8th Regional Science & Technology Congress 2025 – 26

Region 3

(Bankura, Jhargram, Paschim Medinipur, Purba Medinipur and Purulia)

20th and 21st January 2026

BOOK OF ABSTRACTS

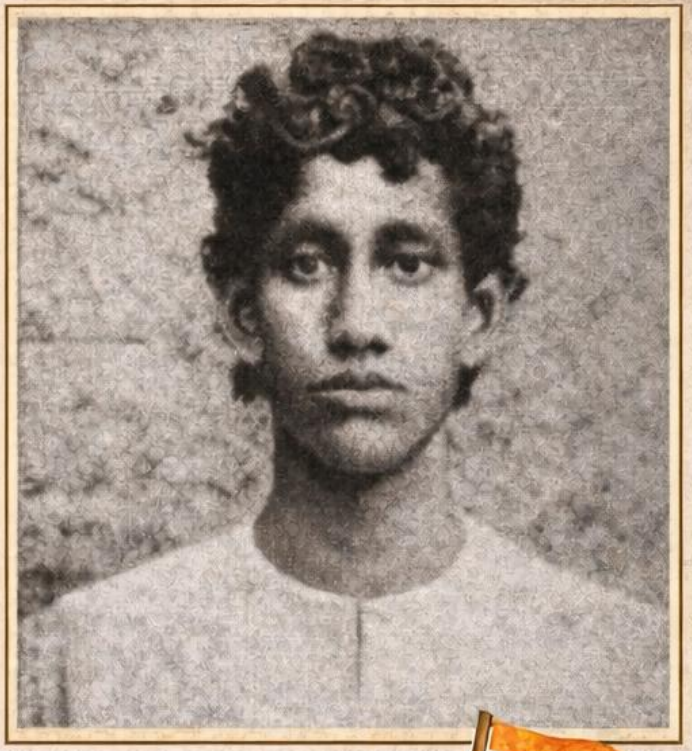
Jointly Organised by

Debra Thana Sahid Kshudiram Smriti Mahavidyalaya (Autonomous)

and

Department of Science and Technology and Biotechnology, Government of West Bengal

Tribute to Sahid Kshudiram Bose



- *Born on 3rd December 1889 at Habibpur, Midnapore, West Bengal*
- *Fought against British rule to free India, embracing martyrdom at the young age of 18*
- *His bravery and sacrifice for the motherland continue to inspire and awaken the spirit of freedom*

"His devotion to the motherland will forever inspire generations of Indians."

DEBRA THANA SAHID KSHUDIRAM SMRITI MAHAVIDYALAYA

Gangaramchak, P.O.: Chakshyampur, District: Paschim Medinipur, PIN: 721124, West Bengal, India.

Debra Thana Sahid Kshudiram Smriti Mahavidyalaya is a premier institution of higher education located in the Debra block of Paschim Medinipur district, West Bengal. Established in 2006 through the generous contributions of the local community, **the college is the only Government or Government-aided degree college in the Debra block and has been receiving continuous support and grants from the Government since its inception.**

Spread across a campus of more than five acres, the college offers a serene, green, and academically enriching environment. **The campus is eco-friendly, plastic-free, vehicle-free**, and is equipped with modern infrastructure including ICT-enabled classrooms, advanced science laboratories, computer laboratories, an automobile workshop, a language laboratory, e-learning facilities, and an open-access automated library. **A dedicated research centre promotes scholarly activities among faculty members and students**, fostering a culture of innovation and inquiry.

The institution also provides **state-of-the-art facilities for academic administration, examination management, and academic interaction**, including a modern controller section, video-conferencing-enabled meeting hall, and well-equipped seminar and cultural halls. Emphasis on holistic development is reflected through facilities such as a gymnasium, yoga centre, playground, and various skill-development and self-reliance training programmes under the Institutional Innovation Council.

Committed to sustainable practices, the college has implemented several green initiatives such as **rainwater harvesting, solar energy systems, medicinal plant gardens, mushroom cultivation, vermicomposting, and biogas generation**, making it **a green, environment-friendly institution and a self-reliant educational centre.**

In recognition of its academic excellence and institutional quality, **the college has been accredited with NAAC 'A' Grade, and has been granted autonomous status by UGC along with recognition as a Hub College of Paschim Medinipur District and approval for conducting research programmes.** Guided by the ideals of knowledge, discipline, and service, the institution remains committed to its vision of evolving into one of the finest educational institutions in West Bengal.

উজ্জল বিশ্বাস
(ভারপ্রাপ্ত মন্ত্রী)
বিজ্ঞান ও প্রযুক্তি এবং জৈবপ্রযুক্তি দপ্তর
পশ্চিমবঙ্গ সরকার
বিজ্ঞান চেতনা ভবন
২৬/বি, ডিডি ব্লক, সেক্টর - ১, সল্টলেক
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MESSAGE

Department of Science & Technology and Biotechnology, Government of West Bengal organises West Bengal State Science and Technology Congress to provide a forum for Scientific Research especially for young scientists and to synergise new ideas with societal needs. State level programme will be participated by the best participants of four Regional Science & Technology Congresses to be held across the State in collaboration with various colleges and universities as a precursor of the programme.

Debra Thana Sahid Kshudiram Smriti Mahavidyalaya, Paschim Medinipur has taken a leading responsibility for hoisting the 8th Regional Science and Technology Congress, on 20th and 21st January, 2026. I would also extend my heartfelt gratitude to the organisers.

I take this opportunity to welcome all the participants to 8th Regional Science & Technology Congress to be held at Debra Thana Sahid Kshudiram Smriti Mahavidyalaya, Paschim Medinipur and wish the event a resounding success.

(Ujjal Biswas)

UJJAL BISWAS
Minister-in-Charge
Department of Science & Technology
Government

To,

The Principal
Debra Thana Sahid Kshudiram Smriti Mahavidyalaya

Vijay Bharti, IAS
Secretary

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Government of West Bengal
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FOREWORD

It is a moment of immense pride to join in celebrating the 33rd West Bengal State Science and Technology Congress along with the 8th Regional Congresses. This distinguished platform continues to symbolize the state's strong commitment to nurturing scientific inquiry, advancing technological innovation, and empowering young minds to contribute meaningfully to society.

Over the past decades, the Congress has grown into a vital ecosystem where researchers, educators, students, and innovators come together to exchange ideas, present new findings, and explore interdisciplinary collaborations. At a time when the world is undergoing rapid transformation - driven by digital technologies, sustainable energy transitions, artificial intelligence, biotechnology, and climate action—such collective engagement is more important than ever.

West Bengal has a rich legacy of scientific excellence, shaped by iconic thinkers, pioneering institutions and a vibrant culture of curiosity. This Congress continues that tradition by providing a forum where emerging researchers can showcase their work and gain the mentorship, exposure, and motivation needed to reach global standards. The inclusion of the Regional Congresses further strengthens the grassroots scientific network, ensuring that innovation is not limited to urban centers but reaches every district, school, and community.

As we look toward the future, it is essential to promote research that addresses real-world challenges - sustainable agriculture, healthcare accessibility, environmental conservation, disaster resilience, and entrepreneurial innovation. The Congress serves as a bridge between knowledge and impact, helping transform scientific understanding into practical solutions that uplift society and promote inclusive development.

On this special occasion, let us reaffirm our collective commitment to fostering a scientific temperament, encouraging evidence-based decision-making, and supporting the next generation of innovators. May this Congress continue to spark new ideas, inspire collaborations, and contribute to a brighter, more sustainable future for the State.

My best wishes for the success of the 33rd State Science and Technology Congress and the 8th Regional Congresses. May the discussions, discoveries, and innovations emerging from this gathering illuminate new pathways for progress and human betterment.

Vijay Bharti, IAS

Professor Dipak Kumar Kar
Vice-Chancellor
Vidyasagar University
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West Bengal, India

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VIDYASAGAR UNIVERSITY

Date: 13.01.2026

MESSAGE

It is heartening to note that Debra Thana Sahid Kshudiram Smriti Mahavidyalaya, Paschim Medinipur has been selected by the Department of Science & Technology and Biotechnology, Government of West Bengal to host the 8th Regional Science Technology and Biotechnology Congress (Region 3) on January 20 & 21, 2026.

I commend the endeavour of the organizers and hope that the deliberations in the Congress will really be enriching to all the participants.

I wish the confluence a great success.

Dipak Kumar Kar

(Professor Dipak Kumar Kar)

Dr. Rupa Dasgupta,
Principal,
Debra Thana Sahid Kshudiram Smriti Mahavidyalaya,
P.O. – Chakshyampur,
Paschim Medinipur – 721 124

OFFICE OF THE PRINCIPAL
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Ref No: DTSKSM/RSC/2026

Date: 13-01-2026

Message

Science shapes the destiny of civilization, technology drives it to the valley of well being and growth of society with a cause and carrier. It's really a challenging task to socialize technology through community mobilization. We are now confronting with the brunt of global warming, erosion of soil, depletion of ground water, impoverishment of natural resources, wraths of pollution and almost an unabated population explosion. We need to produce 550 million tons of foodgrain India for a projected population 1600 million by 2050. By this time, our ground water availability will be reduced from 5500 cubic meter per capita per year to a tiny volume, 1200 cubic meter. In all vital sectors energy, food, health, education, communication and space, both scope and challenges are escalating at a pace that our civilisation have witnessed ever before.

So, this science and technology congress, I hope and believe, will generate valuable inputs over a wide spectrum of issues and intervention in the context social ecology of lateritic West Bengal. The feat of AI to threat of Arsenic contamination, shall invite both terrains and pedagogy of science and technology expectation and application. The outcome of these conceptual and empirical exercises around the congress shall be driven for the better tomorrow of human kind with a focus on the western part of West Bengal.

The Regional Congress, encompassing the districts of Bankura, Purulia, Jhargram, Purba Medinipur, and Paschim Medinipur, serves as a significant academic platform for fostering scientific temper, research aptitude, and innovation among students, researchers, and academicians. Such initiatives play a vital role in strengthening the culture of inquiry and interdisciplinary research, which are essential for sustainable development and societal progress.

I sincerely appreciate the efforts of the organisers, faculty members, and all stakeholders involved in successfully bringing together this congregation of scholars and young researchers. I am confident that the deliberations, presentations, and interactions during the Congress will lead to meaningful academic exchange and future collaborations.

I wish the Congress every success and hope that it will inspire the participants to pursue excellence in science, technology, and biotechnology for the betterment of society.

With warm regards and best wishes.

Prof. (Dr.) Sankar Kumar Acharya
Chairperson
Governing Body
Debra Thana Sahid Khudiram Smriti Mahavidyalaya (Autonomous)

Chairperson,
Governing Body
Debra Thana Sahid Kshudiram
Smriti Mahavidyalaya (Autonomous)
Chakshyampur, Paschim Medinipur

OFFICE OF THE PRINCIPAL

DEBRA THANA SAHID KSHUDIRAM SMRITI MAHAVIDYALAYA (AUTONOMOUS)

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Ref No: DTSKSM/RSC-1/2026 Date: 13-01-2026

Message

I am pleased to convey my warm greetings on the occasion of the 8th Regional Science, Technology and Biotechnology Congress (Region 3) being organised at Debra Thana Sahid Khudiram Smriti Mahavidyalaya (Autonomous), Paschim Medinipur.

On behalf of the institution, I express our sincere gratitude to the Department of Science, Technology and Biotechnology, Government of West Bengal, for selecting our college as the Host College for this prestigious regional academic event. The Congress provides a valuable opportunity for students, researchers, and academicians from Bankura, Purulia, Jhargram, Purba Medinipur, and Paschim Medinipur to engage in meaningful scientific discourse and knowledge sharing.

I commend the organisers and participating institutions for their collective efforts and wish the Congress a productive and successful outcome.

With best wishes.

Principal
Debra Thana Sahid Khudiram Smriti
Mahavidyalaya (Autonomous)

Principal,
Debra Thana Sahid Kshudiram
Smriti Mahavidyalaya (Autonomous)
P.O.- Chakshyampur-721124
Paschim Medinipur

MEMORIAL LECTURES

Sir C.V Raman Memorial Lecture

Title of the Talk: Innovating for Impact: Affordable Diagnostics to Transform Grassroots Health

Prof. Suman Chakraborty

Director, Indian Institute of Technology, Kharagpur, West Bengal

Sir Jagadish Chandra Bose Memorial Lecture

Title of the Talk: Water-Climate Nexus

Dr. Kalyan Rudra

Chairman, Pollution Control Board, Govt. of West Bengal

Prof. Prasanta Chandra Mahalanabis Memorial Lecture

Title of the Talk: ZSI and Indian Faunal Heritage: Past, Present and Future Perspectives

Dr. Dhriti Banerjee,

Director Zoological Survey of India, Govt. of India

Sir C.V Raman Memorial Lecture

Innovating for Impact: Affordable Diagnostics to Transform Grassroots Health

Suman Chakraborty

Director, Institute Chair Professor and Sir J. C. Bose National Fellow
Indian Institute of Technology Kharagpur, Kharagpur-721302, W.B., India
suman@mech.iitkgp.ac.in

Abstract

This lecture explores a central question of our times — how can engineering innovation be reimagined to serve the most fundamental human need: health, particularly among underserved communities? Despite India's rapid advances in sophisticated medical technologies, vast sections of the population still lack timely and affordable diagnostic access. The real gap lies not in treatment but in early detection. The challenge, therefore, is to design diagnostic systems that transcend infrastructural and economic constraints, making precision health universally accessible rather than confined to urban hospitals and laboratories.

At IIT Kharagpur, our research group has pursued the philosophy that healthcare equity begins with diagnostic equity. Through interdisciplinary work spanning microfluidics, interfacial transport, and frugal engineering, we have developed a new generation of "Lab-on-a-Chip" and "Lab-on-Paper" systems capable of detecting diseases using only microliters of fluid, without reliance on electricity or bulky instruments. These devices exploit fundamental physical principles — capillary action, electrokinetic transport, and surface tension–driven reactions — coupled with smartphone-based imaging, embedded artificial intelligence, and cloud analytics to enable real-time, community-level health decisions.

Yet, bridging the laboratory-to-livelihood divide demanded empathy and social engagement beyond technological excellence. Field implementation across eastern and northeastern India — including the Sundarbans and tribal hinterlands — revealed that sustainable impact arises only when innovation resonates with local realities. By co-creating solutions with women's self-help groups, community health workers, and rural entrepreneurs, we transformed passive beneficiaries into empowered health actors. These collaborations not only expanded diagnostic coverage but also enhanced women's livelihood, self-reliance, and leadership in their communities.

This fusion of technology, socioeconomic empowerment, and gender inclusion redefines engineering's social purpose. Affordable diagnostics evolve from mere instruments of disease detection into catalysts of human development. Local manufacturing and maintenance nurture rural entrepreneurship, aligning with the national vision of *Atmanirbhar Bharat*.

Looking forward, regional innovation hubs, open-source design ecosystems, and AI-enabled community health clouds can democratize and accelerate such transformation. A new model of *Public–Private–People Partnership* (PPPP) will ensure that innovation is co-owned by the communities it serves. Ultimately, the future of healthcare lies not in scaling complexity but in scaling simplicity — powered by intelligence, compassion, and inclusivity — to make diagnostics a fundamental right for every citizen.

Sir Jagadish Chandra Bose Memorial Lecture

Water-Climate Nexus

Kalyan Rudra

Chairman, West Bengal Pollution Control Board, Govt of West Bengal

Abstract

It is a matter of great honour for me to deliver a lecture in memory of Professor Jagadish Chandra Bose in the Regional Science Congress being organized by Debra *Sahid Kshudiram* Smriti Mahavidyalaya. In 1894, Professor Jagadish Chandra Bose wrote an article entitled "Bhagirathir Utse Sandhane." It is a simplistic description of the Hydrological Cycle, which governs the Himalayan River system. Bose explored the source of the Ganga or Bhagirathi in Garwal Himalaya and explained how mighty hydrological system operates.

In the hydrological cycle, Water continuously moves in three layers:

a. Atmospheric flow.
b. Terrestrial flow.
c. Underground flow.

Being impacted by Climate Change, all three layers of water movement tend to change, posing a significant threat to human civilization. The Himalaya, the water tower of Asia, covers over five million square kilometers, with 100000 glaciers,12000 lakes feeding 10 major Asian rivers. It serves nearly 2 billion people across 8 countries. 25% of the global population relies on these rivers for their survival. It has already warmed by +1.5C, faster than the global rate, putting the mountain water system under severe stress. It has lost about 25% of its glacier area over the past 30 years. The winter 2024-2025 snow cover was 23.6% below normal, the lowest of the last two decades.

The lecture will explain how climate change has been impacting the fluvial regime, especially that of the Ganga.

Prof. Prasanta Chandra Mahalanabis Memorial Lecture

ZSI and Indian Faunal Heritage: Past, Present and Future Perspectives

Dr. Dhriti Banerjee

Director, Zoological Survey of India

Abstract

The Zoological Survey of India, whose genesis traces to the establishment of the Indian Museum in 1875 and the zoological collections of the Asiatic Society of Bengal founded by Sir William Jones in 1784, was formally constituted as an independent organization on 1 July 1916 under the directorship of Thomas Nelson Annandale following years of advocacy that began with a representation in March 1913 from the Superintendent of the Zoological and Anthropological Section requesting recognition of the Zoological Section as a Zoological Survey. Operating under the Ministry of Environment, Forest and Climate Change as the National Repository for Zoological Collections under Section 39 of the National Biodiversity Act 2002, ZSI has evolved from the Zoological Gallery under Nathaniel Wallich's care through successive superintendents including John McClelland, Edward Blyth, John Anderson, James Wood-Mason, and Alfred William Alcock into one of India's premier institutions for animal taxonomy and biodiversity research, maintaining headquarters in Kolkata with sixteen regional centers across India and conducting approximately 125-150 annual research surveys covering taxonomy, systematics, ecology, behavior, distribution, and status assessment of endangered and threatened species across protected areas, biogeographic zones, and Ramsar sites. As custodian of one of the world's largest zoological collections enriched through political and military expeditions and notable acquisitions including Francis Day's Indian fishes, Lionel de Nicéville's butterflies, Dudgeon and Edward Ernest Green's moths, Jacob R. H. Neervoort van de Poll's beetles, and Godwin Austen's molluscs, the organization has systematically documented the rich biodiversity of India for over 109 years, currently operating with more than 200 research projects that have yielded remarkable results including identification of over 100,000 specimens belonging to more than 7,000 species annually, registration of 7,473 species across 17 animal groups, augmentation of 1,113 species from 28 faunal communities in National Zoological Collections, discovery of 146 new species including one new genus and 111 new records for India during 2025 alone alongside an annual

discovery rate of 125-135 new species. ZSI has significantly advanced molecular taxonomy through its DNA Barcoding Centre generating over 13,000 barcodes since April 2012 for endemic species and those of medical, forensic, and veterinary importance with over 1,500 Digital Sequence Information entries, resolving numerous taxonomic queries while maintaining a robust publication record annually comprising around 50 books, 250+ research articles in peer-reviewed SCI journals, and 350+

articles in NAAS-rated journals demonstrating commitment to scientific dissemination. Beyond research excellence, the organization provides critical identification and advisory services having identified approximately 4,900 specimens from 225 institutions and assisted law enforcement agencies by identifying 751 specimens and 4,177 photographs belonging to 105 species for 120 agencies including Wildlife Crime Control Bureau, Forest Departments, and Customs authorities, particularly in cases involving confiscated wildlife materials, while developing innovative protocols for wildlife forensics including methods for identifying authentic whale ambergris samples. Having documented faunal communities in over 125 of India's 1,022 protected areas spanning nearly 178,000 square kilometers, ZSI has expanded its mandate beyond traditional taxonomy to address contemporary challenges including climate change monitoring, species distribution modeling, forensic science, human-wildlife conflict mitigation, ecosystem services evaluation, invasive species management, conservation genetics, vector biology, wildlife forensics, development of geo-spatial databases, bioacoustic repositories, climate impact analyses, and biodiversity corridor mapping, contributing substantially to national missions including the National Coastal Mission and Deep Sea Mission while serving as India's Environmental Information System center and CITES authority. The organization's comprehensive capacity-building initiatives encompass over 120 training programs, workshops, seminars, and webinars conducted across headquarters and regional centers targeting scientists, students, forest personnel, and other stakeholders. The wildlife identification and conservation practices are further facilitated by numerous memoranda of understanding with universities, colleges, and research institutions for inter-disciplinary collaboration in animal taxonomy and conservation research, alongside operation of galleries at the Indian Museum in Kolkata. As India faces mounting environmental pressures from climate change, habitat fragmentation, and rapid development, the future of

ZSI lies in leveraging cutting-edge technologies including artificial intelligence and machine learning for automated species identification and predictive modeling of range shifts, advanced GIS and remote sensing for ecological corridor mapping ensuring landscape connectivity and genetic flow between fragmented populations, next-generation sequencing and environmental DNA analysis for non-invasive monitoring of rare and cryptic species, IoT-enabled sensor networks for real-time biodiversity monitoring with instant alerts for conservation threats, LiDAR and hyperspectral imaging for detailed habitat characterization integrated with species distribution models, Corridor mapping and blockchain technology for secure specimen tracking and data management, positioning this institution built upon 110 years of taxonomic expertise as a predictive conservation

powerhouse providing actionable intelligence at unprecedented scales. Here artificial intelligence augments human expertise, molecular data complements morphological analysis, and real-time monitoring enhances long-term ecological research, ensuring that India's remarkable faunal heritage receives the protection it deserves while supporting sustainable development goals and meeting international biodiversity obligations in an era of intensifying environmental challenges.

INVITED LECTURES		
Sl No.	**Discipline**	**Invited Speakers**
1.	**Physical Sciences**	**Prof (Dr.). Tapan Kumar Nath** Professor Department of Physics, Indian Institute of Technology, Kharagpur
2.	**Chemical Sciences**	**Prof. Suhrit Ghosh** Senior Professor School of Applied & Interdisciplinary Sciences, Indian Association for the Cultivation of Science
3.	**Mathematical Sciences including Statistics**	**Prof. Madhumangal Pal** Professor Department of Mathematics, Vidyasagar University
4.	**Engineering Science and Technology**	**Prof. Prasanta Kumar Guha** **Professor** Department of Electronics and Electrical Communication Engg, Indian Institute of Technology, Kharagpur
5.	**Earth Sciences including Geoinformatics and Hydrogeology**	**Prof. Ramkrishna Maity** Professor Department of Geography, Vidyasagar University
6.	**Botany**	**Prof. Krishnendu Acharya** Professor Department of Botany, Calcutta University
7.	**Zoology**	**Prof. Koushik Pramanik** Professor Dept of Life Science, Presidency University
8.	**Biotechnology**	**Prof. Dhrubajyoti Chattopadhay** Former Dean of Science, Calcutta University Former Pro VC Academic, Calcutta University Vice Chancellor, Sister Nivedita University
9.	**Physiology and Medical Sciences, including Forensic Sciences**	**Prof. Chandradipa Ghosh** Professor Department of Physiology, Vidyasagar University
10.	**Environmental Sciences including Climate Change**	**Prof. Nabakumar Mondal** Professor Dept of Environmental Science, Burdwan University
11.	**Agriculture, Horticulture, Forestry, Fisheries and Veterinary Sciences**	**Prof. (Dr.) Sankar Kumar Acharya** Dean, Postgraduate Studies, Bidhan Chandra Krishi Viswavidyalaya
12.	**Information and Communication Science and Technology (Including Computer Sciences)**	**Prof. Amlan Chakrabarty** Director, A.K. Choudhury School of Information Technology, University of Calcutta

LIST OF DISCIPLINE SPECIFIC NODALS

Sl No	Discipline	Nodal
1	**Physical Sciences**	**Mr. Sougata Mondal** Department of Physics
2	**Chemical Sciences**	**Sk Sarfaraj Ali** Department of Chemistry
3	**Mathematical Sciences including Statistics**	**Dr. Soumya Kanti Hota** Department of Mathematics
4	**Engineering Science and Technology**	**Dr. Amita Samanta Adhya** Department of BCA
5	**Earth Sciences including Geoinformatics and Hydrogeology**	**Mr. Partha Pratim Pramanik** Department of Geography
6	**Botany**	**Dr. Amit Kumar Jana** Department of Nutrition
7	**Zoology**	**Dr. Pathik Kumar Jana** Department of Zoology
8	**Biotechnology**	**Dr. Barnali Das** Department of BMLT & MMLT
9	**Physiology and Medical Sciences, including Forensic Sciences**	**Dr. Subhankar Manna** Department of Physiology
10	**Environmental Sciences including Climate Change**	**Dr. Santanu Dinda** Departament of Geography
11	**Agriculture, Horticulture, Forestry, Fisheries and Veterinary Sciences**	**Mr. Puspendu Shit** Department of Zoology
12	**Information and Communication Science and Technology (including Computer Sciences)**	**Mr. Rakesh Paul** Department of Computer Science

ORGANIZING COMMITTEE

CHIEF PATRON

- **Prof. (Dr.) Dipak Kr. Kar**, Hon'ble Vice Chancellor, Vidyasagar University

PATRONS

- **Prof. Sankar Kumar Acharya,** President, Governing Body Debra Thana Sahid Kshudiram Smriti Mahavidyalaya (Autonomous)
- **Dr. Humayun Kabir,** Hon'ble Member of GB & MLA, Debra, Paschim Medinipur

CHAIRPERSON

- **Dr. Rupa Dasgupta,** Principal, Debra Thana Sahid Kshudiram Smriti Mahavidyalaya (Autonomous), Secretary- Organising Committee

VICE-CHAIRPERSONS

- **Prof. Debidas Ghosh,** Emeritus Professor of BMLT
- **Dr. Joydev De**, Assistant Professor in Physics, Nodal Officer
- **Dr. Soumya Kanti Hota,** Assistant Professor in Mathematics

STEERING COMMITTEE

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- **Mr. Pradip Kumar Paul** (Head Clerk)
- **Mr. Barun Chakraborty** (Cashier)
- **Mr. Subrata Panda, Joint Convener** (Accountant)

REGISTRATION AND RECEPTION

- **Dr. Arpita Tripathy** (Department of Sanskrit), **Convener**
- **Mrs. Bipasha Majumdar (De)**, (Department of English), **Jt. Convener**
- **Dr. Barnali Das** (Department of BMLT)
- **Mrs. Koyel Ghosh** (Department of Philosophy)
- **Mr. Debabrata Ghorai** (Department of Mathematics)
- **Dr. Amita Samanta Adhya** (Department of BCA**)**
- **Mrs. Tanushri Maity** (Department of Geography)

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- **Mr. Partha Pratim Pramanik** (Department of Geography, **Convener**
- **Mr. Sunirmal Dolai, Convener** (Department of Education), **Jt. Convener**
- **Mr. Avishek Musib** (Department of Bengali)
- **Mr. Pradip Paul** (Head Clerk)
- **Mr. Aloke Mahata** (NTS)

ACCOMMODATION

- **Mr. Avishek Musib** (Department of Bengali), **Convener**
- **Dr. Pankoj Kanti Sarkar** (Department of Philosophy), **Jt. Convener**
- **Mr. Bholanath Das** (Department of English)
- **Dr. Amit Kumar Jana** (Department of Nutrition)
- **Mr. Subhadip Pal (**Department of Physical Education)
- **Mr. Pradip Kumar Pal**, **Joint Convener** (Head Clerk)
- **Mr. Anindya Das** (NTS)

FOOD AND REFRESHMENT

- **Dr. Gobinda Das, Convener** (Department of Sanskrit), **Convener**
- **Mr. Avhisek Musib** (Department of Bengali)
- **Dr. Mrinal Kanti Saren** (Department of History)
- **Dr. Shatrughan Kahar** (Department of History)
- **Dr. Santanu Dinda** (Department of Geography)

- **Mr. Sougata Mandal (Department of Physics)**
- **Sri Barun Chakrabarty, (NTS), Joint Convener**
- **Mr. Debabrata Maity (NTS)**
- **Mr. Anindya Das (NTS)**
- **Mr. Sridam Patar (NTS)**

TECHNICAL ARRANGEMENTS

- **Dr. Soumya Kanti Hota (Department of Mathematics), Convener**
- **Mr. Prasanta Dutta (Department of BCA)**
- **Mr. Prasanta Shit (Department of BCA)**
- **Dr. Santanu Dinda (Department of Geography), Jt. Convener**
- **Dr. Amit Kumar Jana (Department of Nutrition)**
- **Mr. Rakesh Paul (Department of Computer Science)**
- **Mr. Subhadip Pal (Department of Physical Education)**
- **Mr. Rabisankar Pramanik (Department of Computer Science)**
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ABSTRACTS

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PHYSICAL SCIENCE

Abstract ID- 063411100

Optical properties and enhanced photocatalytic activity of Mg and Nd doped ZnO nanoparticles

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In recent times significant progresses have taken place in semiconductor nanostructures arena for enhanced electrical, gas sensing, magnetic, optical and photocatalytic applications. ZnO has large exciton binding energy, superior physical and chemical stability and nontoxicity which make its prominence as decent photocatalyst for degradation of various pollutants. Optically active Mg^{2+} and Nd^{3+} ions have large advantages with creating luminescence centres in doped ZnO nanoparticles. Recently, it has been set up that the Mg^{2+} and Nd^{3+} ion doped ZnO nanoparticles are emerging photocatalyst to despoil the harmful pollutants of dye based industries. In the recent work, $Zn_{1-x}Mg_xO$ and $Zn_{1-x}Nd_xO$ nanoparticles have been prepared through chemical precipitation method using hydroxyoxalate type precursors. Mg^{2+} and Nd^{3+} ions doped ZnO nanoparticles have been analyzed by XRD, HRTEM, UV-VIS, FL and photocatalytic activity. All the samples retain hexagonal wurtzite structure. The TEM photographs have explore the nanoparticles size within 50 nm range. These nanocompounds represent an increased band gap relative to undoped ZnO due to Moss-Burstein band filling effect. Strong excitonic emissions have been revealed from fluorescence spectra of Mg and Nd incorporated ZnO nanoparticles. Enhanced photocatalytic performances have been realized in both Mg^{2+} and Nd^{3+} ion incorporated ZnO nanoparticles. The photocatalytic rate constant of modified ZnO nanostructures improves by 300% for 15% Mg doping, while 15% Nd doping raises it by 375%. These values are significant for effective sunlight-irradiated photocatalytic reaction, self-cleaning and photovoltaic applications. Detailed discussion will be delivered at the time of presentation.

Abstract ID- 051211626

Tunable Thermal-Photonic Crystal Sensor Based on HfO_2 for Ultra-High Temperature Sensing

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The proposed one-dimensional photonic crystal (PC) model with alternating layers of Titanium Dioxide (TiO_2) and Silicon Dioxide (SiO_2) with single defect layer of Hafnium Dioxide (HfO_2) making it highly suitable for high-temperature sensing applications. The periodic variation in the refractive index between TiO_2 and SiO_2 forms a well-defined photonic bandgap (PBG) for the excellent optical behavior of PC. While a single HfO_2 defect layer introduced a localized resonance mode creates within the PBG. This resonance peak shifts with temperature variation makes a precise thermal sensor. The thickness of the active defect layer (HfO_2) was optimized by adjusting it around the quarter-wavelength condition which ensure the maximum light confinement and sharper resonance peaks. The optimization enhances sensitivity, quality factor, and overall sensor response under high-temperature environments. The optical response of the proposed PC was analyzed using the well-known Transfer Matrix Method implemented in Python, considering near-infrared (IR) light as the input source to match the transparency range of the sensor. The calculated transmission spectra, sensitivity, and quality factor (Q-factor) confirm that the optimized PC sensor performed well and thermal resolution. Hence, the TiO_2/SiO_2-based 1-D PC with an HfO_2 defect layer offers a compact and efficient design for advanced high-temperature sensing applications.

Abstract ID- 091151161

A hybrid PDM CO-OFDM technique for high-capacity underwater communication-system

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With the growing requirement for large data-rate communication in marine environments, the progress of underwater optical-wireless communication (UOWC) system has become a promising solution. UOWC system presents a substantial advancement in underwater-wireless communication, offering large data-rates and longer-distance. Underwater acoustic-communication has limited-bandwidth and smaller transmission-distance. Application of radio-frequency on underwater communication is restricted owing to high-attenuation of water. UOWC system is a propitious technology because of its longer-bandwidth, smaller power-consumption, low-latency, and cost-effectiveness. Despite its potential, UOWC performance is strongly influenced by the unique characteristics of the underwater optical channel. Factors such as absorption, scattering, beam-divergence, turbidity, and ambient light-interference significantly affect the propagation of optical signals. Coherent-Optical Orthogonal Frequency-Division Multiplexing (CO-OFDM) combined with Polarization-Division-Multiplexing (PDM) has recently gained significant attention as a high-capacity and spectrally efficient solution for next-generation UOWC systems. We have proposed an UOWC-system employing coherent-detection OFDM modulation with PDM. This integrated approach is plays a pivotal role in enabling high-capacity, real-time underwater connectivity for emerging scientific, industrial, and defense applications.

Abstract ID- 071442763

Acoustic Control of Nonlinear Cavity Magnon-Polariton States

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Magnon polarization using acoustic waves is an emerging topic in spintronics and magnonics, focusing on the interaction between magnons (quanta of spin waves) and phonons (quanta of acoustic waves). In such systems, bistable behaviors manifest as sharp frequency switching of cavity magnon-polaritons, corresponding to transitions between states with high and low polariton populations. The ability to switch the polarization of a transmitted electromagnetic wave—from vertical to horizontal or vice versa is of significant technological interest due to its applications in long-distance communication. Furthermore, quantum information processing critically depends on efficient quantum state transfer between different physical systems. In cavity magnonic systems, beyond the hybridization of magnons and cavity photons, nonlinear effects play a vital role, often characterized by the coexistence of two stable oscillatory states under the same set of parameters. By introducing an externally driven acoustic wave, we exploit magnetoelastic coupling to dynamically modulate the magnon frequency and the magnon-photon detuning. Using a semiclassical approach based on coupled-mode theory and nonlinear differential equations, we derive the steady-state solutions of the hybrid system and analyze the conditions for bistability and hysteresis. Our analysis reveals that the frequency, amplitude, and phase of the acoustic wave can be precisely tuned to switch the system between bistable states or completely suppress bistability. These results provide a low-power and coherent method for the dynamic control of magnon-photon interactions, with potential applications in quantum nonlinear optics, phonon-assisted spintronic control, and hybrid quantum systems.

Abstract ID- 032418205

Work-Function Engineered Crumpled V_2C MXene via Copper Phthalocyanine Delamination for High-Performance Flexible Supercapacitors

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Two-dimensional MXenes are emerging as promising energy storage materials with excellent conductivity, adjustable surfaces, and high flexibility. Among them, Vanadium-based Mxenes, especially V_2CT_x have gained significant attention for their rich redox activity and efficient charge transport characteristics. Although MXene layers tend to restack through strong interlayer interactions, reducing surface area and slowing ion transport, weakens their electrochemical performance. Preventing restacking and tuning surface features are key to developing high-performance, flexible supercapacitors. Etching, doping, and surface modification reduce restacking but affect stability, while molecular intercalation effectively tunes MXene structure and electronics. Molecular intercalation tunes the work function, boosting charge transfer. Building on these concepts, we developed a work-function-engineered, crumpled V_2C MXene realized via copper phthalocyanine (CuPc) salt-assisted delamination of V_2CT_x. The π-d orbital coupling between CuPc molecules and V_2C layers prevents restacking and induces nanoscale crumpling, creating wrinkled structure with large spacing and more active sites. CuPc molecules incorporation also tunes the work function, improving band alignment and charge transfer. In an all-solid-state asymmetric set-up using pristine V_2CT_x as the negative and CuPc-intercalated V_2C as the positive electrode, the device shows a wider voltage window, higher capacitance, and strong flexibility compared to the symmetric pristine V_2CT_x supercapacitor. The design boosts energy and power densities while remaining scalable for flexible, wearable supercapacitors.

Abstract ID- 090827203

Smartphone-Integrated Low-Cost Setup for Measuring Surface Tension, Density, and Viscosity Using the Modified Tate's Law (LCP Model)

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A low-cost, smartphone-assisted experimental setup is designed to determine the surface tension (ST), density (D), and viscosity (η) of pure, binary, and trinary liquid systems. The apparatus employs simple and recyclable components such as a waste saline bottle, saline needle, and titration tube, promoting sustainable laboratory practices through reuse of materials.

For low-viscous liquids, droplet formation is achieved using a capillary or saline needle, while the titration tube method is applicable to both low and high viscous samples. The experimental procedure is fundamentally based on Tate's law, which relates droplet weight to surface tension. To improve model accuracy for viscous and multicomponent systems, the classical formulation is modified using the Lee–Chan–Pogaku (LCP) model, providing a more realistic description of liquid dynamics.

A smartphone camera captures droplet images, and ImageJ software performs geometrical and analytical measurements. This integration minimizes instrumental error and enhances precision, reproducibility, and accessibility. The method also enables detection of impurities and deviations from ideal behavior in multicomponent liquid mixtures. Despite minor limitations associated with temperature control and droplet uniformity, the approach serves as a safe, economical, and pedagogically valuable tool for experimental physics and physical chemistry laboratories.

Abstract ID- 090407127

Modulating Supramolecular Synthons with Weak Intermolecular Interactions: A Combined PXRD and Hirshfeld Surface Analysis

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The fusion of an oxygen-containing heterocyclic ring, characterized by dominant electron density, significantly influences the physical, chemical, and biological properties of heterocyclic compounds. Chromene are heterocyclic compounds fused with benzene and pyran moiety is found in a variety of natural and synthetic compound with wide range of biological activities such as anti-bacterial, anti-viral, anti-malaria, anti-cancer etc. Non covalent interactions in particular hydrogen bond D-H...A (D=donor, A=acceptor) act as an important role in supramolecular chemistry and crystal engineering. Crystal structure of 4-oxo-4H-chromene-3-carbaldehyde has been determined from x-ray powder diffraction data along with Hirshfeld surface analysis and associated 2D fingerprint plot. A comparison of intermolecular interaction of related compound shows the contribution of weak intermolecular interactions formed the supramolecular assembly forming $C_1^1(5)$, $C_1^1(3)$ polymeric chain and $R_1^1(8)$, $R_4^4(20)$ rings generating two-dimensional honeycomb framework. Hirshfeld surface analysis of the compound and a few related chloro/bromo/iodo derivatives obtained from CSD also shows that moderately weak inter molecular interactions play a significant role in crystal engineering. Additionally, interpretation of Full Interaction Map (FIM) also supports the observed packing arrangements.

Abstract ID- 020448925

Tailoring Broadband Photoresponse through Surface Plasmon Coupling and Schottky Barrier Modulation in Ag-SnO2 Nanocomposite

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Rapid progress in optoelectronic technologies demands highly sensitive, broadband, and low-cost photodetectors (PDs) for next-generation optical sensing and imaging. In this study, high-performance silver (Ag)–tin oxide (SnO_2) nanocomposite (NC)-based PDs were successfully fabricated using scalable and cost-effective dip coating technique. The surface modification of SnO_2 with Ag nanoparticles (NPs) noticeably enhanced the photoresponse of Ag–SnO_2 PDs. We observed nearly 22-fold increase in responsivity (R_λ) (~1.68 A/W) and external quantum efficiency (EQE) (~207%), along with an order-of-magnitude enhancement in detectivity (D*) (~2.7×10^{13} Jones) in the optimized Ag–SnO_2 PD under deep ultraviolet (UV) illumination. Moreover, the Ag–SnO_2 PDs not only demonstrated higher R_λ in the UV region but also have a noticeable R_λ in visible region (~400-500 nm) in comparison to the bare SnO_2 PD confirming its broadband applicability. The coupling of Ag with SnO_2 also faster the response time (~3 times) of the PDs. The observed superior performance in Ag–SnO_2 PDs is explained by plasmon mediated modification of charge carrier dynamics and Schottky barrier at the Ag–SnO_2 interface. The simplicity and scalability of the solution-based fabrication approach further underscore the potential of Ag–SnO_2 NC for low-cost, large-scale integration in next-generation broadband PD applications.

Abstract ID- 114428543

High–Surface-Area Porous MXene–Fe3O4@Ag Hybrid as a Dual-Functional Material for Photocatalysis and Flexible Supercapacitor Applications

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High surface area and porous MXene-based hybrid nanocomposites offer a versatile platform for addressing both environmental remediation and flexible energy storage applications. In this work, we synthesised a highly engineered MXene-Fe_3O_4@Ag hybrid featuring interconnected porosity, uniformly distributed Fe_3O_4@Ag nanoparticles. The incorporation of Fe_3O_4@Ag effectively induces a stable porous network, while Ag nanoparticles facilitate plasmonic excitation and rapid electron transport. BET surface area analysis confirms the formation of a high-surface-area mesoporous structure, and microscopic imaging reveals excellent morphology with homogeneous dispersion of Fe_3O_4@Ag across the MXene layers. The photocatalytic efficiency of the hybrid nanocomposite was assessed using doxycycline as a pharmaceutical waste, achieving complete degradation under sunlight irradiation due to the synergistic coupling of MXene's conductivity, Fe_3O_4-induced porosity, and Ag-mediated charge separation. Additionally, the nanocomposite was utilized in a flexible solid-state supercapacitor, exhibiting high areal capacitance and excellent rate capability. The porous architecture enables rapid ion diffusion, while the conductive MXene framework ensures efficient charge storage, leading to a promising energy and power densities as well as stable long-term cycling performance. Overall, the porous MXene-Fe_3O_4@Ag nanocomposite demonstrates strong potential as a dual-functional material for efficient photocatalytic degradation of pharmaceutical pollutants and for next-generation flexible, high-efficiency energy storage technologies.

Abstract ID- 113540947

Dispersion Characteristics in Chalcogenide-Borosilicate Composite Fiber

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Due to the numerous advantageous features the composite fibers based on non-silica glasses are receiving significant attention. We investigate the dispersion characteristics of step index composite fiber with chalcogenide (As_2S_3) made core and borosilicate made cladding having two core radii, 1.0 μm and 2.0 μm with the variation of wavelength in the range of 1.0 μm to 4.0 μm. The scalar wave equation: $\frac{\partial^2\psi}{\partial R^2}+\frac{1}{R}\frac{\partial\psi}{\partial R}+a_0k_0^2(n^2(R)-n_e^2)\psi=0$ is solved numerically to obtain the propagation characteristics, where, ψ, R and a_0 represents wave function, radial distance and core radius respectively. Again the dispersion coefficient is calculated using, $D(\lambda)=-\frac{\lambda}{c}\frac{d^2n_{eff}}{d\lambda^2}$, where λ, c and n_{eff} are wavelength, velocity of light and effective refractive index respectively. The variation of dispersion with wavelength is shown in the figure 1. The zero dispersion is achieved at current operating wavelength of practical interest 1.55 μm at a_0=1.0 μm, while a large near zero dispersion window is observed at a_0=2.0 μm. Therefore, this fiber will have potential applications in various photonic devices.

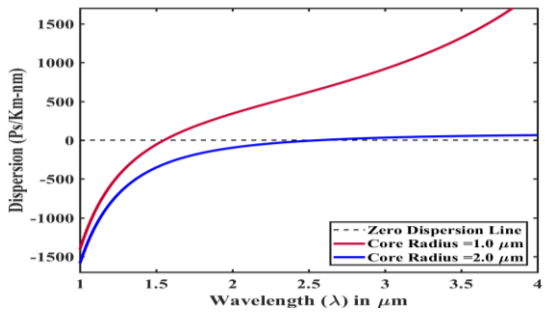

Figure 1: Dispersion with variation of wavelength in Step index composite fiber for two core radii

Abstract ID- 121342444

Green synthesis of Carbon dots: an efficient Photocatalyst for Wastewater treatment through degradation of Pollutant dyes

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Recently, carbon dots (CDs) have emerged as exciting photocatalyst materials for removing synthetic dyes due to their high efficiency and eco-friendly nature. Their low-dimensional structure, large surface-to-volume ratio, tunable bandgap, and controllable photoluminescence enable strong photocatalytic performance under both UV and visible light. Conventional semiconductor photocatalysts often face challenges such as, limited light absorption and high charge recombination, which reduce their degradation efficiency. In contrast, CDs serve as effective electron reservoirs and transporters, which when coupled with other materials, such as, TiO_2, ZnO, or g-C_3N_4 facilitates efficient charge separation and thereby reduces the recombination probability. Additionally, the presence of abundant surface functional groups on CDs promotes strong interactions with dye molecules, improving adsorption and accelerating degradation kinetics. Their simple synthesis from low-cost carbon precursors, along with low toxicity and high chemical stability, makes CDs a sustainable alternative to traditional metal-based photocatalysts.

This study presents a green synthesis of carbon dots via hydrothermal method using *Bixa orellana* seed extract. The formation of CDs was confirmed by UV–Vis, XRD, SEM-EDS, and FTIR analyses. The CDs exhibited strong photocatalytic activity, achieving degradation efficiency of 97% for methylene blue and 90% for rhodamine B dye. Moreover, a mixed dye of MB+RhB, with equal concentration of each dye demonstrated excellent removal by the synthesized CDs, depicting its broad-spectrum photocatalytic potential.

Abstract ID- 073856224

Exploring Acousto-Optic Effects Mediated by Piezoelectric Vibrations: Next-Gen Sensing and Imaging Applications in Biomedicine

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We have explored the acousto-optic interaction phenomena mediated by piezoelectric transducers (Such as $\mathbf{LiNbO_3}$, $\mathbf{LiTaO_3}$, $\mathbf{TeO_2}$ etc) that offers a promising pathway toward the development of next-generation biomedical sensing and imaging technologies. In our study, acousto-optic waves were generated by piezoelectric transducers, tuning an alternating voltage across the transducers. The piezo material deforms mechanically and creates pressure oscillation via the photoelastic effect, enabling controlled light scattering, diffraction, or modulation. These modulations are detected optically and extract biological information that is applicable in imaging, flow sensing, and diagnostics. We can generate stable ultrasonic fields in the MHz range, enabling precise control over light intensity and phase. A near-IR pulsed laser and an MHz-range ultrasound transducer are used with lock-in detection to extract the frequency-shifted optical signal. Ultrasound can localize or enhance light activation in tissue, while acousto-optic deflectors (AOD) enable rapid light patterning for optogenetics. Experimental and simulation results show that acoustic excitation depends on optical diffraction efficiency. By optimizing acoustic power, transducer geometry, and optical alignment, greater sensitivity to light and vibration-induced effects in biological tissues is realized. Our study has potential applications in blood flow monitoring, real-time tissue imaging. The ultrasonic generator helps to design ultrasound-modulated light spectroscopy for preclinical disease detection. This work presents theoretical evidence showing how piezoelectric vibrations generate acousto-optic effects for biomedical imaging. The integration of piezoelectric transduction with optical sensing gives compact, portable, and multifunctional diagnostic devices. These findings demonstrate unified mechanical excitation and optical probing, paving the way for next-generation biomedical diagnostics.

