

ChemBio Bulletin

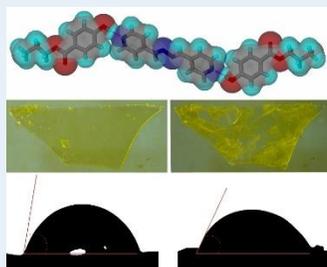
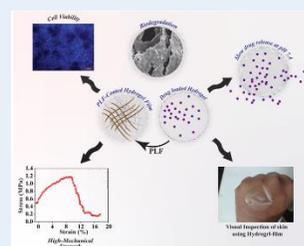
(A bi-monthly e-magazine of the department of chemical and biological sciences)

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*Featured article:
Nanotechnology for a
sustainable future*

*Chitosan- α -naphthaldehyde
hydrogel film containing
pineapple leaf fiber as wound
dressing material*



*Crystal-to-crystal polymorphic
phase transition in a cocrystal
accompanied by expansion and
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*Bimetallic ORR
electrocatalyst for zinc
air battery application*



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National Institute of Technology Meghalaya
(An Institute of National Importance under MoE, Govt. of India)
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“If you thought that science was certain - well, that is just an error on your part.” — Richard P. Feynman

Table of Contents

Contents	pages
1. About the institute	3
2. About the department	4
3. Message from the director	5
4. Message from the head of the department	6
5. Editor's note	7
6. Department details	8
7. Department news	9
8. Featured article	9-12
9. Research highlights	13-15
10. Recent publications	15
11. Achievements	15
12. Student contributions	16
13. Alumni corner	16-17
14. Career guidance	17-19

Departmental magazine committee:

Editor: Dr. Harshit Joshi (Asst. Prof., Dept. of Chemical & Biological Sciences)

Editorial board members: Basudha Deb and Satabdi Debroy (Ph.D. Scholars, Dept. of Chemical & Biological Sciences)

About the Institute



The National Institute of Technology (NIT) Meghalaya is one among the thirty-one NITs in India established under the NIT Act 2007 (Amended 2012) of the Parliament of India as Institutes of National Importance with full funding support from the Ministry of Education (Shiksha Mantralaya), Government of India. Ranked 68th in the NIRF 2024 rankings, NIT Meghalaya has been operational from its temporary campus in Shillong since 2012 and has made significant strides in becoming one of India's leading educational institutions.

The institute offers a diverse range of programs across nine academic departments, encompassing Engineering (Civil, Computer Science, Electrical, Electronics & Communication, Mechanical), Sciences (Physics, Chemistry, Mathematics), and Humanities & Social Sciences. Approximately 1000 students are enrolled in B.Tech., M.Tech., M.Sc., and Ph.D. programs, contributing to a vibrant learning community where faculty members are deeply involved in both teaching and cutting-edge research.

NIT Meghalaya's commitment to research is evident in its numerous publications, funded projects, and consultancy services. The institute has provided consultancy to prestigious organizations such as the Indian Air Force, Airport Authority of India, PWD, and CPWD, while fostering collaborations with industries like Vedanta Resources and Jindal Stainless Pvt. Ltd. It also maintains strong ties with research funding agencies such as DST-SERB and CSIR. Since 2018, the institute's international collaborations with institutions in countries like South Korea, France, and Austria have further enhanced its global research footprint.

In addition to academic excellence, NIT Meghalaya hosts a wide range of events, including workshops, conferences, and faculty development programs, aimed at fostering innovation and skill development. The Centre for Career Development plays a pivotal role in student success, with 80% of eligible students securing placements in top-tier companies such as Microsoft, Bharat Petroleum, Power Grid Corporation, and Infosys.

NIT Meghalaya continues to strive for excellence by blending high-quality education with impactful research and industry collaboration, preparing its students to become future leaders and innovators.

About the Department



Established in 2012, the Department of Chemical and Biological Sciences at the National Institute of Technology Meghalaya offers a comprehensive education in chemistry and related fields. Currently, the department provides M.Sc. and Ph.D. degree programs, along with a B. Tech. course in Chemical and Biological Sciences. The M.Sc. program commenced in 2015 with an initial intake of 13 students, while Ph.D. programs have been available since 2014 in various disciplines, including Organic Chemistry, Inorganic Chemistry, Biophysical Chemistry, Materials Chemistry, and Computational Chemistry.

