtering, frequency-dependent potentiation and depression, Hebbian learning, and logic-gate operations,” states the department.

Compared to the existing materials used to demonstrate optoelectronic synapse, ScN is more stable, CMOS compatible, and can be seamlessly integrated with existing Si technology. It can act as a platform for both excitatory and inhibitory functions. The industrial processing techniques of ScN are similar to the existing semiconductor fabrication infrastructure. Response to the optical stimuli also has the advantage of possible integration with photonic circuits known for higher speed and broader bandwidth than electronic circuits.

Source: <https://www.thehindu.com/news/cities/bangalore/jncasr-scientists-develop-brain-like-computing-with-industry-compatible-nitride-semiconductors/article66424094.ece>

The fungi that can freeze water better than bacteria

Pure water struggles to freeze, posing dangers to species adapted to living in cold environs – but life has found a way



Water crystallising on a surface to form ice

Water doesn't always freeze at 0 degrees C. Unlike what we have been taught in school, the transformation of liquid water into ice is more nuanced than dropping the temperature down to its freezing point. Supercooled water found in clouds remains in a liquid state at temperatures as low as minus 40 degrees C.

Scientists have even found that completely pure water can remain unfrozen until it's cooled to temperatures below minus 46 degrees C.

What does water need to freeze?

To freeze, water molecules need to arrange themselves in an ordered way and form a crystalline structure. But ice formation is also kinetically hindered, meaning it requires a bit of extra energy – especially for the first step, called ice nucleation. This energy demand is not small.

To correctly orient themselves to create a crystalline structure, water molecules also need an initiation point, or a nucleus – a place that can serve as a surface on which the ice crystals can grow. This nucleus could be an ice particle or an impurity like dust, minerals, or microorganisms commonly found in water. The lack of these nucleators prevents pure water from freezing, whereas less-pure tap water readily freezes at minus 5 degrees C in our refrigerators.

So pure water struggles to freeze, and this could pose dangers to species adapted to living in cold environs. Then again, life always finds a way. Several microorganisms like bacteria, lichen, and fungi have evolved to manipulate water so that it forms ice more easily. They achieve this with the help of efficient molecular strategies that trigger the nucleation process. This phenomenon is called biological ice nucleation.

Source: <https://www.thehindu.com/sci-tech/science/fusarium-acuminatum-biological-ice-nucleation-study/article67751963.ece>



ENVIRONMENT

2023 was world's hottest year on record, EU scientists confirm

Top scientist says it is "very likely" that 2023 was the warmest year in the last 1,00,000 years



A farmer walks in his dried up field near Yaragatti village in Belagavi district

Last year was the planet's hottest on record by a substantial margin and likely the world's warmest in the last 1,00,000 years, the European Union's Copernicus Climate Change Service (C3S) said on January 9.

Scientists had widely expected the milestone after climate records were repeatedly broken. Since June, every month has been the world's hottest on record compared with the corresponding month in previous years. "This has been a very exceptional year, climate-wise, in a league of its own, even when compared to other very warm years," C3S Director Carlo Buontempo said.

C3S confirmed 2023 as the hottest year in global temperature records going back to 1850. When checked against paleoclimatic data records from sources such as tree rings and air bubbles in glaciers, Mr. Buontempo said it was "very likely" the warmest year in the last 1,00,000 years.

On an average, in 2023 the planet was 1.48 degrees Celsius warmer than in the 1850-1900 pre-industrial period, when humans began burning fossil fuels on an industrial scale, pumping carbon dioxide into the atmosphere.

Countries agreed in the 2015 Paris Agreement to try to prevent global warming surpassing 1.5C (2.7 degrees Fahrenheit), to avoid its most severe consequences.

The world has not breached that target - which refers to an average global temperature of 1.5C over decades - but C3S said that temperatures had exceeded the level on nearly half of the days of 2023 set "a dire precedent".

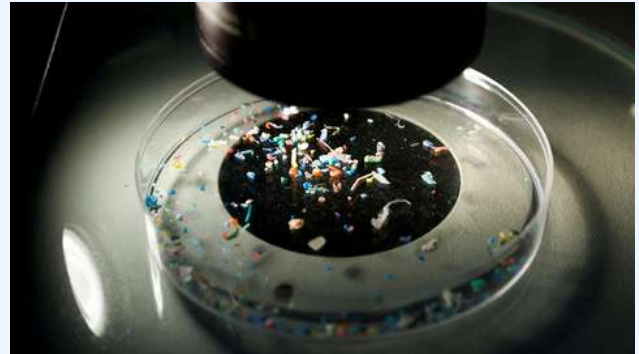
CO2 emissions at record highs

Despite the proliferation of governments' and companies' climate targets, CO2 emissions remain stubbornly high. The world's CO2 emissions from burning coal, oil and gas hit record levels in 2023.

Source: <https://www.thehindu.com/sci-tech/energy-and-environment/2023-was-worlds-hottest-year-on-record-eu-scientists-confirm/article67723209.ece>

Microplastics in the Antarctic studied in penguin droppings and water

Microplastics - particles smaller than 5 millimeters - were a global problem due to large use of plastics and were harmful to life, because they are often ingested, causing accumulation within organisms that can lead to diseases



Marine scientist Anna Sanchez Vidal shows microplastics collected from the sea with a microscope at Barcelona's University, during a research project "Surfing for Science" to assess contamination by microplastics on the coastline, in Barcelona, Spain, July 5, 2022

The amount of microplastics in the Antarctic is being analysed by using nuclear science to study the region's waters, sediment and even penguin droppings.