Abstract ID-103801755

Orographic Rainfall Dynamics over the Darjeeling–Sikkim Himalaya

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A three-dimensional moist dynamical model is developed to examine the orographic modification of monsoon flow and rainfall over the Darjeeling–Sikkim Himalaya. Vertically interpolated profiles of zonal and meridional winds, temperature, and specific humidity are used to define the background state for the linearised Boussinesq system. A horizontal Fourier transform is applied to obtain the moist, rotating, sheared vertical-structure equation for vertical velocity, with stability governed by the moist Brunt–Väisälä frequency and terrain-induced forcing. The resulting three-dimensional vertical motion field is used to estimate rainfall intensity through vertically integrated condensation and moisture-flux divergence. Application of the model to two monsoon episodes (29 July 2022 and 25 August 2023) reproduces the observed windward enhancement and structured rainfall patterns seen in IMD gridded daily rainfall and GPM–IMERG data. The results highlight the strong influence of moist stability and vertical shear in shaping orographic rainfall over the eastern Himalaya.

Abstract ID- 102600363

Chiral Symmetry Structure in ^{141}Sm

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Considerable effort has been made over the last 30 years for the conclusive evidence of triaxial nuclear shape. Experimental signatures of triaxiality are the chirality and wobbling mode in nuclei. Nuclear chirality results when both a proton and a neutron from opposite-shape-driving orbits are added to a γ-soft core. In the present study, we are motivated to investigate the chiral structure in ^{141}Sm. High spin states in the dipole structure of ^{141}Sm have been investigated using the reaction ^{116}Cd (^{30}Si, 5n) with E_{lab} =149 MeV using the Indian National Gamma Array consisted of seventeen Compton-suppressed clover detector. Twenty seven new transitions have been identified using γ-γ coincidence measurements and arranged them into three dipole band structures, DB1, DB2 and DB3. The present investigation explores the triaxial deformation in ^{141}Sm nucleus through observation of the degenerate doublet bands (ΔI = 1) of DB2 and DB3 at the end of dipole band DB1 above 2978 keV, $25/2^+$ spin. The energy degeneracy for the bands DB2 and DB3 in ^{141}Sm shows almost identical behavior indicating strong influence core other than the valance particles. And the absence of staggering for both the bands indicate that these bands are chiral partners owing to their characteristics. The band crossing in quasi-particle alignment shows that DB2 and DB3 may originate from the same five quasi-particle configuration $\pi h^3_{11/2} g^{-1}_{7/2} \times \nu h^{-1}_{11/2}$. Thus, five quasi-particle chiral bands have been predicted in 141Sm for the first time in atomic nuclei all over the nuclear chart.

Abstract ID- 075506683

Relevance of calculation of the impact parameters of phonon around rotating Acoustic Black Hole (ABH) as a function of the radial turning points

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The rotating Acoustic Black Hole (ABH) is analogous to the (1+2) dimensional fluid vortex. The physics behind this phenomenon is that if a train of phonons is allowed to go towards the ABH, the phonons are dragged by the moving fluid and if the speed of the fluid becomes supersonic then the phonons will never be able to escape from the supersonic region. This implies the resistance of a dumb hole. Our main objective is to investigate a general behavior of the trajectory of the phonon around ABH for the calculation of the impact parameters of phonon as a function of the radial turning points and to find out the ratio between the turning points.

Abstract ID- 103356473

Splice Loss in Liquid-filled Tellurite-Based Photonic Crystal Fibers

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We estimate the splice loss between the step index single mode fiber (SMF) and the tellurite based liquid filled photonic crystal fiber (TLFPCF) having the first ring filled with 20% glycerin-water solution as shown in figure-1 using our full vectorial finite difference method (FVFDM). In this investigation, we vary the fiber parameters of TLFPCF to achieve the minimum loss. The splice losses with the variation of pitch at the operating wavelength 1.55 μm are shown in figure 2. It is observed that the minimum loss region are gradually shifting towards the higher pitch values with increasing values of the relative air hole size (d/Λ). Our technique for calculating splice loss will have significant importance for the system designer.

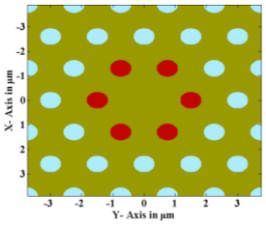

Figure 1: TLFPCF infiltrated with liquids in its first ring

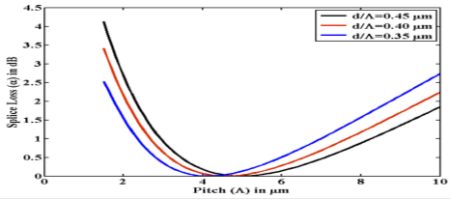

Figure 2: Splice loss between SMF and TLFPCF with variation of pitch

The Helmholtz equation $\nabla^2\vec{E} + \vec{\nabla}\left((\vec{E}/n^2)\cdot\vec{\nabla}n^2\right) = k_0^2 n^2\vec{E}$ is solved using FVFDM to find various propagation characteristics of TLFPCF and then we calculate the splice loss using the following equation: $\alpha = -20\log\left[\left(\frac{2w_{TLFPCF}w_{SMF}}{w_{SMF}^2 + w_{TLFPCF}^2}\right)\right]$ where w_{SMF} and w_{TLFPCF} represents the spot sizes of SMF and TLFPCF.

Acknowledgement: The second author is grateful to the Department of Science &

Abstract ID- 080442408

Bias Field Mediated Exchange Coupled Tunable Vertical Loop Shift in $Ni_{80}Fe_{20}$ – BFO - $SrRuO_3$ Heterostructures

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We have observed a distinct novel vertical hysteresis loop shift i.e., vertical bias in an exchange biased system of ferromagnetic – multiferroic thin film heterostructure consisting of $Ni_{80}Fe_{20}$ – BFO - $SrRuO_3$, grown on Nb doped $SrTiO_3$ substrate. The vertical bias is observed only after field cooling through the Curie temperature of SrRuO3 (~125 K), whereas zero-field-cooled magnetic measurements reveal no hysteresis loop shift. The onset of the vertical bias occurs below ~125 K and its magnitude increases progressively with decreasing temperature, reaching a maximum loop shift of approximately 33% at 2 K. A systematic temperature-dependent measurements confirms the strong correlation between ferromagnetic – multiferroic coupling and the emergence of vertical bias. Micromagnetic simulations accurately reproduce the experimentally observed behavior and demonstrate the critical role of the relative thicknesses of the constituent layers. It is also revealed that the magnitude of vertical bias is governed by the competition between the thickness-dependent exchange-spring effect (Spring Thickness Law) and the anisotropy-driven Imperial Law. Based on these findings, we propose a generalized model for vertical hysteresis loop shifts that can be applicable to other ferromagnetic heterostructures. This work thus offers new insights into the tunability of vertical bias, with promising implications for next generation spintronic device.

Abstract ID- 053400794

Nonreciprocity in a graphene assisted coupled micro-resonators: Chaotic dynamics

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The nonreciprocal transmission of the input cavity field and chaotic nature are analyzed in a graphene assisted coupled micro-resonators. One of the resonators is active and it provides gain via optical pumping i.e. Raman scattering. Another one possesses symmetric loss as induced by graphene layer. The model system shows Parity-Time symmetry and breaking of the symmetry leads to significant transmission properties under different system parameters. The revival and suppression of intra-cavity field may be tuned via graphene induced loss. The system shows nonreciprocity with isolation ratio about $\mathbf{16}\ \boldsymbol{dB}$. The chaotic nature of the present system is described via analyzing field trajectories in phase space, temporal evaluation of the field intensity and power spectrum of the output field. The system changes from self-induced oscillation to doubling bifurcation state and chaotic state. The gain coefficient due to Raman scattering plays the key role for the transition from periodic state to chaotic state. This study may have the potential to be used for optical isolation, data encryption and chaos-based computing in nano-fabricated devices.

Abstract ID- 044450425

Winged Radio Galaxies from FIRST and TGSS Survey

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In this work, we present characteristics of a sample of winged radio galaxies. A typical radio galaxy includes jets, an active supermassive black hole at the centre also called the active galactic nuclei (AGN) or the central engine, and a pair of radio lobes. Winged radio galaxies are found to have two pairs of lobes, one usual active primary lobe pair with high surface brightness and an unusual secondary lobe pair. This extra secondary lobe pair with less surface brightness is referred to as "wing". Winged radio galaxies are generally hosted by massive elliptical galaxies. Winged radio galaxies are further morphologically classified by X-shaped radio galaxy (XRG) and Z-shaped radio galaxy (ZRG) depending on the angle between the primary and secondary lobe pair and origin of the secondary lobe pair. Our sample includes 201 such XRGs and 153 ZRGs detected in two complimentary deep sky surveys; one at low frequency and another at high frequency. The TIFR GMRT Sky Survey (TGSS) at 150 MHz enables to study extended diffuse radio emission whether the VLA Faint Images of the Radio Sky at Twenty-centimetre (VLA FIRST) survey at 1400 MHz gives high resolution and sensitivity. We explore the properties of these winged radio galaxies such as, spectral index, variation of radio luminosity with redshift, optical counterpart and possible formation scenario.

Abstract ID- 020634115

Unconventional 2D Nanomaterial Based Stable Sensors

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Conventional 2D nanomaterial-based sensors are very attractive for high sensing of different toxic gases. The limited stability of conventional 2D nanomaterials in real-world applications imposes many constraints on their practical uses. Unconventional 2D nanomaterials like 2D oxide semiconducting nanomaterials possess stability against the sensing of toxic gases under real environments. In this presentation, we mainly focused on the fabrication of stable sensors based on 2D semiconducting oxide nanomaterials (cerium oxide nanoflake) for sensing of toxic CO gases within the threshold limit as per the WHO. The response and recovery time of the sensors was very fast in nature. The fabricated sensor selectively senses CO gas among other tested gases. The sensor resistance showed a stable nature for a large window of humidity as well as long-time stability for practical applications.

Chemical Sciences

Abstract ID- 060557308

New Perspectives on Neonatal Jaundice Phototherapy: Unveiling a New Photochemical Pathway in Bilirubin

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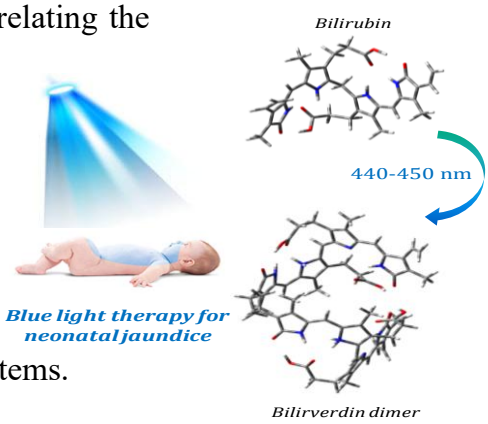
Jaundice is a common condition in newborns, arising from the accumulation of bilirubin in the bloodstream due to the immature hepatic clearance system. Since its discovery in the 1950s, phototherapy using blue–green light has served as the most effective and widely adopted treatment. The underlying concept of this therapy lies in the photoinduced transformation of bilirubin, a heme degradation product, into more polar and water-soluble forms that can be efficiently metabolized by the liver and excreted from the body. Previous studies shown that bilirubin undergoes photooxidation to biliverdin and isomerization to lumirubin under light exposure. However, the complete photochemical behavior of bilirubin under physiological conditions is still not fully defined, and the possibility of alternative photoproducts has long intrigued researchers. To probe the products formed upon controlled photoirradiation (440-450 nm) of an aqueous bilirubin solution at biological pH (7.4), ion mobility mass spectrometry (IMMS) integrated with high-performance liquid chromatography (HPLC) is employed. Remarkably, our findings reveal—for the first time to our knowledge—the formation of a previously unreported dimeric photoproduct of biliverdin as a major reaction pathway. Furthermore, the three-dimensional structure of this newly identified photodimer has been characterized through a combined experimental–computational approach, correlating the measured collision cross section (CCS) values of the protonated ions with the theoretically predicted values. This discovery suggests a new dimension in the photochemistry of bilirubin, expanding current understanding beyond the oxidation and rearrangement routes. It holds potential implications for optimizing phototherapy protocols and understanding long-term photostability in biological systems.



Abstract ID- 043844274

Design and Green Synthesis of 2-Aminonaphtho [2, 3-b] thiophene-4,9-dione Derivatives as Promising Anticancer Agents against MDA-MB-231 Breast Cancer Cell

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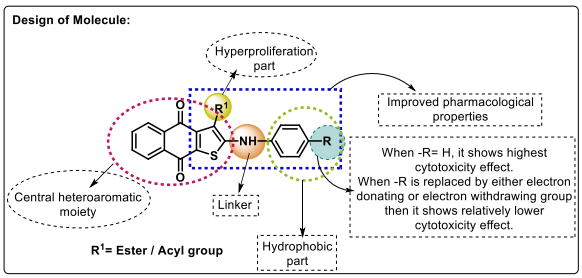
With increasing incidence rates and little progress in treatment, cancer is a serious worldwide health concern, mainly because of side effects and drug resistance. According to *GLOBOCAN* 2022, female breast cancer is among the most prevalent type of cancer in India and the second largest cause of cancer worldwide, which has an expected 2.3 million new instances, or 11.6% of all instances of cancer. 6.9% of all cancer-related fatalities were caused by this, making it the fourth greatest cause of cancer mortality. Therefore, the development and implementation of more effective cancer treatment strategies is a critical public health priority.

To address this, a target-oriented drug design strategy was employed for the synthesis and development of twenty-two (39 entry) novel 2-aminonaphtho [2,3-b]thiophene-4,9-dione derivatives to evaluate their potential anticancer activity. In terms of environmental concern, this protocol has a lower E-factor compared to existing methods. Mechanistic DFT is included with this protocol. The drug likeness of compound 4a was also established through ADMET studies. Compound 4a demonstrated the highest cytotoxicity against MDA-MB-231 human TNBC cells, determined by the dose-dependent standard MTT assay. Both in vitro and in vivo investigations have demonstrated that compound 4a exhibits significant selectivity towards MDA-MB-231 cells, having an IC_{50} value of 3.29 ± 0.46 µM, but shows negligible cytotoxicity to NKE cells. According to mechanistic studies, compound 4a caused apoptosis by activating caspase-3, arresting the G2/M cell cycle, and disrupting the potential of the mitochondrial membrane. We believe this drug would be effective for breast cancer treatment.



Abstract ID- 124131676

Iron-Catalyzed One-Pot Synthesis of Indenofurans with Potential as Novel Cancer Therapeutics

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Cancer remains one of the leading global health challenges, and despite significant advances in therapy, existing treatments are often limited by resistance, toxicity, and a lack of long-term efficacy. As a result, there is an urgent need to discover and develop new small molecules that can offer improved therapeutic options. The development of novel anticancer agents relies heavily on the efficient synthesis of bioactive heterocycles. We have developed a sustainable one-pot iron-catalyzed method for synthesizing indenofurans from ninhydrin and olefins, achieving high regioselectivity and good yields under mild conditions. The reaction proceeds through a cascade cyclization mechanism, forming the fused tricyclic indenofuran core. Preliminary molecular docking studies show that some of the synthesized indenofurans have notable activity against cancer cell lines, suggesting their potential as future drug molecules. By combining an environmentally friendly chemical strategy with promising biological results, this study highlights indenofurans scaffolds as a new class of anticancer agents.

Abstract ID- 014732103

Investigation of Gas Separation Characteristics in Two-Dimensional Hexagonal Boron Nitride/Polyimide Composite Membranes

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The search for efficient gas-separation membranes has intensified as industries seek sustainable, low-energy solutions. This study focuses on fabricating mixed-matrix membranes (MMMs) comprising a polyimide (PI) matrix reinforced with two-dimensional hexagonal boron nitride (h-BN) nanosheets. Polyimide is well regarded for its thermal and chemical robustness, yet its permeability–selectivity trade-off remains a barrier. Recent literature indicates that two-dimensional fillers can deliver high aspect ratios and better polymer compatibility, leading to enhanced transport channels and selectivity. For example, reviews highlight that 2D materials offer improved interfacial adhesion and filler dispersion in MMMs. In our work, membranes with multiple loadings of h-BN were synthesized and characterized by SEM, XRD, and FTIR, confirming homogeneous nanosheet dispersion and strong polymer–filler interaction. Gas permeation tests for CO_2, N_2, CH_4 and O_2 revealed notable improvements in permeability, with minimal or favourable changes in selectivity. These enhancements are attributed to formation of ordered diffusion paths and reduced chain packing facilitated by the 2D filler. The membranes also showed excellent mechanical integrity and thermal stability, aligning with recent studies on PI membranes and MMMs. The results demonstrate that h-BN/PI MMMs hold considerable promise for next-generation gas separation systems, consistent with the current research direction emphasising 2D nanomaterials in mixed-matrix membranes. Future work will optimise nanosheet orientation, loading, and interfacial engineering to further elevate performance.

Abstract ID- 015341638

A mixed N-, O-donor ligand conjugated microporous Cd (II) MOF for selective sensing of Fluoride ion from contaminated water samples

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Removal of water contaminants, such as fluoride ion (F^-) from wastewater by using metal organic framework (MOF) has become a field of intensive research. To serve this purpose, we have synthesized a water-stable, microporous Cd (II) appended MOF (JU7) (Cd-Bpy-2-ATPA) solvothermally by using mixed N-, O-donor based coligands. The SCXRD analysis discloses the structural architecture of JU7. Other characterization techniques such as PXRD, SEM and EDX, fully validate its structural orientation. Very interestingly, JU7 emits blue fluorescence in the aqueous solution under the UV light (λ_{ex} = 365 nm), exhibiting fluorescence maxima at λ_{em} = 430 nm (λ_{ex} = 330 nm) on a fluorescence spectrophotometer. After rigorous characterization and photophysical elucidation of the MOF, primarily, it is intended to identify anions in aqueous solution. It is astonishing to explore that JU7 can swiftly and selectively detect only F^- ion via fluorescence enhancement phenomena among several anions. The LOD is calculated to be 57 nm and the binding constant K_b is found to be 2.87×10^4 M^{-1}. Several spectroscopic studies also support the F^- detection by the MOF. This sensing process is governed by the synchronous occurrence of the H-bonding interaction between the MOF and F^- ions and the structural rigidity of the system. Interestingly XRF experiment discloses the F^- ion extraction ability of JU7 exhibits within the range of 0.15 mM to 1.22 mM using the NaF solution (N/20 to 5N). As a real application, this MOF can remove F^- ion from wastewater with a good recovery.

Abstract ID- 031655791

Three in One: Concurrent Detection and Isolation of Antiaromatic, Non-aromatic and Aromatic Congeners of a Hexaphyrin Derivative

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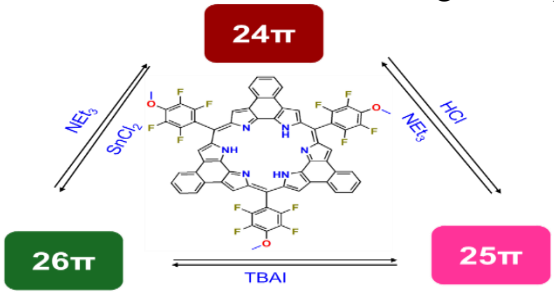
The synthesis of a 24π antiaromatic hexaphyrin molecule has been achieved via a nucleophilic aromatic substitution reaction of a parent hexaphyrin derivative. The newly obtained hexaphyrin exhibits the spectroscopic characteristics expected for a fully conjugated [4n] π-electron antiaromatic system. Alongside the desired product, a side product was isolated and identified as a mono-β-substituted derivative of the hexaphyrin. This type of functional group insertion is unprecedented and remains unexplored within this class of hexaphyrin derivatives. The planar antiaromatic compound displays unusual redox reactivity and distinct spectroscopic behavior. Notably, a clean and nearly quantitative two-electron reduction of the hexaphyrin produces a bench-stable 26π aromatic congener. The formation of this aromatic species is confirmed by highly upfield NH proton signals in the ^{1}H NMR spectrum and characteristic Q and Soret bands in its UV-Vis absorption spectrum. The remarkable stability of this aromatic form has been verified through time-dependent spectroscopic studies. Furthermore, treatment of the antiaromatic compound with HCl results in a one-electron reduction, generating a 25π non-aromatic dication radical species. The interconversion among all three distinct electronic states—antiaromatic (24π), non-aromatic (25π), and aromatic (26π)—has been successfully accomplished using appropriate reagents. These successive reductions are proposed to proceed via a proton-coupled electron transfer (PCET) mechanism. Thus, the synthesis and reversible interconversion of three distinct electronic states of a single hexaphyrin molecule have been demonstrated.



Abstract ID- 073219169

FRET-Based Probing of Gold Nanoclusters for Insights into Protein Conformation

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Fluorescence Resonance Energy Transfer (FRET) provides a powerful nanoscopic tool for investigating conformational dynamics in proteins. In the present work, gold nanoclusters (AuNCs) are explored as FRET acceptors owing to their tunable photoluminescence, high photostability, and biocompatibility. Noble metal nanoclusters (NCs), composed of a few to hundreds of atoms with core sizes below 2 nm, represent a unique class of fluorescent nanomaterials bridging the gap between molecules and nanoparticles. Their ultrasmall size, high surface-to-volume ratio and exceptional fluorescence have enabled promising applications in biosensing, bioimaging, and therapeutics. However, when introduced into biological environments, NCs inevitably interact with proteins secondary structure leading to the formation of a protein corona that dictates their biological identity, stability, and functionality. Understanding these nano–bio interactions is therefore crucial for assessing biocompatibility and ensuring reliable biomedical applications. In this work, we adopt histidine-stabilized gold nanoclusters and human serum albumin as a model system to understand interaction mechanism. A comprehensive set of spectroscopic techniques (e.g., UV-Vis, Fluorescence, DLS, ITC, CD) and transmission electron microscopy were employed to unravel the binding mechanisms, thermodynamic parameters, conformational changes, and stoichiometry of the interaction between human serum albumin and histidine stabilized gold nanoclusters.

Abstract ID- 013825384

First Mechanochemical Oxidative Lactonization towards Bioactive Fluorescent Phthalide Analogue

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In modern era, where sustainable development is closely linked to environmental preservation, mechanochemistry plays a vital role. By harnessing mechanical forces generated through milling or grinding, mechanochemical techniques provide the required energy to promote a wide range of chemical transformations while significantly reducing solvent use, minimizing waste generation, and lowering overall environmental impact.

Phthalide is an important class of oxacycles that are found in numerous natural products and synthetic materials, serving as key structural motifs in pharmaceuticals, fragrances, and fluorescent materials. We have developed stoichiometry dependent domino synthesis of bioactive phthalide analogue by applying oxidative lactonization under eco-friendly and cost-effective mechanochemical synthetic approach. In this protocol phthalide derivative has been synthesized using oxidant sodium chlorite, tert-butylhydroperoxide, and sodium dihydrogen phosphate (as a proton source) under an energy-efficient hand-grinding technique with a simple mortar and pestle under high reagent loading. In contrast, using the same reagent combination at low reagent loading resulted in a mixture of major amount of dihydronaphthyl lactone along with minor portion of its aromatized phthalide analogue. Further investigation of the water-sensing behaviour of our synthesized bioactive fluorescent phthalide may help in developing effective sensing strategies for real-world applications.

Abstract ID- 105517662

Exploring in vitro dual bioactivity of Cu (II) and Ni (II) complexes with N, N, O donor Schiff base ligand: Anticancer effect on MDA-MB-231 Cells and Antifungal action on phytopathogens

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In quest of more proficient targeted therapeutics and the identification of promising bioactive compounds, the present work emphases on the synthesis of copper (II) $[Cu_2(L)_2Cl_2]$ (complex 1) and nickel (II) $[Ni(L)_2]$ (complex 2) complexes incorporating N, N, O-donor Schiff base ligands. The newly achieved complexes were comprehensively characterized through structural and spectroscopic analyses and further evaluated for their anticancer, antifungal, and biomolecular binding properties.

Comprehensive *in-vitro* investigations exposed that complex 1 exhibits potent cytotoxic activity against the MDA-MB-231 breast cancer cell line, whereas complex 2 displays selective antifungal efficacy against *Colletotrichum siamense* (AP1) and *Fusarium equisetum* (F.E.), the causative agents of anthracnose and wilt diseases, respectively.

Spectroscopic interaction studies with DNA and bovine serum albumin (BSA) confirmed strong and stable binding affinities of both the complexes, providing insight into their potential mechanisms of biological action. Moreover, complex 1 displayed admirable hemocompatibility, showing no red blood cell lysis, which emphasizes its suitability for safe intraperitoneal and oral administration. In contrast, complex 2 shows significant promise as an eco-friendly fungicidal candidate for agricultural applications, offering a potential alternative to conventional agents such as hexaconazole to reduce crop losses.

Abstract ID- 015747719

Bioactive Cu(II) Complexes with a Novel Schiff Base Ligand: Structural Insights, Biomolecular Interactions, and Therapeutic Potential

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Copper complexes with Schiff base ligands have garnered significant attention due to their versatile coordination chemistry, structural diversity, and promising applications in bioinorganic chemistry, catalysis, and medicinal research. In this study, we report the systematic design and synthesis of a novel tridentate N, N, O-donor Schiff base ligand, 5-(diethylamino)-2-((quinolin-8-ylimino) methyl) phenol (HL), obtained via the condensation of 4-(diethylamino)-salicylaldehyde with 8-aminoquinoline. This ligand has been employed to synthesize three Cu (II) complexes: [Cu(L)(H_2O) (ClO_4)] (1), [$Cu_2(L_2)$ (PHBA)] (2), and [$Cu_2(L_2)$ (PNBA)] (3). Complexes 2 and 3 are developed by incorporating para-hydroxybenzoic acid (PHBA) and para-nitrobenzoic acid (PNBA), respectively, during the synthesis process. All three complexes are fully characterized using spectroscopic techniques and single-crystal X-ray diffraction. Structural analysis revealed a mono-nuclear Cu (II) center in complex 1, while complexes 2 and 3 are isostructural di-nuclear species interconnected through phenoxo and acetate bridges, adopting distorted trigonal bipyramidal geometries. Biomolecular interaction studies demonstrated efficient binding of DNA and human serum albumin (HSA), confirmed by absorption and fluorescence titration, DAPI displacement, and melting temperature analysis, indicating a groove-binding mode during DNA binding. Molecular docking studies provide strong validation of the experimental findings. The complexes exhibit potent antibacterial activity against both Gram-positive and Gram-negative bacteria, as well as effective anticancer properties with minimal toxicity to normal cells, as evidenced by MTT assay results. Tyni comparison discloses superior antibacterial activity of complex 2 and anticancer activity of 1. Additionally, complex 1 shows significant reactive oxygen species (ROS) generation ability. These findings highlight the therapeutic potential of these Cu(II) complexes in biomedical applications.

Abstract ID- 034530119

Integrating Cheminformatics and Machine Learning to Predict BACE1 Inhibitors from ChEMBL

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Alzheimer's disease remains one of the most challenging neurodegenerative disorders, with β-secretase 1 (BACE1) recognized as a crucial therapeutic target. In this study, an integrated cheminformatics and machine learning pipeline was developed to elucidate the key molecular determinants governing BACE1 inhibition. Bioactivity data were retrieved and curated from the ChEMBL database, converted to pIC_{50} values, and complemented with computed molecular descriptors and PubChem fingerprints. Statistical analyses identified molecular weight and lipophilicity as primary factors influencing inhibitory activity. Machine learning models, including Random Forest and Support Vector Regression, were trained and evaluated, with the Random Forest model demonstrating superior predictive performance ($R^2 = 0.63$ for regression; AUC = 0.92 for classification). Overall, this study highlights the effectiveness of descriptor-based modeling in predicting BACE1 inhibitory activity and underscores its potential application in virtual screening and the rational design of new therapeutic candidates for Alzheimer's disease.

Abstract ID- 094607867

Molecular Insights into Coralyne-Mediated Disaggregation of Amyloid Fibrils: Biophysical and Morphological Aspects

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Amyloid fibril formation by misfolded proteins is the hallmark of several neurodgenerative disorders. Although numerous small molecules have been reported to inhibit fibrillogenesis but recent strategies promote the disintegration of performed fibrils which is a field of research that is comparatively unexplored. So in the present study we evaluated the ability of Coralyne (COR), a protoberberine alkaloid, to disaggregate preformed Hen Egg White Lysozyme (HEWL) fibrils. Thioflavin T (ThT) fluorescence assay demonstrated the capability of COR to destabilize existing fibrillar assemblies. Nile red (NR) and 8-Anilinonaphthalene-1-sulphonic acid (ANS) binding assay revealed a significant hydrophobic surface exposure change due to presence of COR which was consistent with disruption of fibrillar core. Far-UV circular dichroism spectroscopy (CD) confirmed the loss of β sheet secondary structure of fibrillar assemblies on COR treatment. Atomic Force Microscopy (AFM) provided direct morphological evidence of fibril fragmentation and reduced height distribution in presence of COR. Furthermore molecular docking analysis identified the probable binding mechanism of COR with fibrillar assembly and suggested key non covalent interactions underlying its activity. Collectively these findings establish COR as a potent defibrillating agent and underline its potential as a lead scaffold for therapeutic intervention targeting amyloid clearance.

Abstract ID- 034937445

Design and Synthesis of Azo-Ligand based Iron MOF for Visible-Light Photocatalytic Organic Transformations

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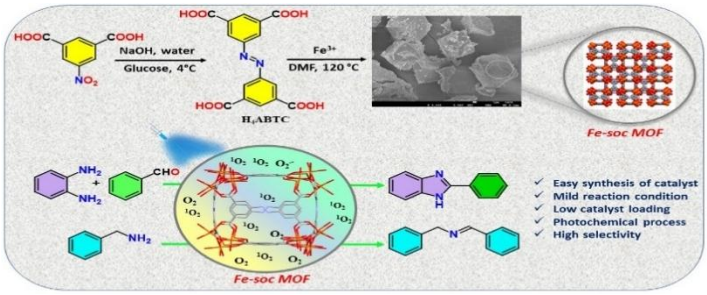
Metal–Organic Frameworks (MOFs) are crystalline microporous materials synthesized by using multidentate organic ligands linked with metal ions. They have high specific surface area and low density. They are widely used for catalysis, gas storage & separation, and biomedical applications. The area of photocatalysis is still in its infancy, and the use of MOFs in photocatalysis is highly intriguing because of their distinctive organic-inorganic hybrid structures. To make a small contribution in this area, we have synthesized modulator free Fe-soc MOF in the cubic phase (100), which is highly crystalline and microporous in nature. We first synthesized the H_4ABTC ligand via N=N coupling reaction. This azo-group (–N=N–) act as a chromophore. We have modified the traditional synthesis process of Fe-soc MOF by using Fe^{3+}, H_4ABTC ligand, and DMF as solvent through solvothermal process at 120°C for 48 hours. This MOF have high BET surface area (889 m^2g^{-1}), fairly stable up to 370°C and 2.03 eV band gap. We have used this brick-red colour MOF as photocatalyst since it has a low band gap, a strong photocurrent response, and the potential to activate oxygen. In the presence of oxygen and blue light, we have done two photocatalysis reactions, namely the synthesis of benzimidazoles derivatives and the coupling reaction of benzylamines. In synthetic organic chemistry and medicinal chemistry, benzimidazole derivatives and imine molecules are extremely valuable. In both reactions we have obtained high yield with a maximum 99% selectivity. The stability and reactivity of the catalyst up to four cycles remain unchanged. The Fe-soc-MOF described here may pave the way for future environmentally beneficial photocatalytic reactions.



Abstract ID- 122342798

1,2,3-Triazole Functionalized π-Conjugated Polymer Probes for Sensing Nitroaromatic Explosives

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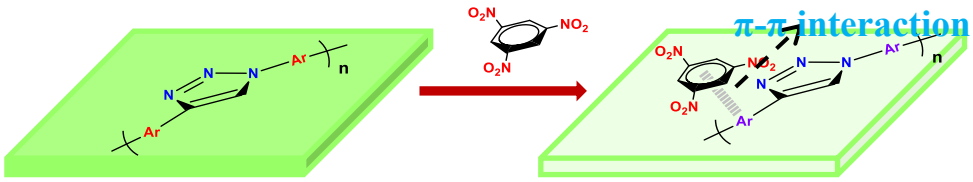
The rising need to develop fast and efficient chemical sensors for detecting explosives is of current interest for a variety of reasons, including national security and environmental concerns. Recently *p*-type π-conjugated polymers are found to be effective chemsosensors for nitroaromatic explosives.[1] Highly electron rich π-conjugated polymers are good candidates to undergo a donor-acceptor electron transfer through π-π interaction with the electron deficient nitroaromatics.[2] This work describes synthesis of polyfluorene based π-conjugated soluble polymers, employing a dipolar 1,2,3-triazole[3] unit in main chain through Cu(I) catalyzed azide-alkyne cycloaddition. The synthesized π-conjugated polymers are explored as efficient sensor for nitroaromatic explosives through fluorescence quenching. In this presentation the sensitivity of the synthesized π-conjugated polymers towards nitroaromatics will be demonstrated.



Abstract ID- 025653212

Facile Synthesis of Unsymmetrical Acridines by a Pd(II)-Catalyzed Allylation/Arylation/Aromatization Cascade

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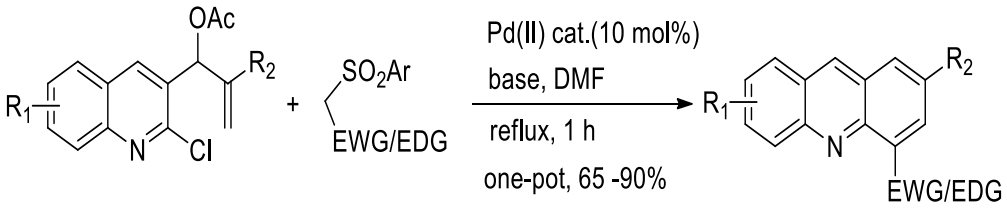
Acridine-based heterocycles have exhibited a wide range of biological and pharmaceutical properties including antibacterial, anti-inflammatory, antiparasitic, antitumor, anti-Alzheimer's and anti-HIV properties. Recently, acridines are utilized as organic photosensitizers, COFs bearing photocatalysts and biosensitive photovoltaic cells. Although its prevalence in many naturally occurring molecules, the regioselective assembly of acridines with substitution on both rings is still challenging. In contrast, the palladium-aided cascade sequence reported here provides rapid entry into acridine derivatives with diverse functionality from Morita–Baylis–Hillman acetates and arylsulfonylated methylene compounds in good to excellent yields. (Scheme 1).



R_1 = H, Me, OMe, Br
R_2 = CO_2Me, CO_2Et, CN, COO^tBu; Ar = phenyl, tolyl
EWG = CO_2Me, CO_2Et, CN, CF_3, NO_2,COMe, SO_2Ph; EDG = NC, OMe

22 examples

Scheme 1. Synthesis of substituted acridines.

This methodology is operationally simple, regioselective and takes place under mild conditions. The substrate scope and functional group tolerance have been investigated. Further exploration towards late-stage modification, computational (DFT) studies and natural product synthesis is currently operative.

Abstract ID- 113348668

Design, Structural Characterization, and Electrocatalytic Hydrogen Evolution Performance of Cu(II) and Mn(II) Based Coordination Polymers

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Environment and energy are two great issues in the present civilisation. Use of fossil fuel increases the C-precipitation and is the cause of Global warming. The UNDP has declared in 2015 the program on the Sustainable Development Goals (SDGs) and has proposed the C-neutrality by 2030. The exploration of C-free green energy sources are the only alternative for the sustenance of the civilisation. Hydrogen is the promising candidate in this aspect. Electrocatalytic water splitting is an effective and convenient way of producing hydrogen. Recently, several materials have been investigated for this purpose, with coordination polymers (CPs) emerging as promising options due to their structural plasticity and catalytic potential. In this aspects two newly designed coordination polymers of Cu(II) and Mn(II), namely $\{[Cu(2pbi)(tdc)_2(H_2O)]\}_n$ (CP1) and $\{[Mn(2pbi)(tdc).(H_2O)]\cdot H_2O\}_n$ (CP2) (2pbi = 2-(2-Pyridyl)benzimidazole, tdc= 2,5 thiophene dicarboxylic acid) are synthesized and structurally characterized by single-crystal X-ray diffraction (SXRD), powder X-ray diffraction (PXRD), and Fourier transform infrared data. The CP1 shows electrocatalytic HER activity with an overpotential of 512 mV at a current density of 10 mA cm^{-2} (η10) in 0.5 M H_2SO_4 with a Tafel slope of 97.2 mV dec^{-1}. For CP2, η10 and Tafel slope are found to be 825 mV and 172.1 mV dec^{-1}. The comparative catalytic activity of CP1 and CP2 was thoroughly investigated and well supported by Tafel slope, charge-transfer resistance (Rct), and electrochemically active surface area calculation. All the results indicate that CP1 has better electrocatalytic performance compare to CP2 towards HER activity. For the efficient use of CPs in state-of-the-art energy conversion technologies, this finding has significant implications for electrochemical energy science.

Abstract ID- 100921641

Solvent-free Synthetic Approach to the Tryptamine-relevant Biomolecules *via* Pictet–Spengler-Type Reaction

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Pictet–Spengler reactions have always drawn special attention from the synthetic community due to its potential to synthesise the numerous bioactive alkaloids from the indole-based precursors. Tryptamine is a celebrated bio-molecule in the world of medicinal chemistry due to their wide range of bioactivities. Tryptamine-embedded relevant biomolecules are extensively used for the treatment of HIV inhibitors, pesticides, and chemotherapeutic agents for different types of cancer. This bioactive molecule has several reactive sites, such as amine in the open-chain alkyl substituents, and it has a C-2 position to adduct readily with the aldehyde group. Based on these novel bioactivities, researchers are continuously involved in the development of synthetic scaffolds using tryptamine. The Pictet–Spengler reaction started its journey with phenethylamine and a formaldehyde dimethyl acetal to produce 1,2,3,4-tetrahydroisoquinoline in the presence of hydrochloric acid. Recently, we have reported an acetic acid-promoted Pictet-Spengler-type reaction under a solvent-free approach to the tryptamine-relevant biomolecules for the first time to construct pyrroloazepinoindole moieties in good to excellent yields. This greener approach is superior to the traditional Pictet-Spengler-type reactions due to its eco-friendly conditions, shorter reaction time, lower energy consumption, reduced cost, higher yields, and broader substrate scope.

Abstract ID- 065057389

Microwave-Assisted Base-Catalyzed Acetylation of Alcohols Using Ethyl Acetate as an Eco-Friendly Acetylating Agent

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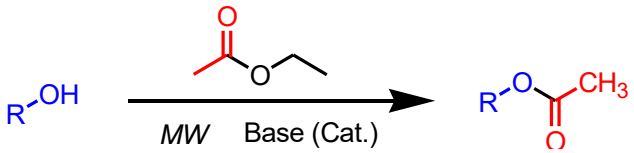
A rapid and efficient method for the acetylation of alcohols using microwave-assisted base catalysis has been developed, where ethyl acetate serves as the acetylating agent. The reaction proceeds through a transesterification mechanism in the presence of a catalytic amount of base, enabling a highly selective conversion of primary alcohols compared to secondary alcohols, phenols, and thiols. The microwave-assisted approach significantly enhances the reaction rate, achieving high yields under mild and solvent-free conditions within a very short reaction time. This method represents a green and sustainable alternative to conventional acetylation processes, minimizing reagent consumption and energy requirements while maintaining excellent selectivity and efficiency.



Abstract ID- 082313867

Synthesis of Fluorescent Annulated Benzimidazole

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An easy and facile approach towards annulated benzimidazole (benzo[4,5]imidazo[2,1-a]isoquinoline) has been developed in moderate to good yield. Here Sonogashira coupling reaction has been utilized for the preparation of the starting material from *β*-bromovinylaldehyde scaffold. This *β*-bromovinylaldehyde scaffold was prepared by Vilsmeier reaction on tetralone motif. The Sonogashira coupling product reacts with *ortho*-phenylene derivatives and followed two step one pot protocol for the formation of annulated/polycyclic benzimidazole. The 1,2-phenylenediamine (or naphthalene-1,2-diamine) and Sonogashira derivative in presence of DMF and 100 °C furnished a library of molecules (16 examples). Each molecule has a long conjugation. Conjugated pentacyclic and hexacyclic molecules have been prepared with varieties of electron donating and withdrawing substituent. Synthesized all the molecules are fluorescent and their photophysical properties are under investigation. We have extended this work by changing one of the substrates (Sonogashira product) by acrylic amide derivative and we obtain the fluorescent polycyclic benzimidazole derivatives.

Abstract ID- 074537231

C-3 Activation of Glucose-Phthalimide Enables β-D-Mannose Installation and the Synthesis of the *Salmonella* O6,7 (C_1), Thompson *O*-Antigen Pentasaccharide

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Salmonella O6,7 (C_1), belonging to serogroup C_1, includes serovar Thompson, an important human pathogen frequently associated with foodborne outbreaks worldwide. This serovar is characterized by its distinctive *O*-antigenic repeating unit, which defines host–pathogen interactions, immune evasion, and serological classification. The O6,7 *O*-antigen is a cell-wall lipopolysaccharide (LPS) determinant, typically composed of a pentasaccharide repeating unit whose fine structural features contribute to serum resistance and pathogenicity. Infections by S. Thompson commonly arise from contaminated poultry, eggs, fresh produce, and water sources, leading to gastroenteritis, fever, abdominal pain, and diarrhea. The increasing global detection of S. Thompson reflects its environmental persistence, adaptive evolution, and rising antimicrobial resistance. Understanding the structural, biosynthetic, and functional aspects of the O6,7 *O*-antigen is crucial for developing glycoconjugate vaccines, diagnostic reagents, and targeted therapeutic strategies. Recent advances in chemical synthesis of the *O*-antigen repeating unit provide new opportunities to investigate its immunological role and to design structure–function studies relevant to controlling *Salmonella* infections.

MATHEMATICAL SCIENCES INCLUDING STATISTICS

Abstract ID- 094254162

Solving a pollution sensitive deteriorative EOQ model under Intuitionistic Monsoon fuzzy environment

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This study presents an Economic Order Quantity (EOQ) inventory model that incorporates pollution-sensitive deterioration within an intuitionistic monsoon-type fuzzy environment. The pollution index is influenced by the order quantity, while the deterioration rate is modelled as a function of the cycle time. Initially, a crisp cost-minimization model is developed, taking into account natural idle time and an imprecise demand function. Given the uncertainty in market conditions, the model assumes that demand rate and various cost parameters are uncertain and are described using both membership and non-membership degrees. A fuzzy model is then formulated using appropriate intuitionistic fuzzy parameters. To convert the fuzzy model into a workable form, a multi-stage defuzzification process is employed using score functions for intuitionistic fuzzy numbers. A solution algorithm is introduced to solve the resulting nonlinear optimization problem. To validate the model, a comparative analysis is conducted involving the crisp model, a general fuzzy model, a monsoon fuzzy model, and two existing techniques: fuzzy bi-matrix game and fuzzy Hasse diagram methods. Statistical tools, including confidence intervals, are applied under the assumption of normally distributed data to assess the global applicability of the approach. The results indicate that the proposed method achieves a lower root mean square error (RMSE) of 0.0739 compared to 0.3296 for existing methods, demonstrating superior performance in optimization. The findings suggest that decision-makers should consistently use the Intuitionistic Monsoon Fuzzy Number to manage the inventory effectively. Additionally, sensitivity analysis and graphical representations are provided to support and validate the proposed approach.

Abstract ID- 073746347

Exact Analytical Solution of Full Incompressible Navier-Stokes Equations

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Despite being formulated in the 19th century, the analytical solution of the full Navier–Stokes (N–S) equations remains an open challenge in fluid mechanics and is recognized as one of the *Millennium Prize Problems* by the Clay Mathematics Institute. Consequently, computational fluid dynamics (CFD) has become the primary tool for simulation and analysis. However, CFD suffers from discretization errors, grid dependence, numerical errors and instability, high computational cost, and is importantly restricted to finite domains. On the other hand, existing analytical or semi-analytical studies typically address reduced forms of the N–S equations using traveling waves, self-similarity, or other assumptions. While such simplifications reduce mathematical complexity, they may lead to physically inconsistent results, especially in incompressible flows.

To overcome these limitations, we developed a semi-analytical method, namely optimal and modified homotopy perturbation method (OM-HPM) for the direct solution of the full incompressible N–S equations without any simplifications. Unlike CFD methods, which are domain-restricted, OM-HPM solutions enable seamless extension of domains and analysis of flow and transport phenomena in arbitrary geometries. Moreover, by avoiding linearization, discretization, grid generation, and iterative looping, our method is free from numerical errors and instabilities, offering superior reliability compared to CFD tools and providing flexibility along with closed-form solutions. Through comprehensive numerical and analytical analyses on several Newtonian and non-Newtonian fluid flows, we demonstrate the superiority of our method in solving fluid dynamical challenges.

Abstract ID- 010505301

Comparison between m-polar fuzzy Z-number and m-polar fuzzy number for different operators and application in stock selection with multi-attribute decision-making

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This article introduces the concept of $\boldsymbol{m}$-polar fuzzy Z-numbers, offering a robust and flexible framework for representing uncertain, inconsistent, and subjective information along with its reliability. To enhance decision-making, new aggregation operation rules are developed using Dombi, Schweizer–Sklar, power, Hamacher, and Einstein operators. Unlike existing research, which primarily employs homogeneous sub-characteristics for each attribute, this study presents a novel algorithm that incorporates heterogeneous sub-characteristic collections. The study applies this framework to stock market investment, where multiple uncertain factors are expressed through $\boldsymbol{m}$-polar fuzzy Z-numbers. The proposed algorithm systematically identifies the most suitable company for investment, demonstrating its potential as an AI-driven decision-support tool. From an artificial intelligence perspective, this approach enables the joint handling of possibility and reliability, allowing AI systems to process complex, imprecise, and subjective data more effectively. Comparative analysis shows clear differences in score values between $\boldsymbol{m}$-polar fuzzy Z-numbers and conventional $\boldsymbol{m}$-polar fuzzy numbers. Moreover, the Dombi averaging operator effectively minimizes bias, establishing it as a reliable computational mechanism. Overall, the proposed $\boldsymbol{m}$-polar fuzzy Z-number framework provides a strong foundation for intelligent decision-making under uncertainty, with potential applications in financial engineering, risk assessment, and operational analysis.

Abstract ID- 092149857

Solving a bi-objective cyber-physical supply chain model: Entropy based intuitionistic fuzzy approach

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This article discusses a fuzzy bi-objective economic production quantity (EPQ) model where total demand has two parts, one for the online customers and the other for offline customers. Here online demand is frauding risk sensitive, follows a normal distribution but offline demand is considered as an intuitionistic fuzzy number. First of all, a crisp bi-objective (producer's profit and customer's cost optimization) production inventory model has been solved. Then due to the existence of uncertainty in offline demand, it is considered as a triangular intuitionistic fuzzy number (TIFN) and hence an intuitionistic fuzzy bi-objective mathematical model has been constructed. To defuzzify the intuitionistic fuzzy model, the defuzzification method based on score functions are utilized. All the models are solved by an entropy-based optimization technique. A case study has been picked up from a daily news forecast for numerical illustrations. For model validation, some comparative analyses have been discussed. Numerical illustration disclose that our approach is more profitable for decision maker which gives +1.94% more profit than the existing one. Finally, sensitivity analysis and graphical illustrations also have been done to validate the proposed approach.