Our mission is to deliver high-quality education and conduct both fundamental and industry-oriented research. Faculty research interests span a wide range of core and interdisciplinary areas within chemical and biological sciences, including electrochemical sensors, carbon-based and composite materials for energy storage devices, electrocatalysts for oxygen reduction reactions, biophysical chemistry, nanomaterials, solid-state forms of pharmaceuticals, stimuli-responsive materials, crystal engineering, energy-converting smart materials, and synthetic organic chemistry.

Our department is equipped with advanced laboratory facilities, including a conductivity meter, pH meter, double beam UV-visible spectrophotometer with variable bandwidth and diffuse reflectance accessory, steady-state fluorescence spectrophotometer, Fourier transform infrared (FT-IR) spectrophotometer with ATR accessory, multichannel electrochemical analyzer including electrochemical impedance spectroscopy, differential scanning calorimeter, polarizing microscope with heating stage applications, and stereoscopic zoom microscope.

We are committed to fostering an environment conducive to innovative research and quality education in the fields of chemical and biological sciences.

Messages from the Director



It is with great pride and enthusiasm that I extend my warmest congratulations to the Department of Chemical & Biological Sciences on the launch of its bi-monthly E-Magazine. This initiative truly reflects the vibrant academic and research culture upheld at NIT Meghalaya—centered on excellence, collaboration, and continuous innovation.

Our institute is committed to the holistic development of students, embracing core values such as academic integrity, excellence in teaching through student-centric pedagogy, and fostering interdisciplinary interaction through electives and projects. We also encourage creativity and innovation, skill development, and social responsibility. NIT Meghalaya's mission aligns with the goals of NEP-2020, offering skill-based multifaceted courses and implementing the Academic Bank of Credit for our students. A dynamic curriculum development process is underway, with updates already in effect for the different programs at the institute.

The publication of this magazine comes at a pivotal time when science and education are rapidly evolving. It serves as an excellent platform to showcase the strides we are making in both teaching and research. The dedication and talent of our faculty, staff, and students are evident in the numerous achievements we celebrate today. Through this magazine, we can ensure that these accomplishments receive the recognition they deserve, not only within our institute but also in the broader academic and professional communities.

At NIT Meghalaya, we foster a culture where knowledge is shared, ideas are nurtured, and everyone—from students just beginning their academic journey to established researchers—can contribute meaningfully. This E-Magazine is a testament to that belief, providing a space where creativity, intellect, and innovation can flourish. In addition to highlighting key research, it will amplify the voices of our students and alumni, inspiring continued excellence.

Congratulations to the entire team behind this initiative. I look forward to seeing the positive impact it will have.

- Prof. Pinakeswar Mahanta

Messages from the Head of the Department



Greetings from the Department of Chemical and Biological Sciences!

It gives me great pleasure to present an overview of the Department of Chemical and Biological Sciences on the occasion of the inauguration of our bi-monthly e-magazine. I would also like to extend warm greetings to all faculty members, staff, and students of the department.

The department was founded in 2012, and it currently offers M.Sc. degree in Chemistry and Ph.D. degree in broad areas of chemical sciences like physical chemistry, organic chemistry, biophysical chemistry, materials chemistry, and theoretical chemistry.

The department currently has 4 regular faculty members and 3 guest faculty members, along with 27 Ph.D. students and 37 M.Sc. students. To date, a total of 94 M.Sc. students have graduated from our department, and 16 students have received their Ph.D. degrees.

In 2024, the department's name was changed from "Chemistry" to "Chemical and Biological Sciences" to enhance our interdisciplinary approach in teaching and research. In alignment with NEP 2020, we have recently revised the course syllabi for the undergraduate programs.

Our department is equipped with essential research facilities, including a double-beam UV-visible spectrophotometer, fluorescence spectrophotometer, Fourier transform infrared (FT-IR) spectrophotometer, electrochemical workstation, differential scanning calorimeter, stereoscopic zoom microscope, and contact angle measuring equipment. Additionally, our research scholars regularly utilize instrument facilities at the Central Instrumentation Facility (CIF) on the main campus in Sohra.

Our faculty members have secured a total of 14 sponsored research projects from various funding agencies such as DST, SERB, CSIR, and BIRAC. The department also organizes conferences and workshops to showcase our research activities.

Finally, I would like to extend my sincere gratitude to all past and present faculty members, students, staff, and alumni for their unwavering support and valuable contributions to the department and the institute over the past few years. The department is committed to quality research and teaching and to the growth and development of our nation.

-Prof. Gitish Kishor Dutta

Editor's Note: A New Chapter Begins

It is with immense pride and excitement that I introduce the inaugural issue of the Department of Chemical & Biological Sciences' bi-monthly e-magazine, *ChemBio Bulletin*. This publication marks the beginning of a new tradition at NIT Meghalaya—a platform where the achievements, innovations, and dedication of our faculty, staff, and students will be celebrated and shared with the wider community.

