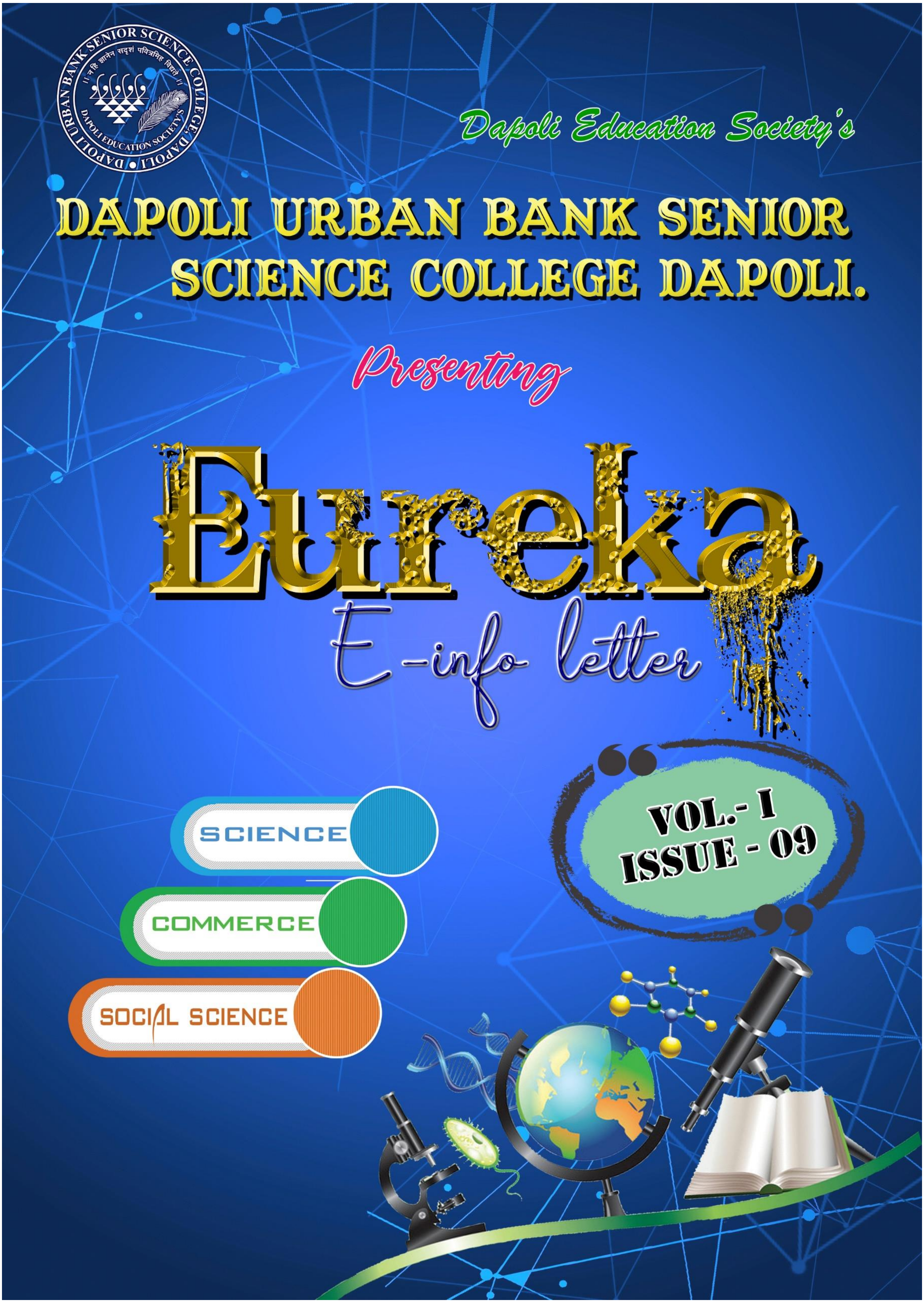
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I, Shri Dr. S. P. Jagadale hereby declared that the particulars given above are true to the best of my knowledge and belief.

Sign /-
(Dr. S.P. Jagadale, Principal)
(The editor and publisher may not agree with the views expressed in articles.)