Abstract ID- 075916981

Solving a demand and selling price sensitive vegetables cultivation model with budget constraint using fuzzy goal programming approach

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Vegetable cultivation not only strengthens farmers economically but also plays a vital role in human health. Among the various factors influencing vegetable cultivation, the timing and duration of cultivation periods hold particular importance, as they significantly affect both yield and quality. Generally, the demand for vegetables increases from the start of a season, and after a certain period, the demand decreases due to boredom with the food list. The exact opposite happens with vegetable prices. So, when the farmers will destroy the vegetable trees is a big question, retaining cycle time and periodic profit as decision variables. In this proposed study, an EPQ model of vegetable farming with having budget constraint has been developed with a non-linear demand rate. The selling price and production rate of the vegetables are considered as a quadratic function of time. Generally, a traditional inventory practitioner calculates inventory profit at the end of cycle time. But farmers usually wish to calculate his/her profit in every short period to determine the end of cycle time. The problem has been solved with the help of the fuzzy goal programming approach. Numerical results have been taken from a real case study. Sensitivity analysis and graphical illustration reveal the justification of the proposed model.

Abstract ID- 024118172

Analytical Study of Planar Linguistic Z-Graphs for Smart Urban City Modeling

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This paper presents an analytical exploration of Planar Linguistic Z-Graphs (PLZGs), an advanced class of Fuzzy Planar Graphs (FPGs) where both vertices and edges are characterized by Z-numbers, enabling nuanced representation of uncertainty and vagueness in complex real-world systems. PLZGs serve as an effective mathematical framework for transforming congested urban environments into intelligent, well-structured city networks by modeling interconnections among metro lines, railway tracks, drainage systems, and bus routes. A scale function is introduced to compute the expected values (𝔼Vs) of vertices and edges, which, together with the Strength of Connectedness (STCNN) between terminal vertices, facilitate a realistic quantification of edge reliability. Based on these parameters, edges are classified as strong or weak, leading to the formulation of the Strong Planar Linguistic Z-Graph (SPLZG). Several theorems are developed to establish a rigorous theoretical foundation for evaluating edge stability, connectivity, and planarity within the network. The study further addresses ambiguities in measuring the degree of planarity and introduces the dual of an SPLZG for enhanced structural and spatial analysis. Practical applications of PLZGs extend to urban planning, civil construction, and infrastructure optimization, particularly in designing flyovers, metro tunnels, and pipeline systems where minimizing edge crossings is crucial. By integrating Linguistic Z-Numbers (LZNs), PLZGs offer superior interpretability, flexibility, and realism. Ultimately, this work contributes to developing safer, smarter, and more sustainable urban infrastructures, paving the way for next-generation smart city design.

Abstract ID- 044240241

Super-Exponential Cosmic Acceleration in a Three-Fluid Dynamical Framework: Future Evolution of the Universe

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We propose a coupled three-fluid dynamical system that captures the chronological evolution of the accelerated universe. The model incorporates a variable-modified Chaplygin gas as a dark energy candidate interacting with dark matter. By introducing suitable dimensionless parameters, a two-dimensional autonomous system is constructed for a spatially flat universe, allowing us to examine the evolution of key cosmological quantities such as the deceleration parameter and the matter–energy density parameters under different coupling strengths. The dynamical evolution of the coupling parameter is analyzed. Extending the framework to spatially homogeneous and isotropic cosmologies that include both the cosmological constant and non-zero spatial curvature, we further develop three- and four-dimensional autonomous systems. The four-dimensional system, incorporating the dynamical evolution of the cosmological constant density, demonstrates how higher-dimensional analysis enhances our understanding of the universe's late-time acceleration.

Abstract ID- 124018696

Game-theoretic approaches to sustainable supply chains for handling perishable goods through the inclusion of transportation schemes

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As supply chains evolve toward sustainability-oriented strategies, handling of perishable products, which quickly lose their freshness and value, has become a critical concern and since buyers prioritize fresh products over cheaper alternatives, companies must navigate the trade-off between financial objectives and sustainable practices. Recognizing this, the present study develops a two-echelon sustainable model that jointly considers product perishability, transportation parameters, and carbon trading mechanisms to enhance overall supply chain performance. The proposed framework incorporates realistic operational aspects such as transport duration and delivery delays, factors often overlooked in earlier analytical studies. Furthermore, a carbon trading scheme is integrated to quantify the economic consequences of carbon emissions, rewarding environmentally efficient firms while penalizing those with excessive emissions.

Decision-making interactions between supply chain members are examined using four game-theoretic frameworks: two of them are non-cooperative models and two are cooperative. For each game configuration, best price-setting and inventory lot decisions are established. The models are validated with secondary data, and comparative numerical analyses are performed using MATLAB. Empirical outcomes confirm that leadership strategies result in superior profit and eco-efficiency levels for each participant, though customers tend to disfavour the models over manufacturer-led Stackelberg as its costly selling price. The Pareto-efficient framework emerges as the most equitable and mutually beneficial configuration. Overall, incorporating product deterioration, transportation costs, and emission control enhances decision flexibility, supports sustainable practices, and strengthens the operational efficiency of perishable supply chains.

Abstract ID- 095911499

Evolutionary Game Theoretic Analysis of Smart Sustainable Supply Chains: From Infancy to Maturity

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Over the past two decades, widespread environmental degradation has led consumers, enterprises, and governments to prioritize sustainability in industries as well as supply chains. Despite the importance of technology in advancing sustainable supply chains (SSC), its efficiency falls short due to the complex, dynamic interactions among stakeholders. This study aims to analyze the government policies and internal entities' sensitivities to build a steady robust SSC in a dynamic environment. Illuminating the intricate dynamics, this study presents a quadrilateral evolutionary game model that encompasses traceability and sustainability-sensitive governments, manufacturers, third-party collectors, and consumers within SSCs. Blockchain technology (BT) presumes to ensure product traceability, while qualified recycling practices integrated with sustainable manufacturing processes uphold sustainability in SSCs. Solving replicator dynamics, we identify the equilibriums and their stability. Our numerical simulations reveal that the strategies of each entity are significantly influenced by the decisions and policies of others. We find that both traceability and sustainability sensitivities significantly impact the evolutionary trajectory and stable strategies of SSCs. Importantly, as SSCs evolve, these sensitivities can substitute for policy factors, highlighting the need for regulatory frameworks to align with the evolving SSC landscape. Our study offers a comprehensive framework for understanding the evolutions of SSCs, emphasizing the critical role of technology and stakeholder sensitivities—both independently and in conjunction with regulatory measures— in shaping sustainable practices across development stages.

Abstract ID- 21400904

Exploring the Role of Fear and Awareness in a Fractional-Order HIV–TB Co-Epidemic Model with Dynamic Transmission

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In the context of psychological fear arising from awareness and treatment, a fractional-order (α: $0 < \alpha \leq 1$) embedded non-linear HIV–TB dual-epidemic model in the Caputo sense is developed. The fractional order captures the memory effect of both diseases, while awareness and infection rates are assumed to be dynamic, depending on infection level within the system.

The solution's positiveness and biologically feasible region are established using the generalized mean value theorem and Mittag–Leffler function properties, and the Banach fixed point theorem ensures existence and uniqueness. Basic reproduction numbers for HIV ($\mathbf{R_0^H}$) and TB ($\mathbf{R_0^T}$), and for the whole system $\mathbf{R_0} = \max\{\mathbf{R_0^H}, \mathbf{R_0^T}\}$, are derived through the next-generation matrix approach. The stability of equilibrium points is examined, and the bifurcation direction at $\mathbf{R_0^T} = 1$ concerning the effective contact rate of TB infection is also analyzed.

Numerical simulations are carried out using the Adams–Bashforth–Moulton predictor–corrector method. Non-linear dynamical tools, including time series, phase diagrams, contour plots, and spectra, are employed to study the effects of transmission rate, sex education, treatment, and fear factor on dual epidemic dynamics. The results reveal that the fractional-order memory effect significantly influences the system's transitional behavior and contributes in reducing co-infection load. Furthermore, the model highlights unsteady dynamics in disease progression, providing deeper insight into the coupled HIV–TB system. This phenomenon may help researchers formulate effective control strategies to reduce the viral load in dual infections. Finally, the model's limitations and future research directions are outlined.

Abstract ID- 115438347

Failure mode and effect analysis of nuclear reheat valve system under bipolar-valued fuzzy information

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Industries across the world are trying to minimize the failures during a product's life cycle. So, a scientific method is needed to solve this issue. Failure mode and effect analysis (FMEA) is a very useful method to understand and rectify the primary reasons of failures. The group-based FMEA has three phases: 1) Evaluation of failure modes, 2) Calculation of risk factors' weight, and 3) Failure modes' ranking. In this paper a new framework for FMEA is proposed in the bipolar-valued fuzzy environment which contains three steps: 1) Construction of group risk assessment matrix of individual opinions based on bipolar valued fuzzy Bonferroni mean (BVFBM) aggregation operator, 2) Computation of risk factors' weights by grey relational analysis and the decision-making trial and evaluation laboratory (GRA-DEMATEL) method and 3) Failure modes' ranking by extended organization, rangement et synthese de donnes rela tionnels (ORESTE) method. Finally, a case study of the reheat valve system in a nuclear steam turbine is considered. A comparative study with validation analysis is also carried out.

Abstract ID- 121109479

Investigation of Epidemic Thresholds and Traveling Wave Solutions in a Diffusive SEIRS Model

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This study formulates and investigates a spatially diffusive SEIRS epidemic model incorporating a nonlinear infection mechanism. The analysis emphasizes the role of basic reproduction number ($\mathcal{R}_0$), in dictating the dynamical outcomes of the system. It is shown that the equilibrium states, disease-free and endemic, exhibit local and global stability behaviors entirely governed by this threshold. Furthermore, the existence of traveling wavefronts describing the spatial spread of infection from the disease-free state to the endemic state is established using the framework of upper and lower solution methods combined with Schauder's fixed point theorem. The criterion is extended by constructing a weak upper-lower solution pair, which may exhibit discontinuities in derivatives at a countable set of points. It is demonstrated that traveling wave solutions do not emerge when $\mathcal{R}_0 \leq 1$, or when $\mathcal{R}_0 > 1$ but the wave speed c remains below the critical wave speed c^*. The analytical results are substantiated through numerical simulations, which confirm the theoretical findings and illustrate the spatial propagation patterns of the disease.

Abstract ID- 011652830

Cattaneo-Christov double-diffusive bioconvection of trihybrid ferro-nanofluid through Darcy-Forchheimer porous medium under activation energy: Applications in thermal and bioengineering systems

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This study presents a numerical investigation of bioconvective trihybrid ferro-nanofluid flow in a Darcy –Forchheimer porous medium over an elastic stretching surface. The model incorporates multiple transport mechanisms, including magnetic dipole interaction, thermophoresis, Brownian motion, thermal radiation, activation energy, Cattaneo-Christov heat and mass fluxes, and microbial motility. The governing nonlinear equations are transformed via similarity variables into dimensionless form and solved using MATLAB's bvp4c solver. Results demonstrate that ferrohydrodynamic interaction suppresses velocity, elevates temperature, and increases skin friction while reducing the Nusselt number. Stronger inertial resistance due to the Forchheimer term further diminishes velocity and enhances wall shear. Thermal relaxation time delays heat flux response but enhances the Nusselt number, whereas solute relaxation time lowers near-wall concentration and reduces the Sherwood number. Higher activation energy suppresses reaction kinetics, thereby decreasing the Sherwood number. Moreover, increasing the Peclet number diminishes microbial concentration near the surface, enhancing microbial density distribution. The developed framework provides new physical insights into heat, mass, and microorganism transport in ferro-nanofluids, with potential applications in biomedical systems, microelectronics cooling, solar thermal technologies, energy harvesting, and bioreactor engineering.

Abstract ID- 035951927

A Study on Linguistic Z-threshold Graphs

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The threshold graph is a well-established concept in graph theory, known for its structural simplicity and wide applicability. In this study, we introduce the notion of a Linguistic Z-threshold graph (LZTG) by incorporating the concept of linguistic Z-numbers. By using Score function we convert both uncertainty and reliability of Linguistic Z-number into a single numerical value. We define key graph-theoretic elements under this framework, such as L-stable sets, L-cliques, L-isolated vertices, L-dominating vertices, and L-alternating 4-cycles. Furthermore, we discuss L-threshold dimension and L-split graphs. Like classical threshold graphs, we investigate structural properties and derive significant results for LZTGs. One key finding is that an LZTG can be constructed from a single vertex by iteratively adding either an L-isolated vertex or an L-dominating vertex. Consequently, every LZTG is an L-split graph. This study lays the foundation for extending classical graph theoretical ideas to a linguistic and uncertain environment, enhancing their applicability in real-world scenarios involving vague or imprecise information.

Abstract ID- 071224404

Picture Fuzzy Graphs with Dominating Energy: A New Paradigm for Complex Problem Solving

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Picture fuzzy graphs effectively represent complex problems that cannot be accurately modeled using traditional fuzzy graphs and intuitionistic fuzzy graphs. The incorporation of neutrality degree significantly enhances the representation of uncertain membership values. In the context of energy applications, dominating energy plays a crucial role. Therefore, study of dominating energy in picture fuzzy graphs give more accurate results than other existing methods in the field of energy. In this article, we introduced the notion of dominating energy in picture fuzzy graphs. Picture fuzzy dominating adjacency matrix, eigen values, spectrum of picture fuzzy graphs are presented with examples. Dominating set and domination number of picture fuzzy graph is introduced. Dominating degree of a vertex, weight of a vertex is presented. Energy arithmetic mean is introduced. Apart from these, dominating energy in various operations like, union, join, complement of picture fuzzy graphs are developed. Also, some theorems regarding dominating energy are derived in this paper. We calculated lower and upper bound of dominating energy. Finally, a practical application of dominating energy is demonstrated through fund distribution among various sports. This innovative approach enables more effective resource allocation and decision-making in complex scenarios.

Abstract ID- 082337929

Finite Difference Method for Solving Neutrosophic Fuzzy Wave Equation

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In this presentation, we introduce a new computational approach for solving the Neutrosophic Fuzzy Wave Equation (NFWE) using the Finite Difference Method (FDM). Wave propagation in real-world environments is often influenced by uncertainty, imprecision, and indeterminacy arising from complex media, fluctuating boundary conditions, and incomplete data. Classical wave equations assume precise parameters, while fuzzy models account only for membership uncertainty, and intuitionistic fuzzy models consider both membership and non-membership degrees, which can address vagueness to some extent; however, they fail to explicitly account for the indeterminate and inconsistent information inherent in real-world systems. To overcome this limitation, the present work uses a Neutrosophic fuzzy framework, which integrates the concepts of truth-membership, indeterminacy-membership, and falsity-membership functions to model uncertainty in the governing partial differential equation more effectively. The proposed model exhibits significant advantages over both the Fuzzy and Intuitionistic Fuzzy approaches by explicitly including an indeterminacy component that captures unknown or conflicting data. The Finite Difference Method (FDM) is utilized to obtain numerical solutions of the Neutrosophic Fuzzy Wave Equation, ensuring stability and convergence under appropriate discretization schemes. Numerical and graphical analyses confirm that NFWE offers enhanced precision, better adaptability, and improved interpretability in modelling complex physical systems.

Abstract ID- 105047547

A Credibility-based Approach to Joint Production and Maintenance Decisions for Deteriorating Products in Hybrid Payment Setting

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In the modern era of Industry 4.0, many manufacturers include predictive maintenance within their production process to extend the lifetime of machines and avoid unexpected breakdowns. By using IoT sensors and data analysis, these systems can identify possible failures early, reducing production stoppages and the number of defective items.

In real business practices, an advance–cash–credit (ACC) payment system helps increase monetary flexibility and stability across participants in the supply chain. However, research shows that preventive maintenance may still require high cost and more time. Some earlier works developed EPQ models that considered both upstream and downstream trade credit periods for deteriorating or perishable products. In a few cases, the demand rate was assumed to depend on price and freshness, while suppliers offered ACC payment to manufacturers and manufacturers allowed cash–credit payment to customers. These studies also considered discounted cash flow (DCF) analysis to account for the effect of time-based valuation of money.

This paper proposes a supplier–manufacturer system where the manufacturer uses predictive maintenance and receives ACC payment from the supplier. By optimizing the production period and maintenance effort, the model reduces the total cost associated with deteriorating items. Using DCF analysis, the cost function captures monetary valuation over time and maintains strict convexity. Numerical results and sensitivity tests illustrate the model's performance and managerial significance.

Abstract ID- 043901284

Some aspects of coupled fixed point result and its application to solution of system of functional equations

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In this paper a coupled system of two functional equations is considered. The existence and uniqueness of the solution of the above system under certain contractive inequality condition are obtained by an application of a coupled fixed point theorem. Ulam- Hyers-stability, well-posedness of the problem are considered and data dependence of the solution sets has been investigated. Further, the error estimate and rate of convergence of the iteration constructed herein are also calculated.

Abstract ID- 02220459

A sustainable supply chain of an edible-biomass with imprecise system parameters: A Stackelberg game approach

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A supply chain model (SCM) for an edible biomass involving a supplier, a wholesaler, and consumers is analysed under fuzzy system parameters. The model incorporates imprecise expiration time (a fuzzy number (FN)), expiration-time-dependent dynamic freshness, freshness-dependent selling price, and demand that varies with both price and freshness. The wholesaler collects units of the biomass (like fish, prawn, crab, etc.) and uses appropriate refrigeration to prevent deterioration, ensuring that freshness remains unchanged during storage. The retailer purchases biomass from the wholesaler at regular intervals and sells the same in a local market. To reduce deterioration and maintain an acceptable freshness level, the retailer applies preservation tools like ice bars, transparent refrigerators, etc., based on the level of requirement, which in turn invites the emission of greenhouse gas (GHG). Hence, both parties bear the associated preservation and carbon emission costs.

However, the wholesaler aims to determine the optimal selling price and cycle length; the retailer determines the optimal consumer price, order quantity, preservation level, and cycle length to optimize average return. Since a decision of each party depends on the other and vice versa, a Stackelberg game framework is adopted to determine the marketing decision (MD). Fuzzy mathematical tools are used to formulate the model and decision-making. An efficient heuristic is designed, implemented, and applied in a nested structure to obtain the MD. It is experimentally found that both decision-makers benefitted from the use of preservation technology.

Abstract ID- 105656387

A Choice-Range Driven n-Polygonal Fuzzy MCDM Framework for Leukemia Treatment Selection

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The importance of a fuzzy number lies in its capacity to represent the uncertainty inherent in real-world problems. This paper introduces a fuzzy multi-criteria decision-making (MCDM) model in which the uncertainty associated with the attributes of alternatives is expressed using an n-Polygonal Fuzzy Number (*nPFN*). This representation captures hidden uncertainties more realistically than conventional fuzzy number forms. A key contribution of the study is the incorporation of a novel concept—the decision maker's "choice range", which reflects their flexibility in expressing preferences.

To address such problems, we develop a two-level selection mechanism termed the *CRnPFN* algorithmic framework, tailored specifically for MCDM scenarios involving n-Polygonal Fuzzy Numbers. The method includes the formulation of potentiality and stretches values for an *nPFN*, along with measures for comparing and distinguishing between two fuzzy numbers.

The proposed framework is applied to a real-world case involving the selection of the most appropriate therapy for severe blood cancers such as leukemia. The findings highlight the approach's effectiveness, adaptability, and practical utility in handling complex decision environments under uncertainty. Furthermore, a sensitivity analysis is performed by varying the criteria weights to verify the robustness of the method.

ENGINEERING SCIENCE AND TECHNOLOGY

Abstract ID- 025752593

Laser Shock Peening on Optimized Laser Surface Melted Ti-13Nb-13Zr Alloy for Enhanced Surface Performance

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The present study investigates the synergistic effect of laser surface melting (LSM) followed by laser shock peening (LSP) on the β-type titanium alloy Ti-13Nb-13Zr to enhance its surface integrity, wear resistance, and corrosion performance. Initially, LSM was performed using a continuous-wave diode laser by varying the laser power (700–1100 W) and scan speed (3–9 mm/s). Multi-response optimization of the process parameters was carried out using Taguchi's Grey Relational Analysis (GRA), considering melt depth, hardness, wear and corrosion rate as key responses. The optimized condition (700 W power and 9 mm/s scan speed) provided a refined α/β microstructure with superior mechanical characteristics and was selected for subsequent LSP treatment. Laser shock peening was then conducted at different laser intensities (3–9 GW/cm²) to induce beneficial compressive residual stresses and further refine the near-surface grain structure. The treated specimens were comprehensively characterized using SEM, EDS, and XRD to evaluate the surface morphology, phase transformation, and residual stress evolution. Tribological and electrochemical assessments were performed to determine the improvement in wear and corrosion resistance under simulated physiological conditions. The combined LSM–LSP treatment resulted in a substantial improvement in surface hardness, reduced wear rate, and enhanced corrosion resistance due to grain refinement, work hardening, and improved passivity. The study demonstrates that sequential laser surface melting and laser shock peening can effectively tailor the surface characteristics of Ti-13Nb-13Zr for advanced biomedical and tribological applications.

Abstract ID- 010019993

Graph-Theoretic Modeling of Quantum Attack Surfaces

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As quantum communication and computing infrastructures rapidly evolve, the ability to identify and counteract security threats is an important area of research. Quantum Key Distribution (QKD) and entanglement-themed schemes boast perfect security in theory, but practice shows that these aspects are undermined by side-channel attacks, compromised node, and outside network vulnerabilities. This paper presents a formal model of quantum attack surface characterization based on graphs for qualitatively and quantitatively evaluating the structural vulnerability and attack resilience of quantum systems.

In the proposed model, quantum networks are modeled as directed graphs, where quantum devices or repeaters correspond to vertices, and edges correspond to quantum channels or entangled links. Attacks, attempted eavesdropping, or failures due to decoherence can be modeled as edge or vertex perturbations, to determine edge connectivity or corresponding cut sets (to ascertain important edges and vertices), and combinations of centrality and betweenness metrics to identify key components affecting the overall network security. Ultimately, the proposed framework provides quantitative modeling, both before and after any attacks, of the potential reachability of an attack, the resilience of any redundancies, and the associated fault tolerance. This represents new ways to evaluate and quantify the robustness of entanglement distribution and secure key agreements.

In addition, the work investigates using graph entropy and spectral characteristics to quantify uncertainty and information leakage in a compromised quantum link. The combination of graph-theoretic methods and quantum communication protocols establishes a foundation for automated vulnerability assessments, secure topology designs, and real-time threat visualization in quantum infrastructure.

Abstract ID- 025317256

An Integrated Solar-Powered Multifunctional Agricultural Machine for Sustainable Small-Scale Farming

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Agriculture is the backbone of India's economy and remains the main source of livelihood for many people. While modern agricultural machinery has improved productivity, its high cost and maintenance needs often limit use among small and marginal farmers. To tackle this issue, the sector needs new and sustainable solutions that can boost efficiency while cutting down energy use. The introduction of smart and autonomous machines is a promising step forward. Though precision farming has already helped with better resource management, there is still a need for compact, smart, and energy-efficient systems. This paper introduces an Integrated Solar-Powered Prototype Machine for Agriculture, designed to fit with sustainable and modern farming practices. The prototype combines several agricultural tasks, such as rotavating, grass cutting, and pesticide spraying, into one solar-powered unit. By using renewable solar energy, the system removes the need for traditional fuels, which lowers operational costs and reduces environmental harm. Moreover, its lightweight and portable design makes it ideal for small-scale and remote farming operations. The integrated design not only reduces manual labour but also encourages energy savings and long-term affordability. Overall, this solar-powered multifunctional agricultural machine provides a practical, eco-friendly, and cost-effective solution that supports the growth of sustainable agriculture in India.

Abstract ID- 053024518

InGaN–$ZnSnN_2$ Material System for Next-Generation High-Efficiency Solar Cells

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The InGaN–$ZnSnN_2$ material system is investigated as a promising platform for next-generation high-efficiency solar cells. Although InGaN and $ZnSnN_2$ have individually shown outstanding optoelectronic properties, their combined utilization in photovoltaic device design remains largely unexplored. Comprehensive material and electronic analyses reveal several critical advantages of this system. Both InGaN and $ZnSnN_2$ exhibit strong optical absorption and tunable direct bandgaps ranging from approximately 0.7 to 3.4 eV, enabling broad solar-spectrum utilization from the visible to near-infrared region. The low lattice mismatch (<3%) between the two materials minimizes interfacial strain and defect generation, thereby improving carrier mobility and lifetime. These results identify the InGaN–$ZnSnN_2$ material system as a highly versatile and sustainable candidate for thin-film photovoltaic devices, offering a pathway toward superior energy conversion efficiency and long-term material stability.

Abstract ID- 024519690

A TOPSIS-Based Multi-Criteria Decision-Making Approach for Agricultural Drone Selection in Pesticide and Fertilizer Spraying Applications

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The rapid advancement of drone technology has revolutionized precision agriculture by enabling efficient and uniform application of pesticides and fertilizers. However, selecting the most suitable agricultural drone from the wide range of available models remains a complex task due to multiple conflicting criteria such as payload capacity, flight time, spraying width, cost, battery efficiency, and operational ease. This study employs the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) a widely recognized multi-criteria decision-making (MCDM) method to identify the optimal agricultural drone for spraying operations. A set of evaluation criteria was established through literature review and expert consultation, and alternative drone models were assessed based on normalized performance data. The TOPSIS approach was then applied to determine the relative closeness of each alternative to the ideal solution. The results highlight the most efficient drone that balances performance, cost, and energy consumption while ensuring precision in spraying operations. The findings demonstrate that the TOPSIS method provides a systematic, objective, and flexible framework for supporting rational decision-making in drone selection. This research contributes to the advancement of smart and sustainable farming practices by optimizing technology adoption in agricultural mechanization.

Abstract ID- 095027911

FactLense-KG: A Knowledge-Augmented Framework for Fact-Checked Detection of Online News Deception

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The expansion of online news platforms has been combined with by an significant increase in inaccurate and misleading content, threatening the integrity of digital information ecosystems. Traditional detection of fake news models focus mainly on textual and structural feature, often omitting Knowledge-level accuracy and Contextual fact validation. To Deal with this shortcoming, this study introduces FactLense-KG, an enhanced version of the FactLense framework that integrates Fact-Checked Knowledge Integration through Knowledge Graphs and Retrieval-Augmented Generation (RAG). The proposed model Identifies key factual entities—such as names, dates, and numerical claims—from news text and cross-verifies them against reliable knowledge bases like Wikidata and FactCheck.org. By Aligning semantic text embeddings with factual cross-validation, FactLense-KG transitions from pattern-based deception detection Fact-based verification, assuring Understandability and ethical accountability. Experimental results on benchmark fake and true news datasets demonstrate that FactLense-KG achieves an Accuracy of 99.54%, Precision of 98.46%, Recall of 98.58%, and F1-score of 99.52%, Emphasizing its Consistency and real-world applicability for Digital news ecosystem and misinformation forensics.

Abstract ID- 104546678

Selection of Optimal Biomaterial for Orthopaedic Implants Using the MOORA Method

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The choice of appropriate biomaterials for orthopaedic implants is the critical factor in attaining long-term performance, biocompatibility, and mechanical stability. Because there are several conflicting factors i.e., tensile strength, Young's modulus, hardness, corrosion resistance, wear resistance, biocompatibility, and cost, the decision-making situation is very complicated. In this research, the Multi-Objective Optimization based on Ratio Analysis (MOORA) technique, a strong and computationally effective Multi-Criteria Decision-Making (MCDM) tool, was used to determine the best biomaterial for orthopaedic implant applications. The candidate materials like titanium alloys, stainless steel, cobalt-chromium alloys, and ceramics were weighed against each other using normalized and weighted performance data acquired from experimental results and literature materials. MOORA technique was used to prioritize these options in their overall performance indices. The study showed that titanium alloy had the best balanced properties with respect to mechanical strength, corrosion resistance, and biocompatibility. The research proves that MOORA technique offers a systematic, transparent, and consistent approach for material selection in biomedical engineering. The suggested methodology can help researchers and design engineers to come up with long-lasting, affordable, and patient-specific orthopaedic implants

Abstract ID- 110749257

AI-Driven Flood Prediction and Management for Bengal's Deltaic Regions.

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In West Bengal's deltaic belt, which includes the Sundarbans, Hooghly, Nadia, Purba and Paschim Midnapur and the North and South 24Parganas, monsoon rains, overflowing rivers cause floods that leave fields covered in murky water. Traditional flood control often reacts after the damage occurs, so warnings come too late. By that time, streets are already knee-deep in water, and impact rate is also being high. Using Artificial Intelligence (AI), the Internet of Things (IoT), and Digital Twin technology can transform how we forecast accurately; issue warnings before problems arise. We are building an AI-driven predictive model that can forecast floods in delta regions in real time. We are bringing together IoT-based sensors and remote imagery to monitor rain fall, river flow, and water levels, as well developing a decision-support dashboard that shares early warnings. We collect real time data from IoT sensors, such as temperature, humidity, and river levels. We combine this information with privious flood records, IMD rain fall data, and clear satellite images from Sentinel-2 and Landsat-8. We use Long Short-Term Memory (LSTM) networks for forecasting floods over time, Convolutional Neural Networks (CNN) to predict the spatial extent of floods using satellite images. We check model accuracy using RMSE and F1-score metrics against historical flood data. This will help the farmers, fishermen as well the commuters to have an early weather alert system.

Abstract ID- 093643144

Electric Eel mimicked protein/electrolyte composite for high performance moisture enable green energy source

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Moisture electric generator (MEG) gained significantly attention due to their ability to harvest energy from moisture without any external power supply. Here we developed an electric eel (*Electrophorus electricus*) fish mimicked protein/electrolyte composite based electrical power source which can produce electrical power through environmental moisture. A single MEG device can generate V_{oc} ~0.65 V, I_{sc}~9.5 μA with power density (P)~154 μW/cm^2 under relative humidity (RH) of 90% which is higher than most of the previously reported MEG devices. Moisture induced ion generation and gradient induced ion diffusion between two electrodes generates the substantial power output. In addition, this device can generate output using human breath and proximity of hands which is much important for wearable electronics, low-power medical devices and many more. Again, the system can produce high V_{oc} and I_{sc} by just connecting series and parallel respectively. Thus, this study underscores the potential of MEGs in addressing energy challenges through innovative and sustainable approaches.

Abstract ID- 095944730

Effect of Friction and Wear Behaviour with the Reinforcement of rGO in the Electroless Ni-P matrix.

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Friction and wear are two of the most major problems that influence the performance and life of mechanical components that work under sliding or contact motions. Electroless Ni-P coating is chosen for its good hardness, corrosion resistance, and surface finish uniformity. Yet, its tribological characteristics can be improved by incorporating self lubricanting materials. In this work, Ni-P–rGO composite coating was created by incorporating reduced graphene oxide was remains Ni-P matrix using electroless deposition on mild steel substrate. To enhance the coating quality and surface strength, mild steel samples were coated with the prepared Ni-P–rGO solution, then thoroughly dried and finished. The resulting surface morphology and the structure were examined using EDX,SEM and XRD . The friction and wear characteristics were analyzed by the pin-on-disc method experiments under sliding speeds. The study indicated that the Ni-P coating reinforced with rGO exhibited better results in terms of friction coefficient and wear rate than the non-reinforced Ni-P samples. During sliding, rGO was present on the surface leading to the development of thin lubricating films that minimized metal-to-metal contact. As a result, the Ni-P–rGO coating showed enhanced self-lubricating capabilities, as well as greater hardness and wear resistance. Therefore, incorporating rGO into Ni-P can be a potential approach to improving the tribological properties of such coatings. Thus, they can be used in manufacturing and automotive industries.

Abstract ID- 012006848

A New Approach to Quantum Image Representation for Data Hiding Using Hamiltonian-Based Encoding and Quantum Differential Expansion

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The emergence of quantum computation provides a trans- formative paradigm for secure data hiding beyond the scope of classical image steganography. This paper introduces a Hamiltonian-driven quantum image steganographic frame- work that combines the Modified Novel Enhanced Quantum Representation (M-NEQR) with Hamiltonian phase encod- ing and Quantum Differential Expansion (QDE). In contrast to the conventional NEQR approach, where pixel intensi- ties are represented as fixed binary amplitudes, the proposed method encodes each pixel's gray-level information through unitary Hamiltonian encoding, allowing intensity to be ex- pressed as a quantum phase function e^{-iHt} . This encod- ing technique enhances state compactness, coherence sta- bility, and noise reduction under quantum operations. Sub- sequently, the Quantum Differential Expansion mechanism embeds secret qubits within pairs of Hamiltonian-encoded pixel states by employing controlled quantum arithmetic, reversible logic, and entanglement-assisted embedding strate- gies. The hybrid framework ensures perfect reversibility as recovering both the hidden message and the original cover image without noticible distortion also preserving the Uni- tarity of the system. Experimental analysis demonstrates an Average Embedding Capacity (AEC) of 2 bpp and Peak Signal-to-Noise Ratio (PSNR) of nearly 40 dB, achieved with only O(log N) qubit complexity compared to $O(N^2)$ classical system. The utilization of quantum superposition, entanglement correlation, and phase coherence control fur- ther strengthens resistance against various attacks due to the quantum property. This research establishes a robust foundation for quantum steganographic techniques, fusing Hamiltonian encoding with reversible quantum data hiding to maintain secure, efficient, and fully recoverable informa- tion concealment in quantum domain.

Abstract ID- 015622147

Impact of Openings in Masonry Infill Walls on the Seismic Resistance of RC Frames

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Masonry infill walls, commonly used as partition walls in reinforced concrete (RC) frame buildings, are often treated as non-structural elements and considered only for their mass contribution to seismic weight. However, during earthquakes, the frame and infill walls act together as a single system, significantly influencing the building's stiffness and seismic response. Neglecting the stiffness contribution of infill walls can result in inaccurate analysis and unsafe design. The stiffness of an infill wall is largely affected by the percentage of openings, such as doors and windows, which reduce its strength and stiffness, thereby impacting overall seismic performance. Owing to the complex frame–infill interaction, several analytical and empirical models have been developed to represent this behaviour accurately. One of the most common approaches is to represent the infill as an equivalent diagonal strut. This study focuses on modelling RC frames with masonry infill panels using different equivalent strut formulations, incorporating reduction factors which is not specified in IS 1893 (Part 1): (Seismic Design Code). It also studies how varying percentages of openings in the infill affect key seismic parameters such as Base Shear, Time period and Displacement. It is found that with the increase in percentage of openings, the displacement increases and this is related to the decrease in stiffness and the base shear is also found to decrease. The comparative analytical study aims to provide better understanding of infill behaviour and support more conservative seismic design and analysis of RC frame buildings.

Abstract ID- 032538855

Neurovision: an approach to brain tumor detection

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Manually detecting a brain tumor is very difficult for analyzing Magnetic Resonance Imaging (MRI) data. Improving patient outcomes and treatment success rates requires early brain tumor identification. We used Convolutional Neural Networks (CNNs) in this study to automatically detect and classify brain cancers, utilizing a deep learning-based methodology. The main objective of our work is to develop a dependable, automatic system that helps radiologists make accurate and timely diagnoses of brain tumors. A publicly available dataset of 3,000 MRI scans, equally split into two groups—tumor and no tumor—is used by the suggested model. To boost image quality and feature visibility, a variety of preprocessing techniques were used before training, such as contrast improvement, brightness correction, and skull stripping. To improve generalization and avoid overfitting, the CNN architecture has numerous Convolutional layers, pooling layers, dense layers, and dropout regularization. The model's remarkable classification accuracy is 96.5%, precision is 96.47%, recall is 95.12%, and ROC AUC score of 0.9894 on the testing dataset are all demonstrated by the experimental findings. The model's strong diagnostic performance was further confirmed by the confusion matrix, which successfully distinguished between brain MRI scans with tumors and those without. This research successfully demonstrates the potential of deep learning and CNNs, as a supportive diagnostic tool in the medical imaging domain. The proposed model can significantly aid radiologists by providing rapid, consistent, and accurate tumor detection, thereby facilitating early diagnosis and improving clinical outcomes for patients with brain tumors.

Abstract ID- 055903475

Magnetic and Hydrodynamic force driven immunomagnetic cell capturing in a microfluidic bi-phasic flow system

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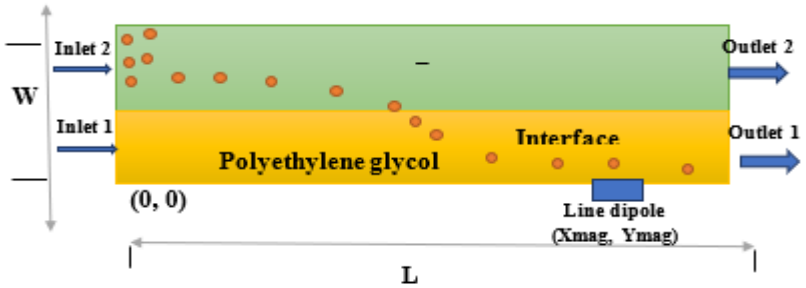
For biomedical diagnostic and therapeutic purposes, the manipulation and separation of living cells utilizing magnetic fields in microfluidic devices has drawn a lot of interest. The impact of magnetic force on immune-magnetic cell capture in a microfluidic bi-phasic flow system is examined in this work. The microfluidic system consists of two immiscible and aqueous solutions of Dextran (DEX) polymer with aqueous polyethylene glycol (PEG). It is assumed that a flat interface between the two aqueous polymer solutions have exists and are driven by pressure. The behavior of the two aqueous solutions exhibits as Newtonian fluid. The present analysis takes into account the two aqueous phases' continuous flow arrangement. To achieve selective cell capture through the lower outlet, non-magnetic cells functionalized with magnetic nanoparticles are added to the aqueous Dextran phase while an external magnetic field is applied perpendicular to the flow direction. The interaction between hydrodynamic drag and magnetic attraction is examined using a computational model that combines particle tracing, laminar flow dynamics, and magnetic force field distribution. The capture efficiency is a measure of the device's performance. The findings show that the capture efficiency is significantly influenced by the interface height, magnetic field, viscosity and flow rate of the two phases. For effective magnetic cell separation in continuous bi-phasic micro-flows, the study offers quantitative insights into operational parameter optimization. The creation of next-generation lab-on-a-chip systems for targeted bio-separation, rare cell identification, and cell sorting in clinical and biotechnological applications may be made easier by these findings.



Abstract ID- 094832184

Sustainable Detoxification and Energy Recovery from Wastewater through Microbial Fuel Cell (MFC)

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The global energy crisis is intensifying due to the exhaustion of fossil fuel reserves and the increasing demand for energy, prompting the exploration of sustainable and alternative energy technologies. Microbial Fuel Cells (MFCs) have surfaced as a promising bio-electrochemical system that can tackle both energy and environmental issues by employing microorganisms to oxidize organic and inorganic substances, thus producing electricity while purifying wastewater. This project concentrates on the sustainable detoxification and energy recovery from industrial wastewater and by-products produced by oil refinery, battery and fertilizer industry—three significant entities within the Haldia industrial complex in West Bengal, India.

The proposed MFC system is intended to process complex industrial effluents that contain organic materials, heavy metals, spent caustic, and oily residues which act as substrates for microbial consortia Laboratory-scale experiments revealed a voltage output of 0.9 V in a 50 mL MFC model utilizing refinery effluent, achieving significant COD reduction within 24 hours. These results validate the MFC's ability for both energy production and bioremediation.

Integrating MFC technology into current industrial wastewater treatment facilities can significantly diminish pollutant loads, improve effluent quality, and alleviate internal energy requirements. This integration aligns with corporate sustainability objectives—water reuse, zero liquid discharge, and reduction of carbon footprints—while also contributing to national clean energy and circular economy efforts. This research highlights the promise of MFCs as scalable green technologies that can contribute to clean water, environmental sustainability, and energy security in a world that is becoming increasingly constrained in resources.

Abstract ID- 102840672

A hybrid CNN LSTM framework for Emotion detection from audio signal

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Speech Emotion Recognition (SER) has become an important research area in Human Computer Interaction. It helps systems understand the emotional state of a speaker from their voice. It will help in real-life applications such as virtual assistants, customer service systems, and smart home devices. It also has important use in the medical field, where emotion recognition can help doctors and therapists monitor a person's mental and emotional health, such as stress, anxiety, or depression levels. The hybrid CNN–LSTM model architecture is used to identify emotions from audio signals. The speech signals are first converted into mel-spectrograms, which show the frequency and time information of the sound. The CNN layers extract important features from these spectrograms, while the LSTM layers learn the temporal patterns and changes in the speech that represent emotions. The proposed system is trained and tested using the RAVDESS dataset. The experiment results achieve adequate accuracy. This technique can be used in AI based Mental counseling projects, Lie detection, Emotion aware response from AI assistant etc.

Abstract ID- 101836427

AI-Enhanced Thermal Management in Next Generation Batteries

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The next generation of electric vehicles (EVs) demands batteries that can charge faster and last longer without compromising safety. Silicon-anode lithium-ion batteries promise a tenfold boost in capacity over today's graphite cells, offering a future where EVs drive further and smartphones last days on a single charge. Yet, this advance brings a deadly challenge, silicon anodes swell up to 400% during charging, triggering extreme heat spikes that can result in catastrophic "thermal runaway" events, battery fires or explosions.

In this work, a new approach is proposed to battery safety and performance by leveraging artificial intelligence to predict and prevent these dangerous episodes in real time. Using cutting-edge electrochemical-thermal physics-based simulations and advanced machine learning models (LSTM, XGBoost), my research develops the battery system that forecasts cell temperature 30-60 seconds ahead with an error margin less than 1 °C. This AI-powered "thermal guardian" activates cooling systems instantly, maintaining battery temperatures within the critical 5 °C safety window even during ultra-fast charging.

The work's impact is twofold, it drastically reduces the risk of EV battery fires and paves the way for rapid, widespread adoption of silicon-based batteries accelerating the global transition to green mobility. By uniting state-of-the-art simulation, predictive modeling, and real-world control, my thesis creates a pathway for safer, smarter, and more sustainable energy storage powering tomorrow's technologies.

Abstract ID- 045833948

Hybrid Optical and Digital Nonlinearity Mitigation for OFDM-Based Coherent Optical Networks Using Optical Phase Conjugation and Digital Backpropagation

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High-speed coherent optical communication systems using orthogonal frequency division multiplexing (OFDM) suffer severely from fiber nonlinearities such as self-phase modulation (SPM), cross-phase modulation (XPM), and four-wave mixing (FWM). These effects accumulate over long-haul transmission and significantly degrade system performance in terms of bit error rate (BER) and optical signal-to-noise ratio (OSNR). This paper presents a hybrid nonlinearity mitigation scheme that combines optical phase conjugation (OPC) in the optical domain with digital backpropagation (DBP) in the digital signal processing (DSP) domain to efficiently counteract nonlinear impairments in OFDM-based coherent optical systems. The optical phase conjugator reverses the accumulated phase distortion in the middle of the transmission link, while the partial DBP algorithm digitally compensates for the residual nonlinear phase rotation and dispersion. Simulation results demonstrate that the proposed hybrid technique achieves up to a 400 Gbps 16-QAM OFDM transmission over 1000 km of standard single-mode fiber (SSMF). The clear constellation diagrams and BER values $< 10^{-3}$ show that the system can receive the data without ambiguity after a 1000 km transmission. The comparison between the techniques confirms that the hybrid combination of optical and digital compensation works better. The results confirm the efficiency of combining optical and digital compensation techniques for next-generation high-capacity optical networks.

Abstract ID- 085815853

Influence of Soaking Duration and Pressure- Parboiling Time on Gelatinization Behavior and Quality Attributes of Puffed Rice

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The quality of puffed rice depends on the physicochemical transformations that occur during parboiling, with the degree of gelatinization (DG) playing a crucial role in determining expansion, texture, moisture behavior, and optical properties. To identify the DG range suitable for producing uniformly expanded puffed rice, two soaking durations (0.5 h and 14 h) and pressure-parboiling at 35 psi for 5-50 min were applied to Ratna variety paddy. Increasing DG was associated with greater kernel swelling, dimensional changes, and improved milling yield due to enhanced water absorption and starch softening. Maximum puffing performance occurred at DG values of about 68.66% for 0.5 h soaking and 71.68% for 14 h soaking, both obtained at 30 min steaming. At these levels, expansion ratio and crispiness were highest, while hardness remained low. Steaming beyond this point resulted in DG values exceeding the optimal range, leading to reduced expansion due to starch retrogradation and decreased internal vapor pressure. Longer soaking consistently resulted in higher DG, better milling yield, and more uniform hydration. Color attributes, including lightness, redness, yellowness, and whiteness index, changed progressively with DG and thermal severity. Multivariate analysis revealed strong interactions among DG, expansion, texture, moisture uptake, and color, indicating that DG is a reliable indicator for achieving consistent puffed rice quality.

Abstract ID- 105019145

A study of slope effect in nano-tribological properties.

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In material science, understanding the surface properties of a material is important to study the friction, wear of that surface during a relative motion with another surface. This analysis, known as the tribological study and the surface properties are called tribological properties. In this study, a model of surface slope for a hydroxyapatite coated Ti6Al4V surface is proposed using the coefficient of friction (COF) value for very low applied load (e.g. 100mN). This is known as nanotribological study, an advanced field of nanomechanical research utilizing instruments like the surface force apparatus, atomic force microscope, friction force microscope and scanning tunnel microscope. Nanotribological studies are primarily fundamental and find applications in MEMS, HDD technologies and bio- related systems. At the nanoscale, no surface is perfectly smooth there must be some hills and valleys that contributes to frictional behaviour. Under high loads, these asperities break down, affecting the COF values. A scratch test was conducted under very low load, so the intender tip could not damage the surface features. This condition introduces a slope effect, influencing the COF. During the test, 1000 data points of tangential and normal loads were collected across a 0.5 mm scratch length, from which a relationship between COF and the slope was established. In this study these slopes are calculated corresponding to each COF and a surface model is proposed same as the real one.

EARTH SCIENCES INCLUDING GEOINFORMATICS AND HYDROGEOLOGY

Abstract ID - 123237750

Evaluation of relative active tectonics and their impact on landslide dynamics within the part of Garhwal Himalay a, India

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The geomorphic vicissitudes are highly prejudiced by the ongoing tectonic activities over the earth's crust and the Himalayan region including the Garhwal Himalaya. These regions have been facing several kinds of tectonic processes since their formation. The tectonic activities can affect the rate of erosion and exert a first-order imprint on the drainage system of the area. Here, the main objective is to achieve the relative active tectonics over the Garhwal Himalaya (part of Yamuna, Bhagirathi, and Alakananda basin) and try to correlate the landslide incidents with active tectonics. The drainage system of the classified sub-basins and its geomorphic as well as topographic expressions are significantly influenced by active tectonics. For the numerical analysis, we have used several morphotectonic parameters such as asymmetry factor (Af), basin shape index (Bs), hypsometric integral (HI), stream length gradient index (SL), and valley floor width to height ratio (Vf). The index of relative active tectonics (IRAT) shows that approximately 76% of areas of the sub-basins are under high and very high relative active tectonic zones (IRAT<2). The major parts of the lesser and central Himalayas in the Garhwal region are facing ongoing tectonic activities and this result is highly supported by the presence of seismic activities (>5 Mw) and gravity anomaly data (ranges from -188.899 to -349.44 mGal). The landslide density map shows high landslide density over the high tectonically active sub-basins, mainly in the sub-basins of 1, 5, 7, 8, 9 (Yamuna); 9, 11, 12 (Bhagirathi); and 3, 4, 5 (Alakananda). The considered outcome of active tectonics is also strengthened by the extensive geomorphic field evidence and imprints of neo-tectonism within the area.