The department has always been a hub of scientific discovery, collaborative research, and academic excellence. Through this magazine, we aim to bring to light the many efforts that often go unnoticed but contribute significantly to our academic and research ecosystem. Each edition will serve as a testament to the hard work and passion of everyone involved.

In this issue, you'll find an insightful message from our esteemed Director and Head of Department, reflecting on the future of science and education in our institution. Our faculty's latest research highlights and achievements are prominently showcased, alongside a corner dedicated to our alumni, whose professional journeys continue to inspire. Our students, the heart of the department, will find their voices amplified through contributions that showcase their creativity and intellect, whether through articles, event coverage, or career guidance.

In addition to this, we are thrilled to present a featured article on *Nanotechnology for a sustainable future*. The piece delves into the cutting-edge research on quantum dots, exploring their potential applications in medicine, electronics, and environmental solutions.

This magazine is more than just a publication; it is a shared space for learning, celebrating success, and building a stronger, more connected community. It reflects the vibrant intellectual life we foster here at NIT Meghalaya. As we move forward, we hope this initiative will not only document our progress but also inspire future innovations.

I encourage you to engage with this magazine—whether by reading, contributing, or sharing your feedback. Together, we can make it a meaningful and lasting contribution to our department's legacy.

Here's to the beginning of a new chapter in our academic journey!

-Harshit Joshi

Department Details

- ❑ Number of faculties : 7
- ❑ Number of technical staff : 2
- ❑ Number of students enrolled in Ph.D. program : 27
- ❑ Number of students enrolled in M.Sc. program : 37
- ❑ Number of students enrolled in undergrad course : 107

Our faculties:

Faculty

Research interest



Dr. Gitish Kishor Dutta

Carbon-based and composite materials for energy storage devices, fuel cell, electrocatalyst for oxygen reduction reactions and electrochemical sensors



Dr. Atanu Singha Roy

Biophysical chemistry, protein-ligand interaction studies, biomolecular spectroscopy, protein denaturation studies, DNA-ligand binding and DNA damaging experiments, protein modification and impact on ligand binding, protein-nano particle interaction, quantum dots and their biological applications.



Dr. Naba Kamal Nath

Crystal Engineering, Energy Converting Smart Materials, Solid State Forms of Pharmaceuticals



Dr. Harshit Joshi

Synthetic organic chemistry, methodology development and total synthesis of natural and non-natural compounds of biological interest

Dr. Esha Bala Guest faculty

Dr. Meera Kumari Guest faculty

Dr. Tarun Roy Guest faculty

Department News

Lab developed: B.Tech. Chemistry Lab developed at Sohra Campus of National Institute of Technology Meghalaya.

New faculty joined: Dr. Harshit Joshi has recently joined the Department of Chemical and Biological Sciences at the National Institute of Technology Meghalaya as an Assistant Professor. He earned his M.Sc. degree in Organic Chemistry from Kumaun University, Nainital, in 2012. Dr. Joshi then pursued his doctoral research at IIT Kanpur under the supervision of eminent scientist Prof. Vinod K. Singh (Padma Shri), where he earned a Ph.D. in 2020. His research on the development of asymmetric organocatalysis has been published in several prestigious international journals. After completing his Ph.D., Dr. Joshi served as a Project Scientist in the Department of Chemistry at IIT Kanpur. In 2021, he joined the University of Kansas as a postdoctoral researcher, focusing on the development of new tethered olefin functionalization strategies for the synthesis of anti-infective compounds. His research group at the Department of Chemical and Biological Sciences, NIT Meghalaya will be focusing on synthetic organic chemistry, methodology development and total synthesis of natural & non-natural compounds of biological interest.

Featured Article

Nanotechnology for a sustainable future

Mahabul Haque and Atanu Singha Roy

Introduction: why nanomaterials?

In today's world, with the increasing hurdles in addressing the ever-increasing population, biodiversity loss, economy, and industrialization, which results in a substantial need for energy along with environmental sustainability, discovering and developing new technologies has become an imperative challenge. Nanotechnology can play a crucial role in the fulfillment of the increasing demand for energy and biomedical applications. A fascinating new class of materials called nanomaterials (e.g., nanoclusters, nanoparticles, quantum dots, etc.) is in great demand for a variety of practical uses. These tiny sized (1-100 nm) materials possess unique optical and electronic properties and have a potential impact on different domains such as energy storage devices, environmental remediation, electronics, sports equipments, cosmetics, medicine, sensors, imaging agents, food and agriculture.¹⁻³

Rather than merely enhancing current technologies, nanotechnology offers advanced nanomaterials engineering for revolutionary, disruptive breakthroughs and advancements that

can deliver prompt responses and fixes to improve our civilization, the society and environment. Let's dive into the world of the "nano" and discover how this advanced material is reshaping our world in remarkable ways.