# Plants Use RNA to Talk to Neighbours

A study finds that plants sharing the same growth medium can exchange micro RNAs that silence genes in the recipient, suggesting the nucleic acids may act as signalling molecules.

Plants use a variety of mechanisms to communicate with other organisms, including one another. Volatile compounds can signal flowering and attract pollinators, for instance, and mycorrhizal fungal networks can transmit warnings or transfer resources. Small RNAs are on that list of communication molecules, and new findings confirm their potential: according to a paper published October 14 in Nature Plants, the plant Arabidopsis thaliana secretes micro RNAs (miRNAs)—a type of small, single-stranded RNAs—into its liquid growth medium. Nearby individuals then take up these RNAs, which alter their gene expression patterns by binding to messenger RNAs and preventing certain genes from being translated into proteins (a process known as RNA interference).

Hailing Jin, a plant molecular geneticist at the University of California, Riverside, who was not involved in the study, says it's exciting to see that plants can take up micro RNAs from the environment, including those "secreted by other plants through the roots."

That small RNAs can be exchanged between different organisms is not new. In addition to their role as regulators of gene expression within an individual—as part of development or in response to stress—they have been implicated in defence against pathogens in recent years. For instance, Arabidopsis cells infected with the pathogenic fungus Botrytis cinerea secrete small RNAs packed in extracellular vesicles that, when delivered into their attacker, inhibit its virulence. Plants are also able to take up sprayed RNA molecules targeting genes from pathogens. The recent findings are the first evidence of plants taking up RNA secreted by other plants into the environment.

"The results were totally unexpected," Pierdomenico Perata, a plant physiologist at the Sant Anna School of Advanced Studies in Pisa, Italy, and coauthor on the study, writes in an email to The Scientist. Given RNAs' reputation as "highly unstable" molecules outside of a cell, he writes his team "expected miRNA to be incompatible with a non-sterile environment such as the growth medium."

Perata relates that his team was working "on a totally unrelated topic"—exploring the role of RNA interference under limited oxygen availability—and it was for that purpose that they hydroponically grew

Arabidopsis plants engineered to produce large quantities of specific miRNAs. As they simply wanted them to produce seeds, he adds, the researchers "didn't care about placing different plant lines in separate trays." But then they noticed that wild type plants sharing the mutants' hydroponic solution had phenotypes different from those expected—for example, those growing next to mutants that over expressed miRNAs targeting developmental genes had their own flowering time altered. According to Perata, that's when he and his colleagues wondered "if miRNAs could be released in the liquid growth medium, thereby affecting the phenotype of wild type plants."

The researchers tested the hydroponic solution, and lo and behold, they detected miRNAs. These miRNAs were present regardless of whether the plants growing in the solution were wild type or mutated to over express them, although more RNAs were detected in the mutants' solution. Furthermore, cultivating both lines in the same solution resulted in wild type plants with notably lower expression levels of the genes targeted by the mutants' boosted miRNA molecules. Applying miRNAs extracted from the mutants or chemically synthesized equivalents also reduced gene expression.

Why would a plant need to affect another plant's gene expression? One possibility, Perata posits, is that "sharing information by exchanging RNA would allow plants experiencing a stress to warn nearby plants, not yet affected by the stress." Competition could be another explanation, he writes; for instance, if a plant releasing miRNAs "could inhibit physiological functions in a nearby plant," it could gain "a competitive advantage for the use of resources."

One unanswered question is how the plants take up these tiny molecules from the environment. Previous work studying RNA exchange between plants and pathogens suggests that exosomes, a type of vesicles that can act as delivery vehicles, might be involved in the process. However, the researchers found that applying extracted, presumably naked miRNAs or synthetic RNAs had an effect in gene expression, suggesting that exosomes aren't needed for uptake.

Hui-Shan Guo, a plant microbiologist at the Institute of Microbiology at the Chinese Academy of Sciences, says the study's evidence for naked RNA uptake confirms previous reports of gene silencing via sprayed-on RNA. She suggests in an email to The Scientist that, as with nutrients, plants might actively assimilate small RNAs from the environment. But unlike the substances plants are known to import, naked RNA molecules "were thought instable," she says, so "RNA uptake was ignored or underestimated."