The new joint investigation launched this weekend by the U.N.'s International Atomic Energy Agency and the Argentine Antarctic Institute (IAA) is part of the IAEA's NUTEC Plastics Initiative that has looked at microplastic pollution in countries around the world.

Rafael Grossi, director general of the IAEA, said that by using nuclear applications, it was possible to determine with good accuracy the amount of pollutants found on the seabed and also where they had come from.

"The health of Antarctica is essential for the health of the planet," Grossi told Reuters from the "white continent", where he visited on Saturday with Argentine President Javier Milei.

"Microplastics are affecting the environment and this place is no exception." The program will use Argentine icebreaker *Almirante Irizar* and scientists will take samples from penguin guano, sediment from the seabed and from the water around the ice sheet to analyze at Argentina's Carlini Base in the Antarctic. Others will be sent to the IAEA research center in Monaco.

"We are paying special attention to the smallest fraction of microplastics and trying to identify their origins," said Lucas Ruberto, researcher at the IAA, adding they would then identify how to clean them up and even prevent them in the first place.

Source: <https://www.thehindu.com/sci-tech/energy-and-environment/microplastics-in-the-antarctic-studied-in-penguin-droppings-and-water/article67722726.ece>



ENVIRONMENT

At least 8 Olive Ridley turtles wash ashore dead along Chennai's southern coast

While the oil spill in early December 2023 in Ennore raised concern on the possible perils to Olive Ridley turtles that visit the beaches of the city to nest, Wildlife Warden E. Prasanth rules out the spillage as the reason for the deaths



Olive Ridley turtle carcasses seen on the beach in Palavakkam along East Coast Road

At least eight Olive Ridley turtles have washed ashore dead along the southern coast of Chennai over the last three days.

As the annual season of turtle nesting begins, so have the deaths. On Tuesday, carcasses of two Olive Ridelys were seen on Thiruvanmiyur beach and at least four near Injambakkam. Residents promptly buried the carcasses in Injambakkam after notifying the Forest Department. They said a few more were found dead over the weekend. When The Hindu visited Palavakkam, two more dead Olive Ridelys were seen.

While the oil spill in early December 2023 in Ennore raised concern on the possible perils to Olive Ridley turtles that visit the beaches of the city to nest, Wildlife Warden E. Prasanth ruled out the spillage as the reason for the deaths.

“It is not [due to] oil spill. From January to March, the beaching of 150 to 200 turtles is normal. In the recent cases, it was confirmed by the vet that there were injury marks, so they may have been hit by trawlers. The ocean current also brings turtles that die in the waters to the shore,” he said. However, Mr. Prasanth added that a clear picture of the effects of the oil spill on Olive Ridley nesting would emerge only as the season progresses.

Forest Department guards and volunteers from organisations, such as the Students' Sea Turtle Conservation Network and TREE Foundation, patrol the beaches to transport turtle eggs to hatcheries as the stray dog menace is high. “Hatcheries in Besant Nagar, Pulicat, Injambakkam, and Kovalam are ready,” Mr. Prasanth said.

Source: <https://www.thehindu.com/sci-tech/energy-and-environment/at-least-8-olive-ridley-turtles-wash-ashore-dead-along-chennais-southern-coast/article67699075.ece>

Carbon benefits of not using cookstoves overestimated: study

Scientists evaluated five methods used to measure emissions reductions of cookstoves and found them all wanting.



Traditional cookstove burning is considered to be one of the largest sources of pollutants in India.

The greenhouse gas-reducing benefit of replacing highly polluting cookstoves has been overestimated by up to 10-fold, researchers reported on January 23.

A peer-reviewed study looked at carbon offset schemes based on getting rid of primitive charcoal- or wood-burning home stoves used by some 2.4 billion people that contribute to global warming and cause millions of pollution-related deaths every year.

Projects to provide cleaner, more efficient alternatives often raise funds by the sales of credits, which are based on estimates of how much carbon the new cookers keep out of Earth's atmosphere -- one credit should equal one tonne of carbon dioxide.

The problem, according to the study published in the journal Nature Sustainability, is that a lack of methodological “rigour” is causing overestimation.

The scientists evaluated five methodologies used to measure emission reductions of the cookstove projects system, and found them all wanting. Data covering some 40% of cookstove credits worldwide showed that 26.7 million carbon credits barely avoided a tenth of the carbon dioxide emissions claimed, about 2.9 million tonnes.

In carbon markets, one credit corresponded to one tonne of carbon dioxide. Extrapolating out across all cookstove projects, the authors estimated credits were overvalued by more than 10-fold. Carbon credits allow corporations -- or countries under certain conditions -- to offset greenhouse gas emissions by investing in projects that avoid carbon dioxide emissions, or remove carbon dioxide from the air.

Source: <https://www.thehindu.com/sci-tech/energy-and-environment/carbon-benefits-cookstoves-overestimated-nature-sustainability/article67772148.ece>



ENVIRONMENT

Scientists explain Antarctica's raving 2022 heatwave in groundbreaking papers

In March 2022, Antarctica experienced an extraordinary heatwave. Large swathes of East Antarctica experienced temperatures up to 40°C (72°F) above normal, shattering temperature records.



Climate scientists don't like surprises. It means our deep understanding of how the climate works isn't quite as complete as we need. But unfortunately, as climate change worsens, surprises and unprecedented events keep happening.

In March 2022, Antarctica experienced an extraordinary heatwave. Large swathes of East Antarctica experienced temperatures up to 40°C (72°F) above normal, shattering temperature records. It was the most intense heatwave ever recorded anywhere in the world.