Abstract ID - 043746482

Harnessing India's Lithological Wealth for Durable Soil-to-Sea CO_2 Sequestration

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Both natural and enhanced rock weathering (ERW) offer effective pathways for atmospheric CO_2 removal through mineral dissolution, cation release, and the formation of bicarbonates and carbonates. These reactions transfer alkalinity to riverine and marine systems—shaped by microbial activity, organic ligands, and soil moisture—and store carbon as marine carbonates or dissolved inorganic carbon (DIC). ERW accelerates this process by applying finely ground silicate rocks to croplands, providing dual benefits of CO_2 drawdown and soil fertility enhancement. Global estimates indicate a removal potential of 2–4 Gt CO_2 yr^{-1}, while integrated models highlight synergies with nutrient cycling and land-use management. Field projects such as the UK ERW Demonstrator are evaluating performance, crop responses, and monitoring approaches.

India holds significant scalability potential due to extensive basalt-rich regions in the Deccan and Rajmahal Traps overlapping with agricultural zones. Emerging ventures like Alt Carbon, Mati, and Varaha are piloting scalable ERW pathways aligned with sustainable farming. Yet, challenges persist—mainly the energy demand of rock mining and grinding, which may offset gains. Despite slower dissolution than ultramafic rocks, basalt remains abundant, safe, and agronomically beneficial. Improved measurement, reporting, and verification (MRV) will rely on alkalinity fluxes, isotopic tracers, and digital soil-to-ocean DIC tracking to refine carbon accounting.

A coordinated "soil-to-sea" approach integrating ERW, in-situ carbonation, and ocean alkalinity enhancement, supported by robust MRV frameworks and policy incentives, can position India to achieve durable, scalable carbon removal.

Abstract ID - 030459422

Assessment of NORMs (Ra-226, Th-232 and K-40) in and around Purulia district of West Bengal

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Among all the "Naturally Occurring Radioactive Materials (NORMs)", Ra-226, Th-232 and K-40 are considered to be important for assessment due to their substantial impact on the environment and associated health issues to human beings. In this work, sub-surface soil samples have been analysed to study the potential of these natural radionuclides in terms of spatial distribution in the Purulia district under the Chota Nagpur Granite Gneissic Complex of eastern India, using a Tl doped 2''x2" NaI gamma detector. Moderate to high levels of Ra-226 activity were observed, with several samples within 150–200 Bq/kg range. Few samples exhibited Ra-226 activities exceeding global averages and this may be attributed to uranium and phosphate enrichment within Precambrian lithology of this region. Th-232 concentrations were found to be low, with 73.3% of samples below 100 Bq/kg. On the other hand, occurrence of potassium-rich minerals such as feldspar and granitic rocks caused significant K-40 variability in this study region. The calculated Radium Equivalent Activity (Ra_{eq}) and other dose parameters obtained using the results indicate potential radiation exposure risks among local people residing in this region.

Abstract ID - 061904413

The Mythology of Paddy Rice Cultivation: A Nexus Between Rainbird and Monsoon Onset

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The rice is one of the major crops in India, and it provide dominant energy sources of rural population and maintain food security. During kharif season (June to September), farmers prepared nursery of rice plants after the first signing of monsoon. Farmers know how to read monsoon signs like the colour of the sky, the presence of a rainbow, the appearance of Clamator jacobinus and so on. Of course, water is essential for rice cultivation, and it transplanted in flood field, this unique characteristic has a strong connection with monsoon. Thereby, in this study we scientifically re-establish the mythology of paddy rice cultivation is a nexus between rainbird (Clamator jacobinus) and monsoon onset. To evaluate the relationship, we used eBird data for the first sighting of Clamator jacobinus (pied cuckoo) only the earliest (before August) sight was used in the different location of West Bengal. Monsoon onset data has been collected from the Skymet weather forecasting services. Besides, we used MODIS EVI product for driving the rice onset (indicates the development of leaf and canopy emergence) using threshold-based phenology identification approach. The results show that the rice onset significantly correlated with monsoon onset and the first sighting of Clamator jacobinus. The value of correlation coefficients 0.68 ($p < 0.001$) and 0.65 ($p < 0.001$) with R^2 value 0.47 and 0.42 respectively. Furthermore, the relationship between monsoon onset and the first sighting of Clamator jacobinus were analyzed, which also showed significant positive correlation (0.71, $p < 0.001$) with R^2 value 0.5. This result re-established the appearance of Clamator jacobinus (rainbird) provide an early signal of monsoon onset which is helpful to farmer for rice cultivation.

Abstract ID - 121304246

Digital Shoreline Analysis System (DSAS) model run through Machine Learning Techniques (MLT) in evaluating shoreline changes along coastal districts in Odisha and West Bengal, India

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Shoreline change research is required to safeguard coastal environments, mitigate risks, and promote sustainable development. Because of abrasion and accretion brought on by sedimentation, tidal waves, wave breaking, climate change, sea level change, geomorphological changes, and other factors. The shoreline is a dynamic line that sensitively shifts its position. The Digital Shoreline Analysis System (DSAS) tool used for estimating coastal alterations using machine learning approaches. Analyzing and estimating shoreline changes between 1980 and 2025 is the study's main goal after Cohan Kappa accuracy calculation. Multi-temporal satellite data used from Landsat MSS, TM, and OLI/TIRS images to analyze shoreline shift. Shoreline changes examined on seven coastal districts, where End Point Rate (EPR), Net Shoreline Movement (NSM) and Shoreline Change Envelope (SCE) techniques applied stands on statistical basement. Total 708 km coastline results indicate shift like Jagatsinghpur (moderate), Puri (substantial), Kendrapara (almost perfect), Bhadrak (moderate), Balasore (Fair), Purba Medinipur (slight) and South 24 Pargana (fair). According to EPR and NSM results, abrasion occurred along the South 24 Pargana coastal tract at rates of 3.90 m/ year and 175.57 m for this period. Purba Medinipur district has shown consistent and modest changes, with annual rates of 0.01 m/year (EPR) and 0.32 m/ year (NSM), respectively. Net shoreline movement (m) for Puri, Jagatsinghpur, Kendrapara, Bhadrak and Balasore are 8.41 m, -4.98 m, -84.10 m, -46.61m and 43.23 m respectively for this period. Only, Puri's findings show factual of significant accumulation over the period.

Abstract ID - 090029277

Anthropo-natural Impacts on Riverscape Dynamics Using Multi-Sensor Satellite Image Fusion Technique and Machine Learning Approaches in Google Earth Engine: A Study on Kangsabati River, India

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Riverscape, the landscape on and along a river, is most sensitive to natural processes and anthropogenic activities of earth surface. For this study the objectives were to assess the impacts of natural processes and anthropogenic activities on riverscape dynamics with assessing future riverscape also. For this, natural processes (bankline and centerline dynamics) and anthropogenic activities (land use land cover change and sand mining activities) were considered. Multi-temporal and multi-sensor satellite images (Landsat 5, Landsat 8, Sentinel 2A, LISS III and LISS IV) were utilized using fusion technique and machine learning (ML) approaches in Google Earth Engine (GEE). DSAS model was utilized for analysing migration of historical centerline and bankline. Increasing trend of anthropogenic activities on riverscape was witnessed along with the important role of bankline migration on riverscape dynamics. Centerline migration rate towards right bank was 3.7 meter/year and left bank was 3.3 meter/year. For the left bankline, erosion rate was 3.8 meter/year while accretion rate was 3 meter/year. For the right bankline, the erosion rate was 3.3 meter/year while accretion rate was 3 meter/year. From the riverscape future prediction it was found that about 6 sq.km. land have the possibility to be lost where About 0.77 square km area of cropland was there within 2035 due to bankline migration. It was also found that the GEE, ML approaches with multi-sensor image data and DSAS model has effectiveness on study riverscape dynamics, which can enhance the understanding on management of riverscape with promoting harmonious co-existence between river and human.

Abstract ID - 052300256

Process–Form Dynamics of River Bank Erosion and Its Implications for Sustainable Management along the Lower Reach of the Ganga River

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Riverbank instability in the Lower Ganga Plain has persisted since the mid-19th century, primarily driven by substantial catchment fluxes from the upper basin which significantly impact the Malda and Murshidabad districts. This study introduces **'ADCP–Sediment–DSAS' integration** to elucidate the process–form interactions of river bank erosion and to develop sustainable management strategies. Field surveys collected 38 ADCP cross-sections and 53 sediment samples, enabling detailed hydraulic–sediment characterisation. Results reveal distinct hydrodynamic contrasts shaped by the Farakka Barrage: average velocity increases from 0.86 m/s in the upper reach to 1.06 m/s downstream, shear stress rises from 5.63 $\boldsymbol{N/m^2}$ to 9.48 $\boldsymbol{N/m^2}$, and unit stream power escalates from 0.92 $\boldsymbol{N/m.s}$ to 2.255 $\boldsymbol{N/m.s}$. The average mobility index is lower in the upper Farakka (51.03) than in the lower Farakka (242.52). Lateral channel expansion is more significant in Upper Farakka, although vertical erosion dominates in Lower Farakka. Long-term channel dynamics reveal a dominant left-bank erosion tendency (−19.38 ± 2.83 $\boldsymbol{m/yr}$; 38.61% of transects are significant) with concurrent right-bank accretion (6.82 ± 2.83 $\boldsymbol{m/yr}$; 14.95% of transects are significant). Lower Farakka experiences markedly higher bank and total shear stress during the monsoon season (June–September), while Upper Farakka shows moderate yet distinct seasonal variations, indicating notable upstream instability. Peak stream power and significant bank instability are recorded during the monsoon season in the lower Farakka locations of Debidaspur, Shikdapur, Chanchanda, Loharpur, Dhushripara, and Nimtita. Incorporating geomorphic and hydraulic perspectives into riverbank erosion management promotes long-term sustainability in the study region.

Abstract ID - 093544841

Sustainable modeliing of groundwater potentiality zonation using AHP and FR weights of evidence in coastal track of Orisha, India

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Groundwater is an essential natural resource that is overused in Odisha coastal area to meet freshwater demands brought on by population growth, climate change, shifting land use patterns, and increased mining activity. Accurately determining its availability and quality is still difficult, though. Thus the goal of the current study was to define groundwater potential zones and look into groundwater level (GWL) forecasts in Odisha coastal track and offer insightful information for sustainable management and decision making using the Frequency Ratio (FR) model and Analytical Hierarchy Process (AHP). Using conventional and remote sensing data in ArcGIS platform, we have integrated twelve conditioning elements for this purpose: rainfall, geomorphology, geology, slope, distance from river, soil LULC, NDVI, NDWI, MNDWI, TWI and line density map. 417 points were chosen at random and divided into training and testing data at a 70:30 ratio. The implemented methods have significantly classified five GWPZs specifically Very Good, Good, Moderate, Poor and Very Poor with high and acceptable accuracy. The receiver operator characteristics (ROC) approach has been used to validate the model's performance. Area under curve (AUC) in ROC curves show that AHP method (AUC= 67.9%) is well obtained for GPZs in comparison with FR method (AUC=73.2%). As a result, this statistical approach is strongly advised for groundwater potential zone investigations and the results are appropriate for future sustainable groundwater management. By optimizing resource distribution, this information guarantees an adequate supply for long-term development.

Abstract ID - 082205100

High Resolution Paddy Intensity mapping with phenology-based algorithm in lower Ganga Basin using Using Gap-Filled Time Series

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Mapping paddy intensity in monsoon regions is challenging due to persistent cloud cover, fragmented fields, and multiple cropping cycles that reduce the accuracy of optical remote sensing. To overcome these limitations, this study developed a gap-filling based paddy intensity mapping framework using the Google Earth Engine (GEE) platform. The framework integrates high-resolution Sentinel-2 imagery with temporally dense MODIS vegetation index time series to reconstruct cloud-free vegetation dynamics. Regression analysis indicated a strong correlation ($R^2 > 0.85$) between the reconstructed and observed Sentinel-2 vegetation indices across diverse agro-climatic zones, confirming the reliability of the approach. Using the reconstructed time series, a 10-meter resolution paddy intensity map was produced for the Lower Ganga Basin for 2024. The map achieved an overall accuracy of 89% and a kappa coefficient of 0.78, outperforming existing datasets in spatial detail, field boundary delineation, and discrimination of single, double, and triple cropping cycles. The framework demonstrated robustness even under heavy cloud conditions, enabling precise monitoring of paddy cultivation dynamics throughout the monsoon season. The resulting maps provide valuable insights for food security assessment, irrigation scheduling, and sustainable agricultural management. Furthermore, the high-resolution outputs can support water resource planning and agricultural policy formulation. Overall, the proposed methodology offers an efficient, scalable, and adaptable solution for mapping paddy cropping intensity across cloud-prone tropical and subtropical regions, contributing to improved understanding and management of paddy based agro-ecosystems worldwide.

Abstract ID - 084753794

Anthropogenic and Natural Drivers of Landslide Susceptibility: A Case Study from the Darjeeling Himalayas

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Landslides are a recurrent and destructive hazard in the Darjeeling Himalayas, where steep slopes, fragile geology, and intense rainfall combine with rapid human intervention. The present study examines how both natural and anthropogenic factors influence landslide susceptibility in this highly vulnerable mountain environment. Using GIS and Analytical Hierarchy Process (AHP), a detailed Landslide Susceptibility Index (LSI) map was generated by analyzing nine key parameters namely slope, aspect, elevation, geology, rainfall, NDVI, soil type, soil moisture, and proximity to roads. Field surveys conducted across ten major landslide-prone locations helped to validate the spatial patterns identified through modeling. The findings reveal that areas with steep gradients (above 30°), highly weathered schist and phyllite rocks, and high rainfall intensities (more than 300 mm per month) are inherently at risk of slope failure. However, human activities such as unplanned urbanization, deforestation, road cutting and tea plantation expansion have greatly increased the instability of the slopes. About one-third of Darjeeling district now falls in high to very high susceptibility zones, especially along transport corridors and densely populated hill slopes. The study emphasizes the urgent need for improved slope management, improved drainage systems and adoption of eco-engineering and afforestation measures. Integrating scientific mapping with community awareness and planning can play a key role in reducing landslide risks in the future. The results of this study provide valuable insights for disaster managers, planners and local authorities in developing sustainable mitigation strategies for the Darjeeling Himalayas.

Abstract ID - 050645639

Ecosystem service of wetlands and it's future in North & South 24 Parganas District, West Bengal

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Wetlands are vital ecosystems, providing a range of benefits like clean water, groundwater recharge, flood control, and supporting diverse species, cultural practices, and biodiversity conservation. These are very crucial for human well-being and economic support; thus, the valuation of ecosystem services is very important for wetland conservation and management. This study conducts the quantification and prediction of wetlands and habitat quality ecosystem services (ESS) in response to land cover changes using machine learning and deep learning models in North and South 24 Parganas of the last 30 years, from 1995 to 2025. The study also focuses on projecting the conditions of wetland ESS by 2050 and 2070. The findings indicate that the wetland has declined in size over the last 30 years. These findings on the spatio-temporal changes of wetlands and ESS can inform wetland decision-making processes and facilitate effective conservation, protection, and restoration of wetlands for future sustainability of the area, providing safety against emerging issues such as climate change, food production for an increasing population, regulating disturbances, providing clean water, and overall well-being of society.

Abstract ID - 013028409

Assessment of Urban Environmental Quality using RS-GIS Based Multi-Criteria Techniques of Midnapore Municipality Area, West Bengal

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This study presents a comprehensive assessment of Urban Environmental Quality (UEQ) within Midnapore Municipality area, in West Bengal. The research integrates ecological parameters, landscape components with socio-economic indicators by employing a multi-dimensional RS-GIS based analytical framework to evaluate spatial disparities in environmental quality across 25 municipal wards. The key environmental indices such as Land Surface Temperature (LST), Normalized Difference Vegetation Index (NDVI), Normalized Difference Water Index (NDWI), and Normalized Difference Built-up Index (NDBI) are analysed from high-resolution satellite imagery (Sentinel 2A and Landsat 8) along with population density, unemployment rate, literacy rate, and household density as socio-economic data. The green space, NDVI, population density and household density are the main components derived from the Principal Component Analysis (PCA).The spatial variation of Urban Environmental Quality Index (UEQI) map highlights the distinct patterns of environmental stress particularly in densely populated core areas with limited green coverage, noise pollution, proximity to slums and dumping grounds, while better UEQI is found in green-rich, higher literacy levels and better employment peripheral zones. The study underscores the urgent need for integrated urban planning strategies focusing on green infrastructure, decentralization of settlement, and sustainable land use. This research contributes a valuable baseline data to inform policy makers for enhancing liability and environmental resilience in small but rapidly urbanizing Indian cities.

Abstract ID - 104945389

Integrating GIS and Machine Learning approaches to identify Eco-Tourism Potential Zones (ETPZ) in the Jangal Mahal region, West Bengal

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Unrestricted growth of mass tourism is responsible for massive environmental degradation. Therefore, to mitigate this issue promoting eco-tourism development is essential. In recent years eco-tourism has evolved as a highly acknowledged approach globally due to its huge potentiality in endorsing sustainability by ensuring economic opportunities while protecting the environment and cultural heritage. Therefore, identifying ETPZ is necessary for sustainable tourism development. The present study utilized Remote Sensing and GIS techniques integrated with three machine learning algorithms such as Decision Tree, Support Vector Machine, and Random Forest to generate ETPZ map employing fourteen conditioning parameters for the Jangal Mahal region. The analysis identified 28 potential sites in Purulia, 14 in Jhargram, 11 in Bankura, and 6 in Paschim Midnapore as highly suitable for eco-tourism development. The reliability of the models is assessed using Receiver Operating Characteristic (ROC), Kappa coefficient and proximity test. All the three models performed well in detecting eco-tourism potential zones but the Random Forest model outperform than other two models. Random Forest model recognized forest, geo-sites, waterbodies, elevation, and rural area as the key influencing factors in modelling ETPZ. The outcome of the study will help the policymakers, tourism planners, and stakeholders in promoting sustainable tourism development in the Jangal Mahal region.

Abstract ID - 125358392

Morphometric analysis for lower reaches of the Subarnarekha River corridor, India, under Remote Sensing and GIS environment

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Expertise the river basin requires expertise in morphometric analysis. The lower reaches of Subarnarekha River are used in this study's morphometric analysis, which includes both aerial and linear aspects that are highly regulative for morphological producers. For this study, the entire river corridor, 2335.36 square kilometres has been taken into consideration. The ArcGIS 10.4.1 platform is used to build and analyze digital contours and various thematic layers of aerial aspects, using 30 meters resolution SRTM DEM. Both linear and aerial aspects have been confirmed for finite parameters selection. Moreover, a 5th order stream with a mean length of 1.21 km, a bifurcation ratio of 5.025 magnitude and a positive stream length ratio are shown by using linear aspects. According to these results, there is a medium to high chance of flooding for the full bank season. On the other hand, the aerial aspect displays the drainage density (0.37), stream frequency (0.42), drainage density (1.14), from factor, circulatory ratio, and shape factor in addition to the exact probability of flooding at a specific rate. The infiltration number, compactness co-efficient, constant channel maintenance, and other criteria indicates that regular monitoring is necessary to reduce the intensity of floods on a local and medium scale basis. The "Rho" co-efficient values vary from 0.02 to 0.15 for this basin. The spatial distribution of a few chosen aerial characteristics was strongly correlated with elevation and slope. Categorization of results under linear and aerial aspects, minutely differ from the interrelationship between selected parameters. and "Rho" co-efficient is quite disquieting.

Abstract ID - 103146549

Anthropogenic Stress on Wetland Water Quality and Ecosystem Services: Insights from Chaltia and Bishnupur Wetlands, Murshidabad District, West Bengal

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Wetland ecosystems deliver crucial socioeconomic and ecological benefits, yet they have become increasingly vulnerable to human-induced disturbances. This study assesses water quality and community perceptions regarding the declining ecosystem services of two wetlands—Chaltia and Bishnupur. A total of 40 water samples were collected during the pre-monsoon season, 20 from each wetland, and analysed for 12 physicochemical parameters. The findings revealed pronounced spatial variations in water quality, evaluated using Inverse Distance Weighting (IDW) interpolation and correlation matrix analysis. Chaltia wetland has suffered severe degradation due to urban encroachment, agricultural expansion, and landfilling, whereas Bishnupur wetland has experienced continuous deterioration over the past three decades from urban waste discharge and polluted drainage inflow. Critically, parameters such as SPC, EC, TDS, salinity, DO, and BOD exceeded the permissible limits set by the World Health Organization (WHO) in both sites. The computed Water Quality Index (WQI) values—90.79 for Chaltia and 86.11 for Bishnupur—indicate poor water quality, unsuitable for human consumption or aquatic life. Community insights further confirm the substantial decline in ecosystem services that once supported local livelihoods and biodiversity. Addressing Sustainable Development Goals (SDGs) 6 and 11, the study emphasizes the escalating pollution and degradation of wetland health, underscoring the urgent need for integrated urban and agricultural planning. These findings provide critical guidance for policymakers and stakeholders to implement sustainable management and restoration strategies to safeguard wetland ecosystems and their essential services.

Abstract ID - 094824709

Comparative Assessment of Machine Learning Algorithms for Landslide Susceptibility Mapping in the Kalimpong District, Eastern Himalaya

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The Kalimpong district of the Eastern Himalaya is highly prone to landslides due to its rugged topography, steep terrain, fragile lithology, intense monsoonal precipitation, and increasing anthropogenic stress. This study aims to develop a Landslide Susceptibility Model for Kalimpong using thirty-three conditioning parameters, encompassing topographic (Elevation, Slope aspect, Plan Curvature, Profile Curvature, Roughness, TPI, TRI, TWI, LS Factor, Relative Slope Position, Valley Depth, Relief Amplitude, Slope Classes), hydrological (Drainage Density, Distance to River, MFI, SPI, STI, Rainfall), geological (Geology, Geomorphology, Lithology, Soil Texture, Earthquake Depth, Lineament Density, Distance to Lineament), environmental (NDVI, mNDWI, NDMI, LULC), and anthropogenic (Road Density, Distance to Road) factors. Seven supervised machine learning algorithms, Logistic Regression, Random Forest, AdaBoost, Gradient Boosting, XGBoost, Support Vector Machine, K-Nearest Neighbour, and Extra Trees, were employed to model the spatial probability of landslide occurrence. Model validation was conducted using multiple statistical indices including Accuracy, Kappa, F-measure, MCC, ROC Area, and PRC Area. The comparative results revealed that the XGBoost model achieved the highest prediction accuracy (95.63%) and a robust ROC value of 0.990, followed closely by Extra Trees (Accuracy = 95.31%, ROC = 0.991) and Gradient Boosting (Accuracy = 95.31%, ROC = 0.989). The resulting landslide susceptibility map effectively delineates very high, high, moderate, low, and very low susceptibility zones, identifying Pedong, Algarah, and Relli Valley as critical hotspots. The study highlights the potential of ensemble learning approaches in producing accurate and reliable landslide susceptibility assessments, supporting sustainable land-use planning and disaster risk reduction in the geodynamically sensitive Kalimpong district.

Abstract ID - 055935199

Quantifying Urban Expansion and Its Influence on Surface Thermal Dynamics in Kolkata Using Advanced Geospatial Techniques

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Rapid urbanization is reshaping the Kolkata Metropolitan Development Authority (KMDA) region, increasing thermal stress and posing significant challenges to sustainable development. Understanding these dynamics is crucial for developing climate-aware spatial plans in one of India's fastest-expanding deltaic megacities. This study investigates urban expansion patterns and their effects on thermal conditions from 2018 to 2025, using advanced geospatial datasets and machine learning to analyze the KMDA and a 6 km buffer. The study combines multi-temporal MODIS land surface temperature (LST), Sentinel-1 SAR, and Sentinel-2 optical imagery to evaluate urban expansion and UHI effects. Random Forest and XGBoost algorithms in Google Earth Engine and Colab achieved more than 96% accuracy. Additionally, over 200 ground-truth points and high-resolution imagery validated findings. Data composites combined radar backscatter (VV, VH) and spectral indices (NDVI, NDBI, MNDWI, BSI, UI) to depict urban form.The results show a significant increase in built-up area from 709.73 km² in 2018 to 889.56 km² in 2025, with the highest growth in northeastern and southeastern corridors like Rajarhat, Barasat, Sonarpur, and Kalyani. Spatial indices such as BUDI, AUSEI, and ABUCI indicate different development paths. LST and UHI analyses reveal a strong link between high built-up density and increased thermal intensity, with UHI maps highlighting areas vulnerable to heat.

Using effective classification, new spatial indices, and high-resolution thermal assessment, the study offers a replicable framework for real-time urban monitoring. The framework offers a pathway towards climate-resilient urban futures for Kolkata and comparable cities.

Abstract ID - 060741377

Geospatial Strategies for a Cleaner Future: Enhancing Solid Waste Management in Panskura Municipality, Purba Medinipur, West Bengal

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Solid waste management (SWM) in Panshkura Municipality, East Midnapore, despite rapid urban growth and increasing waste generation, faces infrastructural and behavioural challenges. This study assessed the existing system using household surveys (n = 180), GIS-based spatial analysis, municipal infrastructure assessment and field observation across 18 wards. The results show that biodegradable waste is predominant, originating from households, markets, food shops and institutional areas. 72% of households use a mixed bin, while only 18% practice segregation, mainly in wards 12, 14 and 9, which recorded the highest compliance (80%, 76% and 68% respectively). In contrast, peripheral wards like 6, 13 and 17 showed segregation rates below 20%. Waste collection rates vary sharply: in core wards (1, 2, 5) waste is collected 5-7 times a week, while in wards 10 and 15 waste is collected irregularly or twice a week, resulting in open dustbins and burning. Public satisfaction is low, with 48% dissatisfied with municipal collection and 38% reporting a dirty environment. GIS mapping has identified hotspots around markets, transport hubs and high-density settlements. The municipality lacks the necessary infrastructure, including a scientific landfill, transfer station and material recovery facilities, and relies on an old fleet of 4 mini-trucks, 3 tractor trolleys and 25-30 handcarts. Although the informal sector contributes significantly to recycling, it is still under-resourced. The study recommends geospatial route optimization, implementation of source segregation, infrastructure modernization and formal integration of informal recyclers to achieve sustainable SWM.

Abstract ID - 054259687

Assessment of River Morphology and Flood Risk through Geospatial Approaches of Sheonath River Bain in Chhatisgarh

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The topographic diversity of the Sheonath river basin in Chattisgarh is very significant, accordingly, morphometric analysis and sub-watershed prioritization were carried out in this present endeavor. The total ranking approach will be used to prioritize the sub-watersheds based on their susceptibility to floods. The subject region's drainage order system, pattern, and elongated form have been revealed by the morphometric study. The results of the prioritization process have showed how susceptible some sub-watersheds to floods, which is a common occurrence in the basin area. The main morphometric features have been included as low basin shape value, roughness number, circulatory ratio, high drainage density, stream frequency, high basin relief, and basin slope. The basin's topography is frequently rugged, with steep hills and considerable relief. Since the basin is still ungauged and no previous hydrological behavior is known, the findings of this study can be utilized as guidance by appropriate authorities to start flood protection or artificial groundwater recharge operations.

Abstract ID - 042331696

Assessment of Ground Water Potentiality of Midnapore Municipal Area Using Remote Sensing and Geographical Information System Techniques

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Rapid urbanization, unawareness, limitless use of ground water without knowing its potentiality significantly trigger water scarcity and deterioration of ground water quality in many urban areas in India. Midnapore municipal area is not an exception. This study mainly aims to delineate the ground water potential zones and its quality. Ground water potential zone mapping has been done by using ARC GIS software. Field survey has been conducted for ground truth verification. Analytic Hierarchy Process Model has been used to detect the most significant controlling factor of spatial variation of ground water potentiality. Elevation, slope, rainfall, drainage density, lineament density and land-use and land cover are considered as the important environmental factors. The study revealed that ground water potentiality in the study area is alarming and needs a serious attention. Water Quality Index shows that the quality of potable ground water is poor in most of the wards. The results and maps dispense significant information which local authorities could use to restrict exploitation and sustainable management of ground water resource because a serious trouble is waiting in the near future if immediate action has not been taken by both the local authorities and urban dwellers on an emergency note.

Abstract ID - 095204341

Seismic Cycles and Strain Accumulation in the Himalayan Fold Belt: Insights from Recent Earthquakes

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The Himalayan Fold Belt represents one of the most dynamic and seismically active continental collision zones anywhere in the world, which extends between the Nanga Parbat and Namcha Barwa syntaxes. It has evolved through the ongoing convergence of the Indian and Eurasian plates since the Eocene, generating intense crustal shortening, uplift, and complex deformation. Major structural features such as the Main Frontal Thrust (MFT), Main Boundary Thrust (MBT), and Main Central Thrust (MCT) accommodate much of this crustal strain and serve as the primary seismogenic zones across the orogen.

In recent decades, the Himalayan arc has experienced several damaging earthquakes, including the 1934 Bihar–Nepal earthquake (Mw 8.2), the 1950 Assam–Tibet earthquake (Mw 8.6), and the devastating 2015 Gorkha earthquake in central Nepal (Mw 7.8) Geologic and geodetic (GPS) data document that this quiescence reflects continued strain accumulation along locked thrust segments of the Main Himalayan Thrust and implies the potential for future large earthquakes. Seismic swarms, crustal deformation, and surface ruptures demonstrate active tectonism and the cyclic nature of Himalayan seismicity.

Understanding these processes is particularly important, as several thrust segments seem to be reaching failure and pose significant seismic hazards to densely populated areas along the Himalayan arc. Hence, continued monitoring is required, along with better seismic hazard mapping and increasing preparedness for mitigating future disasters. The Himalayan earthquakes represent, in their geological context, a continuous process of continental collision and active orogenesis shaping the surface of our planet.

Biotechnology

Abstract ID - 125051567

Brinjal Peel Extract as a Green Alternative to Synthetic Dyes for Morphological and DNA Binding Studies

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Natural pigments offer eco-friendly and biodegradable alternatives to conventional synthetic dyes in biological research. In this study, anthocyanin pigment was extracted from brinjal (*Solanum melongena L.*) peel using 5% acetic acid and absolute ethanol, concentrated by rotary evaporation, and lyophilized for further analysis. The UV-Visible spectrum showed a characteristic absorption peak at 523 nm, confirming anthocyanin presence, while a minor red shift upon DNA addition indicated π-π stacking and groove binding. Surface Plasmon Resonance (SPR) demonstrated strong and reversible binding, reaching 221.7 RU at equilibrium. The pigment was successfully applied for morphological studies of bacterial cells (*E. coli* and *Lysinibacillus* sp.), animal squamous epithelial cells, and plant epidermal tissues. Clear cellular outlines and nuclear details were observed, confirming the staining ability of the anthocyanin under light microscopy without cytotoxic effects. The extract also emitted green fluorescence under UV light, indicating its potential as a natural nucleic acid marker. Overall, the eggplant anthocyanin extract exhibited favorable optical, biological, and binding characteristics, establishing it as a safe, effective, and sustainable alternative to toxic chemical stains such as crystal violet and ethidium bromide for microbial, plant, and animal cell visualization in laboratory research.

Abstract ID - 123009571

Antimicrobial Potential of *Bombyx mori* L.-Derived Peptides: An Eco-Friendly Biotechnological Approach for Disease Management in Aquaculture

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Antimicrobial peptides (AMPs) from *Bombyx mori* L. are small, bioactive molecules that play a vital role in innate immunity. This study investigates the antimicrobial potential of two high-performance liquid chromatography (HPLC)-purified peptide fractions: SI-PI and SI-PIII structurally identified by liquid chromatography mass spectroscopy (LC-MS): LKSNYLRLELVLPLWFHKW (SI-PI) and FRLLARKLNETHLLYL (SI-PIII) were studied against bacterial pathogens isolated from diseased *Heteropneustes fossilis* (Sting fish). Polymerase chain reaction (PCR) using universal primers 27F and 1492R identified four pathogenic isolates: *Aeromonas hydrophila* (dbsk1), *Aeromonas sobria* (dbsk2), *Edwardsiella tarda* (dbsk3), and *Flavobacterium columnare* (dbsk4), each showing >99% similarity to GenBank sequences. Antibacterial assays revealed strong inhibition zones (24–37.66 mm) for the peptide fractions, exceeding the efficacy of conventional antibiotics such as Amoxicillin and Bacitracin. Dose–response analysis indicated that peptide activity was concentration-dependent, with minimal toxicity at effective doses. Scanning electron microscopy confirmed pore formation, membrane rupture, and cytoplasmic leakage in peptide-treated cells, leading to bacterial lysis. These findings highlight the potent and broad-spectrum antibacterial efficacy of *B. mori*-derived peptides. Beyond their therapeutic potential, these naturally derived molecules offer environmentally sustainable solutions by reducing antibiotic overuse and preventing resistance development in aquaculture. Their biodegradability, low toxicity, and effectiveness against aquatic pathogens make them promising candidates for eco-friendly disease management in fish farming and future biomedical applications.

Abstract ID - 082013460

Mechanistic Insights into Effective Tetracycline Biodegradation by a Bacterial Consortium

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Rationale: India, being one of the world's largest antibiotic producers, contributes significantly to antibiotic pollution each year through the extensive and indiscriminate use in healthcare and veterinary sectors. Among these, tetracycline (TC) is frequently detected owing to its recalcitrant nature and broad-spectrum activities. To mitigate this burgeoning issue of antibiotic pollution, there is an urgent need for environment-friendly and cost-effective biological solutions. Methods: This study explores the microbial diversity shift of a TC-contaminated manure via Illumina high throughput sequencing upon TC exposure and investigates the TC degradation capacity of a defined bacterial consortium through HPLC and LC-MS analysis. The degradation process was optimized by Response Surface Methodology (RSM). Ecotoxicity reduction of the biodegraded intermediates was assessed through phytotoxicity and antibacterial potency tests. Results: TC exposure induced dynamic microbial community shift at all taxonomic levels, with *Proteobacteria* and *Bacteroidota* emerging as the most abundant phyla. RSM optimization achieved a maximum degradation efficiency of 95.14% under optimal conditions. Eleven distinct intermediates were analysed by LC-MS and four possible biodegradation pathways involving demethylation, epimerization, decarbonylation, and final mineralization were elucidated. Finally, the ecotoxicity assessments revealed a significant reduction ($p < 0.05$) in both phytotoxicity and antibacterial activities post-biodegradation, confirming detoxification of TC by this particular approach. Conclusion: This particular set of works provide an insightful mechanistic overview into the bacterial consortium-mediated TC degradation process. These also highlight the consortium as potential bioremediation tool to mitigate the environmental consequences of pharmaceutical contamination.

Abstract ID - 031934855

Towards the development of fermented soy protein isolate as an effective antidiabetic regimen

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Plant-based prophylactics are emerging as a new hope in managing diabetes. Proteins of soybean origin are known to possess promising anti-diabetic properties. However, some soy proteins reportedly exert anti-nutritional effects in the consumers. Interestingly, studies revealed that fermentation of soybean could be effective in reducing antinutrient proteins and generating bioactive-peptides with anti-hyperglycemic potential. Nonetheless, various hazardous substances, food pathogens and excess-salt content could restrict the benefits of fermented soy foods (FSF). For availing the utmost benefits of soybean protein/peptide in alleviating hyperglycemia without any side effects, the present research approach aims to develop fermented soy protein isolate (FSPI) by fermenting soy protein isolate (SPI) with a competent bacteria isolated from Hawaijar, a popular FSF of North-East India. To meet this aim, predominant bacteria were isolated from Hawaijar and SPI were fermented individually with different bacterium and screened for antidiabetic activities. Protein profile of effective FSPI was also examined. As per observations, FSPI fermented with a proficient bacterium (*Bacillus subtilis* PM_NEIST_3) showed marked α-glucosidase inhibitory action. Experiments in L6 cells revealed that FSPI significantly restored muscle glucose uptake and metabolism via regulating PI3K/AKT phosphorylation and GLUT4 translocation against high-glucose challenge. High fructose-high fat diet-induced rats supplemented with FSPI exhibited improved glycaemic and metabolic parameters and insulin resistance with the modulation of PI3K/AKT/GLUT4 signaling cascade in skeletal muscle. Assessment of chemical profile of FSPI demonstrated alteration in protein content along with reduction of antinutrient components. These promising results endorse the potentiality of FSPI as a functional food-based therapeutic in combating diabetes.

Abstract ID - 034948990

Development of Nano-Enhanced Hair Dye Formulations for Improved Color Retention, Safety, and Sustainability

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Hair dye is immensely popular among all age group for attempting youthfulness and beauty. It contains primary intermediates (Paraphenylenediamines; PPD), coupler (*e.g.* resorcinol), oxidant (hydrogen peroxide), and alkaline agents (*e.g.* ammonia). As PPD is reported as carcinogenic and mutagenic on human, alternative hair dye formulation is become important. Moreover, this development of advanced hair coloring techniques has perceived a significant shift towards nanotechnology-based solutions, offering improved color retention, reduced toxicity to the users, sustainable to the environment. However, existing nano-based systems such as those employing gold, silver, silica nanoparticles, or encapsulated pigments (US7276088B2, US20040010864A1) function mainly as passive carriers. These approaches are limited by high production cost, low biodegradability, and insufficient mechanistic understanding of dye–keratin interactions. Market products such as Kaedo's Nano Color or Yogi Care's Nano Keratin emphasize cosmetic benefits but lack scientific validation, especially regarding toxicity and environmental safety.

Our innovation introduces green-synthesized, optically active carbon/polymeric nanoparticles that inherently exhibit color due to quantum confinement and surface plasmon effects. Importantly, these nanoparticles are functionalized with sulfur-containing moieties, enabling site-specific covalent interaction with cysteine residues in hair keratin via disulfide exchange. This mechanism ensures strong pigment anchorage, enhanced color retention, and high wash resistance without requiring conventional aromatic derivatives, alkaline or oxidative agents.

Beyond cosmetics, the technology platform may be extended to biomedical pigments, textile dyes, or temporary tattoo inks, offering a cross-sectoral innovation. It opens up opportunities for startups, and sustainable cosmetic manufacturers to adopt nano-enabled, high-performance, and green-compliant product lines.

Abstract ID - 084924485

Biogenic Production of Copper Oxide Nanoparticles Utilizing Piperine and Their Effectiveness Against Multidrug-Resistant Uropathogens

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Plants possess their own defense mechanisms against various external threats, often through the production of secondary metabolites. In this context, piperine derived from Piper nigrum L. also acts as a valuable pharmaceutical compound. It showcases multifunctional properties, such as anti-inflammatory, analgesic, antidiabetic, and antimicrobial effects. Some studies indicate that nanoparticles are more effective in biological applications when stabilized with environmentally friendly materials. Consequently, the green synthesis of copper oxide nanoparticles using piperine holds significant promise as a medicinal agent. The nanoparticles produced exhibit a size range of 7-15 nm, as identified through scanning electron microscopy (SEM). Pl-CuNPs exhibit remarkable antimicrobial activity against both nonpathogenic and pathogenic E. coli strains isolated from UTI patients. Additionally, the UTI-specific E. coli strain demonstrates resistance to the antibiotic ciprofloxacin; however, studies have previously shown that both piperine and PI-CuNPs are effective against it. Therefore, Pl-CuNPs could serve as a non-toxic and eco-friendly alternative treatment option.

Abstract ID - 073723334

Psychrotroph studies from the Arctic region, North Pole of the Globe for production of cold bio active molecules

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Now a days, Polar microbiology is one of the most attractive topic for research which mainly focuses on revealing psychrophilic and psychrotophic microorganisms for it's cold active enzymes for biotechnological industries. The maximum growth of the isolates are found in beetween15-23°C temperature, 3-4 days incubation period, 6-10 pH, and 3-7% (w/v) NaCl in LB media. We performed molecular systematic, carbon and nitrogen utilization pattern along with temperature, P^H and NaCl tolerance capacity of these isolates were investigated. Among these isolates, investigation shows that 65% isolates are positive for lipase production, 19% amylase, 8% xylanase and 6% isolates shown phosphates activity. One potent lipase producing strain found and it's details morphological, biochemical, and their molecular characterization were done. 16S rDNA sequence analysis of the strain shows the closest match with *Marinobacter aromaticivorans* (98.36%). Phylogenetic studies explore that the strain has been grouped into *Marinobacter aromaticivorans* in tree making algorthim NJ, ML and MP. Physiochemical data, fatty acid profile comparison for closest ancestor based on the 16S gene matching shows it is far different strain and probably novel. A variety of cold tolerant enzymes counting lipases, proteases, amylases, cellulases have vast requirement in the global market for their useful purpose in the detergent, food, leather and biofuel and biotechnology industries.

Abstract ID - 094402248

MXene–Au@Ag Nanocomposite as a highly potent Multifunctional Platform exhibiting Synergistic Antibacterial and Antibiofilm Activities

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Bacterial infections pose a serious global health threat, intensified by the rise of multidrug-resistant (MDR) strains due to excessive antibiotic use. The WHO reports nearly seven million deaths annually from antibacterial resistance, projected to reach ten million by 2050, with over 80% of infections involving biofilms. Developing multifunctional bactericidal materials is essential to combat antibiotic-resistant bacterial biofilms. In the era of two-dimensional materials, MXene has emerged as a promising antibacterial agent due to its unique properties, including diverse elemental composition, layered structure, large surface area, rich surface terminations, and excellent photothermal, electrical, and mechanical characteristics. In this work, a novel MXene–Au@Ag nanocomposite was synthesized, and its synergistic antibacterial and antibiofilm activities were evaluated against *Escherichia coli* (ATCC 25922) and *Staphylococcus aureus* (ATCC 25923). The present study reports the successful synthesis of an MXene–Au@Ag nanocomposite. Structural and phase characterization were performed using UV–Vis spectroscopy, while X-ray photoelectron spectroscopy (XPS) provided detailed information on elemental composition and chemical states. The morphology of MXene was examined by transmission electron microscopy (TEM), scanning electron microscopy (SEM), and atomic force microscopy (AFM). Compositional analysis was further confirmed using energy-dispersive X-ray (EDX) spectroscopy and elemental mapping. Antibacterial and antibiofilm activities were assessed by determining the minimum inhibitory concentration (MIC) using the turbidimetric method. The antibacterial mechanism was further investigated through FESEM, CLSM, ROS generation, and protein leakage analyses.

Abstract ID - 094841774

Valorization of Rice Bran via Solid-State Fermentation: Production of a Natural Dye and a high nutritive Animal Feed

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The global rice bran market is a significant and growing agro-industrial sector, projected to reach a value of USD 8.4 billion by 2030.In India, West Bengal is a leading rice-producing state, generating an estimated over 1.3 million metric tonnes of rice bran annually as a primary byproduct. The global market for rice bran derivatives, including oil and meal, is a multi-billion dollar industry. However, its full potential as an animal feed is limited due to the high content of phytic acid, an anti-nutritional factor that binds essential minerals and inhibits digestion in monogastric animals.

This study proposes a novel, integrated "zero-waste" valorization strategy to convert this low-cost agricultural waste into two high-value products. The bacterial strain *Bacillus* sp. BBLRB2010, isolated for its unique metabolic capabilities, was cultivated on rice bran powder. The fermentation produced a vibrant, stable orange-red pigment. Preliminary studies demonstrate this pigment's high affinity and efficacy as a natural dye for silk dyeing, offering a sustainable alternative to synthetic colorants. Crucially, the fermentation process simultaneously enhances the value of the residual biomass. The anti-nutrient component of rice bran can be removed by treating with Phytase enzyme which *Bacillus* strains are known to produce. The solid-state fermentation process is thus hypothesized to significantly reduce the phytic acid concentration in the rice bran, transforming it into a more digestible and nutritionally bioavailable animal feed. Furthermore, the orange-red pigment was found to be a carotenoid, which would make the fermented biomass a valuable source of pro-vitamin A and high antioxidant property.

Abstract ID - 084110257

Ganoderma lucidum: A Promising Multifunctional Nutraceutical for Enhancing Human Health

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For generations, East Asians have used the edible mushroom *Ganoderma lucidum* to prevent or treat a variety of illnesses. Polysaccharides and triterpenoids are thought to be the main bioactive components of this mushroom. The study aimed to evaluate the biological efficacy of *G.lucidum* by examining systematic and biochemical indicators, assessing alterations in gut microbiota composition, and observing *in-vitro* morphological changes of intestine. Furthermore, cell culture studies were conducted to determine the cytotoxicity potential of G.lucidum against breast cancer cell line. Various analytical techniques, including hematoanalyzer, Semiautoanalyzer, selective culture media, gel electrophoresis, HPLC, FACS, MTT assay, SEM, and fluroscence microscopy, were employed to compare the pre- and post intervention groups following 30 days of *Ganoderma lucidum* (500 mg/day and 1000 mg/day) supplementation. Following treatment, a considerable drop in glucose levels was noted, along with many enzymatic modulations. The post-treatment group's RBC, Hb, and lymphocyte counts considerably increased. Treatment with *Ganoderma lucidum* alters the gut microbiota by considerably increasing the helpful bacterial group and decreasing the toxic ones ($p<0.05$). Following rat supplementation, the SEM analysis also observed certain morphological changes, such as improved villi impactness and structure. The cell line and fluroscence microscopy evaluations revealed no evidence of cytotoxicity following supplementation. Our findings imply that *Ganoderma lucidum* could be an appealing choice for a dietary supplement to improve health and performance.

Abstract ID - 055748657

In Vitro Regeneration Protocol for Kans Grass (*Saccharum spontaneum* L.) Toward Advanced Genetic Improvement for Bioenergy Applications

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Wild sugarcane *(Saccharum spontaneum L)* is a potential bioenergy crop which serves as a breeding material for modern sugarcane cultivars. Its high lignocellulose and hemicellulose content, renewable nature, widespread availability, and non-competition with the food chain make it a promising feedstock for second generation (2G) biofuel production. Despite its ecological and economic potential, the species remains underutilised due to limited understanding of its reproductive biology and its highly complex genome, which restricts the efficiency of traditional breeding approaches as well. To facilitate its genetic improvement, the development of reliable in vitro regeneration system is essential. In the present study, we successfully established the reproducible regeneration protocol for *Saccharum spontaneum* using shoot apical meristems, cultured on Murashige and Skoog (MS) medium. Various concentrations of plant growth regulators like 2,4-D, BAP, TDZ, ABA were tested with selected amino acids to optimize callus induction followed by shoots and roots regeneration. The regenerated plantlets exhibited robust development and high survival rates under ex vitro conditions. This regeneration system provides a strong platform for future genetic transformation studies aimed at enhancing biomass yield, stress tolerance, and even phytoremediation traits. Additionally, promoting *S. spontaneum* as a sustainable bioenergy crop can contribute to the circular economy and support agricultural development, particularly in regions with underutilized or marginal land resources.