Jin agrees that the evidence in the paper supports the hypothesis that plants can uptake naked miRNA, but she says she wonders whether their secretion still occurs via exosomes from roots—a question the authors did not explore. She adds she also suspects that these vesicles could protect the miRNAs, helping the plants to accomplish a more efficient uptake. Otherwise, the molecules could be more easily degraded in the soil and in the environment, she speculates.

Guo points out that, as this mechanism has only been explored in hydroponically grown plants, it's not yet clear "whether seedlings growing in soil would have effects on regulation of gene expression in [nearby] plants"—something future studies could examine.

Jin adds that these new findings open a lot of new questions, and that there is likely much more to learn about the role of RNA in plant communication. What we currently know about it is just the "tip of the iceberg," she concludes.

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# Soap molecule could help make alternative LED tech commercially viable

**LEDs are normally made from silicon**

Adding a molecule normally used in detergent to an infrared LED could make devices that are easier to manufacture, require less energy and display richer colours than existing ones.

Solar cells and LEDs made from perovskite, a titanium and calcium crystal, have long held promise as being more efficient and easier to produce than commonly used silicon-based devices, but making them both stable and efficient enough to rival silicon's commercial success has proved difficult.

Now, Dawei Di at Zhejiang University in China and his colleagues have developed an infrared perovskite LED device that lasts for more than 10,000 hours, similar to typical silicon LEDs, while also matching on efficiency. The next best perovskite LEDs had only lasted for a few hundred hours before becoming unstable.

"Before we saw our LEDs operating for months without degrading, I personally thought it was impossible," says Di. "But now we think OK, near-infrared perovskite LEDs can last for a very long time."

The key to this improved stability, says Di, is the introduction of a molecule called sulfobetaine 10 (SFB10), which is typically used as a detergent. The molecule attracts positive and negative ions that would normally move freely around in the perovskite crystal structure and compromise its stability. But with SFB10, the ions are prevented from moving.

"If we don't use this dipolar molecular stabiliser, the ions can move and the structure of the perovskite can change… eventually it will decompose into, for example, lead iodide and other organic compounds, which are completely useless for light emission," says Di.

While infrared LEDs aren't suitable for ordinary lighting, it should be possible to apply the same techniques to produce visible light LEDs. "There shouldn't be any problem in principle for us to achieve similar stability results for the green, and for the red," says Di, though blue light may prove more difficult.

The efficiency and stability results from this new perovskite cell are very impressive, says Kyle Frohna at the University of Cambridge. "I think this sort of approach should be immediately tried in some visible LEDs because it's very promising," he says.

**Reference**

Journal reference: Nature Photonics, DOI: 10.1038/s41566-022-01046-3

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# Turing Machines

"There will positively be no internal alteration [of the computer] to be made even if we wish suddenly to switch from calculating the energy levels of the neon atom to the enumeration of groups of order 720. It may appear somewhat puzzling that this can be done. How can one expect a machine to do all this multitudinous variety of things? The answer is that we should consider the machine to be doing something quite simple, namely carrying out orders given to it in a standard form which it is able to understand."

Turing machines, first described by Alan Turing in Turing 1936–7, are simple abstract computational devices intended to help investigate the extent and limitations of what can be computed. Turing's 'automatic machines', as he termed them in 1936, were specifically devised for the computing of real numbers. They were first named 'Turing machines' by Alonzo Church in a review of Turing's paper (Church 1937). Today, they are considered to be one of the foundational models of computability and (theoretical) computer science. Turing gave a brilliant demonstration that everything that can be reasonably said to be computed by a human computer using a fixed procedure can be computed by such a machine. As Turing claimed, any process that can be naturally called an effective procedure is realized by a Turing machine. This is known as Turing's thesis. Enter Alonzo Church (1903--1995). Over the years, all serious attempts to give precise yet intuitively satisfactory definitions of a notion of effective procedure (what Church called effectively calculable function) in the widest possible sense have turned out to be equivalent---to define essentially the same class of processes. In his original paper, Turing established the equivalence of his notion of effective procedure with his automatic machine (a-machine) now called a Turing machine. Turing then showed the formal equivalence of Turing machines with λ-definable functions, the formalism in which Church and Kleene first worked from 1931–1934, and the formalism in which Church first stated his thesis in 1934 privately and informally to Gödel. The Church-Turing thesis states that a function on the positive integers is effectively calculable if and only if it is computable. An informal accumulation of the tradition in S. C. Kleene (1952) has transformed it to the Computability thesis: there is an objective notion of effective computability independent of a particular formalization. The informal arguments Turing sets forth in his 1936 paper are as lucid and convincing now as they were then. To us it seems that it is the best introduction to the subject, and we refer the reader to this superior piece of expository writing. Back then, computers were people; they compiled actuarial tables and did engineering calculations. As the Allies prepared for World War II they faced a critical shortage of human computers for military calculations. When men left for war the shortage got worse, so the U.S. mechanized the problem by building the Harvard Mark 1, an electromechanical monster 50 feet long. It could do calculations in seconds that took people hours.