So shocking and rare was the event, it blew the minds of the Antarctic climate science community. A major global research project was launched to unravel the reasons behind it and the damage it caused. A team of 54 researchers, including me, delved into the intricacies of the phenomenon. The team was led by Swiss climatologist Jonathan Wille, and involved experts from 14 countries. The collaboration resulted in two groundbreaking papers published on 16th January 2024

The results are alarming. But they provide scientists a deeper understanding of the links between the tropics and Antarctica – and give the global community a chance to prepare for what a warmer world may bring.

Head-hurting complexity

The papers tell a complex story that began half a world away from Antarctica. Under La Niña conditions, tropical heat near Indonesia poured into the skies above the Indian Ocean. At the same time, repeated weather troughs pulsing eastwards were generating from southern Africa. These factors combined into a late, Indian Ocean tropical cyclone season.

Source: <https://www.thehindu.com/sci-tech/energy-and-environment/scientists-explain-antarctic-raving-2022-heatwave-in-groundbreaking-papers/article67744430.ece>

IISc study in Arunachal Pradesh reveals how logging and climate change impact Mountain birds

The team found that many bird species have started shifting to higher elevations due to rising temperatures



The IISc. team collected data from the Eaglenest Wildlife Sanctuary in Arunachal Pradesh, which is situated in the biodiversity hotspot of Eastern Himalayas and is home to over 500 bird species.

Researchers at the Indian Institute of Science (IISc.) in Bengaluru have found that logging and climate change pose a threat to montane birds. They studied the effects of forest logging and climate change on bird communities in tropical mountains, by examining over 10 years of data.

In a study published in *Global Ecology and Conservation*, the team used mist netting and bird ringing data to understand how the composition of the mid-elevation Eastern Himalayan understory bird community changed in primary (undisturbed) forests as well as in logged forests. Tropical montane forests are unique ecosystems that can start at about 150-200 metre elevation, and reach up to 3,500 metre high up on mountains around the world. They are critical centres of biodiversity.

“In tropical mountains, each species has a particular niche where it is found. This restriction creates much more diversity in a small space,” said Ritobroto Chanda, former Project Associate at the Centre for Ecological Sciences (CES), IISc., and corresponding author of the study. Forest loss and climate change are major threats to these ecosystems.

“Birds, and indeed much of the flora and fauna of tropical mountain ranges, are extremely temperature-sensitive, and are responding to global heating rapidly. Also, most of the world's terrestrial biodiversity is concentrated in tropical mountains,” said Umesh Srinivasan, Assistant Professor at CES.

Source: <https://www.thehindu.com/sci-tech/energy-and-environment/iisc-study-in-arunachal-pradesh-reveals-how-logging-and-climate-change-impact-montane-birds/article67709047.ece>



AGRICULTURE

'Very sweet' variety gives fresh hope to Pineapple farmers in Kerala

Possibility for mechanised processing for value addition and export being studied



It is estimated that there are more than 10,000 hectares under pineapple cultivation in Kerala.

Farmers are looking at the potential of a pineapple variety, which is yet to be named locally and touted as “very sweet”, suitable for mechanised processing and possibly with shelf life longer than the conventional Mauritius variety widely cultivated in the State.

What has drawn the attention of farmers to the new variety is the possibility of mechanised processing for value addition and export. The Mauritius variety cannot easily be processed. The loss from processing can be as high as 35% to 40%, said a pineapple researcher. But it has other features like being more hardy, making it easy to handle while being dispatched to markets in other parts of the country.

A veteran farmer in Muvattupuzha said that the fruit is larger and weighs around 2.5 kg to 2.7 kg. Its shelf life is to be tested. Only wider cultivation and testing can lead to a firm conclusion on its merits, he added.

Price fall

In the meanwhile, the price of pineapple continued to rule low. The price of best quality green, usually exported to upcountry markets, is ruling at ₹23 to ₹25 a kg while the price of the ripe variety, sold mostly in the Kerala market, is ruling between ₹22 and ₹24 a kg as on Jan 3, 2024.

The formation of Vazhakulam Pineapple Farmer Producer Company has given fresh hope to farmers, who are now reeling under a price fall. The Nadukkara fruit processing plant is in dire straits and little or no market intervention has taken place in recent years due to the financial constraints faced by the company. The crisis gripping the pineapple processing unit has also affected other projects that had been lined up to add value to pineapple farming in the State.

Source: <https://www.thehindu.com/sci-tech/agriculture/very-sweet-variety-gives-fresh-hope-to-pineapple-farmers-in-kerala/article67702243.ece>

Scientists engineer plant microbiome to drastically reduce pesticide use: Study

Scientists claim they have engineered the microbiome of a rice plant, developing a technology that could potentially reduce our dependence on pesticides.



The technology could potentially be used to treat diseases like bacterial blight

An international team of researchers claims they have for the first time engineered the “microbiome” of a plant. This was done to boost the prevalence of good bacteria that protect the plant from disease with hopes of reducing the need for environmentally destructive and deadly pesticides.

The research published in the journal Nature Communications on Tuesday focused on plant microbiomes — the variety of bacteria, fungi, viruses and other microorganisms that live alongside plants. People are growing more aware about the “gut microbiome” — the microorganisms that live in our digestive systems. These microorganisms influence our metabolism, our immune system and many other parts of our life.

Just like how our microbiome affects us, scientists have been investigating how plant’s microbiomes affect their health and how vulnerable they are to diseases, according to the University of Southampton.

“For the first time, we’ve been able to change the makeup of a plant’s microbiome in a targeted way, boosting the numbers of beneficial bacteria that can protect the plant from other, harmful bacteria. This breakthrough could reduce reliance on pesticides, which are harmful to the environment. We’ve achieved this in rice crops, but the framework we’ve created could be applied to other plants and unlock other opportunities to improve their microbiome. For example, microbes that increase nutrient provision to crops could reduce the need for synthetic fertilisers,” said Tomislav Cernava, co-author of the paper, in a press statement.