Abstract ID - 041801372

Enhancing antibacterial functions of silver-gold bimetallic nanoparticles using aqueous leaf extract of *Artemisia nilagirica* (C.B.Clarke) Pam.

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The green synthesis of metal nanoparticles has emerged as a novel, sustainable approach to tackling the challenges of emerging multidrug resistance in recent biomedical research. In this study, bimetallic Ag@Au NPs were successfully synthesized using phytocompounds of *Artemisia nilagirica* aqueous leaf extract as a reducing and stabilizing agent. Such alloy nanoparticle production is categorized as a cost-effective, eco-friendly, simple, and rapid bottom-up approach, providing an alternative to conventional synthesis methods. Additionally, UV-Vis spectroscopy, FT-IR, SEM, TEM, and EDX were used to confirm the successful formation of NPs. In this study, most bimetals had a honeycomb-like shape, with sizes around 20±5 nm (SEM) and 18±5 nm (TEM). FT-IR results showed grooves at 505 cm^{-1} and 615 $cm^{-1,}$ indicating Au & Ag position, respectively, along with a band gap at 1636 cm^{-1} and 3144 $cm^{-1,}$ respectively, which are due to (NH) C=O and C-H aldehyde group binding with NPs acting as a reducing and capping agent. The antimicrobial effectiveness of purified Ag@Au NPs was tested against MDR *S. aureus* and *P. aeruginosa*, showing strong growth inhibition at MIC values of 4-8 µg/ml and MBC values of 8-12 µg/ml, along with a significant reduction (95%) in bacterial viability and biofilm formation. The antibiogram test highlighted notable bacterial reduction compared to standard antibiotics, with zones of inhibition measuring 20mm-30mm against these pathogens. Therefore, the potential antimicrobial use of Ag@Au NPs is highly promising as an antibacterial treatment, but it requires toxicological studies to assess its biocompatibility, stability, and mechanistic assays.

Abstract ID - 120144577

Watering Down Nutrition: How Cooking Practices Dilute Micronutrients in Diverse Vegetarian Diets in West Bengal

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Cooking practices significantly influence the nutritional quality of food, yet dietary diversity scores often overestimate diet quality by disregarding preparation methods. This study examined how water-intensive cooking dilutes micronutrient density in commonly consumed vegetarian dishes in West Bengal. A cross-sectional experimental design was employed during community cooking competitions in Sandeshkhali (rural) and Sankrail (peri-urban), involving fifty participants who prepared fifty-six traditional recipes such as shukto, khichuri, dal, and mixed vegetables. Real-world variations in water use and cooking time were documented to evaluate their effects on nutrient density. Raw ingredient weights, cooking volumes, and preparation methods were recorded under controlled conditions, and nutrient profiles for protein, iron, calcium, and vitamin A were computed per 100 g of cooked food. Despite high dietary diversity (3-9 food groups), nutrient density varied substantially: protein ranged from 2.1-7.8 g, iron 0.4-2.1 mg, vitamin A 28-145 µg, and calcium 24-86 mg. Watery preparations showed up to 65% lower micronutrient density than thicker versions using identical ingredients. These findings indicate that conventional diversity metrics fail to capture nutrient dilution, leading to potential misjudgement of diet quality. Integrating cooking practices into dietary assessments and nutrition interventions can strengthen strategies addressing hidden hunger. The results can inform programs such as the Mid-Day Meal and ICDS by promoting nutrient-dense recipes, training community cooks, and developing cross-sectoral partnerships to enhance food and nutrition outcomes in South Asia.

BOTANY

Abstract ID - 123824563

Fortification with microbial co-culture enhances growth and aroma content in indigenous aromatic rice cultivars of West Bengal

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Rice (*Oryza sativa* L.) serves as a staple food for nearly 60% of the global population, including India. Among various rice types, aromatic varieties are highly valued for their distinct fragrance and quality, driving strong demand in both domestic and international markets. However, a decline in the aromatic quality of traditional scented rice has been observed in West Bengal, likely due to disruptions in the rhizospheric microbial community from intensive modern agricultural practices and excessive inorganic fertiliser use. The present study explores the role of microbial co-culture in enhancing growth and aroma production in two indigenous aromatic rice varieties of West Bengal, Gobinda Bhog (GB) and Badshah Bhog (BB). A plant growth-promoting rhizobacteria (PGPR), *Bacillus cereus,* and a plant growth-promoting fungus (PGPF), *Paradendryphiella arenariae*, were evaluated individually and in combination. Both single and mixed inoculations markedly improved plant growth and productivity. Germination increased by 1.9-fold in GB and 1.65-fold in BB, accompanied by significant enhancement in other growth parameters. Moreover, the concentration of the key aroma compound, 2-acetyl-1-pyrroline (2AP), was substantially elevated in both microbial treatments. Overall, the findings demonstrate the potential of B. cereus and P. arenariae as effective bioinoculants to improve growth and aroma in aromatic rice, offering a sustainable approach to enhance the productivity and quality of traditional cultivars.

Abstract ID - 010720509

Characterization of Natural Fiber from *Calamus viminalis* Willd. as an alternative to Synthetic Surgical Suture

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Calamus viminalis fibers (CVFs) has become a remarkable natural resource with great promise in biomedical and composite applications in the search for biocompatible and sustainable substitutes for synthetic fibers. In order to evaluate *C. viminalis* fibers' potential as a reinforcing material and biodegradable suture substitute, this study examines their chemical, structural, thermal, mechanical, morphological, and biological characteristics. According to chemical analysis, the higher mechanical performance and resistance to biodegradation of CVFs are attributed to their composition of 43.55% cellulose, 18.69% hemicellulose, and 23.62% lignin. The existence of functional groups typical of lignocellulosic materials and a crystallinity index of 41.8% were verified by FTIR and XRD investigations. A thermal stability threshold of up to 780°C was shown by thermogravimetric study. The fibers demonstrated 5.44% elongation at break, a Young's modulus of 2.63 GPa, and a tensile strength of 658 MPa. A smooth, lignin-rich surface that promotes interfacial bonding in composites was shown by SEM and EDX investigations. The crystalline size of C. viminalis is 0.56 nm, and its crystalline index is 41.8%. The *C. viminalis* fiber's advantageous mechanical qualities include an average tensile strength of 658 MPa. The fibers appear to be cytocompatible based on biocompatibility tests conducted on human cells, which showed >65% cell survival and mild oxidative stress. Additionally, mice used in in vivo suture experiments showed successful wound closure devoid of inflammation. All of these findings point to C. viminalis fibers as a practical, environmentally responsible, and biocompatible substitute for synthetic materials in composite and biomedical applications.

Abstract ID - 120632299

Volatile-Mediated Antagonism of *Agroathelia rolfsii* a pathogen of Eggplant by a Novel Endophytic Fungus *Muscodor sp.* CZLE4

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A novel endophytic fungus, *Muscodor sp*. CZLE4, was isolated from *Cinnamomum zeylanicum* (Cinnamon tree, family Lauraceae). The soil borne pathogen *Agroathelia rolfsii* is responsible to cause collar rot disease of egg plant (*Solanum melongena*) and other vegetables. The present study aimed to isolate and identify both the pathogen (*Agroathelia rolfsii)* and the endophytic fungus (*Muscodor sp*.), test the pathogenicity, assess of *in-vitro* antagonistic activity and *GC-MS* analysis of *VOCs* produced by the fungal endophyte. Pathogenicity was confirmed through Koch's postulates. Antagonistic activity was performed through *VOCs* assay. The pathogen *A. rolfsii,* displayed strong pathogenic effect in detached leaf assay showing the complete rotting of the leaf after 7 days of treatment. In pot experimental study, the plant becomes wilted and completely rotted after 72 and 120 hours of treatment, respectively. VOC assay demonstrated that *Muscodor* sp. exhibited potent antagonistic activity, completely inhibiting the growth of *A. rolfsii* as well as other plant pathogens including *Rhizoctonia solani*, *Alternaria alternata*, *Curvularia lunata*, and *Botrytis cinerea*, while showing partial inhibition (15.3%) against *Fusarium oxysporum.* GC-MS analysis of *VOCs produced by Muscodor sp.* CZLE4 revealed seven major compounds ethanol, Phosphine, methyl- ,1-Hexanamine, 6, N-dihydroxy-, aristolene, α-guaiene, caryophyllene, Thujopsene-(I2) and α-longipinene, having antifungal activity. The findings suggest that *VOCs* from *Muscodor sp.* CZLE4 have strong biocontrol potential and could be developed as biofumigants for the sustainable management of collar rot disease in eggplants.

Abstract ID - 043234972

Analysis of proximate composition, phytochemical profiling, LC/MS analysis, antioxidant and antimicrobial activity of different extracts of *Phyllanthus acidus* (L.) Skeels fruits

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Phyllanthus acidus (L.) Skeels, commonly known as the "star gooseberry," belonging to the family Phyllanthaceae, is considered a non-conventional fruit with remarkable nutritional and medicinal importance. Fruits contain essential nutrients such as carbohydrates, proteins, lipids, and dietary fibres. The analysis of its food value could lead to the use of these fruits in food fortification, enhancing dietary supplements and improving overall nutrition. Phytochemical profiling helps to identify key bioactive compounds like phenolics, flavonoids, β-carotene and lycopene etc. These compounds are linked to health benefits like antioxidant, anti-inflammatory and antimicrobial activities. Liquid Chromatography–Mass Spectrometry (LC/MS) provides detailed identification and quantification of these compounds, aiding in understanding their molecular characteristics and pharmacological relevance. The strong antioxidant activity of *P. acidus* fruits suggests their ability to scavenge free radicals and reduce oxidative stress, thereby preventing disorders such as cardiovascular diseases, cancer, and premature aging. Moreover, the fruit extracts demonstrate notable antimicrobial potential against various bacterial (both Gram positive and Gram negative) and fungal strains, highlighting their use as natural alternatives to synthetic antimicrobials and preservatives. This study emphasizes the dual role of *Phyllanthus acidus* as both a functional food and a natural source of bioactive compounds, which can be harnessed for nutraceutical and pharmaceutical application. The findings provide a scientific basis for the utilization of *Phyllanthus acidus* in health promoting formulations. Here we have tried to screen phytochemical characteristics, LC/MS analysis, proximate composition analysis, antioxidant and antimicrobial activity of different extracts of *Phyllanthus acidus* fruits.

Abstract ID - 043918224

First discovery of Cenozoic epiphytic green algae

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Algae represent an exceptionally diverse assemblage of organisms that belong to evolutionarily distinct lineages. Unfortunately, there is no evidence of fossil algae from the Cenozoic sedimentary strata to date. In this study, we report the first evidence of Miocene algae characterised by long, filamentous, laterally branched, and oppositely arranged, featuring cylindrical or clavate cells on cuticular fragments of a compressed monocot leaf recovered from the middle Siwalik sediments (Late Miocene; 12–8 Ma) of Himachal Himalaya, India. The morphological features are akin to those of the modern macroscopic freshwater green algal genus *Cladophora* Kütz. (Cladophoraceae: Cladophorales: Chlorophyta). This remarkable preservation of epiphytic fossil algae provides a glimpse into the freshwater conditions that prevailed during the Siwalik depositional period (Late Miocene). In addition, this report provides valuable information on the evolution of the lower vascular plants during deep time.

Abstract ID - 090528244

Physiological, Biochemical, and Ultrastructural Responses of *Tetradesmus wisconsinensis* (PX454383) to Arsenic Stress Highlight Dual Potential for Bioremediation and Biofuel Applications

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Arsenic pollution continues to be a significant global concern, necessitating eco-sustainable solutions to cope with its remediation. This study provides detailed analyses of physiological, biochemical, ultrastructural, and bioremediation response of *Tetradesmus wisconsinensis* (PX454383) to trivalent [As(III)] and pentavalent [As(V)] arsenic stress. The identification of the algal species was confirmed through morphological and molecular analyses using 18S rRNA . Growth inhibition was concentration-dependent (25–125 mg L^{-1}), followed by acclimation by *T. wisconsinensis*, indicating physiological plasticity and tolerance against oxidative stress. There was notable degradation of chlorophyll (up to 78%), loss of protein (up to 38%), and moderate depletion of carbohydrates, coupled with a remarkable 67.6% increase of lipid accumulation above the control conditions, suggesting redirection of carbon flux to triacylglycerol under oxidative stress. From a structural perspective, light and scanning electron microscopy showed thickening of the cell wall, disorganization of the chloroplast and rupture of the membrane, suggesting structural reorganization as a possible defense mechanism. ICP-MS analyses demonstrated differential removal efficiencies of arsenic with 55.26% for As(III) and 90.76% for As(V), due to thiol-based intracellular sequestration mechanisms and phosphate-mimetic transport mechanisms. The dual capabilities of *T. wisconsinensis* effective arsenic bioremediation and enhanced lipid biosynthesis—make it a promising candidate for combined wastewater treatment and biofuel production systems. This work contributes mechanistic insight into arsenic detoxification pathways in microalgae and describes how its application can couple environmental remediation and renewable biomass valorization in a circular bioeconomy.

Abstract ID - 030114612

Storage-Associated Fungal Colonization and Its Impact on Germination and Nutritional Profile of Two Indigenous Assamese Sticky Rice Cultivars.

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Assam, one of the seven sister states of Northeast India, is known for its traditional breakfast "jolpan" prepared from boiled sticky rice served with curd or milk and jaggery. Sticky rice varieties are classified as "Bora" and "Chakuwa" are culturally important and stored year-round after harvest. However, fungal deterioration during storage causes significant quality and viability loss.

The present study assessed the effect of storage-associated fungi on two indigenous sticky rice varieties Pikhas Bora and Sukani Bora, over 12 months (September 2024–August 2025). Thirteen fungal isolates were obtained among which *Rhizopus sp*. was dominant followed by *Aspergillus spp.* and *Curvularia sp*. Sukani Bora harboured more fungi than Pikhas Bora indicating higher susceptibility. Germination percentage declined from 90% to 26% in Pikhas Bora and from 100% to 16% in Sukani Bora. Starch content decreased from 40.0% to 25.0% and from 37.0% to 23.0%, while soluble sugars reduced from 3.5% to 1.0% and from 3.0% to 0.825% respectively in Pikhas and Sukani Bora. Protein content fell from 6.77% to 4.70% in Pikhas Bora and from 6.90% to 3.90% in Sukani Bora due to fungal enzymatic degradation.

Aflatoxin levels were estimated at 3.8704 ppb in Pikhas Bora and 5.3274 ppb in Sukani Bora, both within safe limits compared to many other rice varieties. The study highlights that storage fungi critically reduce germination and nutritional quality of sticky rice, emphasizing the need for improved storage practices to maintain its traditional and nutritional value.

Abstract ID - 102739872

Vivipary in *Cucurbita pepo* L. – A Rare Phenomenon in Angiosperms

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Viviparous germination, defined as the premature sprouting of seeds while still enclosed within the fruit, represents a rare and abnormal developmental phenomenon in *Cucurbita pepo* L. The present study investigates the occurrence, physiological basis and consequences of vivipary in this species. Observations indicated that the phenomenon, though uncommon, was associated with high humidity, prolonged fruit retention on the vine and hormonal imbalances particularly reduced levels of abscisic acid (ABA), a hormone that normally inhibits germination during seed maturation. Examination of mature fruits revealed that approximately 48% of the seeds exhibited viviparous germination, with seedlings attaining an average height of 2.8 ± 0.6 cm while still enclosed within the fruit. Transplantation experiments showed a high seedling mortality rate (57.5%), indicating reduced vigor and developmental instability. Fruits produced by surviving viviparous seedlings contained both normal (106.4 ± 0.6) and abnormal (58.3 ± 0.1) seeds, reflecting an approximate 50% reduction in viable seed yield. Additionally, these fruits were smaller in size, irregular in shape and lighter in weight compared to normal fruits. These findings demonstrate that vivipary in *C. pepo* negatively affects seed quality and overall yield, posing a significant limitation to commercial cultivation. The study underscores the importance of understanding the physiological and hormonal mechanisms particularly ABA regulation underlying vivipary. Such insights are crucial for developing effective post-harvest management practices and breeding strategies to minimize vivipary and enhance seed viability and productivity in pumpkin cultivation.

Abstract ID - 044929169

An Ethnobotanical Study in Jhargram, West Bengal

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The ethnomedicinal heritage of India represents a vital pillar of traditional healthcare, particularly in ecologically rich and socio-culturally diverse regions such as the Jhargram Block of West Bengal. This study provides a detailed assessment of medicinal plant utilization among rural and tribal communities, including the Santhal, Munda, Lodha, and Bhumij groups, who have preserved rich indigenous knowledge through generations. A total of 80 medicinal plant species belonging to 44 botanical families were documented from the key villages of Dubrajpur, Amlachati, and Shirshi. Data were collected through ethnobotanical interviews with 44 informants using semi-structured questionnaires and participatory field observations, focusing on plant use, preparation methods, dosage, and associated cultural beliefs. To strengthen spatial understanding, GPS technology was used to geotag plant collection sites and traditional knowledge locations, while GIS tools facilitated mapping the spatial distribution of ethnomedicinal richness across the study area. Quantitative ethnobotanical indices, Frequency of Citation (FC), Relative Frequency of Citation (RFC), Use Reports (UR), and Use Value (UV), were applied to evaluate the cultural importance of each species. Among the highly cited plants, Ocimum tenuiflorum, Rauvolfia serpentina, and Phyllanthus emblica demonstrated broad medicinal applicability and deep cultural embeddedness. Leaves were the most frequently used plant parts, prepared mainly as pastes, juices, and decoctions. The study highlights the urgency of preserving indigenous wisdom through spatial documentation, community participation, and educational awareness. Integrating GIS-GPS technologies provides a novel approach for conserving ethnobotanical resources and supporting sustainable, plant-based rural healthcare.

Abstract ID - 103932499

Linking Elevation to Habitat Structure: An Ecological Study of the Dalma Wildlife Sanctuary, Jharkhand

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Elevation zonation and topographic aspect helps in shaping the forest structure, pattern and diversity. Elevation importantly influences forest characteristics including tree hight, density, distribution and diversity. This study assessed forest dynamics along three different elevation zone (<300m-lower;301-500m-middle;>500m-upper) of Dalma Wildlife Sanctuary. Establishing 9 quadrate sampling plots (20 x20m for tree and 5 x5m for shrubs) from the foothill to the top. Recoding ecological profiling variants (DBH, hight, density, IVI, diversity indices) from tree and shrub species with DBH>5cm.Total 29 tree species with 21 families and 14 shrub species with 11 different families were recorded from the sampling zone. Sal (*Shorea robusta*) is the most denied (18.33s/qm) and abundant tree species with Bhant (*Clerodendron infortunatum*) is most abundant shrub species in the zones. Diversity and IVI peaked in the mid -elevation with Sal and Pial (*Buchanania lanzan)* and Palas (*Butea frondosa*). The study shows higher elevation zone characterized by larger but fewer number of trees, while lower elevations hosted smaller but more densely packed individuals. The middle elevation zone is most suitable zone in terms of plant and animal habitat as it is less disturbed from anthropogenic causes and rich in species density, canopy coverage, biomass and also free from edge effect. These findings highlight that ecological profiling in a sanctuary is crucial for understanding and preserving biodiversity. We recommend sensitive conservation planning integrates long term and also engages local communities in the ecological shift.

Abstract ID - 094833130

Monitoring of aerial pollen load in hilly rural areas of Purulia district with its allergenic potential

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Atmospheric pollen grains are the major cause of respiratory allergies. The present study aims to measure the aero-pollen load of the study area and prepare a pollen calendar for the first time in rural sites of Purulia district, followed by clinical identification of allergy-causing pollen grains. One-year air sampling (January to December 2024) was conducted in the four rural sites of Purulia district. All the villages located in the hilly slopes of Ajodhya Hills, amidst dry deciduous forests, where 60 different types of air-borne pollens belonging to 26 families were recorded. Prevalence of pollen allergy was investigated through Skin Prick Test among respiratory allergy patients, and the blood sera of positive patients were collected for IgE estimation through ELISA test. In the present study, pollen of *Shorea robusta* was found to be most dominant in the air of rural sites, followed by *Alangium salvifolium*, *Acacia auriculiformis*, *Salix tetrasperma*, *Syzygium cumini*, and *Azadirachta indica*. Antigenic extract of 30 pollen types was selected for SPT, out of which 18 types of pollen showed a positive reaction. The maximum allergenicity was caused by the pollen of Shorea robusta. Twelve out of 15 tested sera samples were found to contain higher levels of IgE, ranging from 172.4597 IU/mL to 418.2643 IU/mL. SDS-PAGE was performed with soluble *Shorea robusta* pollen extract to observe the protein components. This study provides information about the pollen allergens so that the rural people of Purulia district can take necessary precautions and treatment to protect themselves from pollen allergy.

Abstract ID - 055207304

Chemotaxonomic Patterns and Phylogenetic Analysis of Plant Secondary Metabolites Across the Families of Seed Plants

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To elucidate the evolutionary trajectories of plant secondary metabolites (PSMs) among 438 seed plant families, we analyzed eight principal classes—alkaloids, flavonoids, phenolic acids, phenylpropanoids, quinones, tannins, terpenoids, and steroids—by mapping their presence onto a modern phylogenetic framework. Data on metabolite occurrence were compiled from literature and phytochemical databases to construct a binary profile for each family. Chemotaxonomic relationships and lineage clustering were then visualized through phylogenetic tree construction using the UPGMA method. Our findings demonstrate pronounced chemical affinities within related families, with notable clustering in groups such as Fabaceae, Lamiaceae, and Asteraceae due to conserved flavonoid and terpenoid pathways, while alkaloid-dominant families like Apocynaceae, Solanaceae, and Rubiaceae formed distinct evolutionary branches. The resulting chemotaxonomic groupings correspond closely with established molecular phylogenies, reinforcing the value of metabolite profiles as reliable biochemical markers in plant classification and phylogenetic studies. This comprehensive integration of phytochemical and phylogenetic analyses substantially enhances our understanding of plant diversification and provides a valuable resource for evolutionary research and the identification of bioactive natural compounds.

Abstract ID - 082453763

Pollination ecology of *Luffa acutangula* (L.) Roxb.: Role of nocturnal visitors in yield enhancement of the crop

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Luffa acutangula (L.) Roxb. (Jhinga in Bengali vernacular), a member of Cucurbitaceae, is an economically important vegetable crop used by the inhabitants of tropical Asia. The crop is monoecious with unisexual male and female flowers. The flowers are disc-shaped and of one-day longevity. *Luffa* is inevitably dependent on insect pollination for its fruit production. Primarily, it is a monsoon crop; the opening of the flower is initiated at 2:00 pm and is completed by 3:30 pm to 5:00 pm. The flowers remain open for 12-14 hours from flower opening. The flowers are bright yellow in colour with an appreciable amount of pollen grains and nectar, which serve as floral rewards. It also emits several volatile organic compounds (VOCs) and acts as a floral attractant for the visitors. The plant has floral and extrafloral nectaries, which are specialised secretory glands and are confirmed by anatomical features and histochemical tests. An array of nocturnal Lepidopteran visitors, starting from 5.00 pm up to 10.00 pm, visit the flowers. Among those visitors, *Diaphania*, *Parotis,* and *Glyphodes* play a pivotal role in pollination, and this plant-pollinator interaction reached its zenith at 8.00 pm. The breeding system of *L. acutangula* is obligatory allogamous, including both geitonogamy and xenogamy. Hence, effective pollinators' service is crucial for the enhancement of crop yield.

Abstract ID - 110434245

Antimicrobial and Extracellular Enzyme Potential of Mycoendophytes isolated from seeds of *Cuminum cyminum* L.

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The seeds of the Apiaceae family, cumin (*Cuminum cyminum* L.), are valued for their culinary uses in Asian cooking as well as their therapeutic properties in the treatment of dysentery, vomiting, diarrhoea, flatulence, and gastrointestinal distress. This species can survive in a cold, dry climate. In exchange for the benefits that mycoendophytes provide, these plants serve as the host, enabling endophytic fungi to proliferate, feed, and spread. Using both macro and microscopical features, the fungal endophyte population from *Cuminum cyminum* L. was isolated and identified in this work. Its antibacterial and extracellular enzymatic activities were then assessed. Using PDA media, fungal strains were isolated, purified, and identified by PCR, BLAST, and microscopy. Six endophytic fungal species were identified from seeds of *C. cyminum* L. *Aspergillus flavus*, *Aspergillus niger, Aspergillus fumigatus, Aspergillus oryzae, Aspergillus* sp. and an unidentified structure. The Asomycotina accounted for the majority of the mycoendophytes that were isolated. The higher value of antibacterial activity shown in *Aspergillus fumigatus* against Gram-positive bacteria (*Staphylococcus aureus*, MTCC87 and *Bacillus subtilis*, MTCC121), Gram-negative bacteria (*Escherichia coli*, MTCC119; *Salmonella typhi* MTCC98). Highest amylase activity shown by *Aspergillus fumigatus,* highest pectinase activity shown by *Aspergillus fumigatus* and highest gelatinase activity shown by *Aspergillus fumigatus.*

Abstract ID - 073819536

Studies on the Pollen Flora of Susunia Hill of Bankura District, West Bengal, India

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Susunia hill is a significant geological and ecological site located at north-western part of Bankura district, West Bengal. The vegetation of the hill is diverse in nature which is yet to be described. As a part of the vegetation study of Susunia hill, the present investigation includes light microscopic studies of pollen morphology of 98 genera, belonging to 38 different families of angiosperms. We have found 20 families having single genus and 18 families having more than one genus. It has been observed that 95% pollen grains are radially symmetrical and rest 5% pollen grains show bilateral symmetry. Varied apertural patterns have also been observed, such as trizonocolporate, trizonocolpate, tetrazonoporate, tetrazonocolporate, trizonoporate, monopororate, pancolpate, pantoporate, pentazonocolporate, monosulcate, oligozonoporate, Hexazonocolpate, monoporate, polyzonocolpate and polyzonocolporate. Two pollen taxa are of inaperturate type e.g. *Croton persimilis* and *Jatropha gossypiifolia*. Regarding apertural pattern, various type of surface ornamentations have been understood viz. gammate, reticulate, rugulo-reticulate, clavate, rugulate, echinate, striate, verrucate, and baculate. 18 pollen taxa belonged to 14 families viz. Bixaceae, Costaceae, Euphorbiaceae, Fabaceae, Lythraceae, Meliaceae, Poaceae, Polygalaceae, Rhamnaceae, Salicaceae, Sapindaceae, Sapotaceae, Verbenaceae and Violaceae are of without any surface features, i.e. psilate type. Several of the pollen taxa are served as important honey bee plants, and many have medicinal uses as well. Pollen morphology of the studied pollen can be useful in the studies of melissopalynology and plant systematics. Many pollen traits are influenced by the strong selective forces involved in reproductive processes, including pollination, dispersal, and germination.

Abstract ID - 072339452

Green Synthesized Gold Nanoparticles Using *Ambrosia Artemisiifolia*: Insights into DNA Interaction, Protein Binding, Enzyme Mimicry, Anticancer Potential, and Dye Degradation Efficiency

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The use of plant extracts in green synthesis has opened up avenues for the development of nanoparticles with unique biological properties. This study focuses on the generation of gold nanoparticles (AuNPs) via a green synthesis method using *Ambrosia artemisiifolia* (AA) and evaluates their effectiveness in biological applications and catalysis. The use of powder X-ray diffraction (PXRD), Fourier transform infrared spectroscopy (FTIR), ultraviolet-visible spectroscopy (UV-Vis), scanning electron microscopy (SEM), TEM, and X-ray Photoelectron Spectroscopy (XPS) study. Followed by the proper identification, several biophysical studies, including UV spectroscopic titration and fluorescence displacement studies, are performed for confirmation of their binding efficacy to DNA and protein. Our study on the anticancer activity of AA–AuNPs against HeLa cancer cells, evaluated alongside HEK-293 normal cells using the MTT assay, demonstrates promising therapeutic potential with minimal toxicity toward normal cells. At the same time, the developed nanoparticles show effective phenoxazinone mimicking activity. Furthermore, these nanoparticles show a remarkable ability to degrade toxic dyes, achieving over 90% degradation within a short timeframe of 80 minutes. These dual functionalities position AA-Au NPs as viable candidates for both biomedical applications and environmental cleanup.

Abstract ID - 095229899

Study of Endemic Plants of Four Sacred Groves of Midnapore Sadar Block, Paschim Medinipur District, West Bengal

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Being the storehouse of endemic, endangered and rare plants along with vulnerable, nearly threatened, critically endangered species with medicinal values in some cases, sacred groves play the role of captain for their in-situ conservation in a traditional way since time immemorial. The sacred groves can be awarded as the vestige of primary forest dedicated to certain deities either in iconic or in non-iconic forms owing to local peoples' ancestral belief, community rituals and folklore. Moreover, these forest patches conserve biodiversity silently in a community-based protective way. Evolution and rate of extinction of flora of any bio-geographic zone have been enlightened often by the endemic species of those areas. The present study on four sacred groves (Manasha or Nag Mata than, Jharna Buri Sacred grove, Faringdanga Jaher Garh and Golap Shah Peer – baba Sacred grove) of Midnapore Sadar Block has explored 60 endemic angiosperms covering herbs, shrubs, climbers, trees of which 20 species were listed in the categories of Rare, Endangered and Threatened (RET) as well. These chunks of forest conserve the germplasm which is supported by the evidence that only 2–3 plants are common in the above-mentioned four groves, while 44 endemic plants are known to be confined within any one of them. Remarkably, 20 species come under the status of RET. This paper highlights the investigation of endemic, RET, and ethnomedicinally important plant diversity of the said sacred groves in order to make public awareness and draw the attention of the Government for their further protection.

Abstract ID - 064248350

Exploring traditional remedies: Taxonomic and phytochemical investigation of plants used by indigenous women for gynaecological purpose in Purulia district of West Bengal

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Traditional knowledge of medicinal plants has long served as a vital resource for healthcare among indigenous communities. The aim of this study was to explore some plants like *Cyanotis tuberosa* (Roxb.) Schult.f., *Senegalia intsia* (L.) Maslin, Seigler & Ebinger and *Abrus precatorius* L. used by indigenous women in Purulia district, West Bengal, combining ethnobotanical documentation with taxonomic identification and phytochemical screening. Field surveys and interviews were conducted to record plants traditionally used for various ailments like menstrual disorder, leucorrhoea and galactagogue. Collected specimens were identified and classified according to standard taxonomic methods. Phytochemical screening was performed to detect the presence of various bioactive compounds which may underlie the plants therapeutic potential. The findings highlight the rich biodiversity and traditional medicinal knowledge of the region, providing a scientific basis for potential development of modern herbal remedies. This study emphasizes the importance of integrating traditional wisdom with modern scientific approaches, bridging the gap between ethnobotany and contemporary medicine and supporting future pharmacological research.

Abstract ID - 065840472

Quantitative ethnobotanical study of medicinal plants used to treat human disease by the local people in Bankura District, West Bengal

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In rural areas Government health care facilities is too laborious for the people of many districts in West Bengal and also in India. In present day people are highly dependent on traditional medicine for their primary health care problem. So, this study was carried out to document the traditional knowledge and utilization of medicinal plants for the people of Gangajal Ghati block under Bankura District. Quantitative analysis of ethnobotanical data was collected through interviewing informants using semi-structured questionnaires, group discussion and field observation. During field survey overall 78 plant species from 38 families and 70 genera were identified. Fabaceae was the most dominant family after that Cucurbitaceae, Apocynaceae and Moraceae. Leaf was the most commonly usable parts of medicinal plants followed by root and bark. Paste was the most popular preparation technique followed by decoction. Ethnomedicinal practices treating various common diseases like blood dysentery, Jaundice, skin problem, cough and cold. Generally the study area is rich in medicinal plants diversity that have significant role in the management of various human diseases.

Abstract ID - 111755537

Pollen Sources of Red Dwarf Honeybee (*Apis florea*) in Rural Areas of Bankura District, West Bengal, India

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The red dwarf honeybee (*Apis florea*) is an important pollinator that significantly contributes to agricultural productivity and biodiversity conservation. Despite its ecological importance, limited information exists regarding its floral resources and foraging preferences. To address this gap, we identified the pollen sources of *Apis florea* in the Bankura district of West Bengal through pollen load analysis and field surveys conducted during 2023–2024. In total, 57 plant species belonging to 24 families were identified as pollen resources. The major pollen-contributing families included Anacardiaceae, Cucurbitaceae, and Fabaceae. The most frequently utilised pollen types (or plant species) were *Acacia auriculiformis*, *Eucalyptus tereticornis*, *Pithecellobium dulce*, *Rhamphospermum nigrum*, *Terminalia arjuna*, and *Vachellia nilotica*. Given the diversity of visited plants, *Apis florea* exhibited a generalist foraging behaviour. The findings highlight the essential pollen sources and foraging patterns of this species, providing valuable insights for its conservation and the effective use of its pollination potential in enhancing crop productivity.

Zoology

Abstract ID - 033352176

Defensive gland secretions from Predaceous Diving Beetle, *Cybister* sp.

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Diving beetle and predacious diving beetle family in all aquatic habitats has the first position with respect to the diversity of global water beetles. During severe disturbances, secretions from two complex glands, i.e. pygidial and prothoracic glands are depleted. Dytiscid beetles (*Cybister* sp.) were collected from Tamluk, Purba Medinipur. Pygidial glands are with an ovoid reservoir that is covered by muscles. The secretory lobes are connected to reservoir by a central collecting canal. Pygidial gland secretion is paste-like material and diving beetles distribute the components (about 10–15% per gland reservoir) on body surface by their legs. Metabolomics study of the pygidial glands were done using LC-MS procedure. We found several compounds, some of which are Acetic acid, 2-Methylpropanoate, Moniliformin, 3-Methylbutanoic acid, Propionic acid, Butanoic acid, Benzaldehyde, Benzoic acid, p-hydroxybenzoic acid methylester etc. The functions of both aromatic and aliphatic compounds of pygidial glands represent good preservatives that maintain a clean body surface that protect the body from contamination by microbes like bacteria, protozoa, fungi or water mite parasite larvae (for example, *Hydrachna* sp.). These secretions from pygidial glands are most important for their lives because of their characteristic behavior of both predators (on other aquatic insects, small fishes, tadpoles etc.) and prey (for large fishes) where molestations or disturbances are common occurrences.

Abstract ID - 063625662

Bifenthrin Induced Neuro-behavioural Alterations in Freshwater Mollusc *Bellamya bengalensis*

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Bifenthrin is extensively used in agricultural and domestic pest control, posing significant ecological threats to non-target aquatic organisms. The present investigation evaluates the behavioural alterations in the freshwater gastropod *Bellamya bengalensis* under bifenthrin exposure to elucidate early neurotoxic manifestations. Experimental treatments with sub-lethal concentrations of bifenthrin induced marked behavioural impairments, including reduced locomotor activity, prolonged operculum closure time, and suppressed feeding response. These alterations indicate neuro-muscular dysfunctions mediated through bifenthrin's interference with neuronal sodium channel kinetics, resulting in impaired neurotransmission. The observed lethargy, uncoordinated movements, and withdrawal behaviours reflect acute stress responses and possible disruption of cholinergic and oxidative signalling pathways. The study highlights that behavioural parameters serve as sensitive biomarkers of pesticide-induced toxicity, providing early diagnostic insights into sub-lethal effects before morphological or biochemical damage becomes evident. Such neuro-behavioural endpoints offer valuable ecological indicators for assessing pesticide contamination in aquatic environments. The findings emphasize the need for continuous biomonitoring and regulation of bifenthrin application to mitigate risks to benthic molluscan populations and maintain aquatic biodiversity. This study provides a mechanistic understanding of bifenthrin-induced behavioural toxicity in *B. bengalensis*, contributing to ecotoxicological assessments and advancing behavioural ecotoxicology as a critical tool for environmental risk evaluation.

Abstract ID - 114754125

Assessing Biodiversity Conservation Practices at Sacred Sites in Midnapore

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Indigenous populations have coexisted with wildlife, often employing traditional knowledge and practices that promote ecological balance. Although modern conservation relies largely on scientific methods, there is increasing acknowledgment of the vital role that traditional cultural practices play in safeguarding biodiversity. Effective conservation cannot simply be enforced—it requires community acceptance and participation to truly succeed.

Recognizing the importance of biodiversity for ecosystem health and human well-being, the aim of our study was to assess prevailing conservation practices of local people vis-à-vis religious sites in Midnapore. The ecological attributes of 18 selected sites and anthropogenic pressures (including encroachment, resource exploitation, and cultural neglect) affecting those sacred sites were studied over 2025. Phytosociological observations were made; semi-structured interviews were conducted using statistical tests and Likert scale. Traditional Value Index (TVI) and Anthropogenic Pressure Index (API) were also calculated.

The study revealed an important relationship between cultural practices and ecological stress in Midnapore. While some religious sites retained strong traditional values, others showed signs of cultural erosion. The findings highlight the critical role of sacred sites in sustaining ecological networks and call for their inclusion in broader biodiversity and conservation planning, particularly in regions facing rapid environmental degradation. Safeguarding biodiversity by embracing cultural heritage requires a combination of interconnected strategies. The traditional practices that emphasize conservation through spiritual reverence enhance long-term habitat protection.

Abstract ID - 043333759

Morphological and molecular character-based description of a new *Aphelenchoides* species (Nematoda: Aphelenchoididae) from mangrove habitat in the Subarnarekha Estuary, India

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Aphelenchoides talsariensis sp. nov. was isolated and described during a survey on the east coast mangroves of Talsari, Odisha, India. The species was isolated from the infected pneumatophores of the white mangrove *Avicennia marina*. The new species were differentiated from the other known *Aphelenchoides* spp. Based on morphological and morphometric distinctions of body length, lateral field, stylet, and basal swelling, oesophageal overlapping, position of excretory pore and nerve ring, length of reproductive tract and post-uterine sac, vulval position, shape of vulval lips, and tail shape with a mucro present on the tail. Notably, *A. talsariensis* was found to have a ventrally curved conoid tail with a single, pointed, unbranched mucro. Molecular characterization was carried out based on 18S small subunit rDNA, internal transcribed spacer sequence (ITS rDNA), and D2-D3 expansion segment of 28S rDNA subunit for species. The phylogenetic analyses based on the marker genes confirmed the clear separation of *A. talsariensis* as a new species. This is the first report of any *Aphelenchoides* species from the east-coast mangrove habitat of India infecting the aerial and ground roots of the mangrove plants.

Abstract ID - 035054785

Macrophyte Diversity as a Determinant of Damselfly Reproductive Success: A Case Study of Ceriagrion cerinorubellum in Wetlands of Paschim Medinipur

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The orange-tailed marsh dart *Ceriagrion cerinorubellum* (Brauer, 1865) (Odonata: Coenagrionidae) is a common tropical damselfly whose reproductive success depends on aquatic macrophyte structure and availability. This study investigated the oviposition behaviour and plant preference of *C. cerinorubellum* in semi-shaded wetland habitats. Field observations were conducted throughout the breeding season (February–November 2024), documenting substrate selection, and egg-laying patterns. Females, guarded by males in tandem, inserted eggs endophytically into living or decaying plant tissues, including stems, petioles, and rootlets near the water surface, following a short post-copulatory interval. The act occurred close to the water surface, and the female did not venture deep into the water. Among eight macrophytes examined—*Spirodela polyrhiza*, *Pistia stratiotes*, *Eichhornia crassipes*, *Nymphaea alba*, *Alternanthera philoxeroides*, *Colocasia esculenta*, *Commelina diffusa*, and *Marsilea quadrifolia*—the underside of *S. polyrhiza* and basal parts of *P. stratiotes* were most frequently used. Oviposition was predominantly discontinuous (97.5%), with continuous egg-laying restricted to large floating substrates such as *N. alba* and *C. esculenta*. Mean clutch size was highest on *E. crassipes* (59.4 ± 3.65 eggs) and *N. alba* (52.06 ± 13.43 eggs), with total egg output per female ranging from 232 to 435 (mean = 350.9 ± 9.2). Landing frequencies differed significantly among plant species ($H = 138.917$, $df = 7$, $p < 0.001$) with *S. polyrhiza* (41%) and *P. stratiotes* (35%) being the most preferred oviposition substrates. These findings underscore the ecological value of macrophyte diversity in maintaining odonate reproductive habitats and offer a behavioural-ecological basis for integrating damselflies into wetland conservation and biomonitoring frameworks.

Abstract ID - 064746416

Nematode Diversity and Soil Function in Rice Agroecosystems: Insights from Eastern India

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The present study investigates the taxonomy, species diversity, and ecological associations of nematodes belonging to the orders Dorylaimida and Triplonchida in paddy fields of Jhargram, West Bengal, India. These nematodes are key components of soil food webs, contributing to nutrient cycling, decomposition, and soil health. The study aimed to document their species composition and explore relationships between nematode community structure and selected soil abiotic factors, including soil temperature, pH, organic carbon, electrical conductivity, and mineral nutrients (N, P, K, Cu etc).

Soil samples were collected from multiple paddy fields at three-month intervals over three-years, covering different crop growth stages. Nematodes were extracted using a modified Baermann funnel technique and identified to the species level based on morphological and morphometric characteristics. Statistical analyses, including diversity indices, evenness, and correlation tests, were employed to assess species richness and determine the influence of soil parameters on nematode assemblages.

Results revealed considerable diversity within both orders, with significant spatial and temporal variations in abundance and community composition. Species richness exhibited strong positive correlations with soil moisture and organic carbon, indicating these variables play dominant roles in controlling nematode distribution and diversity.

This study provides a comprehensive baseline of nematode diversity in a key rice-growing region and highlights the ecological significance of soil physicochemical parameters in shaping nematode communities. The findings enhance understanding of soil ecosystem functioning and provide valuable insights for sustainable soil and crop management in paddy agroecosystems.

Abstract ID - 105414115

A new species, *Tubulanus kajiharai* sp. nov. (Nemertea: Palaeonemertea) from Subarnarekha Estuary, India

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A new species of tubulanid palaeonemertean, *Tubulanus kajiharai* sp. nov., is described based on body coloration and patterns from Subarnarekha Estuary, the northeastern coast of the Bay of Bengal, India. *T. kajiharai* sp. nov. closely conforms to the generic features of *Tubulanus,* including the presence of cephalic furrows, a tripartite body-wall musculature (outer circular, middle longitudinal, inner circular), subdermal brain and lateral nerves, paired buccal and proboscis nerves, absence of eyes and neurochord. The genus *Tubulanus* Renier, 1804 currently comprises 33 valid species; *T. kajiharai* sp. nov. is easily differentiated from its congeners by its unique body coloration—a pale body with longitudinal stripe and transverse bands differing in number, arrangement. Anatomically, the new species is characterized by a complete inner circular muscle layer and muscle crosses between outer and inner circular layers, features that differentiate it from *T. tamias*, *T. misakiensis*, and *T. riceae*. In a molecular phylogenetic tree constructed using available sequences for two genetic markers—16S rRNA and COI, *T. kajiharai* sp. nov. is positioned as sister to a clade containing *T. punctatus*, *T. sexlineatus*, *T. rhabdotus* and *T. superbus* with 90% strong bootstrap support, indicating close phylogenetic affinity but clear lineage separation. Uncorrected COI p-distances show *T. kajiharai* sp. nov. diverges from congeners by 14–18%, validates as a distinct species.

Abstract ID - 041554387

Cardiovascular Disease Risk Assessment among Obese Individuals: Analysis of ACE Gene Polymorphism

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One of the major risk factors for cardiovascular diseases (CVDs), which remain leading cause of death worldwide, is obesity. Genetic variations in angiotensin converting enzyme (ACE) genes affect the optimal functioning of the Renin-Angiotensin-Aldosterone System (RAAS), influencing the risk of CVD. This study was designed to analysis the possible link between obesity-related CVD risk and two inherent ACE polymorphic variants, i.e., ACE2 G>A (rs2285666) single nucleotide polymorphism and the ACE insertion/deletion (I/D) polymorphism. For ACE I/D genotyping, a case-control study was designed that included 14 obese and 24 non-obese participants; for ACE2 genotyping, there were 14 obese & 10 non-obese participants. PCR and PCR-RFLP methods were used for genotyping of ACE I/D and ACE2 G>A SNPs, respectively. Chi-square tests and odds ratios were used for statistical analysis . The ACE DD genotype was found in 28.57% of obese individuals while only 8.33% of controls, showing a strong positive correlation with higher BMI ($p < 0.05$). In case of ACE2 G>A SNP genotyping, the AG genotype was more common in obese individuals (64.28%) than in non-obese controls (30%). This suggests a possible potential in regulating obesity-related CVD risk. However, due to the small sample size and wide confidence intervals, these findings need to be confirmed in larger groups. In addition to emphasizing the need for larger studies, multifactorial investigations are required that include biochemical and lifestyle data for personalized risk assessment. This study provides a preliminary genetic insight into the link between obesity and cardiovascular risk.

Abstract ID - 020902501

Copepods as Carriers of Antibiotic-Resistant Bacteria: Evidence from *Heliodiaptomus viduus* in Waterbodies of West Bengal

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Present work investigates the antibiotics sensitivity (AST) of bacterial strains screened from the exterior surface of a dominant freshwater copepod. Field Emission Scanning Electron Microscopy (FE-SEM) confirmed a dense bacterial colonization on the cuticular surfaces of H. viduus, highlighting the copepod's role as a potential microbial reservoir. A total of 62 bacterial isolates were obtained, of which 38 were as Gram-positive (GP) and 24 as Gram-negative (GN). AST was performed using the VITEK-2 system based on minimum inhibitory concentration (MIC). The results revealed distinct variations in susceptibility of antibiotics among the isolates, indicating the presence of both resistant and susceptible strains. The findings of this study provide critical insights into two major issues: (1) the ecological and pathogenic implications of bacterial association with zooplankton, which are generally regarded as an essential component of the aquatic food web; and (2) the potential public health risks associated with antibiotic-resistant bacteria disseminated through aquatic systems. This largely unexplored area of research underscores the necessity for integrated microbial and ecological monitoring, as well as the development of effective water management strategies to minimize bacterial contamination. The study also emphasizes the importance of assessing copepod-associated microbiota in the broader context of environmental health and antibiotic resistance dissemination.

Abstract ID - 075210528

Palaemonid Prawns of Rupnarayan River: A Molecular Study

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Rupnarayan river is extremely rich in palaemonid prawns. 20 species under 5 genera viz., *Arachnochium* Wowor & Ng (2010) (1 species), *Leptocarpus* Holthuis, 1950 (1 species); *Macrobrachium* Spence Bate, 1868 (16 species); *Nematopalaemon* Holthuis, 1950 (1 species); *Palaemon* Weber, 1795 (1 species) have so far been recorded from this river, mostly on the basis of morphological characters. To confirm the taxonomic status of these species molecular database has been established on the basis of mitochondrial COI gene. COI gene of 14 species have sequenced, pairwise distance computed and neighbour-joining tree with 500 bootstrap replications have been done. The tree shows that *Nematopalaemon tenuipes* and *Palaemon stylifera* constitute a distinct clade. 10 species of *Macrobrachium* belong to two big clades, one included *M.gangeticum, M.lamarrei, M.malcolmsoni, M.rosenbergii, M.villosimanus* and another included *M.dayanum, M.equidens, M.ramae, M.rude, M.scabriculum* intermingled with *Leptocarpus fluminicola* and *Arachnochium mirabile.* This suggests paraphyly of *Macrobrachium.* Morphologically, *Leptocarpus fluminicola* is very similar to *N.tenuipes* and *P.stylifera* , based on rostrum and mouth parts character and closely related to *Macrobrachium*, separated only by the presence of hepatic spine in latter. Present study suggests that *Leptocarpus* is more closely related to *Macrobrachium* rather genera *Nematopalaemon* and *Palaemon.* COI sequence of *A.mirabile* done for the first time in present study strongly suggests that this species belongs to *Macrobrachium* and makes a distinct clade with *M.dayanum* amd *M.equidens*. Present study also reveals that *N.tenuipes,* which was previously assumed locally extinct by Pahari *et al*. (2020) is still extant in Rupnarayan river.