The British also needed mathematicians to crack the German Navy's Enigma code. Turing worked in the British top-secret Government Code and Cipher School at Bletchley Park. There code-breaking became an industrial process; 12,000 people worked three shifts 24/7. Although the Polish had cracked Enigma before the war, the Nazis had made the Enigma machines more complicated; there were approximately 10114 possible permutations. Turing designed an electromechanical machine, called the Bombe, that searched through the permutations, and by the end of the war the British were able to read all daily German Naval Enigma traffic. It has been reported that Eisenhower said the contribution of Turing and others at Bletchley shortened the war by as much as two years, saving millions of lives. As the 1950s progressed business was quick to see the benefits of computers and business computing became a new industry. These computers were all Universal Turing Machines—that's the point, you could program them to do anything.

By the 1970s a generation was born who grew up with "electronic brains" but they wanted their own personal computers. The problem was they had to build them. In 1975 some hobbyists formed the Homebrew Computer Club; they were excited by the potential the new silicon chips had to let them build their own computers.

One Homebrew member was a college dropout called Steve Wozniak who built a simple computer around the 8080 microprocessor, which he hooked up to a keyboard and television. His friend Steve Jobs called it the Apple I and found a Silicon Valley shop that wanted to buy 100 of them for $500 each. Apple had its first sale and Silicon Valley's start-up culture was born. Another college drop-out, Bill Gates, realized that PCs needed software and that people were willing to pay for it—his Microsoft would sell the programs.

Turing's legacy is not complete. In 1950 he published a paper called "Computing machinery and intelligence." He had an idea that computers would become so powerful that they would think. He envisaged a time when artificial intelligence (AI) would be a reality. But, how would you know if a machine was intelligent? He devised the Turing Test: A judge sitting at a computer terminal types questions to two entities, one a person and the other a computer. The judge decides which entity is human and which the computer. If the judge is wrong the computer has passed the Turing Test and is intelligent. sAlthough Turing's vision of AI has not yet been achieved, aspects of AI are increasingly entering our daily lives. Car satellite navigation systems and Google search algorithms use AI. Apple's Siri on the iPhone can understand your voice and intelligently respond. Car manufacturers are developing cars that drive themselves; some U.S. states are drafting legislation that would allow autonomous vehicles on the roads. Turing's vision of AI will soon be a reality. In 1952 Turing was prosecuted for gross indecency, as being gay was then a crime in Britain. He was sentenced to chemical castration. It's believed that this caused depression, and in 1954 Turing committed suicide by eating an apple poisoned with cyanide. Outside of academia Turing remained virtually unknown because his World War II work was top-secret. Slowly word spread about Turing's genius, his invention of the computer and artificial intelligence, and after a petition campaign in 2009, the British Prime Minister Gordon Brown issued a public apology that concluded:

"…on behalf of the British government, and all those who live freely thanks to Alan's work, I am very proud to say: we're sorry. You deserved so much better."

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https://blogs.scientificamarican.com

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# Importance of Graph Theory

**INTRODUCTION:**

Graph theory, branch of mathematics concerned with networks of points connected by lines. The subject of graph theory had its beginnings in recreational math problems (see number game), but it has grown into a significant area of mathematical research, with applications in chemistry, operations research, social sciences, and computer science.

**HISTORY:**

The history of graph theory may be specifically traced to 1735, when the Swiss mathematician Leonhard Euler solved the Königsberg bridge problem. The Königsberg bridge problem was an old puzzle concerning the possibility of finding a path over every one of seven bridges that span a forked river flowing past an island—but without crossing any bridge twice. Euler argued that no such path exists. His proof involved only references to the physical arrangement of the bridges, but essentially he proved the first theorem in graph theory.