Source: <https://indianexpress.com/article/technology/science/scientists-engineer-plant-microbiome-9095137/>



AGRICULTURE

Sustainable Agriculture BioPrime launches 'Farmers Cohort' program to equip farmers with crop and region-specific knowledge



In order to equip farmers with crop-specific, region-specific knowledge and skills, preparing them to thrive in the evolving agricultural landscape, BioPrime AgriSolutions, a leading biotechnology company specialised in developing cutting-edge agri-biologicals, has launched “King Farmers Cohort” programme. Cohort participants will receive business and technical assistance over the entire crop cycle through a mixture of focused technical training sessions, mentorships, one-on-one support, and group farm visits.

“The King Farmers Cohort goes beyond yield maximisation and fosters a holistic approach to agriculture, focusing on crucial areas like climate-resilient practices, soil health management, and building profitability. Each cohort will hold four dedicated ‘Technical’ training sessions led by leading researchers, and innovators to provide targeted knowledge focusing on farmers’ crop-specific needs and empower them to adapt to the ever-changing climate and nurture healthy soil, which is the foundation for sustainable success,” BioPrime AgriSolutions informed.

“The learning extends beyond the classroom with designated field days and harvest days in selected farmer fields for practical learning, inspiration, and networking. Thus, creating a forum for peer-to-peer learning, where shared challenges find collaborative solutions and best practices flourish through hands-on experiences. As one farmer who’s participated in an Onion Cohort noted, there’s a great benefit of learning from other farmers with differing amounts of experience and expertise, and the supportive nature of the group created a space to find solutions to problems collaboratively,” the agri biologicals company further said.

To crown it all, BioPrime will organise a valedictory function to commemorate each cohort with rewards for outstanding achievements in yield, profitability, and sustainability through a grand ceremony, adding a layer of motivation that inspires every farmer to reach their highest potential.

Source: <https://agriculturepost.com/farm-inputs/organic-farming/bioprime-launches-king-farmers-cohort-programme-to-equip-farmers-with-crop-and-region-specific-knowledge/>

NITI aayog, agri ministry, FAO launch investment forum for advancing climate resilient agrifood system



NITI Aayog, Ministry of Agriculture and Farmers' Welfare (MoA&FW), and Food and Agriculture Organization (FAO) of the United Nations on Wednesday jointly launched the 'Investment Forum for Advancing Climate Resilient Agrifood Systems in India', an official statement said. The initiative aims to develop an investment and partnership to advance climate-resilient agrifood systems among the government, private sectors, and farmers' organisations, and financial institutions in India, it said.

Delivering the keynote address at the inauguration, NITI Aayog Member Ramesh Chand emphasised on the need for awareness on how agriculture contributes to climate change, citing a contribution of a little more than 13 per cent of the total greenhouse gas emissions in the country.

He observed that agriculture could play a role in carbon sequestration through tree plantation on farmland. Chand also called for a new direction in economic analysis of agriculture production, considering the impact on natural resources, climate change, and future generations.

He proposed incorporating metrics beyond financial prices to evaluate the economic impact of agricultural activities. MoA&FW Secretary Manoj Ahuja highlighted the significance of a multi-stakeholder approach in addressing climate challenges in India.

He stressed on the importance of considering the perspective of small and marginal farmers, who constitute 85 per cent of the farming population in India.

Source: <https://economictimes.indiatimes.com/news/economy/agriculture/niiti-agri-ministry-fao-launch-investment-forum-for-advancing-climate-resilient-agrifood-system/articleshow/107118014.cms>



AGRICULTURE

310 districts in 28 states, UTs highly vulnerable under NICRA: ICAR report

Uttar Pradesh has the highest number of districts where agricultural land may be vulnerable to climate change



A Farmer In Guna Fertilizes His Crop, Guided By Technology

310 districts belonging to 28 states and Union territories (UTs) in India have been categorised as the most vulnerable under the National Innovations on Climate Resilient Agriculture (NICRA). Of the 28 states and Union territories (UTs) listed, Uttar Pradesh has the highest number of vulnerable districts with 22 districts having a "very high" vulnerability and 26 districts being "highly" vulnerable. The Union Minister of Agriculture and Farmers' Welfare Narendra Singh Tomar provided this information in a written reply in Lok Sabha on Tuesday.

The Indian Council of Agricultural Research (ICAR) launched NICRA as a network project in 2011 with the aim of enhancing the resilience of agriculture to climate change and vulnerability in India. ICAR has played an important role in developing 1971 climate-resilient crop varieties since 2014, including 429 tolerant to abiotic stress and 1542 to biotic stress.

"Very high" and "highly" vulnerable districts

The vulnerability of 109 districts belonging to 23 states/union territories have been classified as "very high", while 201 districts belonging to 28 states/Union territories are considered "highly" vulnerable.

In the "very high" category, Uttar Pradesh has the highest number of districts at 22, followed by Rajasthan (17), Bihar (10), and Kerala (8). Other regions, including Uttarakhand, Orissa, Meghalaya, and Punjab had between five to seven "very high" vulnerable districts. West Bengal, Karnataka, Haryana, and Jammu & Kashmir had three districts each. Mizoram, Maharashtra, Madhya Pradesh, Himachal Pradesh, Gujarat, and Assam, all had two districts each. Sikkim, Nagaland, Arunachal Pradesh, and Andhra Pradesh all had one district that fell into the "very high" vulnerability category.