Abstract ID - 083224877

Epidemiological Assessment of Helminth Infections in Mozambique Tilapia (*Oreochromis mossambicus*, Peters, 1852) from Tamluk, Purba Medinipur, West Bengal, India

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Mozambique tilapia (*Oreochromis mossambicus*) is increasingly threatened by helminth infections, which significantly impact fish health and productivity. In this study, the prevalence, diversity, and organ specificity of helminth parasites were investigated in cultured populations. Nematoda, Acanthocephala, and Trematoda were identified as the primary contributors to infection. Among these, nematodes exhibited the highest overall infection rate at 32.50%, followed by Acanthocephala (12.50%) and Trematoda (5.0%). Detailed species-level analysis revealed five helminth parasites: *Euclinostomum* sp. (5.0%), *Contracaecum* sp. (3.25%), *Paracamallanus* sp. (2.80%), *Acanthogyrus tilapiae* (2.66%), and *Rhabdochona* sp. (0.5%). *Contracaecum* sp. exhibited the widest organ range, infecting the intestine, stomach, pyloric caeca, and liver. *Euclinostomum* sp. targeted the intestine, stomach, and rectum, while *Paracamallanus* sp. and *Rhabdochona* sp. were confined to the intestine and rectum. *Acanthogyrus tilapiae* preferred the intestine and stomach. Prevalence analysis indicated *Contracaecum* sp. as the most widespread parasite (30.0%), followed by *Paracamallanus* sp. (12.50%), *Acanthogyrus tilapiae* (7.50%), *Euclinostomum* sp. (5.0%), and *Rhabdochona* sp. (2.50%) as the least prevalent. These findings underscore the importance of monitoring helminth diversity and organ specificity in tilapia aquaculture. Understanding parasite distribution and host organ preference provides essential insights for targeted management strategies to mitigate helminth-induced losses, improve fish health, and sustain productive fish farming.

Abstract ID - 101412168

Analysing the Interrelationship between Forest Cover Loss and Human-Elephant Conflict in Medinipur Forest Division, West Bengal, India

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Forests act as the indispensable factor for maintaining the ecological balance in the biosphere. It serves as the natural habitat for different species. But recently it has been encountered gradual deterioration in quality and quantity due to the alteration of land use land cover (LULC), fragmentation, habitat loss etc. and the emergence of human-animal conflict at the forest fringe areas have started. The principal focus of this study is to detect the change and alteration in LULC and fragmentation pattern of forest from 1991 to 2006 and 2006 to 2022 in the Medinipur Forest Division, West Bengal. This thirty-year stretch shows that the forest area has been decreased by 16.02% and settlement and built-up area, fallow land and agricultural land are markedly increased by 172.39%, 142.46% and 56.40% respectively. The transition matrix shows that the conversion from bare surface, forest area, and scrubland to agricultural land is the responsible factor for the increase of agricultural land in 2022. Increase in settlement and built-up areas are the results of the alteration of bare surface, scrubland, forest area, and agricultural land. Analysis of forest fragmentation reveals that the edge effect is increasing day by day and the shrinking area of forest patches considers the existence of notable habitat loss and the large forest core areas turn into smaller core and medium core which would be responsible for human-elephant conflict in forest fringe areas due to the modifications of elephant corridors by human interferences and shortage of food and water for wild elephants.

Abstract ID - 052927378

Assessment of Morpho-microanatomical characteristics of a macrobenthic bivalve fauna, *Glauconome chinensis* in the Subarnarekha estuary from West Bengal-Odisha Coast, India

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Bivalve mollusks are an important resource due to their socioeconomic value. The West Bengal-Odisha estuarine-mangrove-coastal ecosystem represent a highly productive and dynamic environment enriched with diversified flora and fauna including mollusks. In the present study, an intertidal bivalve mollusc, *Glauconome chinensis* was discovered in the Subarnarekha estuary, which is situated in the mangrove regions of West Bengal and Odisha and links to the Bay of Bengal. The research work aimed to investigate different morphological features including shape and sizes of the shell, siphon, foot, mantle, gills, digestive gland, adductor muscle and gonads. Furthermore, the study evaluated microanatomical peculiarities (histological characteristics of several body parts) of this newly recorded species from West Bengal-Odisha coast, India.

Abstract ID - 022026849

From Aquatic Ecosystem to Human Health: Zooplankton-Based Multimetric Assessment of Heavy Metal Indices in East Medinipur, India

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The present study evaluated the diversity of zooplankton and the ecological and human health risks associated with heavy metal (HM) contamination across the East Medinipur district, India. A total of 48 water samples revealed three dominant zooplankton groups copepods, branchiopods, and rotifers comprising 72 species, with annual average densities of 1063.5 ind./L (ponds), 973.44 ind./L (waterlogged), and 850.56 ind./L (canals). Seven HMs (Cd, Cu, Fe, Hg, Ni, Pb, and Zn) were quantified, with Hg, Cd, and Ni frequently exceeding the permissible limits set by BIS and WHO. Pollution indices indicated extensive contamination, with 83.34% of samples surpassing the Metal Index (MI) threshold and 97.92% showing high Nemerow Pollution Index (Pn) values. Heavy Metal Pollution Index (HPI) further classified most aquatic systems as moderately to heavily polluted. Pearson's correlation showing a negative relationship with HM concentrations and population abundance ($P < 0.05$), suggesting zooplankton as sensitive bioindicators of HM pollution. The Water Quality Index (WQI) categorized 47.92% of sampling sites as unsuitable for drinking purposes but acceptable for irrigation and industrial applications, reflecting severe water quality degradation due to anthropogenic influences. Human health risk assessment (HI) indicated that Zn and Ni posed the highest non-carcinogenic risks, particularly for children, with ingestion identified as the primary exposure pathway ($HI > 1$). The findings emphasize the urgent need for integrated pollution management, public awareness, and sustainable mitigation strategies to protect freshwater ecosystems and human health.

Abstract ID - 084222641

Study on butterfly diversity in Garh Panchakot, Purulia with special reference to Germplasm Conservation Centre of Climbers, Lianas and the possible causes of butterfly population decline in the studied area

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Background: Butterfly species are one of the most important pollinators which are herbivores in nature, and they eventually coevolved with the nector flowering plants from which they obtain their food. The study was carried out in the biodiversity rich hilly area of Garh Panchakot, Purulia, West Bengal with special reference to Germplasm Conservation Centre of Climbers, Lianas during June 2024 to September, 2025.

Material method: The survey was conducted by using Pollard walk method with some vital modifications (Pollard and Yates 1993). Different species of butterfly were observed and photographed by using a camera (Nikon Coolpix P600). The specimens were identified with the help of available literature. Observation was generally performed under good weather condition in between 07:00 hr. and 16:00 hr.

Results: Butterflies were found to be more abundant during summer and post-monsoon seasons compared to monsoon and winter. In the present study the amount of butterflies belong to family Nymphalidae is the highest (37.5%) which is followed by Lycaenidae (31.25%), Pieridae (12.5%), Papilionidae (12.5%), and Hesperidae (6.25%).

Conclusion: The present study also focuses on the probable causes of decline in butterfly species in the studied area which include unplanned tourism, deforestation, industrialisation, climatic change, urbanisation, plastic pollution. These reports are greatly needed to determine the anthropogenic effect on the study area because these charismatic creatures are sensitive to minor changes in the environment. The outcome of this study may help in conservation management of the lepidopteran insects in this less explored area in West Bengal, India.

Abstract ID - 110737787

Qualitative and Quantitative Assessment of Microplastic Accumulation in Commercially Important Freshwater Bivalves

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Recent investigation has identified the occurrence of microplastics (MPs) in diverse bivalve species inhabiting both marine and freshwater environments. With their various ecological significance and economic value as a food source, bivalves also serve as reliable bioindicators. For environmental contaminants, including heavy metals and MPs. The present study examines the concentration and distribution of MPs in commercially important freshwater bivalve species collected from East Medinipur, West Medinipur and Jhargram district of West Bengal, India. A total of 150 individual specimens were collected from local markets for analysis. The selected bivalves had body weight ranging from approximately 24g to 58g and lengths between 4.5 cm and 8 cm. From 720.6 g of dissected tissue (including gut and muscle),1027 MP particles were isolated, creating an average of 1.42 MP particles per gram of tissue. The MPs were categorized by colour- predominantly red, followed by black, blue, green and white and also by morphology, including fibres, fragments and sheets. Visual identification under stereomicroscope and polymer characterization via Raman micro spectroscopy indicated that the highest MP abundance occurred in bivalves collected from Jhargram district, while the lowest levels were recorded in those from East Medinipur district.

Abstract ID - 012241730

Presence of microplastics and their impact on zooplankton in the Rasulpur river of Purba Medinipur district, West Bengal, India

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Microplastic (MP) pollution poses significant ecological threats to aquatic organisms including zooplankton. This study investigated the concentration, composition and seasonal variation of MPs in surface water and different zooplankton groups from the Rasulpur river (3 sites) of Purba Medinipur district from 2022 to 2025. The abundance of MPs in surface water ranged from 12.5 to 45 particles/L with highest concentration in Petua Ghat due to anthropogenic activities. MPs concentration was higher in surface water than within zooplankton bodies. The size of MPs in surface water varied between 81µm to 3000µm, while in zooplankton, averaged from 50.5µm to 300µm.Total 15 polymer types (e.g., polyester, polyurethanes, PVA, ABS, etc. with different colour) were identified by Micro-Raman spectroscopy, out of them 9 polymer types were found in surface water and 11 polymer types within zooplankton. Among the zooplankton groups, copepods exhibited the highest ingestion (MPs) rates, averaging from 0.24 to 0.33 MP piece/ zooplankton, with fragment: 40% - 49%, fibre: 24% -32% being dominant forms.

Abstract ID - 091831453

The Role of Ants in Human Life: Ecological, Nutritional and Socioeconomic Perspectives

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Insects are the most omnipresent, successful and dominant forms in the whole of animal kingdom. India is one of the mega-diversity nations in the world in terms of insect diversity. The relationships between human and ant have existed for ages, with ants playing multiple ecological, nutritional and economic roles that benefit people across the world. Ants act as natural biological control agents, predators, scavengers, soil aerators, nutrient recyclers, pollinators, and dispersers of many plant species. Edible insects provide nutrition and medicine. Hundreds of people in different forests of Jhargram, Purulia and Bankura districts of West Bengal and other states of India depend on these ants for their livelihood. Most of the indigenous people in these areas make a living by collecting kurkut. The indigenous communities consume them directly or as kurkut chutney, which they consider both a food and a traditional medicine. Not only because of their poverty, but also they get various provisions of life. The present study investigates the multifaceted effects of ants on human life both beneficial and harmful, based on fieldwork conducted between 1994 and 2024.

Abstract ID - 024133365

Climate Change and Vector-Borne Diseases

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Climate change through long term changes in rainfall and temperature has a direct impact on human health and vector-borne diseases. In addition to climate change, vector borne diseases are influenced by anthropogenic activities, control strategies for diseases, insecticide resistance development and rapid diagnostic tests. Vector borne diseases can also be indirectly affected by climate change. For example, frequent floods affect the hygiene and vector control measures in a region. Owing to climate change vectors have already expanded their geographical range. Their length of seasonal activity has also increased. Temperature and humidity affect the life cycle of pathogens, vectors and hosts as they are very sensitive to any change in their surrounding environment. A slight change in temperature can impact the breeding and hatching in mosquito vectors. This ultimately also hampers our ability to tackle various vector borne diseases. This impacts the health and socio-economic sector worldwide. Therefore, better surveillance data and early warning systems on climate change is needed for increasing public awareness and preparations for the outbreaks in future.

Abstract ID - 100851531

Study on the nesting of Grey francolin in Jhargram District West Bengal

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The field biology of the Grey Francolin (*Francolinus pondicerianus*) was studied in 2024 in an agricultural field areas (22°23'09"N 87°01'00"E) of the Jhargram districts in west-Bengal. Breeding season of grey francolin extended from mid March to end of July. All bird nests were spotted on the ground nearby shrubs and dense grass vegetation. During our study, we found nests in the middle of the agricultural field and the bank of the agricultural field where dense shrubs and grass vegetation. In every nests we found 6 to 8 numbers of eggs. All eggs are small and greenish in colour.

During our study we observed serious conservation concerns about their breeding habitat. We found that agricultural activities and feral cattle played an important role. Our study area consists of tribal dwellings, hunting is the part of their Socio-economic culture, they hunts Grey Francolin in great extent. In this area we found many trap. They hunted its delicate flavour and important source of bush meat for poor people in this area.

Hunting, illegal poaching, alternation of agricultural land used, feral cattles are the major threats of grey francolin and their breeding ecology.

PHYSIOLOGY AND MEDICAL SCIENCES INCLUDING FORENSIC SCIENCES

Abstract ID- 102330807

Integrative Ameliorative Effects of *Aloe vera (L.)* Phytoconstituents and Metformin on Oxidative Stress and Androgenic Dysregulation in Diabetic Rats: Insights from a Parallel Therapeutic Strategy

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The present study explored the combined therapeutic efficacy of *Aloe vera (L.)* n-butanol fraction (NBF) and metformin (Met) on diabetes-induced male gonadal dysfunctions through a parallel treatment approach. Adult male Wistar rats were rendered diabetic by streptozotocin injection (4 mg/100 g of bodyweight) and divided into seven groups: vehicle-treated control (VCG), vehicle-treated diabetic (VDG), NBF-treated diabetic (5 mg/100 g), metformin-treated diabetic (2 mg/100 g), and three parallel-treated diabetic groups (PTDG I: ½ effective therapeutic dose (ETD) of NBF + ½ ETD of Met; PTDG II: ¼ ETD of NBF + ¾ ETD of Met; PTDG III: ¾ ETD of NBF + ¼ ETD of Met). Treatments continued orally for 28 days. Biochemical, hormonal, and spermiological parameters were assessed along with histopathological evaluation. Diabetic rats showed hyperglycemia, reduced testicular Δ^5,3β-HSD and 17β-HSD activities, low gonadotropin and testosterone levels, enhanced oxidative stress, and disrupted testicular morphology. Fraction or metformin alone partially restored these alterations; however, the combined therapy exerted superior correction. Among the combinations, PTDG III most effectively normalized all the mentioned parameters along with gene expression of Bcl-2, superoxide dismutase, and catalase increased while caspase-3 decreased, suggesting anti-apoptotic and redox-protective effects. Histological recovery of testis and pancreas, along with reduced hepatic transaminase's turnover, confirmed systemic protection. The synergistic interaction between metformin's glycemic control and NBF's antioxidant-androgenic actions establishes the ¾ ETD NBF + ¼ ETD Met regimen as a potent, low-dose, and safer therapeutic strategy against diabetes-associated male reproductive dysfunctions that can also reduce the probability of standard drug resistance.

Abstract ID-111515517

Male Contraceptive Efficacy of Hydro-ethanol Extract of *Caesalpinia pulcherrima* Leaves in Albino Rat: A Comparative Study with Gold Standard, Tamsulosin – HCl

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Contraception plays a crucial role in controlling the rapidly growing population, and helping to mitigate socio-economic as well as environmental challenges. This study compares the contraceptive efficacies of different doses of hydro-ethanol extract of *Caesalpinia pulcherrima* leaves (HEECPL) in male albino rat in comparison with Tamsulosin HCl (Tam-HCl). Animals were treated orally with HEECPL (5, 10, and 20 mg/100 g BW/day) and Tam-HCl (0.2 mg/100 g BW/day) for four weeks. Spermiological parameters (count, motility, viability), testicular enzymes (Δ5, 3β-HSD, 17β-HSD), and oxidative stress markers [superoxide dismutase (SOD), thiobarbituric acid reactive substances (TBARS)] were evaluated in testes, epididymis, liver, and kidney. Testicular gene expressions (Bax, Bcl-2) were analyzed through agarose gel electrophoresis, while histological and phytochemical analyses (TLC and GC–MS) were also conducted. Treatment with HEECPL or Tam-HCl significantly ($p<0.05$) reduced sperm parameters and testicular enzyme activities compared to the control. Both treatments induced oxidative stress, reflected by increased TBARS and reduced SOD activities. Histological observations showed diminution in the kinetics at stage VII of the spermatogenic cycle. Tam-HCl caused toxicity, evidenced by elevated serum GOT, GPT, urea, and uric acid levels, while HEECPL-treated groups showed no such adverse effects. These findings suggest that HEECPL or Tam-HCl exhibits male contraceptive potential, but HEECPL demonstrates a safer profile with targeted reproductive effects and minimal systemic toxicity. Hence, HEECPL may serve as a promising natural alternative for male contraception from the view point of safety.

Abstract ID-115020937

Fractionation-Based Identification and Sustained Efficacy Assessment of the Hydro-Ethanolic Extract of *Commelina benghalensis* Aerial Parts toward the Development of a Safe Herbal Anti-Diabetic Drug

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Diabetes remains a major public health concern and driving interest is imposed in herbal remedies as safer and sustainable alternatives to synthetic drugs. This study aimed to identify the most effective fraction of the hydro-ethanolic extract (3:2) of *Commelina benghalensis* (HEECB) and to assess the sustainability of its anti-diabetic effects after withdrawal. Sixty-six male Wistar rats were divided into eleven groups (n=6), and diabetes was induced intramuscularly with streptozotocin (4 mg/0.1M citrate buffer/100g body weight). In Phase I, diabetic rats received daily treatment for 28 days with HEECB's different fractions (n-hexane, chloroform, ethyl acetate, and n-butanol) at 2 mg/100g body weight. Glycemic control (FBG, HbA1C, serum insulin, insulin receptor), oxidative stress (SOD, catalase, TBARS), lipid profile (total cholesterol, triglycerides, HDL, LDL), genomic sensors (GLUT-4, HEX, Bax, Bcl-2), hepatic and renal functions (ACP, ALP), DNA integrity (comet assay), and histology were evaluated. All fractions significantly ($p<0.05$) ameliorated hyperglycemia, oxidative stress, dyslipidemia, genomic expression and tissue architecture in diabetic model rat. The n-butanol fraction showed the greatest efficacy and was designated as the effective fraction (EF). In Phase II, post-withdrawal assessment at 14, 28, and 42 days demonstrated significantly sustained ($p<0.05$) glycemic regulation, restoration of lipid and antioxidant balance, and continued histological and genomic recovery, indicating sustained bioactivity. Quantitative analyses and LC-MS study confirmed flavonoids and phenolics as the dominant bioactive constituents in EF. Overall, the findings demonstrate the potent, non-toxic, anti-oxidative effect and enduring anti-diabetic potential of *Commelina benghalensis*'s n-butanol fraction, offering a promising foundation for sustainable herbal drug development.

Abstract ID- 120203669

Immunomodulatory Role of Eugenol Oleate against Drug resistant Visceral Leishmaniasis

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The most severe form of Leishmaniasis, Visceral Leishmaniasis (VL) is a Neglected Tropical Disease caused by the protozoan *Leishmania donovani* parasite and transmitted by female phlebotomine sand-fly. In this study, the experiments were planned to examine the potential of eugenol oleate against SAG and AmpB- registrant strain, as these are the ongoing challenges in the treatment of VL particularly in the Indian subcontinent. Eugenol oleate was synthesized chemically and characterized by ^{1}H-NMR and purity was found 99.98%. Eugenol oleate (25 µg/ml) decreased the promastigote growth by 88.9% (AG83, WT), 85.3% (AmpB-R) and 89.7% (SAG-R) significantly ($p<0.01$). It also decreased the intracellular parasite load significantly ($p<0.05$) in all three types of strain along with prompt nitrite generation, which indicated the potential of it *in vitro*. Similarly, Eugenol oleate was also tested for its in vivo efficacy in BALB/c mice model. The results indicated that, eugenol oleate (10 mg/kg B.W.) for 10 days treatment could significantly decrease the hepatic and splenic LDU. We documented the hepatic LDU reduction by 86.51% (WT), 76.96% (AmpB-R) and 86.54% (SAG-R) significantly ($p<0.05$) compared with their respective infection control; while, splenic LDU was decreased significantly ($p<0.05$) by 82.99% (WT), 74.17% (AmpB-R) and 88.83% (SAG-R). The nitrite generation from splenocytes and T-cell proliferation with Th1 type cytokines shift indicated the immunomodulatory effect of eugenol oleate against drug resistant strain. All together this study clearly specified the potential of eugenol oleate against drug resistant VL.

Abstract ID-033325330

Exploring coumarin derivatives as selective stabilizers of Telomeric G-quadruplex DNA: A step towards anti-cancer therapeutics

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G-quadruplex (G4) DNA structures, formed by the guanine-rich sequences present at the telomere region, have emerged as promising targets for anticancer therapy due to their role in telomere maintenance and genomic stability. Small molecules that selectively stabilize these structures can inhibit telomerase activity and induce telomere dysfunction. In this study, three synthesized coumarin-based molecules- P1, P2, P3 were evaluated for their ability to bind and stabilize human telomeric G-quadruplex DNA. Spectroscopic techniques including fluorescence titration, and circular dichroism (CD), revealed significant interaction of all the compounds with G4 DNA. This binding was accompanied by a notable increase in thermal stability (ΔT_m), confirming G4 stabilization. Fluorescence Intercalator Displacement suggested that the compounds interact mainly through stacking interaction. Electrophoretic Mobility Shift Assay (EMSA) confirmed the interaction of the compounds with Telomeric G4. Moreover, the compounds showed cytotoxic effect on HeLa cells and fluorescence microscopy showed that the compounds were able to localize into the nucleus of HeLa cell. These findings demonstrate that coumarin-based molecules can effectively stabilize telomeric G-quadruplexes and may serve as promising leads for anticancer drug development targeting telomeric DNA.

Abstract ID-091917395

Pathophysiological Impact of Tartrazine on Male Wistar Rat's Reproductive and Hepatorenal Systems

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A synthetic azo dye Tartrazine (E102) is widely use as coloring agent in food, pharmaceutical, and cosmetic industries. Despite vigorous regulatory clearance its potential negative effects on human body are concerning. To investigate the effect of tartrazine on the Liver, kidneys, and testis of adult male Wistar rats were divided into three groups (base on doses, duration 4 weeks): high dose group (450 mg/kg body weight, n=6), low dose group (250 mg/kg body weight, n=6) and control group (standard rat diet, n=6). After that estimation of serum total protein, urea, creatinine, SGOT, SGPT, and antioxidant markers of liver such as glutathione (GSH) and malondialdehyde (MDA) were evaluated. Histological and reproductive changes were also investigated. Tartrazine exposure increased the activity of hepatic enzymes, lipid peroxidation, and MDA whereas decrease in GSH levels organ damage and oxidative stress. Hepatocyte degeneration, seminiferous tubule degeneration and glomerular congestion was observed among Tartrazine treated rats during histological analysis. Furthermore, sperm count and motility declined drastically in both treated groups, with the effects becoming more severe at higher dosages. Daily intake of tartrazine may cause oxidative stress and functional abnormalities in liver, kidney and reproductive organs. Further investigations, proper monitoring and regulations of foods containing tartrazine should be done to avoid its ill effects on general population.

Abstract ID-010307846

An assessment of anti-biofilm aptitude of *n*-hexane extract of *Barleria lupulina* Lindl. Leaf extract on clinical isolates of multidrug-resistant *Staphylococcus aureus*

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Staphylococcus aureus and their biofilm forming ability have become a significant concern in the field of public health-care system globally. Anti-biofilm agents isolated from natural sources have gained considerable attention owing to their potential efficacy and lower toxicity in comparison to conventional therapeutic agents. Present work with leaf extract (92:8, v/v *n*-hexane: ethyl acetate) of *Barleria lupulina* Lindl. lead to the identification of (9Z, 12Z, 15Z)-octadeca-9, 12, 15-trienoic acid (ALA), the structure of which was confirmed by FT-IR, LC-MS, GC-MS, ^{1}H-NMR and ^{13}C-NMR spectra. Cytotoxicity analyses of the said leaf extract on hPBMCs through MTT assay shows no cytotoxic influence of the sample towards hPBMC within the IC_{50} of 406.08 µg.mL^{-1}.

Molecular interaction of isolated phytochemical ALA showed that it can act by modulating the biofilm virulence regulatory gene of multidrug-resistant *Staphylococcus aureus*, and interactions of ALA with IcaR, SarA and AgrA were found to have more thermodynamic indulgence for DNA binding.

Finally, the antibiofilm activity assay of the leaf extract revealed that minimum biofilm inhibitory concentration (MBIC) value and minimum biofilm eradication concentration (MBEC) values to be 200 µg.mL^{-1} and 400 µg.mL^{-1} for *S.aureus* MDR strains AK6 and AK7, respectively. Furthermore, the strains were found to have MBIC of 64 µg.mL^{-1}, 32 µg.mL^{-1} and MBEC of 256 µg.mL^{-1} for vancomycin, respectively. SEM and AFM studies clearly demonstrated the leaf extract-driven biofilm disruption and the reduction of biofilm production, respectively. Present investigation thus establishes therapeutic potential of *B. lupulina* leaf extract as a potent anti-biofilm agent to combat disastrous infections.

Abstract ID-033217159

Hyperglycemic and Oxidative Stress Management by Ethyl-acetated Fraction of Root Tuber of *Ipomoea mauritiana* jacq. in Streptozotocin- Induced Diabetic Male Albino Rat: Dose Selection Study

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Ipomoea mauritiana Jacq. (IM) has diverse pharmacological uses. This study was focused on identifying the potent dose of ethyl-acetate fraction of IM root tuber having hypoglycemic and antioxidative effects in streptozotocin-induced diabetic rats. Streptozotocin was induced at 4 mg/100 g body weight intramuscularly for development of diabetes. Diabetic rats were treated at the dose of 1.25 or 2.5 or 5 mg/ 100 g body weight/ day for 28 days. Fasting blood glucose (FBG), serum insulin levels, metabolic and antioxidative enzyme activities, toxicity markers, mRNA expression of hepatic Bax and Bcl-2, and histological changes in the liver and pancreas were observed. The phytocompounds profile of ethyl-acetate fraction was evaluated using liquid chromatography-mass spectrometry (LC-MS). Treatment with different doses showed significant ($p<0.05$) decrease in FBG level, hepatic glucose-6-phosphatase activity and, increase in serum insulin levels, hexokinase, superoxide dismutase, and catalase activities in liver compared to the diabetic group. Histopathological assessments indicated the amelioration of diabetes-induced tissue damage in hepatocytes that helps in the upregulation of Bcl-2 gene expression and Bax gene downexpression, pancreatic islet diameter and cell density, along with recovery in toxicity marker were observed in fraction-treated diabetic groups compared to the untreated diabetic group. The maximum recovery was noted at 2.5 mg dose. This may be due to the high content of bioactive compounds such as flavonoids, alkaloids, polyphenols, and tannins for managing diabetes and oxidative stress noted by LC-MS study. In-depth investigations are required to justify the mode of action for antidiabetic and antioxidative activity.

Abstract ID-075528946

An ameliorative effect of *Morinda citrifolia* Linn. (Noni) fruit extract on nicotine induced alterations of CVDs: An analysis through BIOPAC system

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Alkaloid nicotine related cardiovascular diseases (CVDs) are critically significant globally to both individual and society due to its massive scale and reach. According to world health organization (WHO) about 70% of patient deaths and the risk of coronary artery diseases with co-morbidity by smoking-related life style illnesses. Plants bioactive components used from ancient to modern health-care system for their wide range of therapeutic properties.

In the present study *Morinda citrifolia* Linn. (Noni) fruit extract (30:70, v/v aqueous: methanol) found to be in the identification of 2-(β-D-Glucopyranosyloxy)-5 -5-hydroxybenzoic acid, structure was confirmed by IR and LC-MS spectra. The fruit extract cell viability assay of liver cell was performed in nicotine induced *Albino* rat shows the presence of basic conditions of liver function remain better at the dose of (ED_{50} 200 $mg.kg^{-1}$ body weight) than other doses.

Measurement of blood pressure, heart rate, electrocardiogram of nicotine and *Morinda citrifolia* fruit extract treated group by BIOPAC system shows that nicotine decreased heart rate and lengthened ORS, RR, QT, and PR intervals compared to normal. In a similar vein, nicotine-induced P and T wave intervals were longer than those of the control group. However, the ECG waves of the rats in the nicotine plus MCFE group resembled those of the control group. Therefore, plant fruit extract may protect against the hepatic and cardiovascular harm that comes from nicotine consumption.

Further investigation are necessary for clinically establishment of *Morinda citrifolia* extracted phytochemicals as therapeutic agent.

Abstract ID-012956821

Role of Lingzi (*Ganoderma lucidum*) in alleviating cardiometabolic, psychomotor and cellular ageing ailments in college females: A triple-arm, blinded, randomized control trial

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Stress is a major concern and contributor to various metabolic dysfunctions in female college students. Lingzi, a well-known fungus comprising a wide range of distinct bioactive phytocompounds, is claimed to cure various ailments. A double-blinded, randomized, placebo-controlled parallel design study was conducted in young healthy college females (n=66, aged 18-24years) to determine the effects of Lingzi at separate dosages (500mg and 1000mg) for distinct experimental trial periods (experimental trial [0 day], mid-experimental trial [15th day], and post-experimental trial [30th day]). Analysis of variance (ANOVA) with post-hoc test was used to statistically evaluate various parameters by using a data analysis software (GraphPad Prism). Maximal oxygen consumption (VO_{2max}), physical work capacity at 170 beats/min (PWC_{170}) reported a higher level of significance ($p<0.01$, $p<0.05$) during the mid-experimental and post-experimental trial after 1000mg Lingzi supplementation. Additionally, significant improvements in psychological general well-being indices (PGWBI) and in different cognitive domains of Montreal cognitive assessment (MoCA) were also reported. Also, 1000mg Lingzi supplementation group in the comparison to the placebo group during the post-experimental trial illustrated significant changes in perceived stress scale ($p<0.05$), HR and SBP ($p<0.01$), heart rate variability (HRV) indices ($p<0.01$), and on anti-ageing marker ($p<0.05$) i.e. telomerase activity. Therefore, a 30-day 1000mg Lingzi supplementation could be a viable preventive measure to enhance the psychophysiological health, wellness and fitness in female college students by minimising sympathetic efficacy, ageing efficiency, and cardiometabolic risk factors through improving sympathovagal balance.

Abstract ID-073011472

Understanding Food Labels in Packaged Foods: An Awareness-based Study Among College Students in West Bengal

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The present community-based study aimed to assess the knowledge, comprehension of nutritional labels on packaged food and consumption habits among college students in West Bengal. The study was conducted at two time points pre and post awareness intervention campaign to evaluate changes in knowledge, interpretation, and practice level. A validated, pilot-tested questionnaire was used to assess knowledge, interpretation ability, challenges faced and consumption practice through 15, 32, 5 and 15 questions, respectively. Total 290 undergraduate students were randomly selected. The awareness intervention campaign included discussions on key aspects of food labelling like colour coding, nutritional declaration, traffic light labelling, guideline daily amounts (GDA), health logos, warning symbols, and the effects of sugar, salt, trans fats, additives, and preservatives on health. Ethical approval was obtained. Data were analysed using Microsoft Excel, applying descriptive statistics, pair-t test, and regression analysis at a significance level of $p<0.05$. Students have very weak knowledge and are unable to accurately interpret nutrient levels, as evidenced by their average interpretation and knowledge scores of 9.2 and 4.7, respectively. It was found that over 72% of students buy packaged food three times a week on their own from the college canteen and surrounding areas. The findings showed that after the intervention, participants' awareness and comprehension of food labelling concepts significantly improved, especially with relation to nutrient information and perceptions of health risks. The study highlights the effectiveness of organised awareness campaigns in promoting informed food choices and health-conscious behaviour among rural youth.

Abstract ID-073631965

Redox-Responsive PEGylated Nano-Assemblies Functionalized with L-Citrulline Orchestrate ROS-Triggered Apoptosis and Antioxidant Defence in HCT-116 colon cancer Cells

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Colon cancer remains a major global health challenge, driven by uncontrolled proliferation, oxidative imbalance, and poor outcomes from conventional chemotherapies. In this study, redox-responsive PEGylated nano-assemblies functionalized with L-citrulline were developed to enhance the therapeutic efficacy of the phytochemical baicalein against HCT-116 colon cancer cells. Baicalein, a flavone derived from *Scutellaria baicalensis*, exhibits potent anticancer, antioxidant, and anti-inflammatory activities through modulation of ROS signalling and mitochondrial pathways. Polyethylene glycol (PEG), a biocompatible, hydrophilic polymer widely used in nanomedicine, confers improved solubility, prolonged circulation time, and increased stability to the nanoparticles, facilitating efficient drug delivery to tumor site and controlled intracellular release. The resulting nano-assemblies exhibited uniform spherical morphology, nanoscale size distribution, and excellent colloidal stability, indicating structural integrity and suitability for tumour-targeted delivery. Spectroscopic molecular analyses confirmed successful PEG and L-citrulline conjugation with effective baicalein loading. *In vitro* studies demonstrated enhanced cellular uptake, strong cytoplasmic localization, and selective cytotoxicity toward HCT-116 cells, with minimal toxicity to normal lymphocytes. Mechanistic investigations revealed ROS overproduction, glutathione depletion, mitochondrial collapse, nuclear condensation, cytoskeletal disorganization, and G_0/G_1 cell-cycle arrest, apoptosis induction by Annexin V-FITC/PI staining. The formulation also showed potent antioxidant activity through DPPH, nitric oxide, superoxide dismutase, and lipid peroxidation assays. These results highlight the potential of PEG–PEG-L-citrulline-functionalized, baicalein-loaded, redox-responsive nanoassembly as a promising nanoplatform that leverages the multifaceted bioactivity of baicalein for targeted colon cancer therapy.

Abstract ID-121957731

Mitigation of Azithromycin-induced reproductive impairment by dietary intervention of *Avina sativa* and *Ficus carica* on Male albino rats

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Azithromycin, a macrolide antibiotic widely used against bacterial infections and repurposed during COVID-19, exhibits limited therapeutic benefit but notable adverse effects upon prolonged use. The present study investigated the protective influence of dietary *Avena sativa* (Oats) and *Ficus carica* (Figs) on Azithromycin-induced reproductive toxicity in male albino rats. Thirty rats were divided into five groups: Control (C), Azithromycin-treated (T; 33 mg/kg/day), Oats + Azithromycin (OA; 100 g oats/kg diet), Figs + Azithromycin (F; 50 g figs/kg diet), and Oats + Figs + Azithromycin (OA + F; 100 g oats + 50 g figs/kg diet). Treatments were administered orally for 14 days, with the control group receiving water via gavage. Post-treatment, sperm motility, viability, count, and morphology, along with oxidative stress biomarkers and testicular histology, were analyzed. Azithromycin induced significant deterioration in sperm quality and elevated oxidative stress, while co-administration of Oats and Figs ameliorated these effects. The combined diet (OA + F) exhibited maximum protection, highlighting the antioxidant and nutritive potential of these dietary agents against drug-induced reproductive dysfunction.

Abstract ID-044201124

Gold Nanoparticle conjugated Dextran decorated Safranal Nanoplatform Induces Apoptosis and Tumor Regression in Colon Cancer: In Vitro and In Vivo Evidence

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Gold nanoparticles are emerging as transformative agents in cancer therapy due to their unique physicochemical properties, which enable precise drug delivery, enhanced imaging, and improved therapeutic efficacy. In this study, a nanoconjugate integrating safranal, a bioactive monoterpene aldehyde from *Crocus sativus L.*, with gold nanoparticles and dextran polymer was developed to potentiate the anticancer activity of safranal against colon cancer. Safranal possesses notable antioxidant, anti-inflammatory, and anticancer effects mediated through disruption of mitochondrial signaling and induction of apoptosis. The conjugation approach was designed to augment the solubility, stability, and selective tumor accumulation of safranal. Nanoparticle formulations were fully characterized using dynamic light scattering, UV-visible spectroscopy, FTIR and SEM confirming stable, uniform distribution at the nanoscale. *In vitro* studies of safranol-conjugated, dextran-coated gold nanoparticles on HCT-116 colon cancer cells demonstrated increased reactive oxygen species generation, loss of mitochondrial membrane potential, nuclear condensation, and induction of apoptosis, as confirmed by fluorescence imaging and cell cycle analysis. *In vivo* assessments in murine tumor models revealed enhanced tumor regression, improved survival rates, and favorable haematological profiles compared to free safranal or gold nanoparticles alone, confirming propitious therapeutic efficacy. Collectively, these results highlight the nanoconjugate, composed of gold nanoparticles, dextran, and safranal, as a viable and biocompatible platform that amplifies the antitumor potential of safranal and signifies a promising approach for nano-enabled, phytochemical-based colon cancer therapeutics.

Abstract ID-080946164

Corrective Effect of *Curcuma amada* Rhizomes in Streptozotocin-Induced Diabetes Linked Testicular Impairment in Rats: Most Potent Extract Selection Study

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Medicinal plants or herbs have been used since ancient times in systems like Ayurveda, Unani, and Folk medicine. Excessive ROS from oxidative stress can cause diseases such as cardiovascular disorders, cancer, metabolic disorders, and male infertility. Medicinal plant, *Curcuma amada* possess bioactive phytocompounds with antioxidant properties that help scavenge free radicals. This study aimed to identify the most effective extract of *Curcuma amada rhizomes* with revitalizing potential against diabetes-induced male reproductive dysfunctions. Diabetic rats were treated aqueous, hydro-methanol (60:40), and methanol extracts of the plant at a dose of 30 mg per 100 g body weight daily for four weeks. After the treatment, diabetes-induced testicular hypofunction was assessed through spermiological, biochemical, androgenic, antioxidant, toxicity, and genomic analyses of testicular tissue. Among the aqueous, hydro-methanol (60:40), and methanol extracts administered at the said dose, the hydro-methanol (60:40) extract showed the most significant recovery. Improvements were observed in count of sperm (105.77 %), motility of sperm (104.47 %), viability of sperm (35.61 %), Δ^5,3β-HSD (83.68 %), 17β-HSD (58.64 %), serum testosterone (161.81 %), catalase activity in testis (142.85 %) and epididymis (110.52 %), and reductions in TBARS levels in testis (42.36 %) and epididymis (50.07 %). Gene expression analysis revealed downregulation of Bax (43.95 %) and upregulation of Bcl-2 (62.71 %) relative to the control, along with decreased metabolic toxicity markers SGOT (54.41 %) and SGPT (45.54 %). These findings indicate that at the 60:40 ratio of hydro-methanol extract of *Curcuma amada* exhibits remarkable restorative effects against diabetes-induced oxidative stress-mediated testicular dysfunction.

Abstract ID-090828661

Anti-biofilm potential of methanolic extract of *Azadirachta indica* leaf against multi-drug resistant (MDR) *Vibrio cholerae*

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Vibrio cholerae, a gram-negative bacterium causes profuse watery diarrhoea due to its toxic secretions. Biofilm is a survival strategy for this bacterium in which they intercommunicate with each other by the process known as quorum sensing. Due to this protective shield of slime they acquire resistance property against several antimicrobial agents and confirm their prolonged survival in their host. Recently phyto-medicines have been portrayed as promising alternative to combat bacterial resistance towards actions of several drugs. Therefore, in this present study the ability to inhibit biofilm formation of *V. cholerae* by *Azadirachta indica* leaf, extracted with methanol, was evaluated. Phytochemicals present in this extract were assessed through LC-MS/MS study and the cytotoxicity of this extract was analysed by MTT assay. Anti-biofilm potential of this extract on MDR *V. cholerae* was studied by MBIC and MBEC assay. SEM and confocal imaging were also done to visualize the anti-biofilm potential of the extract. Results indicate a significant reduction of biofilm formation for methanolic extract of *Azadirachta indica* leaf on MDR *V. cholerae*. So, this extract can be used in future scientific studies as anti-biofilm agent against drug-resistant *V. cholerae*.

Abstract ID-093552693

Protective efficacy of ethyl-acetate fraction of alcoholic leaf extract of *Camellia sinensis* (green tea) on diabetes linked sperm apoptosis in experimental rat

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Diabetes, a chronic noncommunicable syndrome is associated with very subtle disorders which results in certain anomalies in sexual function and spermiograms. The investigation has been designed to unfold the defensive role of ethyl-acetate fraction of *Camellia sinensis* leaves on germ cell apoptosis through genomic and proteomic pathways in STZ-induced diabetic model rat. A primary approach has been taken to find out the effective phyto-ingredients present there by HPLC study. In this respect, the glycaemic sensor, gene expression of oxidative enzymes, synthesis of testicular steroidogenic key enzymes, and markers of programme cell death in testis were assessed along with *in situ* end labelling study. A significant attenuation ($p<0.05$) in the glycated haemoglobin level was noticed in fraction treated diabetic group. Testicular catalase and peroxidase genes expressions were down regulated and the numbers of ISEL-positive apoptotic germ cells in seminiferous tubule were elevated in diabetic rats at significant level which were corrected significantly ($p<0.05$) after the fraction treatment. Recovery in expression of testicular Bax, Bcl-2, Δ5, 3β- HSD and 17β- HSD proteins after fraction treatment to diabetic groups have strengthen the ameliorative effects. Two phyto-ingredients were detected in this fraction from HPLC study. It may be concluded that the fraction has the potentiality to correct the diabetes induced male germ cell apoptosis.

Abstract ID-104121986

Early Selective Detection and Treatment of Breast Cancer Cell Using Nanoplasmonics

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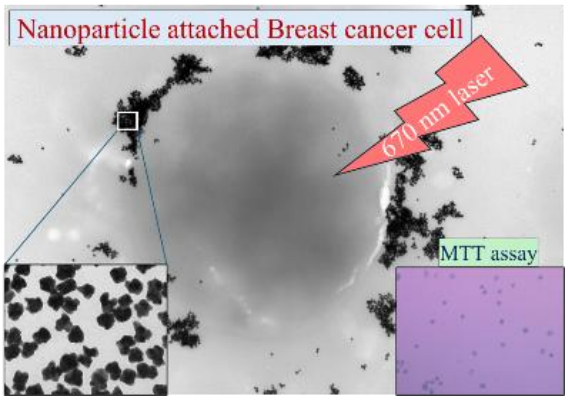
Breast cancer is a leading cause of mortality among women, highlighting the urgent need for highly sensitive, selective, and minimally invasive diagnostic and therapeutic solutions. Nanoplasmonics offers a promising integrated approach, utilizing the unique and tunable optical properties of metallic nanostructures (gold and silver).

These nanoparticles are functionalized with specific ligands or antibodies to selectively bind to breast cancer biomarkers, such as HER2 and MUC1, enabling targeted identification. Localized surface plasmon resonance (LSPR) and surface-enhanced Raman scattering (SERS) facilitate real-time, label-free detection with high molecular sensitivity; spectral shifts or broadening in the plasmonic response reliably signal the presence of malignant cells for early diagnosis.

For therapy, the same nanostructures act as agents through photothermal conversion. Upon near-infrared (NIR) light excitation, they generate localized heat that selectively destroys cancer cells while minimizing damage to surrounding healthy tissue. This theranostic approach provides enhanced precision and reduced systemic side effects. Optimization of factors like particle geometry, surface coating, and biocompatibility is crucial for high selectivity and safety.

This study introduces a novel nanoplasmonic platform for selective recognition and photothermal ablation, leveraging surface plasmon resonance (SPR)-based sensing and LSPR-mediated therapy. Specifically, gold nanopopcorns functionalized with monoclonal antibodies targeting overexpressed HER2 exhibited sharp, tunable resonances in the visible and NIR region. This integrated method holds significant promise for personalized cancer management by combining early detection, targeted treatment, and real-time monitoring within a single system.



Abstract ID-090218419

Exploring the Anti-diabetic Efficacy of *Bauhinia acuminata (L.)* Bark Fractions in Streptozotocin-induced Diabetic Rats

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Diabetes mellitus is a life-threatening global epidemic with a rising prevalence. This study evaluates the anti-diabetic and anti-oxidant efficacy of hexane, chloroform, ethyl acetate, and n-butanol fractions of the hydro-ethanolic (60:40) bark extract of *Bauhinia acuminata* in streptozotocin-induced diabetic rats. Experimental animals were divided into control, diabetes, and fraction treated diabetic groups. Each fraction was orally administered at 2 mg/100 g body weight/day for 28 days. Compared with the diabetic group, treated rats showed significant ($p < 0.05$) reductions in fasting blood glucose, HbA_1C, and improvements in serum insulin, C-peptide, and insulin receptor levels. Fraction treatments also restored key anti-diabetic and antioxidant enzyme activities in metabolic tissues and normalized *GLUT4*, *Bax*, and *Bcl-2* gene expression. Comet assay results revealed significant ($p < 0.05$) protection against oxidative DNA damage in pancreatic β-cells. No metabolic toxicity was observed. Histopathological analysis confirmed reduced hepatic injury and regeneration of pancreatic β-cells in treated groups. Among all fractions, the ethyl acetate fraction exhibited the greatest improvement across biochemical, molecular, and histological parameters. These findings suggest *Bauhinia acuminata* bark, particularly its ethyl acetate fraction, as a potent natural therapeutic agent against diabetes.

Abstract ID-105824953

Folate receptor–targeted Dextran - Geraniol Protein Nano-scaffolds trigger intracellular ROS flux and activate mitochondrial-dependent apoptotic eradication of human colorectal cancer cells

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Colorectal cancer (CRC), the second leading cause of cancer-related mortality worldwide, often exhibits multidrug resistance and suboptimal responses to conventional chemotherapy. Geraniol, a naturally occurring monoterpenoid alcohol, has demonstrated notable anticancer potential through oxidative and apoptotic mechanisms; however, its therapeutic translation is constrained by poor bioavailability and non-specific biodistribution. So we report the rational design and evaluation of folate receptor–targeted, pH-responsive dextran–geraniol protein nano-scaffolds (GER–BSA–DEX–F NPs) as a precision nanoplatform for selective colorectal cancer therapy. The spherical nanostructures (117.8 nm) exhibited high encapsulation efficiency and tunable drug release in an acidic tumor-like microenvironment. Targeted internalization of GER–BSA–DEX–F NPs by HCT-116 colorectal carcinoma cells induced robust intracellular reactive oxygen species (ROS) generation, culminating in redox imbalance and oxidative stress–driven apoptosis. Mechanistic exploration revealed loss of mitochondrial membrane potential, cytoskeletal disorganization, and cell-cycle arrest at the G_2/M checkpoint, signifying mitochondrial-dependent apoptotic signaling. Collectively, these effects orchestrated selective apoptotic demise of HCT-116 cells while minimizing off-target cytotoxicity. Our findings establish GER–BSA–DEX–F NPs as a novel redox-active, folate-guided nanosystem capable of amplifying oxidative perturbation and intrinsic apoptotic pathways in colorectal cancer, highlights a translationally viable strategy integrating natural bioactives and smart nanocarriers against human colorectal cancer cells.