**GRAPH THEORY AND ITS IMPORTANCE:**

Graph Theory is an ordered pair G=(V, E) where V stands for the set of vertices or nodes and E stands for set of edges or lines formed by connecting pair of two vertices.

As used in graph theory, the term graph does not refer to data charts, such as line graphs or bar graphs. Instead, it refers to a set of vertices (that is, points or nodes) and of edges (or lines) that connect the vertices. When any two vertices are joined by more than one edge, the graph is called a multigraph. A graph without loops and with at most one edge between any two vertices is called a simple graph. Unless stated otherwise, graph is assumed to refer to a simple graph. When each vertex is connected by an edge to every other vertex, the graph is called a complete graph. When appropriate, a direction may be assigned to each edge to produce what is known as a directed graph, or digraph.

An important number associated with each vertex is its degree, which is defined as the number of edges that enter or exit from it. Thus, a loop contributes 2 to the degree of its vertex. For instance, the vertices of the simple graph shown in the diagram all have a degree of 2, whereas the vertices of the complete graph shown are all of degree 3. Knowing the number of vertices in a complete graph characterizes its essential nature. For this reason, complete graphs are commonly designated Kn, where n refers to the number of vertices, and all vertices of Kn have degree n − 1. (Translated into the terminology of modern graph theory, Euler’s theorem about the Königsberg bridge problem could be restated as follows: If there is a path along edges of a multigraph that traverses each edge once and only once, then there exist at most two vertices of odd degree; furthermore, if the path begins and ends at the same vertex, then no vertices will have odd degree.

Another important concept in graph theory is the path, which is any route along the edges of a graph. A path may follow a single edge directly between two vertices, or it may follow multiple edges through multiple vertices. If there is a path linking any two vertices in a graph, that graph is said to be connected. A path that begins and ends at the same vertex without traversing any edge more than once is called a circuit, or a closed path. A circuit that follows each edge exactly once while visiting every vertex is known as an Eulerian circuit, and the graph is called an Eulerian graph. An Eulerian graph is connected and, in addition, all its vertices have even degree.

In 1857 the Irish mathematician William Rowan Hamilton invented a puzzle (the Icosian Game) that he later sold to a game manufacturer for £25. The puzzle involved finding a special type of path, later known as a Hamiltonian circuit, along the edges of a dodecahedron (a Platonic solid consisting of 12 pentagonal faces) that begins and ends at the same corner while passing through each corner exactly once. The knight's tour (see number game: Chessboard problems) is another example of a recreational problem involving a Hamiltonian circuit. Hamiltonian graphs have been more challenging to characterize than Eulerian graphs, since the necessary and sufficient conditions for the existence of a Hamiltonian circuit in a connected graph are still unknown.

**CONCLUSION :**

In mathematics Graph theory is the best appliable research area Nowadays .There are so many problems that needs solutions in Graph theory which has to be solved.

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# Mangrove Forests Expand and Contract with A Lunar Cycle

The glossy leaves and branching roots of mangroves are downright eye-catching, and now a study finds that the moon plays a special role in the vigor of these trees.

Mangroves are coastal trees that provide habitat for fish and buffer against erosion (*SN: 9/14/22*). But in some places, the forests face a range of threats, including coastal development, pollution and land clearing for agriculture. To get a bird's-eye view of these forests, Neil Saintilan, an environmental scientist at Macquarie University in Sydney, and his colleagues turned to satellite imagery. Using NASA and U.S. Geological Survey Landsat data from 1987 to 2020, the researchers calculated how the size and density of mangrove forests across Australia changed over time.

After accounting for persistent increases in these trees' growth — probably due to rising carbon dioxide levels, higher sea levels and increasing air temperatures — Saintilan and his colleagues noticed a curious pattern. Mangrove forests tended to expand and contract in both extent and canopy cover in a predictable manner. "I saw this 18-year oscillation," Saintilan says. That regularity got the researchers thinking about the moon. Earth's nearest celestial neighbor has long been known to help drive the tides, which deliver water and necessary nutrients to mangroves. A rhythm called the lunar nodal cycle could explain the mangroves' growth pattern, the team hypothesized.