Source: https://www.business-standard.com/india-news/310-districts-in-28-states-uts-highly-vulnerable-under-nicra-icar-report-123120500815_1.html

Government programmes for adoption of digital and innovative farming technologies

Under NeGPA, funding is given to the states for Digital Agriculture projects using emerging technologies like Artificial Intelligence, Machine Learning, Internet of Things and Blockchain



The adoption of modern, smart and innovative farming technologies by farmers depends on various factors such as socioeconomic conditions, geographical conditions, crop grown, and irrigation facilities among many other factors. However, the Government of India supports and facilitates the State governments to promote agriculture throughout the country and infuse modern and smart farming technologies into the agriculture sector. The use of modern machines including Kisan Drones (agricultural drones) is promoted under the Sub-Mission on Agricultural Mechanization, Union Minister of Agriculture and Farmers' Welfare, Arjun Munda said in a written reply in Lok Sabha on 19 December 2023.

Under NeGPA (National e-Governance Plan in Agriculture) programme, funding is given to State governments for Digital Agriculture projects using emerging technologies like Artificial Intelligence, Machine Learning, the Internet of Things (IoT) and Blockchain. A component called "Innovation and Agri-Entrepreneurship Development" has been launched under Rashtriya Krishi Vikas Yojana (RKVY-RAFTAAR) in 2018-19 to promote innovation and agri-entrepreneurship by providing financial support and nurturing the incubation ecosystem. Under this programme, startups are encouraged to use innovative technologies to resolve challenges faced in agriculture and allied sectors. The funds are released to the states based on their proposals, Munda further informed the lower house of the Indian parliament.

Source: <https://agriculturepost.com/policy/government-programmes-for-adoption-of-digital-and-innovative-farming-technologies/>



HEALTH

IIT researchers engineer plant cells to produce drug for cancer

A plant native to India has been overharvested, pushing it to the endangered list; the researchers say the study could pave the way for effective and efficient commercial production of the drug and reduce the need to cut down endangered plants.



Researchers at the Indian Institutes of Technology Madras and Mandi have metabolically engineered plant cells to increase production of anti-cancer drug camptothecin (CPT).

The allopathic medicine is produced using *Nathapodytes nimmoniana*, a native, endangered plant. It requires nearly 1,000 tonnes of plant material to extract 1 tonne of CPT. The International Union for Conservation of Nature has red-listed the plant as in the past decade alone there has been a 20% decline in the plant's population.

The researchers say the study could pave the way for effective and efficient commercial production of the drug and other medicinally important alkaloids and reduce the need to cut down endangered plants. Karthik Raman, Smita Srivastava, professors in the Biotechnology department and Sarayu Murali, and Maziya Ibrahim of Computational Systems Biology Lab of IIT Madras and Shyam K. Masakapalli and Shagun Saini from Metabolic Systems Biology Lab in IIT Mandi comprised the team that conducted the study.

The Science and Engineering Board (SERB) and the Department of Science and Technology funded the research that was published in a peer-reviewed journal *Frontiers of Plant Science*.

Principal investigator Smita Srivastava of Bhupat and Jyoti Mehta School of Biosciences, Department of Biotechnology, said integration of metabolic engineering with bioprocess engineering principles could ensure enhanced and sustainable production of the drug, meeting the increasing market demand in a short time.

Source: <https://www.thehindu.com/sci-tech/health/iit-researchers-engineer-plant-cells-to-produce-drug-for-cancer/article67683237.ece>

A model that provides all TB services under one roof

To strengthen services at primary health facilities, Tamil Nadu has adopted the 'Walk-in Centre - One Stop TB Solution' in which a primary facility is designated as a walk-in TB centre in each block. Over 100 walk-in centres have been rolled out.



India has a stated goal of eliminating tuberculosis by 2025. Accelerated efforts will be required to meet this target. Tamil Nadu has taken a step towards achieving this goal by improving and focusing on services at the primary healthcare level. The State has rolled out walk-in TB centres as a one-stop solution. All services starting with screening to monetary assistance and provision of nutritional supplements will be provided under one roof.

In an article - 'Walk In Centre - One Stop TB Solution - A Model Game Changer in Tuberculosis Control' - published in the State's public health journal, officials of the directorates of Public Health and Preventive Medicine and of Medical and Rural Health Services have outlined the need for strengthening of TB-related services at primary health care facilities and how such walk-in TB centres could improve TB diagnosis, care and support.

According to the Tamil Nadu TB prevalence survey 2019-2022, the prevalence of TB in the State was 210 per lakh population. In 2022, the State had a case notification rate of 126 cases per lakh people. The aim is to achieve the Sustainable Development Goal related to TB by 2025, that is 90% reduction in TB deaths and 80% reduction in TB incidence rate by 2030 compared to the levels in 2015. Early diagnosis and treatment will play a crucial role in achieving this.

The authors - Anandan Mohan, Sudhakar Thangarasu, Palani Sampath, T.S. Selvavinayagam and Asha Frederick - observed that decentralisation of laboratory services was deemed required for patients to receive testing at neighbouring medical facilities. However in fact most testing takes place in secondary and tertiary health facilities.

Source: <https://www.thehindu.com/sci-tech/health/a-model-that-provides-all-tb-services-under-one-roof/article67751293.ece>



HEALTH

Falling in love changes our brain, finds new study

A new study has found that falling in love can change the way your brain works, making you put your loved one on a pedestal.



The study investigated the link between romantic love and the human brain.

We already know that being in love changes the brain by releasing the so-called “love hormone” oxytocin. A new study has found out that when we are in love, our brain reacts differently, making the object of our affections the centre of our lives.

Researchers from The Australian National University (ANU), the University of Canberra and the University of South Australia (UniSA) worked together to measure how a part of the brain is responsible for putting our loved one on a pedestal when we fall in love. The study published in the journal Behavioral Science investigated the link between the human brain’s “behavioural activation system” and romantic love. To study that, researchers surveyed 1,556 young adults who identified as “being in love.”