ENVIRONMENTAL SCIENCES INCLUDING CLIMATE CHANGE

Abstract ID-114739845

Evaluating the Quality of Life (QOL) in Urban Slums of Older and Newer Municipalities in Purba Medinipur, West Bengal, India

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The growth and development of slums in urban areas is one of the important issues for the urban local bodies (ULBs). Almost one billion people live in slums around the world, typically overcrowded, polluted, and lacking basic amenities. This study aims to assess the Quality of Life (QOL) of slum dwellers in the municipalities of Purba Medinipur (Haldia, Egra, Contai, Panskura, and Tamralipta), West Bengal. The municipality has been classified into two categories: older municipalities (Tamralipta and Contai) and newer municipalities, such as Haldia, Panskura and Egra. A total of 348 notified slum household responses were collected through a pre scheduled door to door primary survey and analyzed using statistical techniques, including composite indexing, standard deviation, component analysis, correlation matrix, and Principal Component Analysis (PCA), alongside GIS for spatial representation. Five major domains, such as Housing Condition Index (HCI), Infrastructure and Sanitation Index (ISI), Health and Healthcare Index (HHI), Education Index (EI) and Employment and Income Index (EII), have been selected to assess the Quality of Life (QOL). The findings reveal significant disparities in living standards across municipalities. Poor hygienic conditions and inadequate access to basic amenities contributes to unsatisfactory living standards in most slums. Notably, Panskura Municipality ranked highest in QOL, while Egra and Haldia lagged behind, particularly in housing, sanitation, and healthcare. The quality of life of slum dwellers in older municipalities is comparatively better than that of newer municipalities. The study underscores the urgent need for targeted policy interventions to improve living conditions in slums.

Abstract ID-122652721

Spatio-Temporal Assessment of Forest Fragmentation and Wildlife Corridor Connectivity in Southern Bankura Using Geospatial Techniques

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Southern Bankura has experienced significant changes in land use due to increasing road construction and human activities. These developments have fragmented forest areas, reducing wildlife connectivity. To analyse the spatio-temporal changes in forest cover in the southern Bankura district from 2010 to 2025. To identify and map potential wildlife corridors. To suggest suitable conservation and restoration measures. Multi-temporal satellite imagery from 2010 to 2025 was processed through remote sensing and GIS tools to delineate changes in forest cover and evaluate landscape connectivity indices. Land Use and Land Cover (LULC) classification was performed through Supervised Classification using the Maximum Likelihood method. Forest fragmentation metrics, such as Patch Density (PD), Edge Density (ED), Mean Patch Density (MPD), etc., were calculated using FRAGSTATS and ArcGIS Spatial Analysis tools. To evaluate wildlife corridor connectivity, Least cost patch (LCP) analysis and theory-based modelling were conducted. The results indicate increased forest fragmentation, reduced patch size, and disrupted wildlife corridors. The study identifies critical fragmentation hotspots near human settlements and the road network. Restoration of ecological corridors through community-based afforestation and sustainable land-use planning is recommended to maintain biodiversity and ecosystem stability in southern Bankura.

Abstract ID-041725112

Isolation, characterization and identification of triclosan degrading aquatic bacteria from Hooghly River at Chandannagar, West Bengal

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Over the last few decades, the antimicrobial compound triclosan has been increasingly recognised as an Emerging contaminant (ECs) by United States Environmental Protection Agency (USEPA) because of its hazardous effects and ubiquitous persistent distribution in the ecosystem, such as water and soil. As an endocrine-disrupting compound, TCS is a powerful, possible potential carcinogen, mutagen & teratogen. As environmental worries about triclosan escalate, its elimination has become a priority. Although physical, chemical and physicochemical methods exist, bacteria mediated biodegradation offers an eco-friendly, cost effective, pollution free, safe alternative approach towards successful decontamination of TCS from various contaminated sites. In this study sixty three bacterial strains were isolated using enrichment culture, following screening by calculating the solubilizing index (SI) on triclosan test agar plates (TTAPs). One amongst these strains, designated GTCS30, showing the maximum SI, was identified as *Serratia* sp. GTCS30 (with 16S rRNA gene sequence accession number: PX250331) by using 16S rRNA gene sequence based molecular phylogenetic approach. To the best of our knowledge, this is the first report of triclosan biodegradation by any representative strain, belonging to the genus *Serratia*. The strain GTCS30 may have biotechnological potential and can be used for bioremediation of triclosan contaminated aquatic sites.

Abstract ID-074721858

High-Efficiency Pendimethalin Degradation by *Bacillus paralicheniformis* PPH2 Provides Insights into Bioremediation and Metabolite Toxicity

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The environmental persistence of Pendimethalin (PEN) necessitates effective bioremediation strategies coupled with a thorough risk assessment of its transformation products. This study investigated the bioremediation potential of *Bacillus paralicheniformis* PPH2, an aerobic gut bacterium isolated from paddy field earthworms, for PEN degradation. Under laboratory conditions, PPH2 exhibited significant growth (OD_{600} = 0.53 ± 0.025) with PEN (100 mg/L) *as the sole carbon source over five days. HPLC analysis demonstrated* 89.06 ± 4.47% *PEN* **degradation** *by PPH2, a marked increase over abiotic controls* (1.30 ± 2.40 %). Subsequent LC-MS/MS *analysis elucidated a biotransformation pathway involving nitro-reduction and oxidative dealkylation, yielding* **3,4-dimethyl-2,6-dinitroaniline (DDA)** *as a primary metabolite. Comparative ecotoxicity assays revealed that* PEN (LC_{50} = 8.902 mg/kg soil) was slightly more toxic to *Eisenia fetida* than DDA (LC_{50} = 9.835 mg/kg soil). However, phytotoxicity studies on *Cucumis sativus* indicated that PEN caused significantly greater reduction in **shoot length** (4.45 ± 0.36 cm) compared to DDA (6.95 ± 0.47 cm), although both inhibited germination and root elongation. These findings highlight *B. paralicheniformis* PPH2 as a promising agent for PEN bioremediation and underscore the critical need to assess metabolite toxicity for accurate environmental risk evaluation of herbicide management.

Abstract ID-092701443

Tiny Plastic–Rock Agglomerates as Novel Contaminant Reservoirs in the Marine Environment

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The proliferation of plastic pollution in marine environments has led to the emergence of complex secondary formations such as plastiglomerates, rock–plastic composites generated through thermal and mechanical fusion. This study introduces and characterizes a novel derivative entity termed microplastiglomerates, microscale fragments derived from the disintegration of plastiglomerates which act as dynamic reservoirs for contaminants in coastal ecosystems. Samples collected from the Bay of Bengal coast (northeastern India) were systematically isolated and analysed using advanced physicochemical techniques. Morphological and surface analyses performed via Confocal Laser Scanning Microscopy (CLSM) with Nile Red and Calcein staining, alongside Field Emission Scanning Electron Microscopy (FESEM), revealed heterogeneous matrices comprising fused polymer and mineral phases. Raman spectroscopy, thermogravimetric analysis (TGA), and X-ray diffraction (XRD) confirmed mixed polymer composition with crystalline mineral inclusions, indicative of thermal alteration processes. To evaluate their pollutant retention capacity, microplastiglomerates were exposed to selected toxic metals, and subsequent adsorption was quantified using Inductively Coupled Plasma–Optical Emission Spectroscopy (ICP-OES), Scanning Electron Microscopy with Energy Dispersive X-ray Spectroscopy (SEM-EDX), and X-ray Photoelectron Spectroscopy (XPS) analyses. Results demonstrated substantial metal retention potential, driven by surface oxidation, micro-porosity, and mineral–polymer interactions. These findings highlight microplastiglomerates as emerging sinks for heavy metals and other contaminants, with implications for trace metal cycling and pollutant persistence in marine environments. The study underscores the need to integrate microplastiglomerates into the conceptual framework of plastic pollution and sediment–contaminant interactions.

Abstract ID-012516248

Preliminary Transcriptomic Insight of a Tropical Collembola (*Xenylla welchi*, Folsom, 1916) Under Lead Stress: A First Report

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Xenylla welchi, a soil-dwelling tropical Collembola, is important for organic matter decomposition and nutrient cycling, and it is sensitive to changes in soil quality, making it a valuable bioindicator. In this work, transcriptome assembly and annotation were carried out for assessing the molecular response of *X. welchi* to sublethal lead exposure. Distinct transcriptional changes were shown between the treated and control groups after 24-hour Pb treatment, indicating that metal poisoning had a significant impact on gene expression. Functional enrichment analysis of differentially expressed genes revealed several GO terms associated with proteolysis, transcriptional regulation, and cytoskeletal organization. Moreover, KEGG pathway analysis showed distruptions in metabolic processes and cellular stress response pathways, indicating active molecular defense of this organism against lead toxicity. These findings, therefore, constitute the first transcriptomic evidence for heavy metal-induced gene regulation in *X. welchi* and shed light upon physiological adaptation under toxic stress of this organism. These results elucidate the responsiveness of this soil microarthropod toward environmental pollutants and further support the use of *X. welchi* as a molecular-level bioindicator for monitoring the extent of soil contamination in tropical environments.

Abstract ID-044435166

Eco-friendly synthesis of carbon dots from agro-biomass waste for detection of imidacloprid insecticide residue in fruits

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In today's market, consumption of fruits such as apple, grape, banana, watermelon and apricot having excessive imidacloprid (IDP) insecticide residue can be highly risky for human health. So, detecting IDP residue effectively and reliably by environmentally benign greener solution is very urgent to mitigate the ecological security and food safety concerns. In order to accomplish this, indian almond shell, an agro-biomass waste, is utilized preserving environment consciousness and sustainability for development of carbon dots (CDs) based fluorescent sensor. Formation of CDs was verified by UV-vis, FL, FT-IR, DLS, PXRD, TCSPC, AFM, XPS & TEM analysis. The FL quantum yield (QY) obtained for CDs (72 %) is much greater with regard to green synthesis. Our prepared system show good sensitivity and selectivity for rapid and effective detection of IDP accompanied by strong linearity relation between CDs FL intensity and IDP concentration in 0-60 µM having a limit of detection (LOD) 0.00125 mg/kg. The CDs was employed pridefully for effective detection of IDP residue in fruits namely apple, grape, banana, watermelon and apricot with superior spiked recoveries of 94-99.79 % and a relative error 0.21-6 %. It is guaranteed that the idea of this research will be used in processing trustworthy analytic nanoprobes for pollution control and food safety assurance in near future.

Abstract ID-050328790

Investigation of the anthropometric and physiological characteristics of deep-sea fishermen in the Purba Medinipur district of West Bengal: An emphasis on dietary choice

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Every year, from July to March, deep-sea fishermen go fishing. They catch a variety of saltwater fish that are rich in fat, protein, vitamins, and minerals. During each fishing trip in the maritime environment, they experience heavy labor, disrupted sleep, irregular eating habits, nicotine use, prolonged exposure to saltwater and direct sunlight on their bodies. This hazardous occupation may have a high rate of morbidity due to changes in hematological, anthropometric, physiological, and blood and urine biochemical characteristics. Data on anthropometric and physiological measurements, along with food choices before and after fishing sessions, are still not available in a specific format for fishermen in the Purba Medinipur area of West Bengal. Therefore, our goal is to develop a database for studying this community. A cross-sectional study was conducted among 1226 deep-sea fishermen aged 18 to 60 years residing along the coastline of the Purba Medinipur district. The fishermen provided all data using specific techniques, and Microsoft Office Excel 2007 was used to analyse the statistical data. The outcome results demonstrated that the experimental condition considerably altered the physiological and anthropometric parameters. Every day, deep-sea fishermen consume extra vitamins, minerals, and nutrients to keep their nutritional state healthy. Therefore, it is more advantageous for fishermen to understand that better physical health leads to better deep-sea fish catching performance.

Abstract ID-052247419

Rag pickers and itinerant waste buyer's role in circular economy: Study on MKDA, Paschim Midnapore, West Bengal

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Circular economy aims to find to reduce solid waste's burden on the environment, society, and economy through reduce, reuse and recycling. Rag pickers and itinerant waste buyers contributes largely in circular economy goal. In Midnapore Kharagpur Development Authority (MKDA) approximately more than 2200 rag pickers and itinerant waste buyers make their living by collecting MSW recyclable material. The main objective of the study is to explore the role of rag pickers and itinerant waste buyers in waste to resource recovery in the circular economy period. To identify the contribution of rag pickers, an extensive social survey has been conducted by using snowball sampling method in Midnapore and Kharagpur Municipality of MKDA, Paschim Midnapore. In Midnapore and Kharagpur municipality recyclable material collected annually accounts for 5.2 & 30.7 thousand ton respectively comprising of valuable recyclable materials such as waste paper and cardboard, plastic, scrap metal, rubber(tyre), e-waste, animal bone and polythene. These create annual economic value of about 1231.93 thousand $US and 7889.56 thousand $US respectively. Parallelly, they contribute to save natural environment and resources. In this process approximately 1.14 lakh adult trees, 6.62 lakh barrels of oil, 2.93 lakh m3 of land fill space, 15.15 lakh barrels of water, 14.84 tons of air pollutant, 13.46 thousand ton iron ore, 7.85thousand ton coal, 5.61thousand ton limestone, 1.11 thousand ton of toxic gases and 668.34 ton soot are saved. Otherwise, the amount of fresh natural resource required to produce the equivalent number of recyclables is also saved annually.

Abstract ID-082523199

Screening of bacterial strains from solid waste for effective biodegradation of low density poly ethylene microplastic

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Low density poly ethylene (LDPE) is a global concern now due to its increasing use as packing materials, carry bags. LDPE microplastics (MP) are ubiquitous, resilient and have adverse effect on biotic and abiotic components. Present study focuses on bio-based degradation of LDPE-MP by two unique strains of *Bacillus sp.*, isolated from municipal solid waste dumping grounds of Bishnupur, Bankura, West Bengal. These two strains were screened on the basis of their hydrophobicity, ability to use MP as the sole carbon source. For biodegradation study, a shake flask experiment was carried out with the bacterial strains incubated in a carbon free mineral salt media supplemented with MP particles. During the degradation process (30 days), bacterial growth, p^H of the media and visual appearance of the MP particles changes considerably. Post-degradation weight loss of the LDPE-MP treated with the two *Bacillus* strains was 11.2 % and 15.5 % respectively. Scanning electron microscopy (SEM) analysis confirms the adherence of bacterial cells to the MP surface and appearance of cracks, crevices on it. Alteration in FTIR spectra, specially in carbonyl group range of 1100-1700 cm^{-1}, C-H group stretching at a range of 2000-2500 cm^{-1} was also evident. Findings and analysis of this study indicate that these two *Bacillus* strains possess characteristics to colonise, degrade microplastics and contribute to environmental remediation.

Abstract ID-103242986

Zero-Waste Bioelectrogenesis: Dual-Chamber H-Type Microbial Fuel Cell Utilizing Waste for Power Generation, Arsenite Biotransformation, and Nutrient Recovery

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The present study demonstrates a sustainable and zero-waste approach to bioenergy generation and pollutant remediation using a dual-chamber H-type microbial fuel cell (MFC) fuelled with chicken waste effluent collected from a local butchery shop. The system was inoculated with a mixed bacterial consortium comprising *Bacillus sp*., *Lysinibacillus sp*., and *Pseudomonas sp*., known for their metabolic versatility and electroactive potential. The aluminum anode and a graphite cathode were employed to facilitate electron transfer and biofilm formation. The MFC achieved a maximum power density of 161 mW/cm² at a current density of 995 mA/cm², indicating efficient bioelectrocatalytic activity. Over a 10-day operational period, the system demonstrated 52% COD removal efficiency and 41% coulombic efficiency, indicating effective degradation of organic matter and recovery of electrons. The cathode chamber, supplemented with 1 ppm Na-arsenite, demonstrated complete biotransformation of arsenite [As (III)] to arsenate [As (V)], as confirmed qualitatively by a silver nitrate assay, indicating a promising route for bio-detoxification of metalloid contaminants. Furthermore, analysis of the residual broth revealed enriched macronutrient values (N: 0.5%, P: 0.30%, K: 0.24%), supporting its potential reuse as an organic liquid fertilizer, thereby achieving complete waste valorization. Overall, this integrated MFC system effectively converts poultry waste into clean energy while simultaneously treating wastewater and enabling resource recovery, illustrating a zero-waste, eco-friendly strategy for sustainable waste management and bioremediation.

Abstract ID-104404242

Climate Variability and Child Malnutrition: Assessing the Environmental Pathways of Nutritional Risk in West Bengal

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Climate variability is becoming an emerging issue on Earth, which is also a critical determinant of child malnutrition, mainly in climate-induced regions. This study investigates how temperature, rainfall, and extreme weather events affect nutritional outcomes in children under the age of five, with a focus on environmental pathways that influence food security and household livelihoods. The research combines National Family Health Survey (NFHS) data on stunting, wasting, and underweight prevalence with district-level climatic variables from Indian Meteorological Department (IMD). The analysis of panel regression and correlation reveals that temperature anomalies and rainfall irregularities are strongly correlated with higher rates of child wasting and underweight in both western drier areas and deltaic flooded regions. Two major findings highlight on nutritional risk in the form of declined agricultural productivity and diversity, and instable access to food. There are many existing nutrition and social protection programmes available, but the limited integration with climate-resilient agricultural hinders the effectiveness. This work emphasizes the necessity of climate-informed child nutrition planning which is aligned with sustainable development goals (SDG 2-Zero Hunger & 13- Climate Action) along with socio-economic development. By identifying the geographical pattern of nutrition risk and environmental factors, this provides the empirical basis for climate resilience and nutrition-sensitive policies in West Bengal.

Abstract ID-120250196

Assessing the Urban Ecological Health Index in a Rapidly Urbanizing Area of Eastern India: A Sustainable Environmental Management Framework for Livable Cities

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Urban environmental livability (UEL) is a critical aspect of sustainable urban development, particularly in fast urbanizing regions like the Kolkata Metropolitan Area (KMA). Urbanization in KMA has led to substantial environmental challenges, including increasing land surface temperatures (LST), urban heat islands (UHI), and the degradation of biodiversity. These challenges are exacerbated by the impacts of climate change, demanding effective strategies for urban ecological health and livability. This study sightsees the role of green infrastructure in enhancing the urban ecological health index and livability in Kolkata by mitigating UHI effects, preserving biodiversity, and improving ecosystem services. The research employs multi-source satellite data to analyze the spatio-temporal dynamics of vital biophysical indices including advance multi-criteria-based Fuzzy-GIS method. The City Biodiversity Index (CBI) and Urban Ecological Vulnerability (UEV) framework estimated based on a Pressure-Sensitivity-Resilience approach to assess biodiversity status and ecological vulnerability across different urban zones. Besides, assessing urban livability, the study introduces multiple indicators, including the micro-scale Ecological Health Index (EHI), per-capita green space index (PCGI), and eco-erosion index (EEI). The results designate a substantial rise in LST and UHI effects, particularly in compact urban areas, with the CBI score for KMA being 35.5%, suggesting poor urban biodiversity. The UEV assessment displays high ecological vulnerability in rapidly urbanizing zones. The findings underscore the requirement for integrating green infrastructure to alleviate climate change impacts, enhance biodiversity, and improve urban livability. This study provides actionable insights for urban planners and policymakers, offering a scalable framework for addressing environmental challenges in rapidly urbanizing cities globally.

Abstract ID-094544428

Climatic Oscillations and Pollution Stress: Biomarker and Gut Microbiota Responses in *Bellamya bengalensis*

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The study explores the collective influence of climatic oscillations and anthropogenic pollution on the freshwater gastropod *Bellamya bengalensis*, accentuation its role as a bioindicator of environmental health. Samples were collected from three ecologically distinct sites of West Bengal—Bichitrapur (control), Kharagpur (Test 1), and Midnapore (Test 2)—across pre-monsoon, monsoon, and post-monsoon seasons. Seasonal monitoring of physico-chemical parameters exposed elevated temperature, hardness, TDS, and heavy metal concentrations (Ni, Pb, Cd, Hg, As) at polluted sites, indicating significant ecological stress. Morphometric variations, including altered shell pigmentation and size, reflected adaptive responses to environmental fluctuations. Biochemical assays of oxidative stress markers—catalase, glutathione reductase, glutathione-S-transferase, lipid peroxidation —showed reduced enzymatic activity in polluted regions, signifying enhanced oxidative damage and metabolic stress. Gut microbiota sketching across oesophagus, stomach and intestine, revealed a decline in beneficial genera (*Bacillus*, *Micrococcus*) and an increase in pathogenic forms (*Pseudomonas*, *Klebsiella*,), demonstrating microbial dysbiosis under environmental stress. The integrative analysis of biochemical and microbial responses establishes *Bellamya bengalensis* as a sensitive ecological sentinel, capable of reflecting both climatic and pollution-induced disturbances. Study highlights the significance of linking physiological biomarkers and microbial community dynamics for effective aquatic ecosystem monitoring and sustainable environmental management.

Abstract ID-012031141

Pollen Calendar of Purulia Town, Clinical Prevalence Study, and Its Correlation with Meteorological Parameters

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A continuous aeropalynological survey was conducted over one year (2024) using a Burkard personal air sampler (air suction rate = 10 liters/min) at various urban sites in the Purulia town. A total of 86 pollen taxa from the study sites were identified, with Poaceae pollen showing the highest frequency, followed by Asteraceae. The highest annual pollen concentrations were observed in April. A comprehensive pollen calendar was created for the first time in the Purulia town. The peak pollen season occurs twice a year, once in the pre-monsoon and once in the post-monsoon periods. Pearson correlation analysis confirmed that the seasonal pollen concentrations were linked with meteorological factors such as temperature, rainfall, wind speed, and relative humidity. Local healthcare centers observed a significant rise in respiratory allergies, asthma, and other allergen-induced conditions during peak pollen periods. The pollen calendars serve as practical tools for allergy forecasting and public health awareness, aiding better predictions during peak allergen seasons. This study emphasizes the necessity of aeropalynological surveys in regions like Purulia, where transitional landscapes and climatic variability pose unique challenges. This survey can guide the medical practitioners in predicting and managing the allergic diseases among local residents.

Abstract ID-021940320

Livelihood Patterns and Climate Resilience among Rural Households in Jungle Mahal: A Multivariate PCA and Cluster-Based Analysis

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This study examines the livelihood vulnerability in climate-sensitive rural and tribal areas of Jungle Mahal. This study examines the effects of five livelihood capitals-human, natural resource, physical, financial, and social-on influencing adaptive capacity in the face of changing climate conditions. To find out the important factors influencing livelihood resilience, multivariate techniques such as Principal Component Analysis (PCA), Multiple Regression, and K-Means Clustering methods were used. The findings show that existing inequalities in economic security and access to resources are exacerbated by climate unpredictability. While highly vulnerable households rely on short-term coping mechanisms driven by financial and social capital, less vulnerable households have more human and natural capital, which allows for diversification and adaptive strategies. At moderate risk, they exhibit transient characteristics, reflecting the volatility of resource use and exposure to climate stress. The results show that increasing education, resource management, and institutional linkages are essential for livelihood resilience, rather than relying solely on financial support. In tribal and rural communities, incorporating climate adaptation into livelihood strategies can successfully reduce vulnerability and advance sustainable development.

Abstract ID-040514416

Clove-Based Natural Preservation: A Novel Approach for Microbial and Physicochemical Stability of Fruit Juices

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The present study introduces an innovative approach to natural food preservation using *Syzygium aromaticum* (clove) to enhance the microbial and physicochemical stability of orange juice during prolonged storage. Fresh orange juice was fortified with clove powder (1 g/100 mL) and stored for 54 days under ambient conditions. Microbial quality (bacterial and fungal CFU/mL), pH, and titratable acidity were periodically analyzed and compared with untreated controls. The control samples showed rapid spoilage, with bacterial counts rising from 4.4×10^3 to $\geq 10^8$ CFU/mL and fungal counts from 3.0×10^4 to $\geq 10^8$ CFU/mL within eight days. In contrast, clove-treated juice maintained bacterial counts between 1×10^2 and 8×10^2 CFU/mL and fungal counts between 2×10^2 and 7×10^2 CFU/mL throughout storage, indicating over 99.98% inhibition ($p < 0.01$). The pH of the treated juice remained stable (4.72–3.85), while titratable acidity increased minimally (0.034 – 0.198), reflecting suppressed microbial metabolism. This innovative use of clove, rich in eugenol and other bioactive phenolics, not only controlled spoilage microorganisms but also preserved the natural sensory and nutritional qualities of the juice. The study's novelty lies in demonstrating that a simple, low-cost, and eco-friendly natural additive can replace synthetic preservatives in fruit-based beverages. These findings open avenues for sustainable food preservation strategies, combining safety, consumer acceptability, and environmental compatibility.

Abstract ID-051731292

Evaluation of Pollution-Induced Ecological and Human Health Impacts in the Damodar River, Eastern India

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Riverbed ecosystem is a complex process of environment where upwelling groundwater and downwelling surface water continuously mixes with each other with exchanging their components. This study examines how increasing pollution stressors adversely affect the water quality of both surface and hyporheic zones of the Damodar River, influencing sediment-dwelling microinvertebrate communities and posing potential health risks to populations dependent on river water. A total of 36 physicochemical and biological parameters were analyzed from 54 water samples collected across selected sites, along with sediment samples from 10 riverbed locations. Descriptive statistical analysis revealed notably higher mean concentrations of calcium, COD, manganese, BOD, nitrates, and iron in hyporheic water compared to surface water, suggesting longer residence times and slower pollutant flow within the sediment layer. The Water Pollution Index (WPI) indicated that all hyporheic water samples were highly polluted, while the Heavy Metal Pollution Index (HMI) confirmed significant contamination from heavy metals. The Potential Ecological Risk Index (RI) further demonstrated that both surface and hyporheic waters were moderately contaminated. The Human Health Hazard Index (HI) revealed that surface water poses a higher risk to children than adults. In terms of biodiversity, microinvertebrate assessment showed Copepoda as the most dominant and Ostracoda as the least dominant species. Areas with higher pollution levels exhibited lower species richness. Therefore, effective pollution control, sustainable management practices, and enhanced public awareness are essential to safeguard the riverine ecosystem.

Abstract ID-061307786

Intertidal Benthic Foraminiferal Test as A Proxy of Biogeochemical Signature of Subarnarekha Estuary, East Coast of India

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The Subarnarekha estuary, along with its associated mudflats and mangrove ecosystems, represents a relatively recent geomorphological development on the eastern coast of India. Benthic foraminiferal assemblages of Subarnarekha estuary in Odisha were studied for understanding response of foraminiferal test to the coastal geochemical signatures. The screening of test was done through scanning electron microscopy (SEM), energy dispersive X-ray spectroscopy (EDS), inductive couple plasma optical spectroscopy (ICPOES), Raman spectroscopy. Nutrient dynamics, trace element, textural composition of newly grown mangrove of the estuary show a significant relationship of standing crop of foraminifera. Presence of elements like Cr, Fe, Zn in test of foraminifera indicate regional pollutant load. Elemental ratios were measured high resolution at a species level. The foraminiferal test chemistry reflects a mixed estuarine environment influenced by both fluvial (Fe, Mn, Si) and marine (Mg) inputs. *Miliammina fusca* was found more dominant in newly grown mangrove. *Ammonia* sp, *Quinqueloculina* sp. were also found which used as reliable proxy for heavy metal contamination. Benthic foraminifera abundance ranges from 0 to142 individuals per 10gm and agglutinated species are dominating. This works aims to provide better insight how photochemistry of foraminiferal calcite test response to different marine environment.

Abstract ID-084253253

Integrating LULC Transformation and Agroforestry Practices for Ecosystem Service Restoration in Gully-Degraded Lands: Study from part of the Jungle Mahal districts (West Bengal)

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Gully erosion, aggravated by rapid LULC transformations, threatens ecological integrity and socio-economic sustainability across gully dominates area of the Chotanagpur Plateau, Eastern India. Agroforestry, the strategic integration of trees with crops, offers a nature-based solution for restoring degraded lands and enhancing multiple ecosystem services. This study employs a CA–Markov modeling framework in conjunction with field-based assessments to quantify LULC transitions and evaluate agroforestry-driven ecosystem restoration under the tropical monsoon climate of Eastern India. Diverse combinations of native and multipurpose species— Bamboo, Sabai grass, Pigeon pea, Sal, Papaya, Cashew, Mango, Aakashmoni, and Eucalyptus— were systematically assessed for their ecological and economic performance. LULC simulations revealed a 33.8% vegetation-to-agriculture conversion (3.73% annual rate) and a 26% bare land-to-agriculture transition (2.24% annual rate), signifying intense agricultural encroachment and erosion-linked land degradation. The degradation cycle—*deforestation → gully expansion → agricultural invasion*—was strongly reflected in spatial correlations. Among the evaluated systems, Sal intercropped with Sabai grass demonstrated the highest composite functionality index and profitability, yielding a 1–2 times higher net present value than other configurations. This system also exhibited superior carbon sequestration, biomass productivity, and microbial resilience, confirmed through Principal Component Analysis (PCA). The findings highlight the efficacy of agroforestry in rehabilitating lateritic degraded landscapes while strengthening ecosystem multifunctionality and climate resilience. This study advances an integrated LULC–agroforestry approach, offering a replicable spatial framework for sustainable land management in alignment with land restoration and resilience strategies.

Abstract ID-100838345

Production of clean and green H_2 in aqueous medium for a sustainable future

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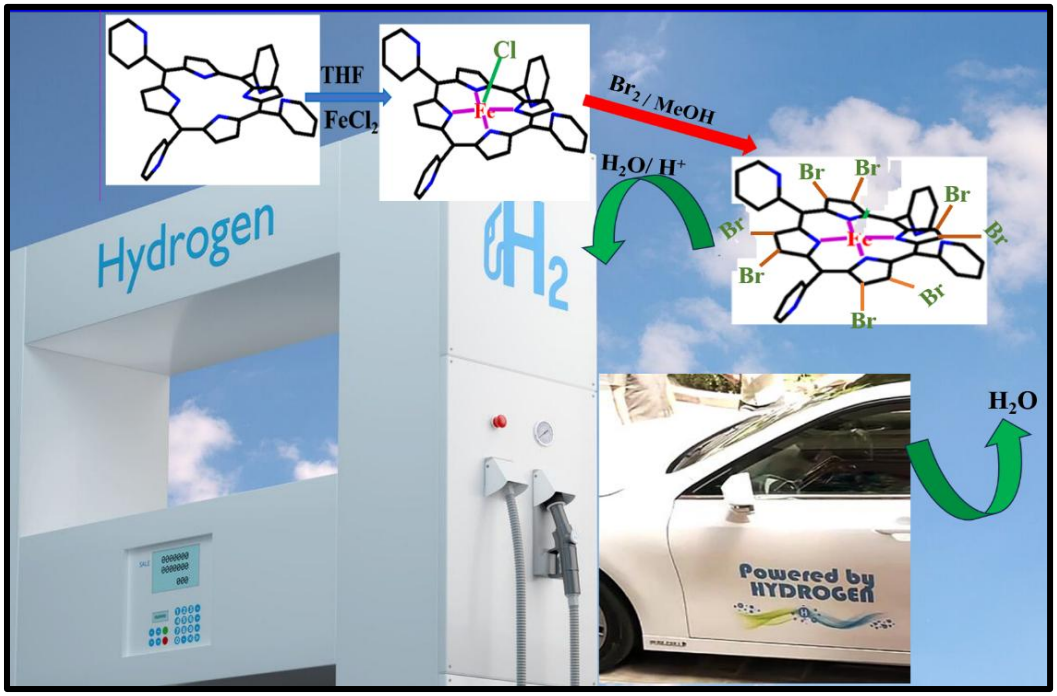
Excessive exploitation of the terrestrial wealth for personal human comfort is giving rise to catastrophic environmental consequences. Large scale pollution is negatively impacting human health. Coal based energy sources are considered key contributors for both pollution as well as global warming. Shifting from coal based economy to H_2 based economy is the need of the hour, since H_2 neither produces pollutant nor greenhouse gas. Efficient catalysts are in high demand for H_2 production. We systematically designed water soluble porphyrin based electrocatalyst that is at par with the naturally occurring Hydrogenase enzyme in terms of turnover number (TON), turnover frequence (TOF) etc. The actual novelty of this work lies in the fact that the electrocatalyst being water soluble, H_2 production is carried out in aqueous medium. This can lead to green route for H_2 production for a sustainable future.



Abstract ID-110550926

An Assessment of Climatic Variability and Its Impact on the Livelihood Conditions of Chhau Artists in Purulia District, West Bengal

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Chhau, a traditional folk dance that reflects strong connection between local communities and their natural surroundings and is closely linked to the region's ecological and cultural landscape. The socioeconomic stability of Chhau artists has been impacted over the past few decades by erratic rainfall, rising temperatures and changing seasonal cycles. The study adopts a mixed-method approach combining both Primary and secondary data. Field surveys, interviews with Chhau artists, BDO and community members were used to gather primary data, while satellite images, meteorological records and literatures were used to gather secondary data. To determine long-term trends, climatic data were analysed using GIS tool and livelihood vulnerability was assessed in connection to income trends, performance frequency and adaptation strategies. However, a decrease in outdoor performances, a decrease in audience participation and financial instability among artists are all consequences of growing climate instability. Consequently, erratic weather patterns are increasingly interfering with traditional costume making and festival schedules. In order to maintain this heritage art in the face of changing climate condition, this study highlights the necessity of adaptive livelihood strategies, cultural preservation initiatives and policy support. As a result, the study emphasizes that Chhau's sustainability as an art form and a means of subsistence is threatened by climatic variability in addition to being an environmental problem.

AGRICULTURE, HORTICULTURE, FORESTRY, FISHERIES AND VETERINARY SCIENCES

Abstract ID-093710924

The Silent Decline: Impacts of Host Tree Diversity Loss on Epiphytic Orchids in South Bengal

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Deciduous Forest patches of south Bengal exhibit diverse array of tree species, few species function as host plants for epiphytic orchids, providing them with the necessary support and habitat for growth and survival. However, their phorophyte preferences is largely dependent on the diversity of tree species in forest ecosystem. Investigating the diversity of tree species across different forest ecosystems is crucial for gaining insights into the specific host plant associations of epiphytic orchids, which is essential for understanding their ecological dependencies. This study aims to evaluate tree species diversity across three forest sites in different districts of South Bengal, with a particular emphasis on the density of host plants that support significant epiphytic orchid species. During the present study a total of 45 tree species belonging to 20 families and 12 number of epiphytic Orchids were documented three distinct forest study sites. Along with calculating the Importance Value Index (IVI) of the dominant tree species, we also calculated the IVI of the orchid host tree species and determined their density per hectare of forest area. The present investigation suggests that the reduced density of orchid host trees in the forest area could be a threat to the survival of epiphytic orchids. In addition, a correlation heatmap has been constructed to examine the relationships between host tree environmental parameters and the presence of epiphytic orchids. This study provides key baseline information on tree diversity and orchid-host relationships in South Bengal forests, which can guide conservation, restoration, and sustainable forest use.

Abstract ID-074557551

Evaluation of palash flower (*Butea monosperma*) powder inclusion in the diet of goldfish (*Carassius auratus*) as natural carotenoid source for pigmentation

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Carotenoid pigments give ornamental fishes their striking red, orange, or yellow colours, which enhance their visual appearance. Nevertheless, their colouring frequently dwindles in captivity. The palash flower, also known as the Flame of the Forest, is one naturally occurring source of carotenoids. In the districts of Purulia, Bankura, and Midnapore in West Bengal, palash flowers are locally available during the season (March to May). Since many flowers were not being used at the time, they were wasted and scattered all over the ground. Six groups participated in a 60-day aquarium-based experiment to assess the impact of powdered palash flower, a natural source of carotenoids, on goldfish pigmentation. Palash flower powder was added to experimental diets in the following graded levels: T2 (2.5%), T3 (5%), T4 (7.5%), and T5 (10%). Control feed (T1) and commercial feed (T6) were also included. The UV spectrophotometry method was used to determine the pigment concentration (Olson, 1979) in fish tissue. Using specialised software, digital images of the experimental fish were processed and examined. Image red, green, and blue (RGB) values were captured, and R, G, and B grayscale values were analysed. In terms of skin pigment concentration, the T4 tank performed the best; p-value < 0.05 indicated a significant difference from the other tanks. Red (R value) colour intensity tended to increase due to the Palash flower incorporated diets. According to recent research, feeding goldfish powdered palash flower petals can help preserve their body pigmentation as an alternate natural source of carotenoids.

Abstract ID-014735882

Economic Significance of Ethnomedicine and Conservation Practices among the Indigenous Communities in Jungle Mahal Areas of West Bengal

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Collection of medicinal plants by indigenous people of western part of West Bengal is a traditional cultural practice and has significant economic value. The rising demand for natural preventive health product as alternative medicine has increased the market demand. Hence preservation of ethnomedicinal knowledge is utmost need of the present time. The study tries to understand the economic importance of ethnomedicine as one of the livelihood provisions and conservation practices among them. Ethnobotanical survey with systematic multistage sampling technique was conducted on 217 households in two blocks of Jambani and Belpahari under Jhargram District during 2024-2025. Information on medicinal Plant species used for economic purpose were collected and Documented Various quantitative indices were calculated to understand the economic dependence, its asymmetric trend and Conservation Effort Score was calculated to understand the present perception and effort of the community towards conservation of these resources. Pertial Least Square Regression was employed to understand the relationship between economic dependency and conservation effort of the community. Based on cross validation two latent components was selected with 62% of variation in CES across household. The Result suggest that high economic dependency, market chain exploitation and selling intensity decrease the conservation attitude among the community. Provident engagement with market, careful resource utilisation and household economic context can help enhancing community level conservation effort.

Abstract ID-031003353

Isolation, Identification and Nitrogen Removal Performances of Culturable Heterotrophic Nitrification-Aerobic Denitrification Bacteria (HN-AD) from Carp Culture Ponds for Water Quality Management

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The rapid growth of the aquaculture industry raises significant concerns about the environment, particularly on the nitrogenous waste pollution. Bacteria exhibiting heterotrophic nitrification–aerobic denitrification (HN-AD) ability can simultaneously remove ammonia, nitrite, and nitrate within the same system. They exhibit enhanced growth and resilience compared to the autotrophic nitrifiers and anaerobic denitrifiers involved in traditional nitrogen removal methods. A bacterial strain, designated HNF_M1, was isolated from carp pond water and identified as *Pseudomonas qingdaonensis* through phylogenetic analysis of its 16S rRNA gene sequence. This strain was selected for its strong capability to remove ammonia compared to other isolates, with no accumulation of nitrite. Under aerobic conditions, it was able to degrade 88 ± 3.21% NH_4^+-N, 85 ± 2.72% NO_3^--N, and 82 ± 2.21% NO_2^--N within 48 hours in culture medium. Therefore, it was inferred that the nitrogen removal by strain HNF_M1 occurred through a mechanism involving heterotrophic nitrification coupled with aerobic denitrification. The optimal conditions for achieving maximum nitrification activity by strain HNF_M1 were determined to be a pH of 7.5, temperature of 31 °C, C/N ratio of 8, and shaking speed of 120 rpm. Moreover, strain HNF_M1 demonstrated excellent biosafety towards *Labeo bata*. These findings suggest that HNF_M1 holds promising potential for use in bioremediation strategies aimed at removing ammonia from freshwater aquaculture environments.

Abstract ID-032027771

Exploring the Potentials of *Moringa oleifera* Leaf as a Plant-Based Feed Ingredient to Sustainable Alternative in Aquaculture : An Analysis of Growth Performance and Haematological parameters in *Labeo bata*

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The rapid expansion of aquaculture has created an urgent demand for cost-effective and nutritional balanced feeds, particularly for *Labeo bata* ,one of the most widely culture fish worldwide. Fishmeal, the conventional protein source, is expensive and unsustainable. *Moringa oleifera*, known as the ''miracle tree'', offers a promising alternative due to its high protein, vitamin, and mineral content. The present study examined the replacement of fish meal(FM) with different ratios of M. oleifera leaves to assess the growth performance, haematological parameters of *Labeo bata* during a 90-day period .Five different dietary groups were prepared with a basal diet and varying amounts of M. oleifera leaf meal by replacing T1(0%MOL), T2 (25%MOL), T3 (50%MOL), T4 (75%MOL) and T5 (100%MOL) of FM component of the diets. The findings revealed significant differences in growth parameters, with the fish fed the T4(75% MOL) diet exhibiting the highest final weight and specific growth rate when compared to the other diets. The mean values of Red Blood Cell,White Blood Cell were significantly highest in fish fed the D4 diets. In conclusion, the aquafeed industries might use MOL in place of 75% FM to improve *Labeo bata* growth and health states. It can also improve fish's ability to withstand adverse environmental conditions and improve their haematological function.

Abstract ID-032351465

Studies on organ indices, Organ-specific Biochemistry in *Anabas testudineus* (Bloch 1792), exposure to Paraquat Dichloride

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Paraquat, a widely used non-selective herbicide, poses significant ecological hazards owing to its persistence and bioaccumulation potential. The present study investigates the impact of the herbicide paraquat dichloride (PD) on the freshwater fish *Anabas testudineus* (Bloch, 1792), focusing on organ indices and organ-specific biochemical responses under both acute and chronic exposure conditions. In this experiment, fish were exposed to sub-lethal concentrations derived from 96-hour LC_{50} values to assess changes in HSI, RSI, SSI, CSI, GSI(M), GSI(F) indices, along with biochemical parameters such as total protein, glucose, Cholesterol, and enzyme activities (ALT, AST, ALP) in liver, kidney, gill and muscle tissues. Results revealed significant organosomatic changes, such as increases in HIS (0.82 to 0.98 in 96h and 0.83 to 1.09 in 28 days) and decreases in the values of RSI (0.65 to 0.48 in 96h and 0.66 to 0.34 in 28 days). Significant alterations were observed in biochemical profiles, indicating metabolic stress and hepatotoxicity. Elevated transaminases and alkaline phosphatase indicated hepatic and renal impairment. Changes were greater and more persistent after chronic exposure than in the acute toxicity test. Together, organ-level indices and tissue biochemical parameters provided sensitive, complementary measures of PD toxicity in *A. testudineus*. These findings underline the ecological risk posed by PD contamination and support the use of environmental monitoring and risk assessment.

Abstract ID-033948404

Impact of Short-term Thermal Stress on Hematological Parameters and Protein Content in Freshwater Walking Catfish *Clarias batrachus* (Linnaeus, 1758)

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Global warming has drastically changed the world's climate, affecting the water ecosystems by rising water temperature that possessed a significant influence on aquatic life especially fish. In view of these environmental changes, the present study was undertaken to explore how acute thermal stress affects blood parameters and protein content of the economically important freshwater walking catfish species Clarias batrachus. Fish were experimentally exposed to four different temperature ranges i.e. 25°C (Control), 28°C, 31°C and 34°C for duration of 24, 48, 72 and 96 hours respectively under controlled laboratory conditions. Some selected hematological parameters were examined and muscle total protein content was estimated in standard methods. Findings revealed that hemoglobin (Hb), total count of erythrocyte and lymphocyte increased progressively with rising temperature and exposure duration, indicating enhanced oxygen demand and compensatory erythropoietic activity under stress. Conversely, erythrocyte sedimentation rate (ESR), mean corpuscular volume (MCV) and mean corpuscular hemoglobin (MCH) showed a marked decline with thermal stress, reflecting altered cell morphology and oxygen-carrying efficiency. Mean corpuscular hemoglobin concentration (MCHC) showed irregular fluctuations rather than a uniform trend with temperature exposure. Muscle protein content decreased significantly with temperature and time, indicating increased proteolysis and as a result reduced nutritional value of the fish. These findings demonstrate that acute thermal stress induces profound hematological and biochemical alterations in C. batrachus. Such alterations, in the context of global warming, may adversely affect fish health, productivity and nutritional quality highlighting the need to develop effective thermal management strategies in aquaculture.

Abstract ID-041654270

Impacts of post-harvest gamma irradiation on guava fruits both at ambient and cold storage condition

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An experiment comprised with four low doses gamma radiation along with a non-irradiated (control) batch of fruits was conducted at Bidhan Chandra Krishi Viswavidyalaya during 2021-22 to study the impact of post-harvest gamma irradiation on shelf life and quality parameters of guava fruits both in ambient and cold storage condition. Experiment results revealed that irradiation with 200 Gy was shown to extend the shelf life of guavas more than other doses as it kept guavas for longer duration of 77% and 33.15% than non-irradiated fruits in ambient and cold storage, respectively. The same treatment showed ability to reduce the decayed fruit percentage with 179.62% and 345.69% higher than the control treatment on 9th day of room storage and 20th day of cold storage, respectively.

Fruits treated with 100 Gy gamma ray dosage had the highest TSS (13.64 °Brix) up to the 9th day of room storage, while fruits treated with 200 Gy had the highest TSS (10.28 °Brix) on the 20th day of cold storage while non-irradiated guava fruits measured less acidity over the storage duration in both keeping conditions.

Guavas treated with comparatively lower doses, i.e., 100 and 200 Gy, retain consumer preferable appearance and texture even up to the 9th day in ambient storage. In cold storage, all four-gamma radiation doses retained a consumer preferable score up to the 20th day, where the chronology for higher score procurement was 200 Gy > 100 Gy > 300 Gy > 400 Gy.

Abstract ID-085443598

Harnessing Selenium as a powerful antioxidant to strengthen salinity resilience in summer Green Gram (*Vigna radiata* L.)

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Selenium (Se) mitigates salinity-induced oxidative stress in plants by enhancing antioxidant defense, maintaining ionic homeostasis, and improving nutrient assimilation. However, its efficacy under varying salinity intensities and application methods remains inadequately explored in salt-sensitive legumes such as green gram (*Vigna radiata* L.). A pot study was therefore conducted to evaluate the influence of selenium on the growth, yield, and nutrient uptake of summer green gram under induced salinity. The experiment employed a factorial completely randomized design with twenty-four treatment combinations, comprising three seed priming levels (0, 3, and 6 mg L^{-1} Se), four salinity levels (0, 2, 4, and 6 dS m^{-1}), and two foliar application treatments (with or without 1.5 mg L^{-1} Se).

Results demonstrated that Se-priming significantly improved plant height, dry matter accumulation, relative leaf water content, and crop growth rate. Moderate salinity (4 dS m^{-1}) elicited adaptive responses, including elevated relative leaf water content and leaf area index, whereas severe salinity (6 dS m^{-1}) severely diminished growth and yield. The combined application of seed priming and foliar Se spray enhanced stress resilience, with the highest grain yield (4.2 t ha^{-1}) achieved using 6 mg L^{-1} priming under 2 dS m^{-1} salinity with foliar Se. A strong positive correlation (R^2 = 0.98) was observed between Se mediated seed priming and grain nitrogen as well as protein content. In conclusion, Se application, through seed priming and foliar spray, effectively foster salt tolerance, improved productivity and enriched grain quality of green gram even under severe salinity stress.

