



**NATURE'S
PALETTE
2025**

**Departmental Magazine
of
Life Sciences
(Zoology & Botany)**



Message from Vice Chancellor



I am delighted to know that the departments of Zoology and Botany of the University is planning to bring out an e-journal “Nature’s Palette 2025”. Since its inception, the Girijananda Chowdhury University has been giving special emphasis in teaching and research of Life Sciences. It is heartening to note that faculty members of the Departments have put their extra effort in research activities of the departments and publishing this journal.

I am confident that in order to promote research activities and inculcate innovative practices in teaching learning, such platform will act as a stimulating force in these directions.

I congratulate the faculty members, Research scholars and the Students of the Departments of Zoology and Botany in their praiseworthy endeavour and wish all success in future. I wish the e-journal “Nature’s Palette 2025” will be academically fruitful and intellectually stimulating.

With kind regards

Kandarpa Das

Vice Chancellor

Message from HOD



This is one of those occasions, when as a departmental head one feels immense pleasure in extending heartiest congratulations to all the students and faculty members on the occasion of publishing the very first edition of our departmental e-magazine “Nature’s Palette”. This is a simple but sincere endeavour by the Departments of Zoology and Botany to inculcate literary aptitude among the students and keep them abreast with the latest developments in the fields of science and technology. This publication is also an attempt to showcase the academic achievements, creative expressions and hard work of our students and faculties as well as reflection of the vibrant spirit that defines our department.

The magazine is conceived with the idea that it will provide a platform for us to share our ideas, celebrate success and engage in meaningful discussions that will enrich our learning environment. It will hopefully act as a catalyst for collective work and contribute towards our passion for knowledge. Students will be able to realise their literary potential through the pages of this magazine.

This is my sincere hope and belief that the magazine will witness continued growth and achievements in the coming years and will be a testament to our sincere efforts for excellence through both curricular and extracurricular activities.

**Prof. Sunayan Bordoloi (HOD)
Department of Zoology & Botany**

Editor's desk note:

Welcome to the first edition of Nature's Palette! We are thrilled to launch this e-magazine, a celebration of the vibrant hues, textures and inspiration that nature offers us every day. As we begin this journey, we are excited to share stories that highlight the beauty of the world around us and explore how nature continues to inspire creativity, awareness and action. In this debut issue, we delve into the colors, textures and patterns that make nature such a remarkable artist.

This edition would not have been possible without the incredible contributions of our talented student writers, photographers and artists. Their passion and creativity bring life to this magazine and we are proud to showcase their work. Each contribution adds a unique perspective to the theme of our magazine.

We deeply appreciate the hard work and dedication of our student contributors, whose diverse voices are the heart of Nature's Palette. This is just the beginning, and we look forward to continue this journey with them and you, our readers. Together, we'll explore the ever-changing and awe-inspiring world of nature.

Our goal is to create a platform where each issue will be a fresh canvas, filled with the stories of the environment, conservation efforts, and the timeless bond between humanity and the natural world.

Thank you for joining us in celebrating nature through the eyes of students. We hope this edition sparks your curiosity and inspires you to see the world around you with renewed appreciation.

Warm regards,

Dr. Salma Mazid
Assistant Professor
Department of Zoology

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100 Years of Symmetry

A tribute to the great woman
mathematician Amalie Emmy Noether

Prof. Amar Saikia
Dean Academics

Amalie Emmy Noether (23/03/1882 - 14/04/1935) was a German mathematician who made many important contributions to Abstract Algebra. She proved Noether's first and second theorems, which are fundamental in mathematical physics. Albert Einstein described Emmy Noether as "the most significant creative mathematical genius thus far produced" in his 1935 obituary for her in the New York Times.

Noether's first theorem states that any continuous symmetry in a physical system with conservative forces corresponds to a conservation law. This theorem was published in 1918. As for example, the law of conservation of energy corresponds to the uniformity of time, and the conservation of momentum corresponds to the homogeneity of space.

Noether's second theorem states that such symmetries exist if and only if there exist differential relations between the Euler-Lagrange equations. Both the theorems deal with symmetry. 100 years had gone and we are still using these theorems to explore the hidden laws of nature. Nature creates symmetrical objects. We, the human being together with all the animals are having mirror symmetry that is appearance of left is similar to right. If we look at flowers, we find radial symmetry in circular pattern, in case of star fish we find radial symmetry.

Similarly, we find symmetry in minerals having crystalline structures. Why does the nature prefers symmetry ? Why do we find symmetrical objects beautiful ? In some cases slight broken symmetry makes an object more beautiful: Leonardo da Vinci's Mona Lisa. Symmetry is a factor in beauty, and is considered attractive in both faces and other objects, that is, symmetry is visually appealing. But, in nature symmetry is never absolute because parts that look similar can't exactly match.

In neuroscience there is a term perceptual constancy which refers to the fact that the perceived geometrical and physical characteristics of objects remain constant despite transformations of the objects such as rigid motion. Perceptual constancy is essential in everything we do, like recognition of familiar objects and scenes, planning and executing visual navigation, visuomotor coordination, and many more. Perceptual constancy would not exist without the geometrical and physical permanence of objects: their shape, size, and weight.

Formally, perceptual constancy and permanence of objects are invariants, also known in mathematics and physics as symmetries. Symmetries of the Laws of Physics received a central status due to theorems of Emmy Noether. These theorems connected symmetries of the physical laws to conservation laws through least-action principle. Noether's theorem is applied to mirror symmetrical objects establishes mental shape preservation (perceptual conservation) through a simplicity (least-action) principle. This way, the formalism of Noether's theorem provides a computational explanation of the relation between the physical world and its mental representation.

In botany, symmetry in relation to Noether's theorem refers to the concept that when a plant exhibits a repeating pattern or structure across its parts, it can be linked to a conserved quantity according to Noether's theorem, implying that the plant's development process is optimised in some way due to this symmetry: essentially, the plant's form minimises energy expenditure while maximising functionality. Phyllotaxis: the spiral arrangement of leaves on a stem, often exhibiting a Fibonacci sequence, which can be seen as a manifestation of optimisation based on spatial symmetry.

The concept of symmetry in zoology can be can be understood through the lens of Noether's theorem by considering the physical constraints that lead to an organism's symmetrical form: for example, bilateral (left-right) symmetry in animals can be seen as a consequence of the need to maintain balance and efficient movement during locomotion, which is a form of physical symmetry that would be predicted by Noether's theorem.

Digital Eye Strain : An emerging Technopathical burden among students.

Dr. Vidhya Srinivasan
Professor & HOD
Allied Health Sciences

In today's digitally driven world, the prevalence of Digital Eye strain (DES) among individuals aged 18 to 25 years has become a significant concern. With the increasing reliance on digital devices for work, education, and leisure, this age group finds itself particularly vulnerable to the adverse effects of prolonged screen time. Digital Eye Strain is also known as Computer vision syndrome (CVS), encompasses a range of ocular and visual discomforts resulting from the extended use of computers, smartphones, tablets, and other electronic screens. This condition has gained recognition as a growing public health issue and is a topic of extensive research and clinical investigation.



The modern era's pervasive technology integration in various aspects of life has driven the younger demographic to spend an unprecedented amount of time engaged with digital displays. Studies have shown that individuals between the ages of 18 and 25, often characterized as "digital natives," spend a substantial portion of their day staring at screens for work, study, communication, entertainment, and social media interaction. Studies indicate that the pervasive use of digital devices in daily life, combined with the high demands of academia and work that involve extended screen time, contributes to the increased vulnerability of this age group to CVS. Furthermore, the COVID-19 pandemic accelerated the adoption of remote work and online learning, making digital screen time even more dominant, thereby amplifying the concern. This age group's affinity for digital devices and the associated health implications makes CVS a compelling subject for further research and exploration.