“We actually know very little about the evolution of romantic love. As a result, every finding that tells us about romantic love’s evolution is an important piece of the puzzle that’s just been started. It is thought that romantic love first emerged some five million years ago after we split from our ancestors, the great apes. We know the ancient Greeks philosophised about it a lot, recognising it both as an amazing as well as traumatic experience. The oldest poem ever to be recovered was in fact a love poem dated to around 2000 BCE,” said study lead Adam Bode in a press statement.

According to the researchers, the way that loved ones take on special importance has something to do with oxytocin combining with dopamine, which is another chemical that human brains release during romantic love. Basically, love activates pathways in our brain associated with positive feelings.

Source: <https://indianexpress.com/article/technology/science/falling-in-love-human-brain-changes-9101742/>

Your bottle of water may contain 2,40,000 plastic pieces, finds study

We already knew that bottled water contained microplastics but how much? A new study indicates a litre of bottled water may contain as much as 2, 40,000 miniscule plastic pieces.



Some of the researchers who conducted the study said they would be cutting down on their bottled water consumption

The packaged bottle of water you drink may be advertised as having come from pristine springs but it may be far worse than you imagined. For the first time new research has detected and categorised how nearly quarter million invisible pieces of tiny nanoplastics can be present in the average litre of bottled water.

It was no mystery that bottled water contains microscopic plastic pieces but we did not quite know how many were present and of what kind until researchers from Columbia University and Rutgers University did the calculations. In a study published in the Proceedings of the National Academy of Sciences on Monday, the researchers documented how the particle level is between 1,10,000 and 4,00,000 plastic pieces per litre, with the average being around 240,000.

The study used a newly-developed laser technology that can find even the smallest of fragments. This increased the number of detectable plastic particles in bottled water by a factor of more than ten and in some cases, 100, according to Time.

A lot of this plastic seems to be coming from the bottle itself, with a large part of the rest coming from the reverse osmosis membrane filter that is used to keep out other contaminants, according to AP. The researchers did not reveal the three brands of bottled water they used in the study because they did not want to single out a few ones before they went and studied more brands. But they did mention that those were commonly available brands in the United States and can be found in a Walmart.

Source: <https://indianexpress.com/article/technology/science/bottled-water-plastic-pieces-study-9101384/>



HEALTH

New antibiotic identified to target a drug-resistant bacterium

The antibiotic zosurabalpin has been evaluated in two phase I clinical trials



Researchers have identified a new class of antibiotics with the potential to tackle a drug-resistant bacterium, *Acinetobacter baumannii*. Zosurabalpin was found to be effective against CRAB (carbapenem-resistant *Acinetobacter baumannii*)-induced pneumonia and sepsis in mouse models.

Writing in *Nature*, Zampaloni et al and Pahil et al reported the identification and analysis of the antibiotic zosurabalpin that can kill *Acinetobacter baumannii*, antibiotic-resistant strains of which are hard to treat in the clinic. Dr. Zampaloni and colleagues identified a tethered macrocyclic peptide (MCP) that selectively kills *A. baumannii*. The compound was further optimised for efficacy and tolerability, and the fine-tuning culminated in zosurabalpin, a drug candidate.

In an article, Morgan K. Gugger and Paul J. Hergenrother, Department of Chemistry, University of Illinois at Urbana-Champaign wrote that copious evidence provided by Zampaloni et al indicates that the antibiotic kills *A. baumannii* through a previously unknown mode of action. It inhibits a key process, transport of the molecule lipopolysaccharide (LPS), by inhibiting a complex of proteins. This complex was essential for transporting LPS to the bacterial surface to create the outer-membrane structure of Gram-negative bacteria. Zosurabalpin blocks LPS transport, and the abnormal build-up of LPS in the cell kills the bacterium.

“It was effective against more than 100 CRAB clinical samples tested in the laboratory and it considerably reduced the levels of bacteria in mice with CRAB-induced pneumonia and prevented the death of mice with a CRAB-induced abnormal immune response called sepsis,” the article said. The antibiotic has been evaluated in two phase I clinical trials.

Source: <https://www.thehindu.com/sci-tech/health/new-antibiotic-identified-to-target-a-drug-resistant-bacterium/article67706338.ece>

IISc study reveals that ageing in cells may increase the spread of ovarian cancer

What you might call in a body ageing, in a cell or tissue, you would call it senescence. According to the researchers, chemotherapy also induces senescence, and that senescence can make things worse



According to the IISc., ovarian cancer is dangerous because it often goes undetected until it has spread beyond the ovaries, and the symptoms can also be attributed to other conditions. Scientists believe that ageing can increase the spread of ovarian and other cancers, but the underlying mechanisms are not fully clear. Now, researchers have found that ovarian cancer cells can spread more easily in tissues that are senescent, or aged, because these tissues secrete a unique extracellular matrix that attracts the spreading cancer.

The researchers used a chemotherapy-induced senescent model to study this phenomenon. They first extracted tissues found in the lining of body cavities from mice models and exposed half of these tissues to chemotherapeutics that are used to treat cancer, pushing them to senescence – a state in which the cells stop replicating, but don't die.

“What you might call in a body ageing, in a cell or tissue, you would call it senescence,” said Ramray Bhat, Associate Professor, Department of Developmental Biology and Genetics (DBG).

The team then exposed both young and aged mouse tissues and human tissue-like cell sheets to ovarian cancer cells. They used time-lapse imaging to tag the normal and cancer cells with different fluorescent markers so that they could be studied under a microscope for extended periods of time.