Over the course of 18.6 years, the plane of the moon's orbit around Earth slowly tips. When the moon's orbit is the least tilted relative to our planet's equator, semidiurnal tides — which consist of two high and two low tides each day — tend to have a larger range. That means that in areas that experience semidiurnal tides, higher high tides and lower low tides are generally more likely. The effect is caused by the angle at which the moon tugs gravitationally on the Earth.

Saintilan and his colleagues found that mangrove forests experiencing semidiurnal tides tended to be larger and denser precisely when higher high tides were expected based on the moon's orbit. The effect even seemed to outweigh other climatic drivers of mangrove growth, such as El Niño conditions. Other regions with mangroves, such as Vietnam and Indonesia, probably experience the same long-term trends, the team suggests.

**Reference:-**

https://www.sciencenews.org/article/mangrove-forest-grow-moon-orbit-lunar-cycle

***Article by***

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# Facts in Sea Turtles

**Sea turtles**, sometimes called **marine turtles** are the are reptiles. They found in all oceans except for the polar regions. For more than 100 million years sea turtles have covered vast distances across the world's oceans, filling a vital role in the balance of marine habitats. Living in the ocean therefore means they usually migrate over large distances. They migrate to reach their spawning beaches, which are limited in numbers. All sea turtles have large body sizes, which is helpful for moving large distances. Large body sizes also offer good protection against the large predators (notably sharks) found in the ocean.

**Following are the interesting facts of the sea Turtle:**

- Sea turtles takes decades to reach sexual maturity.
- Mature sea turtles may migrate thousands of miles to reach breeding sites.
- They maintain an internal environment that is hypotonic to the ocean.
- They are air-breathing reptiles that have lungs, so they regularly surface to breathe.
- Sea turtles spend a majority of their time underwater, so they must be able to hold their breath for long periods.
- Majority of Sea turtles are omnivorous in their entire life.
- Climate change may also cause a threat
- to sea turtles.
- The sand temperature at nesting beaches defines the sex of a sea turtle.
- They even sleep underwater.
- Most sea turtles spend their entire life at sea, only returning to nesting beaches to lay eggs.
- Sea turtles lay their eggs in a nest they dig in the sand with their rear flippers.
- The group of eggs is called a clutch.
- The sex of sea turtles, like many other turtles, is determined by the temperature in the nest.
- Cooler incubation temperatures produce male hatchlings and warmer incubation temperatures produce female hatchlings. Temperatures that fluctuate between the two extremes will produce a mix of male and female hatchlings.
- Most sea turtles nest at night.
- Some turtles nest in large groups, called - arribadas.
- Sea turtles don’t retract into their shells.
- Sea turtles are deep divers and can stay underwater for long periods of time.
- Sea turtles are caught worldwide in illegal manner.
- Sea turtles are very vulnerable to oil pollution, Oil can poison the sea turtles upon entering their digestive system.

## Reference:

Source of Information: Wikipedia

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# Secure Energy Source towards 'Atmanirbhar Bharat'

There are various sources of energy like coal energy, geothermal energy, wind energy, Biomass, Petrol, nuclear energy & many more energy classified into various types based on sustainability as renewable source of energy & non- renewable source of energy and non – renewable source of energy. A renewable source is the natural resource that causes no impact on nature renewable source of energy are available plentiful in nature and are sustainable. This resource of energy can be nature and are safe for environment. e.g. solar energy, geothermal energy, wind energy biomass, hydropower and tidal energy, geothermal energy. Non-renewable source of energy causes an impact on nature and are limited supply source. Non. renewable sources can be extracted from earth and will run out as time passes. Eg. Natural gas, coal, petroleum, nuclear energy and hydrocarbon gas.