Symptoms of CVS:

This constant exposure to digital screens has led to an increase in the prevalence of CVS symptoms, including eye strain, dryness, blurred vision, Double vision, increased sensitivity to light, burning or itchy eyes, difficulty concentrating Headaches, Neck, Shoulder and back pain.

Prevention of CVS (Computer Vision Syndrome) and promoting digital well-being involves adopting strategies to reduce the physical and mental strain caused by excessive digital device use.

Preventing Computer Vision Syndrome (CVS):

- **☒ Follow the 20-20-20 Rule: Every 20 minutes, look at something 20 feet away for at least 20 seconds to relax eye muscles.**
- **Set screen brightness to match ambient lighting and install an anti-glare screen protector.**
- **Blink Often**

Digital Well-being Practices:

- **Reduce screen time and dedicate periods for offline activities like exercise, reading, or hobbies.**
- **Maintain a neutral posture at your desk. Use an adjustable chair and a screen at eye level.**
- **Avoid screens 1–2 hours before bedtime.**

Consistently adopting these practices can help prevent physical discomfort, reduce stress, and improve overall well-being in a technology-driven world.

Unraveled

**Raisa Choudhury
Assistant Registrar (Academic)
Coordinator, International
Division, GCU**

**You untangled
the knots of my chaos,
cleared the wreckage
that stormed through my life.**

**I never knew I'd be left alone,
not when we made promises
of forever—
hand in hand,
heart to heart.**

**Why then did fate sever the strings,
leaving me dangling over a precipice?
I would let go
if only I knew you were truly gone.**

**The dreams we built
shattered like glass,
a house of fragile cards
collapsing in silence.
I bleed, mending
what cannot be healed.**

I walk, I breathe,
I dream of you,
even in nightmares.
We were one—
soul to soul.

I am drowning, I can feel it,
even as I reach the shore.
Cold and alone,
frozen beneath the warmth we once shared.

The stars deceived me—I knew not.
The winds shifted—I knew not.
But you—
I never doubted.

For if I am, then you are.
Every teardrop—an ocean of your smile.
Every ache—a void where you once stood.

I reach out—
just to hear you once.
Once would be enough
to silence the storm,
to bring back— us.

From heaven to hell,
from death to life—
I remain.

Butterfly Wonderland in Deepor Beel : A Sightseer's Dream

Sabnam Nasrin Islam
M.Sc. Zoology (2nd sem)

The morning mist, thick and clinging, draped over Deepor Beel like a translucent curtain. My breath plumed out in white puffs as I began my butterfly survey, field guide clutched in hand. The air buzzed with the awakening wetland - the croaking of frogs, the rustle of unseen birds, and the gentle lapping of water against the reeds. My target: the vibrant butterfly community of this Assamese heaven.

My first butterfly sighting was a Common Mormon, its deep blue wings shimmering against the emerald green of a *Chromolaena odorata* bush. I carefully noted the species, the date, and the specific plant it was nectaring on. This was crucial data for my study. A little further on, a Painted Lady, its wings a mosaic of orange, black, and white, fluttered around a patch of vibrant pink *Bidens pilosa* flowers. These flowers, common weeds though they were, seemed to be a popular feeding spot.

As the sun climbed higher, the butterflies became more active. I encountered a variety of species - the Common Crow, with its jet-black wings, the Grass Yellow, a small and vibrant butterfly with yellow wings, and the Peacock Pansy, its wings displaying striking eye-like markings.

I spent hours observing these winged wonders, captivated by their intricate beauty and graceful flight. The Deepor Beel, with its diverse ecosystem, proved to be a haven for butterflies. I learned about their delicate life cycles, their importance in pollination, and the fragility of their habitats.

The challenges began almost immediately. The dense vegetation made navigating the wetland difficult. I had to wade through knee-high grasses, carefully avoiding hidden holes and thorny bushes. The humidity was oppressive, and sweat trickled down my back, blurring my vision. The butterflies themselves were often elusive. A sudden gust of wind could send them scattering, and some species were incredibly fast and difficult to track. I remember one particularly frustrating encounter with a swift-flying Grass Yellow. It flitted from flower to flower, never staying still for more than a few seconds. I chased it through the reeds, my net flailing, but it always stayed just out of reach. Finally, after what felt like an eternity, it landed on a *Sida acuta* plant, allowing me a brief but clear view and a confirming identification. The heat intensified as the sun climbed higher. I found a shady spot under a large *Eichhornia crassipes* (water hyacinth) leaf to take a break.



As I sipped my water, I reflected on my experience. Despite the challenges, I felt a deep sense of connection to this place. The sheer diversity of life, from the smallest butterfly to the majestic birds I occasionally glimpsed, was astounding. Observing these delicate creatures in their natural habitat filled me with a sense of wonder. It was a stark reminder of the interconnectedness of all living things and the importance of preserving these precious ecosystems.

My visit to Deepor Beel was more than just a scientific survey. It was an immersion into the natural world, a reminder of the beauty and fragility of life. It reinforced my commitment to conservation and deepened my appreciation for the intricate web of life that thrives in places like this. As I left Deepor Beel, the setting sun painting the sky in hues of orange and purple, I carried with me not just data and observations, but also a renewed sense of purpose.



Butterfly Diversity: Deepar Beel



Angled castor



Line blues



Common tit



Common nawab



Common sailor



Common emigrant



Common jay



Grey pansy

The Symphony of Nature :

Exploring the music of the Natural World

Hafsa Begum

M.Sc. Zoology (2nd sem)

NATURE HAS LONG BEEN A SOURCE OF INSPIRATION FOR MUSICIANS AND COMPOSERS. FROM THE SWEET SONGS OF BIRDS TO THE GENTLE RUSTLING OF LEAVES, THE NATURAL WORLD IS FILLED WITH A DIVERSE ARRAY OF SOUNDS THAT CAN BE WOVEN TOGETHER TO CREATE A BEAUTIFUL SYMPHONY.

The Melodic Songs of Birds :

Birds are perhaps the most accomplished musicians in the natural world. With their sweet songs and melodious trills, they add a touch of beauty and elegance to the symphony of nature. From the cheerful chirping of sparrows to the haunting melodies of the nightingale, the songs of birds are a true marvel of nature.



The Instrumental Sounds of Nature :

The natural world is home to a wide range of instrumental sounds, each with its own unique tone and timbre. The gentle babbling of brooks, the crashing of waves against the shore, and the rustling of wind through the trees all contribute to the rich tapestry of sound that fills the natural world.

The Harmony of the Natural World :

The natural world is a place of great harmony, where different sounds and rhythms come together to create a beautiful symphony. The songs of birds, the rustling of leaves, and the gentle babbling of brooks all blend together to create a rich tapestry of sound that is both soothing and uplifting.

The natural world is a place of great beauty and wonder, filled with a diverse array of sounds and rhythms that can be woven together to create a beautiful symphony. Whether you're a musician, a composer, or simply someone who appreciates the beauty of nature, symphony of the natural world is sure inspire and delight.



NATURE'S PLANET: Life of Fungi

Sabina Yesmin
M.Sc. Zoology (2nd sem)



Deep within the whispering woods, where sunlight dappled through ancient trees, lived a tiny mushroom named Fungo. Fungo wasn't like the towering oaks or the vibrant wildflowers. He belonged to a kingdom all his own - the kingdom of Fungi.

Fungo's life began as a minuscule spore, adrift on a gentle breeze. He landed on a decaying log, a feast of organic matter waiting just for him. He unfurled, sending out delicate threads called hyphae, like tiny explorers reaching out into the wood. These threads wove together, forming a hidden network - the mycelium - Fungo's true body.

He wasn't alone. Beneath the forest floor, a vast, interconnected web of mycelia pulsed with life. Fungo was part of this hidden community, sharing nutrients and information with other fungi through this intricate network, like an underground internet.