What they found was that the cancer cells chose to settle down more on the aged tissues. Moreover, they settled closer to the aged normal cells in the cell sheets.

Source: <https://www.thehindu.com/sci-tech/health/iisc-study-reveals-that-ageing-in-cells-may-increase-spread-of-ovarian-cancer/article67743946.ece>



S&T COOPERATION FOR GLOBAL SOUTH

India, Nepal sign power pact, MoU in renewable energy

India's Energy Secretary Pankaj Agrawal and his Nepal counterpart Gopal Sigdel signed the bilateral agreement.



Nepal PM Pushpa Kamal Dahal Prachanda called the agreement a major breakthrough in Nepal's power sector. Nepal's Foreign Ministry said on X: "Various aspects of Nepal-India relations were discussed on the occasion..."

Nepal on January 5, 2024 signed a long-term agreement for the export of 10,000 MW power to India in the next 10 years and an MoU for cooperation in renewable energy while External Affairs Minister S Jaishankar and his Nepal counterpart N P Saud jointly inaugurated 3 cross-border transmission lines. Jaishankar is on a two-day visit to the Himalayan nation.

India's Energy Secretary Pankaj Agrawal and his Nepal counterpart Gopal Sigdel signed the bilateral agreement.

The power export agreement was signed during the 7th meeting of the Nepal-India Joint Commission. On Thursday, an MoU for cooperation in renewable energy was also signed by the Nepal Electricity Authority and National Thermal Power Corporation Limited, India.

"Discussions focused on our overall bilateral ties, trade and economic relations, land, rail and air connectivity projects, cooperation in defence and security, agriculture, energy, power, water resources, disaster management, tourism, civil aviation, people to people and cultural exchange and development partnership," Jaishankar said on X.

Nepal PM Pushpa Kamal Dahal Prachanda called the agreement a major breakthrough in Nepal's power sector. Nepal's Foreign Ministry said on X: "Various aspects of Nepal-India relations were discussed on the occasion..."

Source: <https://indianexpress.com/article/india/india-nepal-sign-power-pact-mou-in-renewable-energy-9095795/>

A bold Budget can pave way for India to be Global South's voice

The recent G20 summit in New Delhi showcased India's growing influence in global fora, with the theme "One Earth, One Family, One Future" highlighting the importance of environmentally sustainable and responsible actions for green development. To sustain India's influence, follow-up measures should be announced in the upcoming Union Budget 2024-25.



Modi says his country is "becoming the voice of the Global South"

The recent G20 summit held under the chairmanship of India in New Delhi amply demonstrated India's growing stature in the world arena in terms of its role and influence in various global fora. The G20 was a meticulously planned year-long event culminating into the Summit in September 2023. The theme of the G20 Presidency was declared as "One Earth, One Family, One Future" signifying LiFE (Lifestyle for Environment) and highlighting the importance of environmentally sustainable and responsible actions for a green and sustainable development. India was instrumental in securing the consensus on the resolution and granting permanent member status to the 55 - member African Union which shows the crucial role played by India in voicing the interests of the Global South.

Perhaps, it is now time to build on the success of G20 summit and bring the Global South countries on board to proactively take forward the decisions and aspirations of the summit. Considering India has time and again raised its voice on behalf of the Global South in various international meetings and in providing humanitarian assistance during calamities and the COVID-19 pandemic, India is appropriately positioned to contribute towards the collective development of the Global South. To sustain the influence and voice of India it is essential that quick on the heels of G20 summit some follow up measures can be announced through the instrument of the Union Budget 2024-25.

Source: <https://economictimes.indiatimes.com/news/economy/policy/paving-the-way-for-global-south-development-through-bold-union-budget-initiatives/articleshow/106922929.cms>



OTHERS

These microbial heroes are saving corals from climate change, finds study

Scientists have discovered that the presence of a certain single-celled microbe could be key to the survival of some corals.



*The virescent sea-whip (*Paramuricea clavata*) is an important part of the Mediterranean temperate reefs that are currently under threat*

Not all heroes wear capes, especially the ones that are single-celled microbes. Researchers discovered for the first time that the presence of certain microbes can tell them whether the coral will survive heat stress, often brought about by climate change.

“This is the first time that a non-algae microbe has been shown to influence the ability of corals to survive a heat-stress event. As corals face more and more heat-stress events due to climate change, a better understanding of all the microbes that may influence survivability can inform conservation practitioners as to which corals they should prioritize for intervention, said the study’s senior author Javier del Campo, in a press statement. Del Campo is an adjunct professor at the University of Miami Rosenstiel School of Marine, Atmospheric, and Earth Science and the Institute of Evolutionary Biology IBE: CSIC-UPF in Barcelona, which led the study.

The international team of researchers collected samples of corals from across the Mediterranean Sea and analysed the bacteria that live with the corals. They then sequenced two types of rRNA to look at the bacteria and other single-celled organisms found in the microbiome of the virescent sea-whip, which is a species of soft coral. After that, they subjected the samples to heat stress to see how they withstood it.

Source: <https://indianexpress.com/article/technology/science/microbe-saving-coral-climate-change-9111960/>

Supernova ‘missing link’ between dead stars, black holes discovered

Scientists have discovered a special "compact remnant" that can help confirm what exactly happens to a dead star after it explodes.



Artist's impression of a star exploding while its companion is in the foreground.

Astronomers have found a direct link between the explosive deaths of massive stars and the formation of black holes and neutron stars, which are the most compact and mysterious objects in the universe.