Nuclear energy has highest capacity factor than other energy source. According to U.S department of energy in 2020 solar energy, wind energy, coal, hydropower product 24.9%, 35.4%, 40.5%, 41.5% and natural gas, geothermal produce 56.6%, 74.3% whereas nuclear power plants are producing maximum power nearly two times more reliable than wind energy and solar energy plants. Nuclear power plant requires less maintenance and are designed to operate for longer stretches before refiling natural gas and coal capacity factor are generally lower due to routine maintenance and refiling at these facilities wind energy, solar energy, hydropower plant all these plants need a backup power source such as large-scale storage. In comparison if we see lifespan of solar, wind, coal, natural gas and geothermal all these have only 20 to 30 years of lifespan whereas nuclear power plant has more than 40 to 50 years

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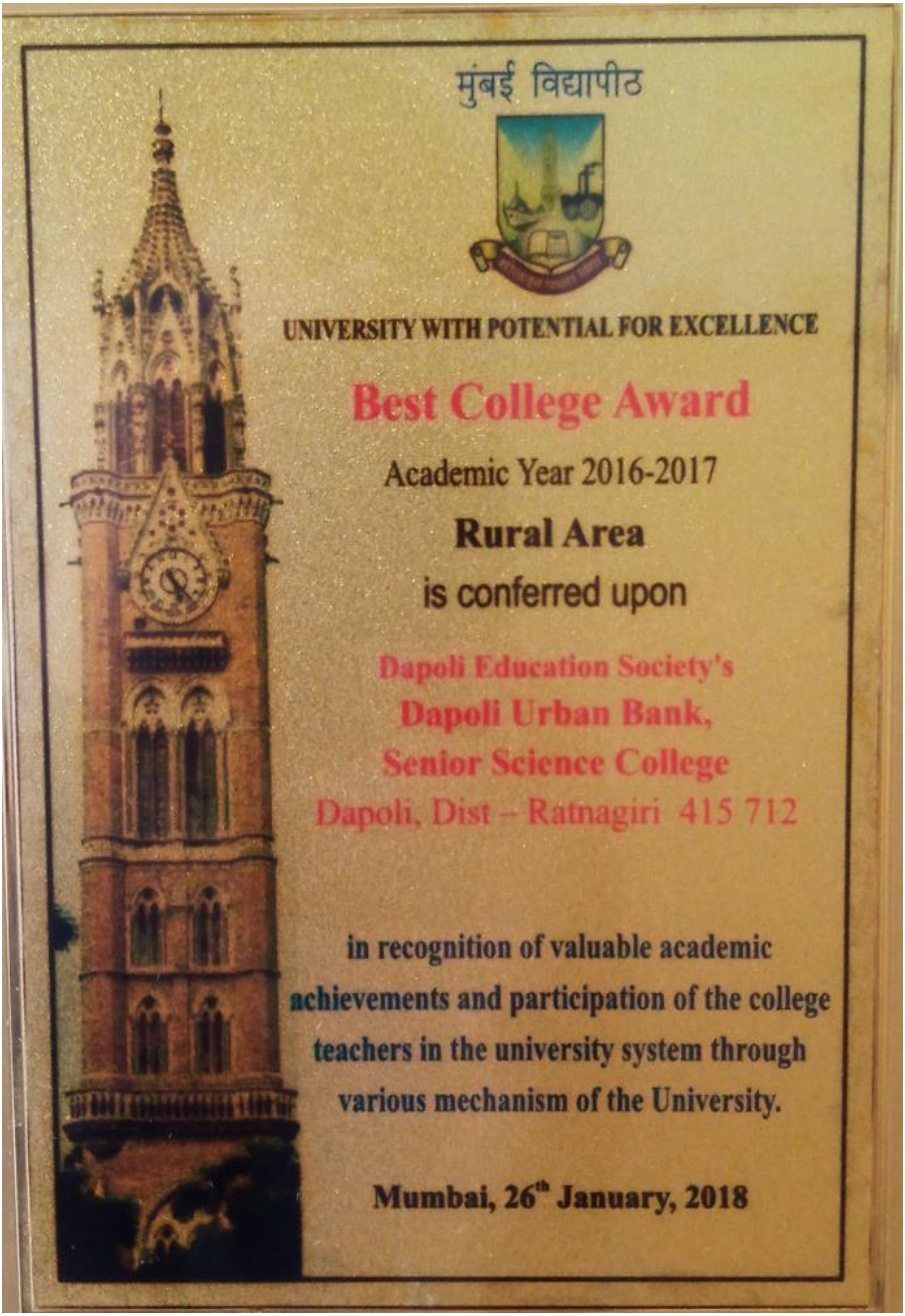
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