Fungo wasn't green like the plants. He couldn't make his own food from sunlight. Instead, he was a recycler, a decomposer. He absorbed nutrients from the decaying log, breaking down the complex molecules into simpler substances that could be used by other organisms. He was nature's clean-up crew, an essential part of the forest's cycle of life and death.

Fungo's life wasn't always easy. He had to compete with other fungi and bacteria for resources. Sometimes, he encountered a hungry snail or slug that nibbled on his cap. But he persevered, driven by the ancient instinct to grow, reproduce, and continue the fungal lineage.



One day, Fungo felt a stirring within him. It was time to reproduce. He pushed upwards, forming a small button that slowly swelled into a beautiful, red-capped mushroom. This was his fruiting body, designed to release countless spores into the wind. These spores, like Fungo once was, would travel far and wide, carried on the breeze, ready to start new fungal colonies elsewhere.

He also learned about the fascinating partnerships some fungi formed. He heard whispers on the mycelial network of mycorrhizae, where fungi connected with the roots of plants, helping them absorb water and nutrients in exchange for sugars. It was a symbiotic dance, a partnership that benefited both the fungi and the plants.



Fungo's life, though seemingly simple, was a vital thread in the tapestry of the forest. He was a decomposer, a recycler, a partner, and a vital part of the ecosystem. He was a testament to the incredible diversity and importance of the fungal kingdom, a world hidden beneath our feet, teeming with life and playing a crucial role in the balance of nature. And as he released his spores into the wind, Fungo knew that his legacy would continue, carried on the breeze to new logs, new forests, and new adventures.



THE ONE-HORNED RHINO:

A remarkable species

Samin Rahman

M.Sc. Zoology (2nd sem)

The One-Horned Rhinoceros

(Rhinoceros unicornis), also known as the Indian rhinoceros or Great Indian rhinoceros, is one of the most distinctive and iconic species of rhino in the world. Known for its single horn and armor-like skin, this magnificent herbivore plays an important ecological role in its native habitats in the Indian subcontinent. Although its population has rebounded in recent decades, the one-horned rhino still faces significant threats that make conservation efforts critical for its survival.

The one-horned rhinoceros is a large mammal that can grow up to 3.8 meters (12.5 feet) in length and weigh as much as 2,200 kg (4,850 lbs). It has a distinctive, thick, gray skin that is folded into armor-like plates, giving it a prehistoric appearance. These folds help protect the animal from predators, although the species does not have many natural enemies due to its large size and powerful build.



Conservation Efforts

Various organizations, including the International Rhino Foundation (IRF), World Wildlife Fund (WWF), and local governments, are working tirelessly to protect this species.

Their efforts include anti-poaching patrols, monitoring populations, restoring natural habitats, and working with local communities to raise awareness about the importance of rhino conservation.

The one-horned rhino is primarily found in the Indian subcontinent, particularly in the grasslands and floodplains of northeastern India, Nepal, Bhutan, and parts of Bangladesh. The largest population resides in Kaziranga National Park in Assam, India, which is home to over 2,400 one-horned rhinos, making it a critical sanctuary for the species.

Other important habitats for the species include Manas National Park, Jaldapara Wildlife Sanctuary, and Chitwan National Park. These protected areas offer the rhino ample space to roam, graze, and find water, which is essential for the animal's survival.



In addition to strict protection measures, community-based programs that promote ecotourism have also provided incentives for local communities to conserve rhino populations. The collaboration of local people and authorities has been instrumental in maintaining a safe environment for the greater one-horned rhinoceros.

The greater one-horned rhinoceros is a species that has faced near-extinction but is now showing signs of recovery thanks to dedicated conservation efforts. With continued vigilance, effective protection, and public awareness, this iconic animal may continue to thrive in the wild, ensuring its survival for future generations. However, the fight for its conservation is ongoing, and it remains crucial to protect its remaining habitats and address threats like poaching and habitat destruction.

Evolution: The Driving Force of Life

Jyotirmoy Nath
M.Sc. Zoology (2nd sem)

Evolution is the process through which life on Earth has diversified and adapted over billions of years. It's a fundamental concept in biology, explaining the incredible variety of organisms we see today, from the smallest bacteria to the largest whales.

Evolution is the process through which life on Earth has diversified and adapted over billions of years. It's a fundamental concept in biology, explaining the incredible variety of organisms we see today, from the smallest bacteria to the largest whales.

Natural Selection: The most well-known mechanism, natural selection favors individuals with traits that make them better suited to their environment. These individuals are more likely to survive and reproduce, passing on their advantageous traits to the next generation. Over time, this can lead to significant changes in a population.

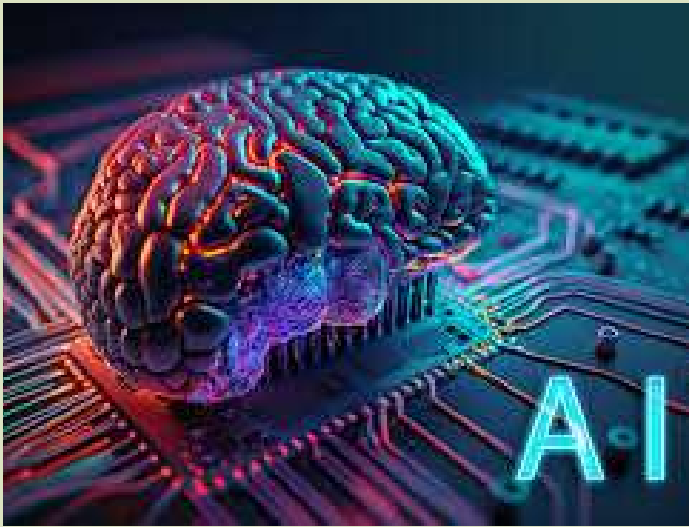
Genetic Mutation: Random changes in an organism's DNA can introduce new traits into a population. While many mutations are harmful or neutral, some can be beneficial, providing the raw material for evolution to act upon.

Gene Flow: The movement of genes between populations can introduce new genetic variation or spread existing variations, influencing the evolution of both populations.

Artificial Intelligence : The Next Frontier

Semina Aktar
M.Sc. Zoology (2nd sem)

Artificial intelligence (AI) has rapidly evolved from a futuristic concept to a present-day reality, permeating various aspects of our lives. From powering personalized recommendations on streaming platforms to enabling self-driving cars, AI's influence is undeniable and its potential seems limitless.



The Future of AI

The future of AI is full of promise and potential. By addressing the ethical considerations and harnessing its power responsibly, we can unlock AI's transformative capabilities to create a better world for everyone.

What is AI?

At its core, AI involves creating machines capable of performing tasks that typically require human intelligence. This includes learning, problem-solving, decision-making, and understanding language. AI achieves this through various techniques, including machine learning, deep learning, and natural language processing.

The Next Frontier

While AI has made significant strides, its journey has just begun. The next frontier of AI holds immense potential for solving some of the world's most pressing challenges.

NOKREK BIOSPHERE RESERVE

**Akanksha R Sangma
Amsimchi R Sagma
M.Sc. Zoology (2nd sem)**



Nokrek Biosphere Reserve is located in the district of West Garo Hills, Meghalaya and is considered as the first Biosphere Reserve of its kind in the North-East region and is counted as amongst the top biosphere reserve of India. The Nokrek Biosphere Reserve is a home to a diverse species of flora and fauna and it is because of this reason a large number of tourists visit it every year.

The myth runs around the village with several reports of sightings of "Mande Burung" or "The Jungle Man", several feet tall. It is also believed that there exist a plant which can make a person hallucinate and wander about in the same place upon stepping on it.