Two teams observed the immediate aftermath of a supernova explosion in a nearby galaxy and found evidence for the mysterious compact object that is left behind. The teams used data from two telescopes — The European Southern Observatory’s Very Large Telescope (VLT) and ESO’s New Technology Telescope (NTT)

When stars much more massive than our sun reach the end of their lives, their own gravity makes them collapse so fast that it causes a violent explosion called a supernova. Astronomers are of the opinion that after the explosion, the ultra-dense core or “compact remnant” of the star is all that remains. And, depending on how much more massive the star was, the remnant will become either a neutron star or a black hole.

A neutron star is an object so dense that a teaspoon of its material would weigh around a trillion kilograms on Earth. A black hole is even more dense with gravity so strong that nothing, not even light, can escape.

This compact remnant theory is held under the many clues hinting about the chain of events as a star explodes. But astronomers have never seen direct evidence of a supernova leaving behind a compact remnant, according to ESO. But that changed in 2022 when South African amateur astronomer Berto Monard discovered the supernova SN 2022jli in the spiral arm of the nearby galaxy NGC 157. It was located about 75 million light-years away and looking at its aftermath, researchers found peculiar behaviour.

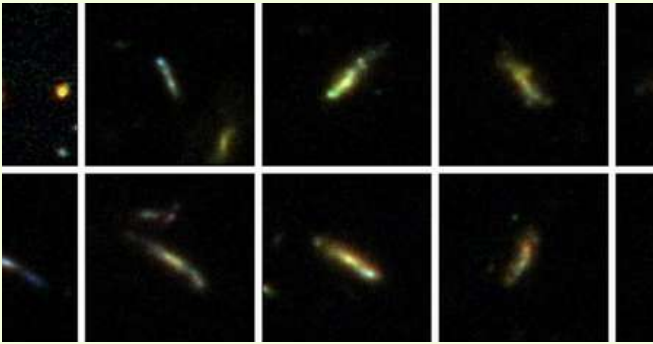
Source: <https://indianexpress.com/article/technology/science/supernova-missing-link-black-hole-neutron-stars-9106510/>



OTHERS

The early Universe was in banana shape

According to an analysis of new images from the James Webb Space Telescope, baby galaxies were neither eggs nor discs. They were bananas. That is the tentative conclusion of a team of astronomers who reexamined images of some 4,000 newborn galaxies observed by Webb at the dawn of time.



Photos of galaxies, all with an elongated shape suggestive of bananas or pickles, captured by the James Webb Space Telescope.

What does a newborn galaxy look like?

For the longest time, many astrophysicists and cosmologists have assumed that newborn galaxies would look like the orbs and spidery discs familiar in the modern universe.

But according to an analysis of new images from the James Webb Space Telescope, baby galaxies were neither eggs nor discs. They were bananas, Or pickles, or cigars, or surfboards — choose your own metaphor. That is the tentative conclusion of a team of astronomers who reexamined images of some 4,000 newborn galaxies observed by Webb at the dawn of time.

“This is both a surprising and unexpected result, though there were already hints of it with Hubble,” said Viraj Pandya, a postdoctoral fellow at Columbia University, referring to the Hubble Space Telescope. He is the lead author of a paper soon to be published in the *Astrophysical Journal* under the provocative title “Galaxies Going Bananas.” Pandya is scheduled to give a talk about his work Wednesday at a meeting of the American Astronomical Society in New Orleans.

If the result holds, astronomers say that it could profoundly alter their understanding of how galaxies emerge and grow. It could also offer insight into the mysterious nature of dark matter, an unknown and invisible form of matter that astronomers say makes up a major part of the universe and outweighs atomic matter 5-to-1. Dark matter engulfs galaxies and provides the gravitational nurseries in which new galaxies arise.

The result builds on hints from earlier observations from the Hubble telescope that the earliest galaxies were shaped like pickles, said Joel Primack, an astronomer at the University of California, Santa Cruz, and an author of the new paper.

Source: <https://indianexpress.com/article/technology/science/the-early-universe-was-bananas-9097690/>

Human intelligence: how cognitive circuitry, rather than brain size, drove its evolution

Brains take up at about 2% of typical human body weight, running them uses around 20% of our metabolism



Humans have demonstrated that having large brains are key to our evolutionary success, and yet such brains are extremely rare in other animals. Most get by on tiny brains, and don't seem to miss the extra brain cells (neurons).

It's one of the great paradoxes of evolution. Humans have demonstrated that having large brains are key to our evolutionary success, and yet such brains are extremely rare in other animals. Most get by on tiny brains, and don't seem to miss the extra brain cells (neurons).

Why? The answer that most biologists have settled on is that large brains are costly in terms of the energy they require to run. And, given the way natural selection works, the benefits simply don't exceed the costs.

But is it just a matter of size? Does the way our brains are laid out also affect their costs? A new study, published in *Science Advances*, has produced some intriguing answers.

All our organs have running costs, but some are cheap and others expensive. Bones, for example, are relatively cheap. Although they make up around 15% of your weight, they only use 5% of your metabolism. Brains are at the other end of the spectrum, and at about 2% of typical human body weight, running them uses around 20% of our metabolism. And this without doing any conscious thinking – it even happens when we're asleep.

For most animals, the benefits of serious thinking are simply not worth it. But for some reason – the greatest puzzle in human evolution, perhaps – humans found ways to overcome the costs of having a larger brain and reap the benefits.

All this is fairly well known, but there is a more tantalising question. Certainly humans have to bear the greater costs of our brains because they are so large, but are there different costs because of the special nature of our cognition? Does thinking, speaking, being self-conscious or doing sums cost more than typical day-to-day animal activities?

Source: <https://www.thehindu.com/sci-tech/science/human-intelligence-how-cognitive-circuitry-rather-than-brain-size-drove-its-evolution/article67683159.ece>