Nanomaterials: characteristics and applications

At the nano level, the properties of substances differ compared to their bulk counterparts. At the nanoscale, size-dependent characteristics become more prominent, e.g., in solution, Au nanoparticles are red/purple in color, whereas bulk Au is yellow. The mean free path of electrons in metal is 10-100 nm, and thus, optical and electronic properties can be observed in the range of 10-100 nm. The optoelectronic property can be tuned by tuning the sizes of the nanomaterials. Semiconductor nanomaterials (quantum dots, QDs) of size 1-10 nm have discrete energy levels (valance band to conduction band) in 3D and, thereby, electronic property of these materials is controlled by quantum mechanical law. The absorption and emission properties of such materials can be controlled by tuning the sizes (the excitation diameter of a photogenerated electron-hole pair is 1-10 nm). The key characteristics of nanomaterials, including surface area, magnetism, quantum effect, high thermal and electrical conductivity, mechanical properties and support for catalysis, could be modulated by altering the morphology and sizes of the nanomaterials. Let's have a look into the following two types of nanomaterials and their essentialities for sustainable development at present.

1. Nanoparticles

Metal nanoparticles (NPs) possess the inherent LSPR (LSPR: localized surface plasmon resonance) property and are the most studied nanomaterials, which transformed in various research fields, from energy conversion domain to medicine. Depending on the synthesis and surface functionalization, their applications are different. Among the metal NPs, functionalized noble metal NPs, especially gold, silver, palladium and platinum, have received the most attention. Au and AgNPs (10000-fold more intense extinction than organic dyes) have extensive applications in the bio nanotechnology, which include nano-drug carriers, chemotherapy drugs straight to the tumor or cancer, targeting cancer cells without affecting primary cells, cosmetics and antimicrobial agents with fewer side effects and more effective treatments. Pd and Pt based NPs are well known for their diverse catalytic applications in organic C-C bond-forming reactions. Plasmonically active NPs (based on Au or Ag) enhance the absorption of light from visible and near-IR regions along with the scattering of light, which leads to higher photon capture efficiency. Thus, Plasmon-enhanced tin-film solar cells will be next-generation solar energy conversion devices.⁴

2. Semiconductor nanoparticle (quantum dots: QDs)

Semiconducting nanocrystals (QDs) were discovered in 1993 by Mounji G. Bawendi, Louis E. Brus and Aleksey Yekimov and was awarded the Nobel Prize in the year of 2023. QDs possess unique size-dependent optical, magnetic, and electrical properties, including broad absorption, sharp and narrow emission spectra, and easily tunable emission, high quantum yield and resistance to photobleaching, which makes them widespread applications in biological imaging and contrast agents, biosensing, drug delivery/therapy, solar energy conversion and in light emitting diodes

(LEDs). Functionalized QDs emerge as non-blinking fluorescent tags in biological systems with superior resistance to photobleaching and better fluorescence lifetime over which high-contrast images could be achieved. Moreover, the development of multi-shell QDs with higher quantum yield, fabrication and device architectures leads to QLED efficiency to commercial standard with brightness of several hundred candelas (per square meter) and are integrated into our daily life, including QD-based displays.⁴ The magic of nanotechnology lies in this ability to explore nanomaterials properties and turn them into superstars in fields like medicine, electronics, and energy.

Sustainable development: concept of society 5.0

Civilization 5.0 (concept of fifth Midterm Science, Technology, and Innovation, key idea of the Japanese government's) is a human-centered civilization that uses sophisticated cyber-physical integration to achieve both economic development and social issue solving.⁵ In Society 5.0 (Fig. 1), everything is interconnected through the Internet of Things (IoT). This fosters knowledge and information sharing, the provision of artificial intelligence (AI) when needed to supply necessary information. As a result, our lives will change dramatically. Preventive healthcare promotes a healthy life expectancy, medical monitors, nursing robots, and minimizes the social cost for medical. Nanomaterials and nanotechnology are anticipated to be key components in the realization of Society 5.0. The digital transition will be propelled by nanotechnology, which will offer a variety of nanodevices for use in Society 5.0, including smart robots, autonomous driving cars, and Internet of things sensors.