A very rare species of Citrus locally known as "Me.mang Narang" orange of the spirits is also found in Nokrek. Nokrek is a home to a variety of rare, endangered and endemic animals which include Hoolock Gibbon, Pig Tailed Macaque, Himalian Black bear, Asiatic Elephant, Red Panda, Snow Leopard, Tiger, Giant Flying Squirrel, Hornbill. Several plant species of orchids like White Meranti, Wild Lemon, Lali, Champaka and Grand Rasamala.

The discovery of *Citrus indica* led to the establishment of the National Gene Sanctuary-cum-Biosphere Reserve. The area has wild Citrus fruit varieties that serve as a gene pool for commercially produced Citrus.



The Secret Lives of Nocturnal Creatures

Abhijit Das
M.Sc Zoology (4th Sem)

Nocturnal life means of or pertaining to the night. A person, animal or plant that is active at night is described as nocturnal. Nocturnal animals have evolved to become active at night primarily to avoid daytime predators. The dark helps both predators and prey move around a bit more stealthily. Cooler temperatures at night in some habitats play a role, as they can be advantageous for animals that need to conserve water or avoid the heat of the day. Nocturnal animals differ from diurnal animals in several ways. While diurnal animals rely heavily on daylight to conduct their activities, nocturnal animals have adapted to a life mostly in darkness.

Enhanced Senses



One of the most critical adaptations for nocturnal animals is enhanced vision. Many species, such as owls and certain big cats, have large eyes relative to their body size, allowing more light to enter and enhancing it.

Camouflage and Stealth



Nocturnal animals often exhibit different camouflage adaptations compared to diurnal animals. They have muted, dark, or patterned coloration that aids in camouflage during the night. Under the cover of darkness, they can move unseen or blend into it.

Reproductive Behaviors



Nocturnal animals have also adapted their reproductive and social behaviors to suit their night-time activity. For instance, the courtship and mating rituals of many nocturnal species are timed to occur at night when they are most active. Frogs and crickets, use sound to attract mates

How Long Do Bees Live?

Cherianchi Marak
M.Sc Zoology (4th Sem)

While some bees have a longer life span than others, a bee might live for about a month. **WORKER BEES** tend to live for 5-6 weeks and **DRONE BEES** tend to live for 7 weeks. **QUEEN BEES** live the longest. Generally, they live for about 1 year, but some queen bees even live for 2-3 years.



BUMBLEBEE LIFESPAN

Female workers and male bumblebees only live for about one month.

Female bees born in late summer become queen bees



HONEYBEE LIFESPAN

Female workers and drones live no more than 2 months.

Honey bees practice overwintering behavior. Young winter bees can live up to 8 months.



CARPENTER BEE LIFESPAN

Healthy subordinate queens live up to 3 years while other females live for 1 year

In larger nesting sites, there is a primary queen bee and other bees living with her are subordinate queen bees.



LONG HORNED BEE LIFESPAN

Most adult longhorn bees are only active for about one month.

Females likely live no more than a year, and males die shortly after mating.

FACTORS AFFECTING A BEES' LIFE

PARASITES and INFECTIONS

Parasites such as **VARROA MITE** and other bacterial, fungal, and viral infections affect and threaten a bee's lifespan

PESTICIDES

Some pesticides that are used to reduce insects and pests are also very harmful to bees and other pollinators

CLIMATE CHANGE & URBANIZATION

Climate change causes stressors on habitat and food & water availability. Urbanization also plays a big role on destruction of bee habitats.

HOW ARTIFICIAL LIGHT DISRUPTS CIRCADIAN RHYTHMS?

Abhijit Goswami
M.Sc Zoology (4th Sem)

Artificial light has become an integral part of modern life, yet its pervasive presence can significantly disrupt our natural circadian rhythms. These internal clocks, which regulate sleep, hormone production, and overall bodily functions, rely heavily on natural light cues to operate effectively. When exposed to artificial light—especially during the evening—our bodies can experience a cascade of disruptions that affect both sleep quality and general health.

At the core of this disruption is melatonin, a hormone that signals the body it's time to wind down for the night. Under natural conditions, melatonin production increases as darkness falls. However, exposure to artificial light, particularly blue light emitted by screens, LED bulbs, and other digital devices, can suppress melatonin levels. This suppression delays the onset of sleep and can lead to a misalignment of the circadian rhythm. Over time, this misalignment may contribute to chronic sleep deprivation, mood disorders, and metabolic issues such as weight gain and impaired glucose tolerance.

The consequences of a disrupted circadian rhythm extend beyond just feeling tired. Poor sleep quality can impact cognitive performance, reduce productivity, and even increase the risk of long-term health problems like cardiovascular disease. Additionally, research suggests that misaligned circadian rhythms may weaken the immune system, making the body more susceptible to infections.

By understanding the influence of artificial light on circadian rhythms and implementing these changes, you can improve your sleep quality and overall well-being. Embracing these strategies is a small adjustment that can lead to significant long-term health benefits

Fortunately, there are practical steps you can take to mitigate the impact of artificial light on your circadian rhythm. One effective strategy is to limit exposure to screens at least one to two hours before bedtime. Many modern devices now offer blue light filters or "night mode" settings, which reduce the intensity of blue light during evening hours. Alternatively, consider using dimmer, warmer lighting in your home after dark to create a more sleep-friendly environment.

Another useful approach is to establish a consistent sleep schedule. Going to bed and waking up at the same time every day helps reinforce your body's natural rhythm, making it easier to fall asleep and wake up refreshed. Incorporating a relaxing pre-sleep routine, such as reading or meditation, can further signal to your body that it's time to wind down.



Student Activities

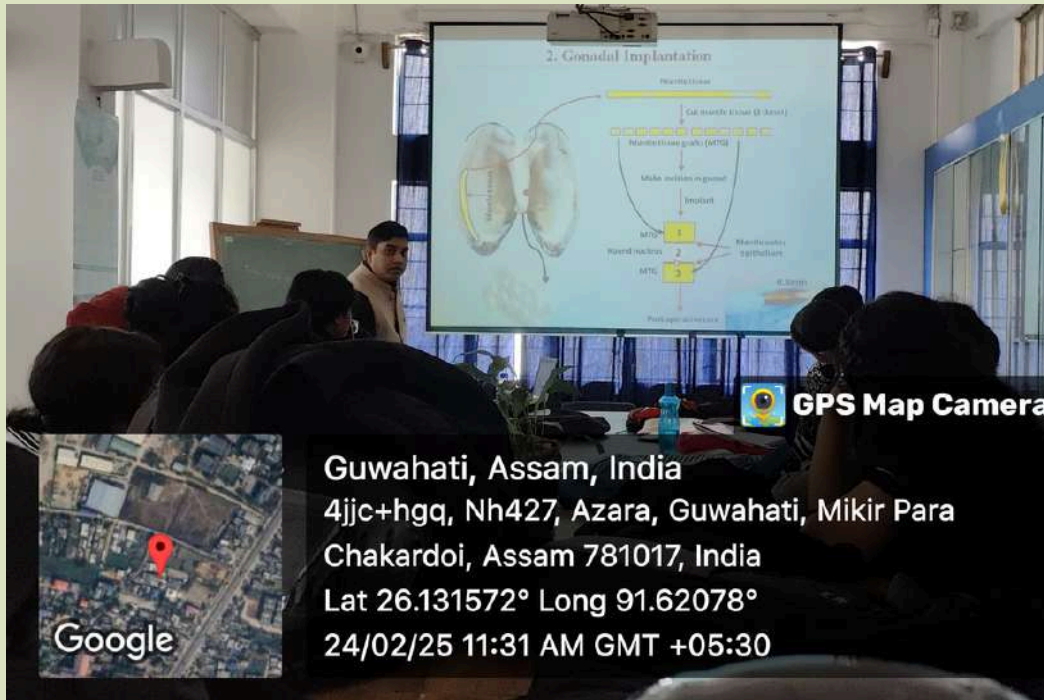


Visit to B.Borooah College for Practical classes



Visit to Vulture Conservation & Breeding Center, Rani

Workshop on Freshwater Pearl Culture at GCU



National Science Day 2025



**Winners of Speech Competition held by the
School of Natural Sciences & NSS UNIT II
on National Science Day 2025**



Sabnam Nasrin Islam
Department of Zoology
1st Prize



Susmita Sarania
Department of Botany
2nd Prize



Visit to Aquaculture Biodiversity Center, Guwahati University.