Abstract ID-122321559

Hunting for salt-tolerant and micronutrient-rich rice in coastal saline zone of West Bengal integrating phenotypic and molecular profiling

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Rice (*Oryza sativa* L.) is a major food crop that feeds billions of people. Its production is now facing severe challenges due to environmental stresses made worse by climate change. Among them, soil salinity is one of the most detrimental. It affects almost every stage of plant growth, reducing yield and grain quality. The problem is more hazardous in coastal areas because of rising sea levels and saltwater intrusion. Most earlier studies focused only on salt tolerance at the seedling stage under controlled conditions. However, tolerance at this stage may not endure during later growth stages. The effect of salinity on important grain micronutrients like zinc and iron is underexplored. The study evaluated 118 traditional rice landraces under natural saline field conditions to find genotypes that can tolerate salt stress while maintaining levels of zinc and iron in grains. Traits such as Na^+/K^+ ratio, days to 50% flowering, number of productive tillers, unfilled grains per panicle, and fertility percentage were found to be the most important for maintaining grain yield under salt stress. The dual-level screening further included 29 salt-linked microsatellite markers, which supported the field results. Marker RM10740 had the highest PIC value, and OsCAX(T) showed the maximum alleles. Based on both phenotypic and molecular data, this study identified Bhutmuri, Okhrajhama, Madhabi, Machkantha, Talmugur, Naichi, Kuthir, and Tapan 2 as true salt-tolerant landraces. These genotypes can serve as valuable sources for breeding programs to develop salt-tolerant and micronutrient-rich rice varieties.

Abstract ID-032848358

Fermented Fish Waste Meal: A Sustainable and Nutrient-Rich Alternative to Conventional Fishmeal

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This study investigated the preparation of Fish Waste Meal (FWM) through natural fermentation of fish processing by-products using molasses and baker's yeast (*Saccharomyces cerevisiae*), and compared its microbial and nutritional characteristics with conventional fish meal (FM). Fish waste consisting of head, viscera, and bones was fermented for 28 days at ambient temperature with 50% molasses and 10% yeast. Microbial counts were assessed at 7-day intervals, and proximate composition was analyzed following AOAC (1990) methods. Results showed a progressive increase in beneficial microbial populations, with lactic acid bacteria and yeast reaching peaks of 10^8 CFU/g by day 14, followed by dominance of *Bacillus* spp. in the later fermentation phase (day 21–28). The fermented FWM exhibited enhanced nutritional quality, with crude protein and lipid contents of 57.62% and 9.85%, respectively, compared to raw fish waste (42.36% and 6.47%) and slightly lower than commercial FM (62.41% and 8.97%). The fermentation process improved product stability, odor, and digestibility. The results demonstrate that naturally fermented FWM possesses comparable nutritional quality to FM and can effectively replace 75–100% of FM in aquafeeds. This eco-friendly bioconversion process offers a sustainable solution for fish waste management and feed cost reduction in aquaculture.

Abstract ID-085612808

Fabrication of CuO-ZnO nanocomposite for efficient photocatalytic degradation of norfloxacin under direct sun light

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The widespread presence of antibiotic contaminants in water poses severe ecological and health risks by promoting antimicrobial resistance, while conventional treatments often fail to eliminate them completely. Solar-driven semiconductor photocatalysis offers a sustainable route for their mineralization. In this study, CuO-ZnO nanocomposite was synthesized via co-precipitation method and structurally characterized using XRD, HR-TEM, and EDX mapping. The XRD pattern revealed a dominant (101) diffraction peak, indicating preferred growth along the c-axis of hexagonal wurtzite ZnO. The XRD analysis reveals that such variations indicate a strong interfacial interaction between the monoclinic CuO and hexagonal wurtzite ZnO phases, resulting in modifications in crystallite size, lattice strain, and preferred orientation. These structural adjustments facilitate efficient charge transfer across the CuO-ZnO interface, enhance charge-carrier separation, and thereby improve the overall photocatalytic activity under visible-light irradiation. The optimized CuO-ZnO composite achieved 93% degradation of norfloxacin (NOR) within 90 min under visible light. This work emphasizes interface engineering and morphological control to enhance light absorption, charge separation, and stability. The photocatalyst will be immobilized on a low-cost substrate for continuous-flow operation, highlighting an environmentally benign and sustainable approach for efficient antibiotic wastewater treatment with potential applications in fisheries and veterinary science.

Abstract ID-093205842

Socio-Ecological Decision-making in Chaotic Agricultural environments: Pathway to adaptation and Sustainability

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A chaotic situation in farming refers to a state of disruption, unpredictability, and uncertainty that affects the normal functioning of agricultural systems. Such conditions emerge from extreme weather events, economic crises, pest outbreaks, and other unforeseen disturbances, leading to significant impacts on food production and farmer livelihoods. Chaotic analysis in agriculture focuses on identifying, evaluating, and interpreting the relationships between different sources of risk and their potential consequences. This analytical approach helps stakeholders understand critical thresholds beyond which farming systems become unstable or inefficient. Adaptation and sustainability are achieved by implementing proactive strategies designed to minimize risk exposure and strengthen system resilience. These measures may include diversification, innovation, and resource optimization practices that enable farmers to maintain stability despite complex disturbances. Decision-making behaviour plays a crucial role in managing uncertainty, as farmers must analyse dynamic conditions and respond with informed, timely actions. By integrating chaotic analysis with adaptive decision processes, farming systems can anticipate disruptions and reduce vulnerability. Empirical evaluations indicate that the use of adaptation models enhances predictive capacity and supports better preparedness for both climatic and economic risks. Scientific assessment shows that farms applying chaotic analysis-based decision frameworks achieved 25 to 30 percent higher yield stability and improved resource use efficiency compared to conventional systems, confirming the practical potential of chaos theory applications for strengthening agricultural resilience and sustainability under uncertain and rapidly changing environmental conditions.

Abstract ID-100219617

Spatial Analysis and Regionalisation of Cropping Patterns: A Case Study in Bankura, West Bengal

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Agriculture plays a pivotal role in the economic development of a country, particularly in rural India, serving as the principal source of livelihood for a substantial portion of the population. Due to increasing demographic pressure and climate change, understanding the dynamics of cropping systems is crucial in ensuring food security and agricultural sustainability. This study thus aims to examine the intra-district differentials in cropping patterns (in terms of crop concentration, crop combination, and crop diversification) of six major crops using the District Statistical Handbook (2020) in Bankura, West Bengal. Karl-Pearson's correlation, composite indices, coefficient variation, standard deviation, and choropleth maps were employed to comprehensively understand the crop dynamics in the study area. The finding reveals a significant variation in the selected crops across the blocks. The higher irrigation intensity reflects the higher productivity and crop diversity. Therefore, it is suggested that policymakers and agro-economists design targeted interventions based on location-specific frameworks to enable farmers to practice cost-effective and sustainable farming.

Abstract ID-105714247

Impact of Sowing Dates on Yield and Radiation Use Efficiency of Greengram (Vigna radiata L.)

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Greengram (mung bean) is an important edible legume due to its high protein content. In India, the total pulse production was 247 lakh tonnes, with a productivity of 843 kg ha^{-1} during 2022-23. Around 10% less productivity in West Bengal might be due to inadequate knowledge of optimal variety selection, sowing time, and agronomic management. Sowing time is a critical towards capturing micrometeorological parameters, especially photosynthetically active radiation, which is essential for crop photosynthesis, biomass accumulation, and yield enhancement. Early sowing increases biomass, while delayed sowing reduces radiation use efficiency (RUE) and dry matter, ultimately lowering yield; thus, both cultivar and sowing time are crucial. The present study aims to identify the optimal sowing time and suitable mung bean cultivar for maximising seed yield and RUE.

The field experiments were conducted during the summer seasons of 2024 and 2025 at B.C.K.V., Kalyani, New Alluvial Zone of West Bengal using a split-plot design with four sowing dates (Feb 14, Feb 28, March 12, March 26) as main plot and three cultivars (Samrat, Sikha, Meha) as sub-plot treatments. Delayed sowing resulted the highest crop growth but suffered severe yield loss due to heavy rainfall during the reproductive stages. The 28th February sowing achieved the highest seed yield (1252 kg ha^{-1}). The highest RUE was recorded in the 14th February sowing (0.60 g MJ^{-1}). Among cultivars, Sikha and Meha demonstrated superior RUE and yield and 28th February is identified as the optimal sowing date, for highest yield and satisfactory RUE in this region.

Abstract ID-064711462

Nematode–Bacteria Interactions and Soil Function in Paddy Agroecosystems: Metagenomic Insights for Sustainable Management

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Soil health and ecosystem stability in paddy fields are profoundly influenced by interactions between free-living nematodes and rhizospheric bacterial communities. This study employs a metagenomic framework to elucidate the co-occurrence patterns, diversity, and functional associations between nematodes and bacteria, with the aim of assessing agroecosystem disturbances and promoting sustainable management of plant-parasitic nematodes (PPNs) in rice, a major staple crop in India.

Rhizospheric soil samples collected from East Midnapore district revealed distinct taxonomic assemblages of free-living nematodes across varying disturbance gradients as indicated by colonizer–persister (c-p) values. Calculated ecological indices – maturity index (3.18–4.20), channel index (14.41–16.80), nematode channel ratio (0.78–0.81), and enrichment index (86.99–88.23) suggests bacterial-dominated decomposition pathway and moderately disturbed agroecosystem. Despite the known prevalence of PPNs such as *Meloidogyne*, *Heterodera* and *Globodera* in Indian rice fields, a higher abundance of free-living, particularly bacterivorous nematodes (*Mesorhabditis*, *Acrobeloides*) were observed.

Metagenomic (16S rRNA) profiling identified forty-five bacterial taxa dominated by *Proteobacteria*, *Acidobacteriota*, *Chloroflexi*, and *Firmicutes*, many of which are key agents in nutrient cycling and phosphorus mobilization. Nematode–bacteria interactions, encompassing trophic associations, enhance microbial turnover, CO_2 and NH_4^+ release, and nutrient mineralization, collectively improving soil fertility. Experimental evidences further demonstrate that bacterial-feeding nematodes such as *Protorhabditis* modulate microbial composition and mitigate N_2O emissions. Additionally, several bacterial genera (*Bacillus*, *Pseudomonas*, *Clostridium*, *Actinomycetes*) exhibited nematicidal activity against major PPNs.

Overall, these findings emphasize the ecological and functional significance of nematode–bacteria interactions and highlight their potential role in sustainable biological management of nematodes in paddy-based agroecosystems.

Abstract ID-035320683

Livelihood and socio-economic status of fishermen community in Digha Coast of West Bengal, India

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Marine fishing is one of the most significant livelihood opportunities for the residents of the Digha Coastal region, and their socioeconomic status is significantly influenced by it. The objective of the current investigation is to evaluate the socioeconomic status of the fishermen Community of Digha Coast. Selected localities in the Digha Coastal region were the source of the data collection. A random sample of 2656 respondents were analysed. In order to ascertain the socioeconomic status of the fishermen community, the questionnaire survey procedure was implemented. Cross-tabulation and percentage analysis were implemented in this investigation. The interpretations that were made during the investigation are the basis for the findings and observations. The outcome indicates that 30% of the 618 families are above the poverty line, while the remaining 70% are below the poverty line, as per the FAO's guidelines. The present investigation will contribute to the creation of novel economic prospects and the expansion of the resource base to impoverished coastal populations.

Abstract ID-112258334

Production Metrics of Citronella under the Influence of Integrated Nutrient Management and Weather Variables

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Citronella, a prolific aromatic crop, is renowned for its monoterpenes-rich essential oil, cultivated for its unique scent, strong repellent properties, holds its economic value for diverse medicinal, cosmetic, and aromatherapy. Growing citronella cv. Jalpallavi, in India's Eastern zone, is deeply influenced by agronomic and environmental factors; consistent nutrient management becomes critical for sustaining production. To make this understanding more conspicuous, this investigation evaluated varying proportions of inorganic and organic nitrogen—applied individually or with Azotobacter—to determine their influence on citronella's growth, yield, essential oil production, and nutrient absorption under favourable agro-climatic conditions. This study addresses a critical gap how inorganic, organic inputs-Azotobacter, enhance nutrient bioavailability and interact with weather fluctuations. A randomized complete block design with eleven treatments and three replications showed that 50% inorganic and 50% organic nitrogen combined with Azotobacter notably enhanced plant height (12.94%), LAI (99.68%), LAR (15.01%), CGR (83.40%), biomass (69.41%), and essential oil (108.57%) over control. Whereas, the synergy between 75% inorganic and 25% organic nitrogen, with Azotobacter, remarkably improved plant height (22.65%), LAI (109.44%), LAR (15.70%), and CGR (116.60%), indicating better nutrient-driven biomass distribution in response to control. Overall, this combination resulted in 76.47% more biomass and 114.28% higher oil yield than control, emphasizing their importance in sustaining productivity. Favourable weather conditions, including moderate rainfall and temperature, further enhanced these benefits, underscoring the influence of environmental context on agronomic outcomes. Combining inorganic, organic inputs-Azotobacter improves nutrient absorption and economic returns, providing a scalable, eco-friendly approach to boost citronella cultivation in resource-limited farming systems.

Abstract ID-060736718

Climate risks through farmers' eyes: a study from two Agro-climatic zones of West Bengal

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More than half of India's population is dependent on its agricultural sector. Although the sector is highly susceptible to climate change, temperature variations, precipitation patterns, and extreme weather patterns. The Terai Alluvial Zone (TAZ) experiences high rainfall, soil acidity, and waterlogging, whereas the New Alluvial Zone (NAZ) has low rainfall, salinity, and drought. The present study attempted to investigate the perceived risk of climate change to farmers in these two zones in terms of its effects on their agriculture and livelihoods. The data were gathered from 300 randomly selected farmers between 2019 and 2024 from TAZ and NAZ through structured interviews and focus group discussions. The responses were analysed using correlation, multiple and stepwise regression, Artificial Neural Network modelling, and path analysis. Results show that in the TAZ, market distance, availability of climate-sensitive technologies, family size, crop rotation variety, and age positively affect the perceived climate risk, whereas social participation, livelihood diversification, agri-allied engagements, access to credit, and coping knowledge have a negative impact on perceived risk. Lower climate risk perception in the NAZ has a strong relationship with credit availability, livelihood diversification, coping strategies, access to climate information, and market distance. The study concludes that farmers in different regions are exposed to usual climatic conditions, but they adopt different forms of adaptation. Site-specific adaptation policies focusing on flood resilience, sustainable irrigation, integrated land use, livelihood diversification, and better access to resilience technologies are critical factors that enhance agricultural sustainability in the long term in West Bengal.

Abstract ID-105857647

Application of GIS and Wroclaw taxonomic method for the Identification of Agriculturally Problematic blocks of West Bengal

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West Bengal is predominantly an agricultural state of eastern India and plays a vital role in its economy. The agricultural status of West Bengal in comparison to other state of India is not so satisfactory. Though this state has all potentialities in terms of climate, soil, water availability, there is a wide variation of such potentialities in local level or block level. Present study aims to identify those blocks having agricultural problem on the basis of two well-known methods like Wroclaw Taxonomic Method and Weightage overlay method. On the basis of Wroclaw taxonomic method, since 1995 to 2015, 2001 is the most problematic year as 99 % blocks of this state have low agricultural status. Purulia, Purba Medinipur, South 24 Paraganas, Howrah, Darjeeling, Bankura, Jhargram, Paschim Burdwan and Birbhum districts are more problematic in agriculture. From the analysis of both methods, it is identified that western, southern and northern districts have more problematic blocks because of having low to moderate agricultural status. In crop wise status, more than 40 % blocks of this state have low to moderately low status in aus paddy, jute, til, and wheat.

INFORMATION & COMMUNICATION SCIENCE AND TECHNOLOGY (INCLUDING COMPUTER SCIENCES)

Abstract ID-082431261

An AI-Driven Framework for Voice Phishing (Vishing) Attack Detection and Prevention

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Voice phishing, also known as vishing, has become to be an alarming cybersecurity risk in which criminals use telecommunications networks to trick victims into disclosing private information. The constantly changing and dynamic nature of vishing attacks frequently makes traditional detection techniques, including rule-based filtering and speech biometrics, unsuccessful. This study proposes an AI-driven architecture for voice phishing attack detection and prevention in order to overcome these issues. To accurately determine fraudulent intent during voice interactions, the system uses lightweight transformer models that integrate context-aware language understanding with speech-to-text conversion. This application improves prevention by combining detection with an adaptive response mechanism that can instantly notify users or stop suspicious calls. In terms of accuracy, scalability, and inference speed, experimental evaluations on benchmark and real-world datasets demonstrate that lightweight transformers perform better than conventional machine learning and deep neural network models. The DistilBERT model shown outstanding performance and efficiency with 98.9% accuracy, 98.8% precision, and 99.0% recall after being trained on 1,089 samples in five categories. These results demonstrate that the proposed system is a workable, deployable, and resource-efficient solution for protecting mobile devices and telecommunications systems against new vishing attacks.

Abstract ID-120925691

Mahalanobis Fuzzy C-Means for skin lesion segmentation in YCbCr color space

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Numerous types of cancers have affected people in recent decades. Unregulated proliferation and neoplasms on the skin may result in skin cancer. Accurate segmentation applying computer-aided diagnostic (CAD) methods for the diagnosis and analysis of dermoscopic images is a substantial obstacle for medical applications. Early detection of skin cancer improves survival and reduces the risk of complications for patients. Scientists employ numerous clustering techniques to identify and delineate the boundaries of cancerous cells. The k-Means (KM) algorithm is a "crisp" or "hard" clustering technique, while the Fuzzy C-Means (FCM) algorithm is a "soft" or "fuzzy" clustering method that is often used for image segmentation. Generally, these algorithms utilize Euclidean distance and are applied to RGB color images. Euclidean distance examines all dimensions uniformly, whereas Mahalanobis distance accounts for data covariance, allowing it to better respond to correlations and scale differences. In our experiment, we constructed a Mahalanobis distance-based Fuzzy C-Means (MFCM) and applied it to a YCbCr color image. The Mahalanobis distance-based fuzzy approach is more effective for image segmentation. It provides a more specific separation of regions for the damaged area of skin. Each image possesses unique characteristics for every color system; hence, we select the YCbCr color space, which is more efficient than RGB. We evaluate our methods using the International Skin Imaging Collaboration (ISIC-2016) dataset and achieve an accuracy of 94.52%. Our work may yield significant advancements in medical science and computer vision.

Abstract ID-055623809

Determinants of Internet Use and Digital Skill Levels in India: Evidence from the NSS 80th Round

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In the twenty-first century, digital skills and internet access are essential communication facilitators for social inclusion, work, and education. Despite India's rapid progress of digital technology and internet users, there are still significant disparities between geographic and socio-demographic groups. The main objectives of the present study are to investigate the level of digital skills and associated factors that influence internet use and digital skills. This study used the 80th round of the National Sample Survey (NSS) data to analyse 91,385 people who were 15 years and above. A composite Digital Skill Index (DSI; range 0-8) was developed from eight ICT related tasks and divided into four levels: No (0), Low (1-3), Moderate (4-6), and High (7-8) digital skills. Bivariate relationships were tested using chi-square analysis, and significant predictors of DSI categories were identified using a partial proportional odds logistic (PPOL) regression model. The results showed that 12.3% had "no", 28.0% had "low", 42.9% had "medium" and 16.7% had "high" digital skills (HDS). All socio-demographic variables were statistically significant both chi-square ($p<0.001$) and PPOL model (pseudo-$R^2=0.14$; $p<0.001$). Younger age, male gender, smaller household size, higher expenditure, urban residence, and western and southern regions had a higher odds ratio of HDS compared to the reference groups. Despite its cross-sectional design, the study shows ongoing digital disparities caused by socioeconomic and geographic disparities. Policies should include affordable infrastructure, increased digital literacy and institutionalized skill development programs to achieve inclusive participation in the digital economy of India.

Abstract ID-083649276

Catching the Lie: An AI-Based and Data-Driven Framework for Deceptive News Detection

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In today's digital era, the rapid spread of misinformation and deceptive news poses a serious threat to public trust, social stability, and information integrity. The study, "Catching the Lie: An AI-Based and Data-Driven Framework for Deceptive News Detection," offers a thorough method that makes use of machine learning (ML) and artificial intelligence (AI) approaches to recognize and categorize fake news on various digital platforms. The suggested system uses cutting-edge Natural Language Processing (NLP) techniques to integrate several text processing phases, such as data collecting, tokenization, text normalization, and feature extraction. The efficiency of a number of machine learning models, including Random Forest, Logistic Regression, Support Vector Machine (SVM), and Transformer-based architectures, in identifying misleading information was assessed. In order to ensure robustness and generalizability, a data-driven approach was used to train and verify the models using real-world news datasets. The model's performance was evaluated using common evaluation metrics, such as F1-score, accuracy, precision, and recall. The findings of the experiment showed that SVM and Logistic Regression had the highest accuracies of 0.90 and 0.88, respectively, indicating good recall and precision in differentiating between real and fake news. Furthermore, using a pre-trained BERT model, the SequenceClassifier produced an amazing accuracy of 99.96%, greatly exceeding conventional machine learning techniques.

Abstract ID-082348282

DeepDetect-Audio: Identifying DeepFake Speech Using XAI

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Fake content produced by AI methods such as deepfakes has reached a level of realism comparable to authentic media. Because of increasingly realistic deepfakes, the integrity of digital content is at risk, and they contribute to spreading false narratives. Altering media content sparks serious concerns across fields ranging from politics and entertainment to social networking. To curb the spread of deception, robust tools for detecting audio deepfakes are required. To mitigate the impact, this study puts forward a robust model for identifying deepfakes, which incorporates various Explainable Artificial Intelligence (XAI) techniques. This research synthesizes fake audio from The Fake or Real (FoR) dataset utilizing Generative Adversarial Neural Networks (GANs). The primary focus of the research is on reliable and accurate detection, and the clear model interpretability supports efficient deepfake identification. We achieve notable success in discerning real from manipulated audio by employing iterative testing and optimization strategies. The evaluation outcomes demonstrate a significant level of accuracy, indicating strong potential for deployment in real-world scenarios. Experimental outcomes reveal clear superiority over earlier frameworks with an accuracy of 99.98% for the FOR-ORIGINAL dataset.

Abstract ID-095940781

Dual Differential Privacy-based Decentralized Federated Learning for Soil Moisture Monitoring

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The conventional cloud computing and Internet of Things (IoT)-based soil moisture monitoring and irrigation management systems often have issues with data security, privacy leakage, high response time, etc. This paper proposes a secure decentralized federated learning (DFL) framework for soil moisture monitoring and irrigation management. Four sensors are used for collecting soil moisture, soil temperature, environmental temperature and humidity data collection. The collected sensor data are distributed among the edge devices. Then data pre-processing is performed for data cleaning, removing data outliers and deal with missing values. After that Gaussian noise is added to the local datasets. For local model training Long Short-Term Memory (LSTM) classifier is used to capture temporal dependencies as well as nonlinear dependencies that characterize irrigation needs. Each edge node performs local model training on the differentially private datasets. During exchange of model updates among themselves the edge nodes add Gaussian noise to the local model weights. As Gaussian noise is added two times, dual differential privacy is performed, and a more secure and privacy-aware framework is obtained. After receiving differentially private local model weights, each edge node performs aggregation, and shares model update with neighbour nodes. This process is repeated until each node's model loss becomes minimal. Experimental results show that the proposed framework achieves above 85% prediction accuracy and reduces the response time than the edge–cloud and cloud-only systems. By performing Gaussian noise addition to the local datasets and model weights, a secure soil moisture monitoring framework is developed for smart irrigation management.

Abstract ID-113125147

A Secure Image Watermarking Optimization Technique using Hybridization of Particle Swarm Optimization (PSO) algorithm and Genetic Algorithm (GA) in Integer Wavelet Transformation Domain

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In digital watermarking technique, to handle robustness and invisibility, simultaneous watermark optimization is essential. In the proposed work, a Particle Swarm Optimization (PSO) algorithm combined with a Genetic Algorithm (GA) and supported by Integer Wavelet Transform (IWT) is introduced. GA performs wide exploration through crossover and mutation to avoid local minima, while PSO rapidly fine-tunes solutions using velocity and position updates. GA adds diversity to help PSO escape local optima. So, this process identifies optimal embedding locations in the host image. It greatly improves robustness and imperceptibility of the watermarked image. Important evaluation matrices such as PSNR, MSE, SSIM and Q-Index are incorporated to determine the quality of the watermarked image, specifically assessing its visual transparency. The average PSNR achieved is 55.10 dB which indicates that visual standard is outstanding. The Q-Index and SSIM scores are almost 1, which confirms the image's significantly enhanced quality. The watermark was extracted almost flawlessly, resulting in a BER value of nearly 0. The minimal difference in SD value and CC score between the cover image and its watermarked version clearly demonstrates the high robustness of the proposed scheme. This ensures that the watermark can be extracted even when the image is subjected to common attacks like JPEG compression, various filtering, noise addition, and geometric changes. As a result, this strong resilience establishes the hybrid model as a powerful, reliable and effective approach for ensuring digital rights management in multimedia applications.

Abstract ID-091104676

A Blockchain-LWT based Reversible Medical Image Watermarking Scheme using CRS Interpolation

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After COVID-19, healthcare has become heavily dependent on digital systems, with doctors providing online consultations and e-prescriptions. However, it increases the risk of data misuse, making medical information security a major concern. Watermarking strategies are widely used to safeguard the identity and copyright of a patient's medical documents.

This proposed work provides a new blockchain-based watermarking approach using Lifting Wavelet Transform (LWT) technique. The distributed nature of blockchain makes it more secure. With a consensus mechanism, the data integrity and authenticity will be preserved when watermarked images are extracted at the receiver end using a watermarked hash ID and shared secret key stored in the blockchain. A shared user key, SHA-256, and Arnold Transformations have been utilized to enhance the security of the suggested scheme. Steganography with multilayer embedding (CRS) interpolation technique is used for embedding. The proposed scheme achieved a PSNR of 63.87 dB, SSIM of 0.99, and an MSE value of 483.63, which is better than other advanced blockchain-based approaches. The average values of NPCR is 96.36, and UACI is 32.84, which are quite close to the optimal value.

Therefore, it concluded that the recommended shared secret key is extremely safe. The encryption and decryption time of the suggested scheme is decreased compared to the other existing schemes. The experimental analysis shows that the suggested model is more effective than some modern techniques in terms of visual quality and security of medical images.

Abstract ID-021845695

Learning Driven Reversible Data Hiding Technique in Medical Imaging using Adaptive Histogram Shifting Strategy

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Artificial Intelligence (AI) has revolutionized the landscape of smart healthcare by enabling intelligent diagnosis, remote monitoring, and secure medical data management. In this context, the transmission of patient information through medical images plays a pivotal role in ensuring both accuracy and privacy. Among various techniques, reversible data hiding (RDH) has gained prominence for enabling secure and fully restorable data embedding. However, traditional RDH methods rely on static histogram-shifting mechanisms, which often limit their adaptability, embedding capacity, and robustness in clinical applications. This paper presents a learning-driven reversible data hiding framework that integrates an adaptive histogram prediction network to achieve intelligent, context-aware embedding in medical images. The proposed approach divides each DICOM image into regions of interest (ROI) and regions of non-interest (RONI) using a segmentation network to safeguard diagnostically relevant content. A convolutional predictor is trained to determine optimal histogram peaks, zero bins, and shifting directions, enabling low-distortion and high-capacity embedding of encrypted patient data. Experimental evaluations on standard X-ray, MRI, and CT datasets demonstrate that AHPN-Med achieves an average PSNR exceeding 68 dB, embedding capacity up to 1.2 bpp, and SSIM approx 1.0, significantly outperforming existing histogram-shifting based RDH approaches. Statistical tests and deep steganalysis tests further validate its imperceptibility, robustness, and reversibility, establishing AHPN-Med as a secure, intelligent, and reliable solution for medical image transmission in telemedicine and electronic health record systems.

Abstract ID-024938763

A heuristic with multiple search strategies for the GTSPs in different environments

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A novel heuristic search approach is proposed for solving Generalized Traveling Salesman Problems(GTSP) involving real and imprecise cost matrices. The process involves two phases where in the first phase sequencing of groups are made using a newly proposed procedure which involves rearrangeof K-nodes, and is named K-node rearrangement(KNR). In the second phase for each sequence of groups several strategies are proposed for the optimal selection of nodes from different groups. 3-opt operationis also used periodically to enhance the improvement of the search process. The algorithm is testedon a set of instances from GTSPLIB involving maximum 318 nodes and 64 groups, achieving 100% accuracy across all the runs and identified multiple optimal paths for some cases. Results demonstrate the algorithm's effectiveness in solving large-scale GTSPs involving real cost matrices. For the GTSPs involving imprecise(fuzzy/rough estimation) cost data, the same heuristic is used with the help of some existing comparison operators for the imprecise tour costs. The goal is to reduce the cost involving different real-life problems, like, municipal water supply, waste management, medical assistance camp, etc., which involves imprecise tour costs due to traffic congestion, road conditions, weather, etc. Internet of Things(IoT) enabled smart technologies are used for the same. The approach is also used to model a smart goods delivery system.

Abstract ID-102741597

A framework for controlled quantum image encryption and steganography using conditional phase embedding in the NEQR domain

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This paper suggest a framework for quantum steganography that makes it possible to secretly and carefully embed classical messages into quantum images that are encoded using the NEQR representation. Our framework logically combines a conditional phase-embedding steganographic operator with a Pauli-based image encryption (seeded by BB84-derived keys) into a single controlled unitary U_total, where recoverability and detectability are traded off by a tunable control-qubit superposition parametrized by angle θ. We offer resource and depth estimates, explicit gate-level decompositions of U_total (including MCX/MCT strategies and ancilla management), and formal security statements that quantify image confidentiality and interception detectability as functions of θ. We provide reproducible Qiskit experiments on NEQR toy states to establish robustness under depolarizing noise models. Multi-control decompositions, ancilla reuse, and noise-aware selections for short-term devices are all covered in the implementation phase. This framework provides a workable, auditable blueprint for secret quantum data transmission in the NEQR domain by bridging the gap between quantum image processing and quantum cryptography. The experimental results are compared with the existing quantum steganographic schemes which outperform with state of the art technology.

Abstract ID-113621554

SP-MSRecNet: A Deep learning based Spectral-Perturbation guided Multiscale Reconstruction Network for hyperspectral band selection

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Hyperspectral Imaging (HSI) acquires comprehensive spectral information over several continuous spectral bands, allowing for precise evaluation of the object of interest. However, the excessive dimensionality of HSI data increases computing cost and decreases classification efficiency when utilizing the Hyperspectral Image Classification (HSIC) model. Band Selection (BS) is important for HSIs to reduce the dimensionality by selecting most informative spectral bands, thereby reduces the computational complexity and enhances the classification performance. Conventional BS approaches sometimes struggle to acquire sensitivity of spectral bands, specifically around the spectral-spatial dimensions, limiting their efficiency. To overcome these issues, this work proposed a novel Spectral-Perturbation based Multiscale Reconstruction Network (SP-MSRecNet) for hyperspectral band selection. Unlike conventional BS method, the proposed Spectral-Perturbation (SP) module explicitly predicts the significant of each band by measuring the response variations cause perturbing each spectral channels, thereby generating adaptive and interpretable attention weights. A Multiscale reconstruction network (MSRecNet) then retrieves the original HSIs using 3D convolutional kernels of variable sizes, allowing discriminative characteristics to be captured at several scales. This SP-MSRecNet model enables efficient transmission of salient features while suppressing redundant or noisy bands, leading to the selection of highly informative spectral bands. Extensive experiments conducted by utilizing Salinas Scene, University of Pavia, and Indian Pines datasets shows that SP-MSRecNet successfully suppresses redundant bands while choosing the most significant ones, outperforming preceding BS methods in classification performance.

Abstract ID-114443108

Adaptive Complexity-Aware Invertible Neural Networks with Blockchain Integration for Secure Medical Image Steganography

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In the age of telemedicine, the security of medical image requires robust techniques to protect sensitive information during transmission while maintaining diagnostic integrity. Traditional reversible data hiding techniques achieve limited embedding capacity (below 4 bpp) and deep learning based methods lack integrity assurance. In this paper we proposed a framework (AC-INN-BC), integrating three security layers: chaotic Logistic-Sine Map encryption, an Adaptive Complexity-aware Invertible Neural Network featuring conditional coupling layers, and blockchain-based tamper detection techniques.

The proposed AC-INN architecture introduces a Complexity Analysis Module (CAM) that guides adaptive embedding of spatial image characteristics and region of interest (ROI) segmentation. Unlike conventional invertible network methods (ISN, HiNet), the conditional adaptive coupling blocks use complexity derived guidance that ensure optimal data concealing within non critical regions. The blockchain component stores cryptographic hashes of original, encrypted, and stego images which enable decentralized tamper detection without extra data transmission.

Experimental results on various medical image datasets shows perfect reversibility (PSNR = ∞, SSIM = 1.0) and excellent stego image quality (PSNR exceeding 51 dB). It also shows resistance to deep learning steganalysis (detection accuracy approx. 52%) and blockchain verification completed under 0.5 seconds. Its computational efficiency is also comparable with established methods. The framework achieves around 24 bits per pixel capacity.

Abstract ID-123710514

Secure Federated Learning Framework for Crop Yield Prediction

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Crop yield prediction has gained significant research interest in last few years in precision agriculture. The integration of artificial intelligence and Internet of Things (IoT) has enabled real-time data collection, analysis, and data-driven crop yield prediction. The soil and environmental data are collected and analysed using machine learning or deep learning models. However, the conventional cloud-centric systems suffer from high response time, compromising data security, privacy leakage, etc. To overcome these challenges, a federated learning framework is proposed for crop yield prediction based on edge-cloud computing. The edge devices train deep learning models on field-specific soil and environmental data, and only model updates are shared for aggregation in the cloud. In our framework, long short-term memory (LSTM) network is used for local data analysis. We have used LSTM to capture sequential data pattern. For secure model updates' exchange, Advanced Encryption Standard (AES)-128 algorithm is used. In our framework, local model weights are encrypted by the edge devices using AES. The encrypted weights are transmitted from the edge nodes to the cloud server that decrypts the model weights and performs aggregation of the local model weights. The experimental results demonstrate that the edge–cloud FL framework achieves prediction accuracy of 95%. The FL-based framework reduces the response time also than the edge-cloud and cloud-only frameworks. The results show that the proposed framework outperforms the existing machine learning and deep learning models used on the same dataset. The results also show that the proposed framework outperforms the existing crop yield prediction approaches.

Abstract ID-085017802

An Intelligent Hybrid Optimization Framework for Heart Disease Prediction Using Random Forest

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Cardiovascular diseases remain one of the global health priority concerns, necessitating increasingly precise and timely prediction models. This research proposes a robust machine learning framework for estimating heart disease by integrating data-driven learning with bioinspired optimization techniques. Cleveland and Hungary heart disease datasets were combined and pre-processed for consistent research data. Several machine learning models were trained and tested, such as Logistic Regression, Decision Tree, Random Forest and XGBoost, all seeking the best predictive model. Among the four, the Random Forest algorithm was the best performer and was selected for further optimization of its performance. For this purpose, a novel hybrid optimization technique has been proposed by combining a Genetic Algorithm with a Grey Wolf Optimizer. In this framework, while GA explores different hyperparameter configurations, the GWO algorithm fine-tunes the best solutions for a balanced search process. Then, the optimized Random Forest model was assessed using standard metrics such as ROC-AUC, F1-score, accuracy, precision and recall. The proposed framework therefore proved that integrating evolutionary optimization with ensemble learning can significantly enhance the predictive performance for healthcare applications.

Abstract ID-012701827

A Hybrid PSO–ANN Framework for Nonlinear Modeling of Urban Sprawl from Land Use and Socioeconomic Data: A Case Study of Jhargram, West Bengal

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Urban sprawl is a serious issue for managing land sustainably, especially in fast-growing areas. Predicting and modeling urban growth requires combining spatial land-use data with socioeconomic indicators. This study presents a hybrid framework that merges Particle Swarm Optimization (PSO) and Artificial Neural Networks (ANN) to model complex patterns of urban growth in Jhargram, West Bengal, from 2000 to 2020. The model uses land-use data and socioeconomic factors such as population density, literacy rate, household income, road proximity, and employment rates. PSO helps optimize the ANN weights and biases, which improves prediction accuracy and speeds up convergence. The framework shows strong reliability, with the ANN achieving a coefficient of determination (R^2) of about 0.90 between observed and predicted urban growth. Spatiotemporal analyses highlight significant growth along major transportation routes and increased pressure on surrounding agricultural land. The proposed PSO-ANN method offers a solid approach for urban planners and policymakers to foresee future sprawl, improve land-use planning, and reduce environmental and social issues. The findings stress the need to combine modern computational techniques with socioeconomic data for better urban development strategies.

Abstract ID-025703613

Artificial Intelligence and West Bengal's Cultural-Economic Sustainabilities

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Artificial Intelligence can be a sort of revolutionary weapon to ensure a resilient future for West Bengal in the fields of cultural preservation, digitization, innovation, cross-cultural negotiation, virtual tourism by creating new employment opportunities and accelerating a healthy economic growth for the respective state. West Bengal, a land of enchanting stories, myths, legends, rituals, customs can be identified with its diversity of cultural expressions. Rural Bengal has a treasure trove of tangible and intangible heritages to share with the global audience with the application of Machine Learning, Neural networks, Deep Learning, and Generative AI. We propose to revolutionize the cultural fields through the cost-effective as well as revenue generating aids of Artificial Intelligence. The incredible folklores and mythical tales can be adapted into AI generated films through AR/VR technologies with their translation into multiple languages and getting released worldwide. The young generation can seek the assistance of GPT, GEMINI, DEEPSEEK in producing rich audio-visual experiences and earn by selling their cultural products. The texts having appealing cultural and historical significance need to be digitized. The rich cultural sites should be enabled with the scope of AI aided virtual tourism to gain global exposure. An innovative Artificial General Intelligence can initiate a new cultural legacy and transform West Bengal dynamically by economically empowering the youth of West Bengal.

Abstract ID-032240262

Intelligent based Video Retrieval system using Keyframes

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The rapid expansion of video data across digital platforms has created an urgent need for efficient and intelligent video retrieval systems. Keyframe-based video retrieval has emerged as a prominent technique for representing, indexing, and retrieving video content by selecting a small set of representative frames that summarize the visual essence of a video. This approach selects keyframes to capture major visual and semantic changes, reducing redundant frame analysis. The process typically involves video shot segmentation, keyframe extraction, feature representation, and similarity-based retrieval. Early techniques relied on low-level visual features such as color histograms, textures, and edge information, while more recent methods employ clustering algorithms, motion analysis, and deep learning architectures to enhance selection accuracy and semantic relevance. Modern frameworks use CNNs and transformers to link pixels with visual understanding. These embeddings allow for efficient feature indexing and fast similarity computation, significantly improving retrieval performance. Keyframe-based retrieval not only reduces computational cost and storage requirements but also provides a concise visual summary useful for applications such as surveillance analysis, video summarization, and digital media management. The proposed method implemented an integrated retrieval framework combining audio feature extraction via VGG, video keyframe clustering (SKM), and cross-modal embedding with contrastive learning. The proposed system achieved a retrieval precision of 91.3% and reduced redundancy by nearly 12%, outperforming traditional techniques. The proposed framework consistently surpasses existing techniques in retrieval accuracy, computational efficiency, and robustness, offering more precise feature representation, enhanced cross-modal alignment, and stable performance even under challenging real-world and adversarial conditions.

Abstract ID-074720959

Secure and Reversible Data Hiding Technique for Healthcare System Using Weighted Matrix and Dual Image Strategy

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Telemedicine has become a demanding area of research in recent year. The major concern of this field is secure medical image transmission. Medical images play a vital role in accurate diagnosis, remote consultation and patient care, but sending them to public networks can expose their identity which are most important to protect for patient caring system. In the year 2018, Pal et. al. proposed a reversible data hiding technique based on weighted matrix which depends on an external index file for watermark extraction, this dependency increases system overhead and complexity and reducing efficiency. To address these limitations, we propose a novel reversible dual-image watermarking scheme based on a modified weighted matrix for securing digital medical images in telemedicine applications. Unlike traditional approaches, the proposed technique embeds watermark data across two stego images simultaneously, ensuring that the secret information cannot be revealed without both images being available. This dual-image mechanism significantly enhances security, robustness, and resistance against potential attacks without the need for any external index file. The experimental results demonstrate that our technique accomplish high visual fidelity with PSNR values above 52 dB and successfully reconstruct the source image and hidden information without loss, that is desirable for security of medical image transmission in telemedicine applications.

Abstract ID-092050271

A Hyper Heuristic with Clustering-Scheduling Approach for an Iot-Based Smart Waste Management System

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Abstract. In this study, an intelligent waste management system is proposed for managing municipal solid waste with minimum effort and expenditure by real time monitoring the garbage in the waste bins using Internet of Things (IoT). An IoT is associated with each community bin to track its position as well as the trash volume at any instant. A strategy for solving multi-depot multiple traveling salesman problems (MDMTSP) is used for clustering the bins and to determine the number the vehicles as well as their best schedules for the collection of waste and disposal. Different strategies are suggested for the dynamic selection of vehicles and their service schedules with the help of Geographic Information System to minimize the total operational cost. To solve the MDMTSP associated with the issue, a hyper-heuristic is designed using K-Means clustering, K-opt operation, and multiple-perturbation rules for the potential schedules. The performance of the said hyper-heuristic is examined using different size instances from TSPLIB and its superiority compared to state-of-the-art algorithms for the MDMTSPs in the literature is well established using statistical tests. This heuristic is used for the determination of the strategies for waste management based on the real time inputs from the IoTs associated with the waste bins. The system has been implemented and tested using data of Panskura Municipality, West Bengal, INDIA, and some managerial insights are outlined.

Abstract ID-095124833

GenAug-NeuroSwap: A Generative Latent Feature Swapping Framework for Robust Image Classification

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Deep learning (DL)'s exceptional performance in image classification is strongly dependent on large, diversified, and well-balanced training datasets. However, standard augmentation strategies such as flipping, rotation, or mixup frequently fail to yield meaningful semantic variations. This paper introduces GenAug-NeuroSwap, a novel Generative AI-based data augmentation method that improves feature diversity without expanding dataset size. Unlike conventional mixup or GAN-based augmentation, NeuroSwap adds a neural feature swapping method that functions within an autoencoder's latent space. During training, pairs of images are encoded into compact latent representations, which are then selectively swapped across samples of various classes. The resulting rebuilt images retain visual realism while displaying hybrid properties that enable the classifier to acquire additional generalizable features. The approach was applied to the CIFAR-10 dataset using a hybrid CNN-Autoencoder backbone, resulting in around 77.52% classification accuracy, greater resilience, and less overfitting than traditional augmentations. The proposed method highlights the potential of latent-level generative manipulation as a viable avenue for improving efficient and adaptive image classification.

Abstract ID-025938108

MSDFF-CCNN: An explainable AI based Multiscale Deep Feature Fusion and Compact Convolutional Neural Networks for crop disease Classification

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Food security and sustainable agriculture depend on the early and precise identification of crop diseases. Although deep learning techniques have demonstrated encouraging results in the categorization of crop diseases, their practical application in real-world situations is limited by their frequent lack of interpretability and computational efficiency. In this work, we provide a Multiscale Deep Feature Fusion and Compact Convolutional Neural Network (MSDFF-CCNN) framework based on Explainable AI (XAI) for reliable and comprehensible crop disease classification. While a deep feature fusion technique adaptively combines high- and low-level representations to improve generalization, the proposed model incorporates multiscale feature extraction modules to collect discriminative spatial-spectral information at various receptive fields. A **compact** CNN architecture with optimised channel and depth settings is created to increase efficiency and enable quicker inference on devices with limited resources. Additionally, explainability is integrated using gradient-based visualisation methods like Layer-wise Relevance Propagation (LRP) and Grad-CAM, which emphasise disease-specific areas on leaf surfaces, guaranteeing model dependability and transparency. The suggested MSDFF-CCNN provides better classification accuracy than current deep models while drastically lowering parameter count and computational cost, according to experimental assessment on the PlantVillage dataset. The model's predictions are based on biologically significant traits, as further supported by the visual explanations. All things considered, the suggested method supports precision agriculture and sustainable agricultural practices by providing a lightweight, precise, and understandable solution for real-time crop disease diagnostics.

Abstract ID-094153606

Predictive Analytics for Maternal Health Risk Assessment in Pregnancy Using Machine Learning

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Maternal health remains a critical factor in both public and social development in underdeveloped countries due to limited medical care. Accordingly, using anonymized prenatal physiological, behavioral, and demographic data, this research puts forward an early detection and continuous monitoring prediction machine learning framework for anaemia, gestational diabetes, hypertension, and prematurity.In order to predict a high-risk pregnancy, complex supervised learning models including Random Forest, XGBoost, and Support Vector Machines were constructed. The dataset's class imbalance was fixed with adaptive resampling. Feature engineering included nutrition, lifestyle, and environmental factors. The model was tested for accuracy by k-fold cross-validation. Its F1-score was 8% higher than the baseline logistic regression models, indicating 93% accuracy. SHAP values helped doctors understand the most important variables of mothers' health. This approach allows community health workers to track threats in real time and inform the people. It connects mobile and IoT devices to low-cost health platforms. AI and IT improve maternal care, preventive medicine, and sustainable development. This exercise contributes to attaining SDG 3 "Good Health and Well-being" by reducing mortality among mothers and children, fighting disease, attaining universal health coverage. SDG 9 "Industry, Innovation, and Infrastructure" ensures resilient infrastructure, inclusive and sustainable industrialisation, and innovation in sustainable development.

Abstract ID-092513499

Transfer Learning-Driven Deep Learning Model for Bengali Sign Language Recognition

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Language is the medium of communication through which people can share or exchange their ideas, thoughts, feelings, emotions etc. But it is difficult for people with speaking and hearing impairments that makes a gap with normal people in the society. The sign language connects these deaf-and-dumb community with mainstream by using several postures of hands, arms and fingers. Bangla sign language (BSL) is a linguistic system with its own alphabet set and vocabulary based on Bengali-script (Bangla-lipi). This study presents a fine-tuned deep learning approach for automatic recognition of hand gesture in Bengali sign language that recognize 39 alphabets (9 Swarbarno and 30 Banjonbarno) and 10 Bengali numerals. First sign images of hand gesture are learned by pre-trained Deep Convolutional Neural Networks (DCNN), that have been further refined with additional layers and hyperparameter alteration. Fine-tuning efficiently classifies the visually similar hand gesture by learning distinct spatial and temporal features of sign images. This end-to-end learning approach provides the advantage of automatic feature extraction while learning, in contrast to previous feature extraction methods. The transfer learning architecture used to train the model faster and shows significant experimental improvement with an accuracy of 99.89%. The system operates robustly in a diverse lighting, orientation, and background scenarios. This architecture highlights in developing real-time Bengali sign language recognition system with speed and accuracy, promoting inclusion and accessible communication for the speaking and hearing-impaired community.


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