Meeting with HOD, Guwahati University.



Visit To Guwahati Biotech Park



Internship Program in Biotech Hub of B. Borooah college

Attended Classes in B. Borooah College



Workshop on Vermicomposting at GCU



Workshop in B. Borooah College



Entomology class for PG students of B. Borooah College conducted by Zoology Department, GCU

আমাৰ ঐতিহ্য

Dikshit Kalita
M.Sc Physics (2nd Sem)

অভেদ্য প্ৰাচীৰ খহাই
অসমক জীপাল কৰাই
নানা বিধ ঐতিহ্যই
ৰংঘৰ,কাৰেংঘৰ,জয়দৌল
শিৱদৌল,মঠ মন্দিৰ ঐতিহাসিক
কীৰ্তিসমূহে আমাৰ ঐতিহ্য
জনগোষ্ঠীয় উৎসৱ বিহু,
বথৌ পূজা,আলি আই লিগাং
বহু বিধ সংস্কৃতিৰে ভৰপূৰ
অসমৰ কলা,সাহিত্যৰো ,জীৱন্ত
ছবি প্ৰতিফলিত হৈছে
কেৱল ভক্তি সাহিত্যৰ বিকাশে নহয়,
চিকিৎসা বিজ্ঞানৰো আছে
চমকপ্ৰদ প্ৰদৰ্শন
মানস আৰু কাজিৰঙা হৈছে
ঐতিহ্যৰ পৰিচয়
সাঁচি পাতৰ পুথি আৰু পাণ্ডুলিপিটো বিচাৰি পাওঁ
ঐতিহ্যৰ আমেজ
কাঁহ,পিতল,কাঠৰ মূৰ্তি,তামৰ ফলি,ৰূপৰ শৰাই, চানেকিঐতিহ্যৰ
ভক্তি সাহিত্যৰ বিকাশে
অশান্ত মনটো শান্ত কৰে
এনেবোৰ ঐতিহ্যই
অসমক জীপাল কৰাই
একতাৰ দোলেৰে বান্ধি
আগবাড়ি যাবলৈ শিকাই-----

শিৰোনাম : 'মৃগাংকৰ জ্যোতি'

Mriganka
M.Sc. Psychology (2nd sem)

সুপ্ৰভ মৃগাংকৰ জ্যোতিত
নীলকমলে অংকিত কৰিছে
এক নীলাশ্ৰীৰ নিশা,
যত, প্ৰিয়মৰ
স্নিগ্ধা ধ্বনিৰ অৰ্ণৱত
প্ৰশান্ত হৈছে কোলাহলৰ দিশা ।

মনিষাৰ নয়নজ্যোতিত
ভৰুন বৃক্ষৰ শিপাবোৰে পায়
পিয়ুসৰ উদ্ভাৱনা
বিষাদৰ ৰাজ্যই সামৰণি মাৰে
আকাংক্ষাৰ বাতৰি আৰু
সুদীপ্ত তৃষ্ণাৰ সম্ভাৱনা ।

মৌনতাৰ বিবেকেও
চিঞৰ মাৰিছে
এক প্ৰাঞ্জল ৰীতিত,
"অনিৰুদ্ধ কৃষ্ণৰ জিজ্ঞাসা
সাৰ্থক হৈছে ,এই
সুপ্ৰভ মৃগাংকৰ জ্যোতিত ।"

জীৱনৰ সংগ্ৰাম

Rashmi Terangpi
M.Sc. Botany (2nd Sem)

এই পৃথিৱীত আপোন কোন?
নামত, মানত, চিনাকিত আপোন,
কিন্তু বাস্তৱত নাই কোনো,
যাৰ আছে, তেওঁৰ সকলো,
যাৰ নাই, সিহঁতৰ একো নাই।

সত্য এৰি মিছাক প্ৰসন্নয়,
ধনী, প্ৰভাৱশালীক সন্মান অনেক,
গৰিব, দুখীয়াই মাথোঁ কৰে সংগ্ৰাম,
সিহঁতক কৰে হেলা, অপমান, তাচ্ছিল্য!

অন্তৰত দয়া নাই, সহানুভূতি নাই,
মানুহে মানুহ চিনিব খোজে কেৱল স্বার্থতহে,
সত্যৰ মূল্য বুজি পায় শেষতহে,
আগতে প্ৰসন্নয় মিছাকেই পায়।

তথাপিও বাচি থাকিবই লাগিব,
সংগ্ৰাম কৰি নিজৰ ঠাই পাবই লাগিব।
জীৱনৰ বাবে, জীৱিকাৰ বাবে,
সুস্থ সমাজৰ বাবে, শুদ্ধতাৰ বাবে!

ধুষৰ পৃথিৱীত , অজস্ৰ আশা লৈ ,
সংগ্ৰাম চলিবই, মাথো জীয়াবলৈ,
যাতে সত্য বিজয়ী হয়,
যাতে মানুহে মানুহ হ'বলৈ শিকে।

Humans -threat to nature

Fellicia Chingre D Marak
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Since time immemorial humans have been exploiting nature in the name of urbanization. As we step further into the modern world, humans seems to be deprived of humanity by ruthlessly destroying large area of forest cover leading to rapid deforestation and thereby directly resulting in habitat loss contributing to extinction of plants and animal species.

Humans have become so engrossed in advancing towards the future so much so that destruction of nature is crucial for development without any alternative plan in safeguarding the environment. It is due to this selfish act , that we ourselves are facing the aftermath of increase in air pollution ,water pollution ,soil pollution , increase in temperature which have an adverse effect on human health .With the increase in deforestation ,we now have to deal with untimely weather change such as heatwaves, floods and drought which affects the production of food and consequently the farmers. Loss of forest leads to shrinking of food resources essential for the survival of wildlife.

In some places, certain plants with economical and medicinal value are being cut down for wood industry. So is the case in wildlife where in certain areas there exist unique animals that are specific to that particular region but are in verge of extinction due to overhunting and habitat destruction. We, humans, often times fail to understand that these are the nature's gem that bring glory and recognition to a place. We , many a time forget to acknowledge that plants and animals are necessary for a balanced environment.

Hence , in order to curb these menace ,we must create awareness among the public and opt for sustainability in ways that we can. We must develop a sense of empathy for the voiceless and educate ourselves better in conserving and preserving the nature.

Future Frontiers in Botany: Unravelling Nature's Secrets

Susmita Sarania
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Botany, the scientific study of plants has long been a cornerstone of human advancement. From ancient civilizations cultivating crops to modern genetic engineering, our relationship with plants has shaped our world. But as we enter a new era of scientific discovery, botany is expanding beyond its traditional boundaries. With cutting-edge technologies and innovative research, the future of botany is more exciting than ever. Let's explore some groundbreaking developments that are redefining our understanding of plant life.

1. Plant Intelligence and Communication:

Recent research has revealed that plants are far more intelligent than we once thought. They can communicate through chemical signals, respond to environmental changes and even exhibit memory-like behaviour. Scientists have discovered that trees in forests form complex underground networks, often called the "Wood Wide Web" through mycorrhizal fungi, sharing nutrients and warning each other of dangers like pests and diseases. Understanding this communication system could revolutionize agriculture and conservation efforts.

2. Synthetic Botany: The Future of Crop Engineering:

Synthetic botany merges genetics, bioengineering and artificial intelligence to create plants with enhanced traits. Scientists are developing crops that require less water, resist pests without pesticides, and even produce higher nutritional value. One promising breakthrough is the engineering of photosynthesis to make plants grow faster and yield more food, a crucial advancement in feeding a growing global population.

3. Biopharming: Plants as Factories for Medicine:

Biopharming is a fascinating field with the potential to revolutionize medicine. By genetically modifying plants to produce pharmaceutical compounds, scientists are exploring ways to grow vaccines, antibodies and even insulin in crops like tobacco and rice. This could potentially make medicine more accessible and affordable worldwide, reducing our reliance on traditional, more expensive manufacturing methods. However, challenges remain in ensuring the safety and efficacy of plant-made pharmaceuticals, preventing the unintentional spread of genetically modified plants and addressing potential ethical concerns surrounding the use of GMOs.

4. Space Botany: Growing Plants Beyond Earth:

As space exploration advances, growing plants in extraterrestrial environments is becoming a priority. Scientists are studying how plants adapt to microgravity, radiation, and extreme conditions to ensure future colonies on Mars or the Moon have sustainable food sources. NASA's Veggie experiment aboard the International Space Station has already demonstrated that astronauts can grow and eat fresh produce in space, paving the way for self-sustaining space habitats.

5. Climate-Resilient Flora: Adapting to a Changing World

With climate change threatening biodiversity, botanists are working to develop resilient plant species. Some researchers are reviving extinct plants using ancient DNA, while others are using CRISPR technology to create drought-resistant crops. Additionally, urban forests and green walls are being designed to combat air pollution and rising temperatures in cities, showcasing how plants can play a key role in climate adaptation.

Conclusion:

Botany is no longer just about studying plants, it's about leveraging their power to solve global challenges. From decoding plant intelligence to engineering super crops and growing food in space, the possibilities are endless. As science continues to push the boundaries of what we know, plants will remain at the heart of innovation, shaping a sustainable and greener future for humanity.



The heart of our planet : Revitalizing rural environment

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As we navigate the complexities of a rapidly changing world, it's easy to overlook the vital role that rural environment play in sustaining our planet. From the rolling hills of countryside farms to the dense forest of rural villages, these areas are the backbone of our ecosystem. Yet, they face numerous challenges that threaten their very existence.

The challenges : Rural environment are grappling with environmental degradation, climate change, rural property and migration. Intensive agriculture has led to soil erosion, water contamination and loss of biodiversity. Rising temperatures and changing precipitation patterns are altering the delicate balance of rural ecosystems.

The opportunities : Despite these challenges, there are numerous opportunities for sustainable rural development. Sustainable agriculture practices like organic farming, agroforestry and pharma culture can enhance soil health, biodiversity and ecosystem services. Eco-tourism can generate income and job for rural communities while promoting conservation and cultural heritage.

Revitalizing rural environments : Firstly, we must recognize the importance of these areas and the people who inhabit them. We must support sustainable agriculture practices, invest in renewable energy and promote Eco-tourism. We must also address the root causes of rural poverty and migration by providing access to education, health care and economic opportunities.

Conclusion : The rural environment is the heart of our planet, providing essential services like food production, water cycling and climate regulation. It's time for us to recognize the value of these areas and work towards revitalization them. By doing so, we can create thriving, resilient rural communities that support both people and the planet.

Vertical Gardening: A Sustainable and Space-Saving Trend

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In urban environments where space is often at a premium, vertical gardening has emerged as an innovative solution for cultivating plants while utilizing limited square footage. This gardening technique involves growing plants upward, rather than outwards, using structures like trellises, towers, and wall-mounted systems. Whether on a balcony, rooftop, or interior wall, vertical gardens are transforming how we think about growing plants in small spaces.

The Basics of Vertical Gardening:

At its core, vertical gardening is about maximizing vertical space by using plants that can grow upwards, supported by various structures. It is not only about aesthetics but also functionality. Vertical gardens can be used to grow a wide variety of plants, including herbs, vegetables, flowers, and even small trees.

Common methods

- ☒ **Trellises and Arches:** Ideal for climbing plants such as peas, beans, cucumbers, and roses.
- ☒ **Living Walls:** Systems that allow plants to grow directly on walls, often using modular panels or felt pockets for plant placement.
- ☒ **Plant Towers and Pockets:** Vertical systems that stack plants in rows, utilizing a small footprint while providing each plant sample access to sunlight.



FIG: OUTDOOR VERTICAL GARDEN



FIG: INDOOR VERTICAL GARDEN

Tips for a Successful Vertical Garden:

- ☒ **Sunlight Considerations:** Ensure that your vertical garden gets enough sunlight. Plants like tomatoes or peppers need at least six hours of sunlight per day, while leafy greens may do fine in partial shade.
- ☒ **Watering:** Vertical gardens, especially those on walls or in pockets, can dry out more quickly than traditional gardens. Make sure to set up an efficient irrigation system or use self-watering planters to maintain adequate moisture.
- ☒ **Support Structures:** Invest in quality frames, pots, or planting systems that are sturdy and designed to handle the weight of soil and plants. A lightweight system may not support larger plants effectively.
- ☒ **Soil and Fertilization:** Use a high-quality potting mix for vertical gardens to ensure good drainage and root health. Since vertical gardens are more compact, regular fertilization is important to provide plants with necessary nutrients.

Conclusion:

Vertical gardening is more than just a trend—it's a practical and sustainable way to cultivate plants, especially in urban areas where space is limited. By using the vertical space available, gardeners can grow everything from fresh herbs to flowering vines while improving their environment in the process.

Conservation of Wild Plant Species: A Step Towards a Sustainable Future

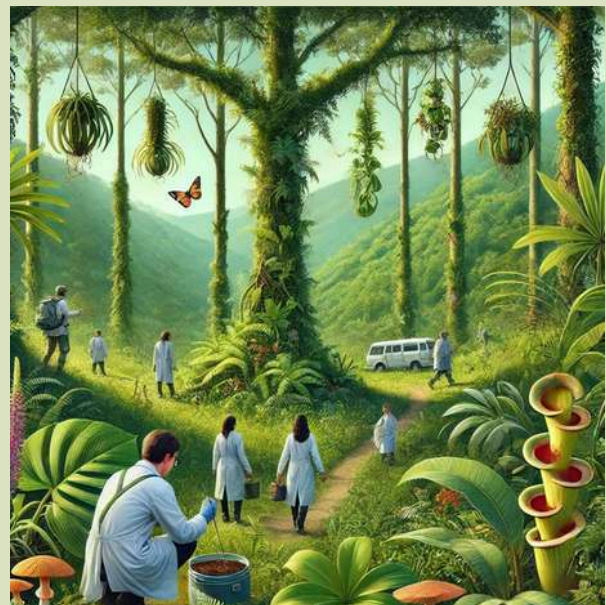
Prity Rani Deka
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Wild plant species are the foundation of life on Earth, supporting biodiversity, providing oxygen, and sustaining ecosystems. They play a crucial role in agriculture, medicine, and climate regulation, yet human activities have led to large-scale habitat destruction, deforestation, and species extinction. As forests disappear, rare and medicinal plants are vanishing, endangering not only wildlife but also the resources humans depend on. The conservation of wild plant species is no longer just an environmental concern—it is a necessity for the survival of future generations. Protecting plant species in their natural habitats, known as in-situ conservation, is one of the most effective ways to preserve biodiversity. National parks, wildlife sanctuaries, and biosphere reserves safeguard countless plant species by providing legal protection to their ecosystems. Sacred groves, traditionally protected by communities, have also played a vital role in conserving rare flora. However, in some cases, plants require preservation outside their natural habitats through ex-situ conservation methods. Botanical gardens, seed banks, and tissue culture techniques ensure that even the most endangered species can survive and be reintroduced into the wild.

Advancements in science and technology have significantly enhanced conservation efforts. Remote sensing and GIS mapping help monitor deforestation and habitat loss, while genetic studies and cryopreservation techniques aid in securing plant diversity. Sustainable agricultural practices, afforestation programs, and climate adaptation strategies further contribute to ecosystem restoration. Community participation is essential, as local knowledge and traditional practices can support large-scale conservation initiatives.

Several wild plant species are now critically endangered, requiring immediate conservation efforts. *Rauvolfia serpentina* (Sarpagandha), once abundant in Indian forests, is now under threat due to excessive harvesting for its medicinal properties. *Taxus wallichiana* (Himalayan Yew), known for its cancer-fighting compound taxol, is also at risk due to illegal collection. Similarly, *Dioscorea deltoidea* (Wild Yam), a key source of steroidal drugs, is declining due to habitat destruction. *Nepenthes khasiana*, a rare carnivorous pitcher plant found in Meghalaya, faces extinction due to habitat loss. These species, along with many others, highlight the critical need for conservation measures.

The loss of wild plant species is not just an environmental issue; it is a crisis that affects human survival and future generations. Without these plants, ecosystems will collapse, leading to food insecurity, loss of medicinal resources, and worsening climate conditions. Conservation must be a collective effort involving governments, scientists, local communities, and individuals. By promoting reforestation, enforcing strict environmental laws, and spreading awareness, we can ensure that these invaluable plant species continue to thrive.



MEDICINAL WONDERS OF SOME WEEDS

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Dandelion

(Taraxacum officinale)

While many people think of the dandelion (*Taraxacum officinale*) as a pesky weed, it is chock full of vitamins A, B, C, and D, as well as minerals, such as iron, potassium, and zinc. Dandelion leaves are used to add flavor to salads, sandwiches, and teas. The roots are used in some coffee substitutes, and the flowers are used to make wines. In Europe, dandelion was used in remedies for fever, boils, eye problems, diabetes, and diarrhea. Dandelion leaves act as a diuretic, increasing the amount of urine your body makes. The leaves are used to stimulate the appetite and help digestion.



Chickweed

(Stellaria media)

Traditionally, leaves decoction of *S. media* has been reported for its curative applications. In Asia and tropical Africa, leaves decoction is used to treat acute gastrointestinal and respiratory diseases. Also, dried leaves are processed. In India, leaf decoction is used to dress deep wounds, stop bleeding and lessen tumour, pulverized leaves, stem and root is used in form of plaster for dislocated bones and swelling. The whole plant is used to treat asthma, bronchitis, pulmonary diseases and obesity.



Stinging nettle

(Urtica dioica)

Stinging nettle (*Urtica dioica* L.) is a wild herbaceous perennial blooming plant that is commonly known as stinging nettle. Europe, Asia, North Africa, and North America are all home to stinging nettle. Young leaves can be used to make curries, herb soups, and sour soups. The root of the stinging nettle is used to treat mictional difficulties associated with benign prostatic hyperplasia, while the leaves are used to treat arthritis, rheumatism, and allergic rhinitis.



The Colourful World of Algae

Thunu Bania
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Algae are simple, plant-like organisms found in oceans, rivers, lakes, and even in moist soil. They are found in many colors , including green, red, brown, and blue-green, because of different pigments that help them absorb sunlight for photosynthesis. This process allows them to produce food and release oxygen



Algae are also an important source of food. They are rich in proteins, vitamins, and minerals. In many cultures, seaweeds (a type of algae) are consumed as food. Spirulina and chlorella are popular health supplements made from algae because they are high in nutrients. Algae also play an important role in environmental protection. They absorb carbon dioxide, helping to reduce global warming. Algae are also used to clean polluted water by absorbing harmful chemicals and heavy metals. This makes them useful for treating wastewater and protecting aquatic ecosystems. The colorful world of algae is not only fascinating but also essential for life on Earth. From producing oxygen to providing food, industrial products, environmental protection, and renewable energy, algae contribute in many ways.

The Hidden Allies: Mycorrhizal Fungi and Their Role in Plant Growth

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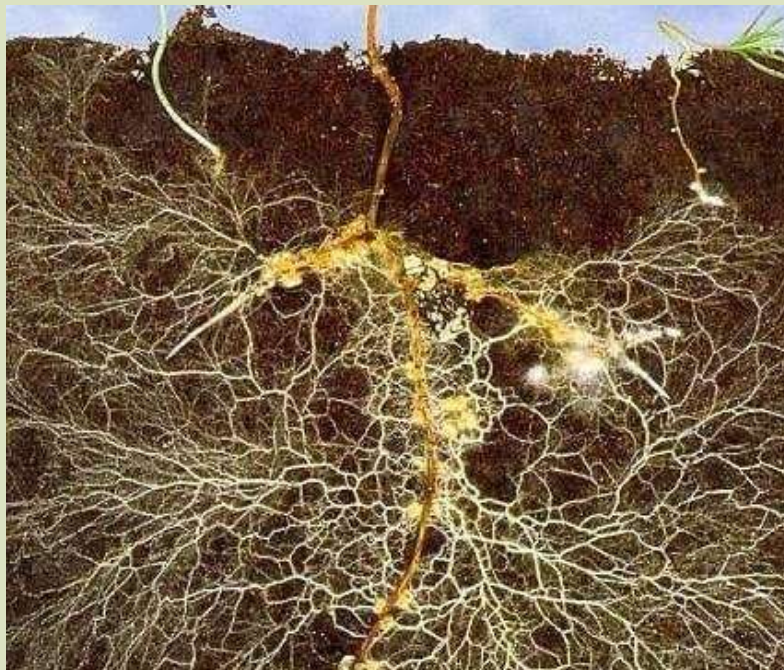
Beneath the soil, an invisible yet essential network exists that supports plant life—mycorrhizal fungi. These fungi form a symbiotic relationship with plant roots, enhancing nutrient absorption and overall plant health. In exchange, they receive carbohydrates from plants, making this partnership mutually beneficial. Mycorrhizal fungi extend their hyphae deep into the soil, allowing plants to access water and nutrients beyond their normal reach. This underground association plays a significant role in plant survival, soil fertility, and ecosystem balance.

There are two primary types of mycorrhizal fungi. Ectomycorrhizal fungi (EMF) form a sheath around root surfaces and associate mainly with trees like pines and oaks. These fungi improve plant growth in nutrient-poor soils. Arbuscular mycorrhizal fungi (AMF), on the other hand, penetrate root cells, forming structures called arbuscules where nutrient exchange occurs. These fungi are found in nearly 80% of land plants, including many agricultural crops such as wheat, maize, and legumes.

The benefits of mycorrhizal fungi go beyond nutrient uptake. They improve drought resistance by enhancing water absorption, making plants more resilient in dry conditions. Additionally, they act as a defense system against soil-borne pathogens by forming a protective barrier around roots. Another remarkable function is their role in plant communication. Mycorrhizal networks connect multiple plants, facilitating the transfer of nutrients and signaling potential threats such as pest attacks. This underground communication, often referred to as the "Wood Wide Web," showcases the interconnected nature of plant life.

Despite their importance, modern agricultural practices have disrupted mycorrhizal networks. Excessive fertilizer use reduces the plant's dependency on fungal symbiosis, leading to a decline in their presence. Deep tilling and monocropping also destroy fungal structures, weakening soil health. However, adopting sustainable farming techniques can help restore these beneficial fungi. Practices like reduced tillage, crop rotation, and the use of organic fertilizers promote fungal growth and improve soil quality.

As climate change and soil degradation threaten global food security, understanding and utilizing mycorrhizal fungi can provide natural solutions for sustainable agriculture. These fungi not only enhance plant productivity but also contribute to soil conservation and ecosystem stability. By harnessing their potential, we can reduce reliance on synthetic fertilizers, improve crop yields, and create a more resilient agricultural system. The world beneath our feet is full of life, and acknowledging the role of mycorrhizal fungi can help us build a greener and more sustainable future.



The Evolution of Flowering Plants

Rozina Ahmed
M.Sc Botany (4th Sem)

Flowering plants, also known as angiosperms, are the most diverse and widespread group of plants on Earth. They provide us with food, oxygen, medicine, and beauty. But how did they evolve? Their journey began millions of years ago and led to the incredible variety of plants we see today.

The earliest plants on Earth were simple and reproduced using spores. Around 350 million years ago, the first seed plants appeared. These plants had seeds that helped them survive harsh conditions, but they did not yet have flowers. Instead, they relied on the wind or water to spread their seeds.

Later, around 200 million years ago, gymnosperms (like pine, fir, and cedar trees) evolved. These plants had cones instead of flowers and reproduced using exposed seeds. They dominated the planet for millions of years, but they had a major limitation—without flowers, they depended mostly on the wind for pollination, which was not always efficient.

Around 140 million years ago, a revolutionary group of plants appeared—angiosperms or flowering plants. Flowers were a game-changer because they attracted pollinators like bees, butterflies, and birds, which helped transfer pollen from one flower to another. This made reproduction more efficient and allowed flowering plants to spread rapidly across different environments.

As flowering plants continued to evolve, they became incredibly diverse. Some developed into grasses, forming vast grasslands, while others grew into towering trees like oaks and maples. Many plants developed fruits, which helped protect their seeds and allowed animals to disperse them to new locations. Today, angiosperms make up nearly 90% of all plant species on Earth and are essential for maintaining ecosystems and human life.

The evolution of flowering plants is a remarkable story of adaptation and survival. From ancient seed plants to the colorful flowers we see today, their journey showcases the power of nature to innovate and thrive.



The Role of Bioluminescence in Marine Ecosystems: Adaptation, Communication, and Survival

Nibha Bora
Research Scholar

Introduction

The ocean is home to some of the most mysterious creatures, many of which possess the ability to glow in the dark. This phenomenon, known as bioluminescence, is widespread in marine ecosystems, particularly in the deep sea, where sunlight does not penetrate. From tiny plankton to large predators like squid, bioluminescence is used for survival in various ways. The light produced by these organisms serves as a tool for attracting mates, deceiving predators, and luring prey.

The presence of bioluminescent organisms in marine habitats highlights the importance of this adaptation in evolution. Scientists estimate that over 75% of deep-sea creatures exhibit bioluminescence, making it one of the most common adaptations in the ocean. However, despite its prevalence, many aspects of bioluminescence remain unknown due to the challenges of deep-sea exploration.

This article delves into the science behind bioluminescence, its role in the marine ecosystem, its evolutionary advantages, and its potential applications in human research and technology.

Mechanisms of Bioluminescence

Bioluminescence is a result of a biochemical reaction that occurs within specialized cells or organs in an organism's body. The key components of this reaction include:

- 1. Luciferin – A light-emitting molecule that undergoes oxidation to produce light.**
- 2. Luciferase – An enzyme that catalyzes the oxidation of luciferin, speeding up the reaction.**
- 3. Oxygen – Required for the reaction to take place.**
- 4. Energy (ATP) – Fuels the reaction, releasing photons (light).**

This reaction occurs in a controlled manner, allowing organisms to emit light in specific patterns or intensities depending on their needs. Some organisms, such as jellyfish and firefly squid, produce continuous light, while others, like certain shrimp species, create brief flashes to startle predators.

Additionally, some marine organisms do not produce their own bioluminescence but instead rely on symbiotic bacteria. For example, the Hawaiian bobtail squid harbors bioluminescent bacteria in specialized light organs, using their glow for camouflage.

Ecological Roles of Bioluminescence

Bioluminescence plays several crucial roles in the survival of marine organisms.

1. Predator Avoidance

One of the most common uses of bioluminescence is to evade predators. Organisms employ various defensive strategies, such as:

- Counterillumination – Many deep-sea fish and squids use bioluminescence to match the ambient light from the ocean surface, making them nearly invisible to predators below.**
- Startle Responses – Some species, like the firefly squid, emit sudden flashes of light to confuse predators, allowing them to escape.**
- Decoys and Misdirection – Certain deep-sea shrimp release glowing mucus when threatened, distracting predators while the shrimp flees.**

2. Prey Attraction

Predatory species utilize bioluminescence as a hunting tool. The deep-sea anglerfish, for instance, has a glowing lure attached to its head that attracts unsuspecting prey. Once the prey gets close enough, the anglerfish quickly engulfs it.

Similarly, dragonfish possess light-emitting organs known as photophores, which they use to lure prey into striking range. The ability to produce red bioluminescent light is particularly rare in marine life, giving dragonfish an advantage in detecting prey that cannot perceive red wavelengths.

3. Intraspecies Communication

Some marine animals use bioluminescence to communicate with their own kind. Firefly squid, for example, display intricate light patterns during mating season to attract potential partners. Certain species of fish and jellyfish also use bioluminescent signals to establish territory and warn off rivals.

4. Camouflage and Stealth

Bioluminescence is also employed as a means of camouflage. The previously mentioned counterillumination technique allows organisms to blend in with their surroundings, making them difficult to detect. Additionally, some fish have bioluminescent patterns that break up their silhouette, reducing visibility to predators.

Evolutionary Significance of Bioluminescence

Bioluminescence has independently evolved multiple times across different taxa, indicating its strong adaptive advantage. Fossil evidence suggests that bioluminescence has been present in marine organisms for millions of years.

Several evolutionary theories attempt to explain the emergence of bioluminescence:

1. **Predation Pressure Hypothesis** – Organisms that developed bioluminescence had a better chance of evading predators, leading to higher survival rates and natural selection favoring this trait.

2. **Deep-Sea Adaptation Hypothesis** – As marine species adapted to deeper waters with limited light, bioluminescence became an essential tool for navigation, hunting, and communication.

Despite the evolutionary success of bioluminescence, it remains an area of ongoing research, with scientists continually discovering new species that exhibit this trait.

Scientific and Technological Applications of Bioluminescence

Beyond its ecological significance, bioluminescence has practical applications in science, medicine, and technology.

1. Biomedical Research

Bioluminescent proteins have been widely used in genetic research and medical diagnostics. For example:

- **Luciferase-based Imaging** – Scientists use luciferase enzymes to track cellular processes in living organisms, helping in cancer research and drug development.
- **Disease Detection** – Bioluminescent markers aid in identifying infections and monitoring the spread of diseases at a molecular level.

2. Environmental Monitoring

Bioluminescent bacteria serve as biosensors for detecting pollutants in water bodies. Changes in their light emission patterns can indicate the presence of toxic substances, providing an early warning system for environmental contamination.

3. Military and Navigation Uses

Bioluminescence has inspired innovations in military technology, such as the development of glow-in-the-dark camouflage and night-vision tracking systems. Additionally, scientists are exploring ways to use bioluminescent organisms for sustainable underwater lighting.

Conclusion

Bioluminescence is one of nature's most captivating adaptations, offering survival benefits to marine organisms while inspiring scientific innovation. From predator evasion to intraspecies communication, its role in marine ecosystems is profound. Understanding bioluminescence not only helps us appreciate the complexity of life in the ocean but also paves the way for groundbreaking advancements in science and technology.

As research continues, bioluminescence may lead to new discoveries in medicine, environmental conservation, and bioengineering, demonstrating the far-reaching impact of this natural wonder.