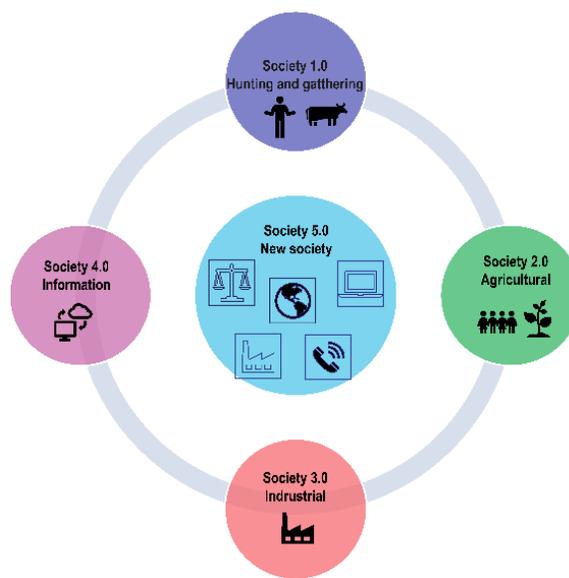


Figure 1: Society 5.0 defines a human-centered society.

The Union Cabinet (*Gov't of India*) approved the National Quantum Mission (NQM) on 19th April 2023 at a total cost of more than Rs.6000 crore from 2023-24 to 2030-31, targeting to seed, nurture and scale up the scientific and industrial Research & Development and to create a vibrant & innovative ecosystem in Quantum Technology (QT) focusing in mounting intermediate-scale quantum computers with 50-1000 physical qubits in coming eight (08) years in diverse platforms. It will also provision the design and synthesis of quantum materials such as superconductors, semiconductors, and topological nanomaterials for the fabrication of quantum devices for technological applications. Further advancement related to the single photon sources/detectors, and entangled photon sources will also be created for sensing, quantum communications, and metrological relevance. NQM has the objective to establish four (04) thematic-hubs related to quantum computing, communications, quantum sensing and metrology and device applications in various top academic and national R&D institutions. The Mission would greatly value diverse

sectors including health, energy, communications, sustainable development goals (SDGs) with further applications in drug design, banking, space, security etc.

Challenges: a new horizon

Functionalized nanomaterials have potential applications in various scientific domains, which has been reflected in the number of articles published in the last few decades. There are numerous scientific developments, including tumor-specific cancer therapy (both *in vitro* and *in vivo*) and third-generation solar cell technology. Yet, we still have very little knowledge about functionalized nanomaterials and how they behave *in vivo* systems or with environmental components. Without sufficient information to evaluate the potential hazards and biodistribution of functionalized nanomaterials, advancing the development of theragnostic nanomaterials will be challenging. The other challenge is establishing a new chemical industry for the development of nanomaterials into successful commercial products, which is still in its early stages. Moreover, a critical challenge is finding novel approaches to control NPs surface chemistry to enhance NPs effectiveness in applications. We strongly believe that the NQM will be supportive to address the current issues of nanotechnology for a better sustainable future in the coming years.

Conclusion: just a beginning

Nanotechnology is esteemed to become a multi-trillion-dollar industry in the coming decades. It is crucial to adopt a life-cycle approach to assess the effects on human health and the environment at each stage of a nano-enabled product's life cycle before drawing any conclusions about its potential environmental benefits or drawbacks. Considering quantum technology, communications, human health and impacts on environment, it is essential to be proactive in designing new nano-based products to ensure a net positive effect in future applications of this ubiquitous technology for sustainable development goals. For nanotechnology to have a long-lasting impact on our society, several real-world obstacles must be overcome, particularly the transition of nanotechnology from a lab discipline to a thriving industry.

References

- (1) Pokrajac, L.; Abbas, A.; Chrzanowski, W.; Dias, G. M.; Eggleton, B. J.; Maguire, S.; Maine, E.; Malloy, T.; Nathwani, J.; Nazar, L.; Sips, A.; Sone, J.; Van Den Berg, A.; Weiss, P. S.; Mitra, S. Nanotechnology for a sustainable future: addressing global challenges with the international network4sustainable nanotechnology. *ACS Nano* **2021**, *15* (12), 18608–18623.
- (2) Dhingra, R.; Naidu, S.; Upreti, G.; Sawhney, R. Sustainable nanotechnology: through green methods and life-cycle thinking. *Sustainability* **2010**, *2* (10), 3323–3338.
- (3) Baig, N.; Kammakakam, I.; Falath, W.; Kammakakam, I. Nanomaterials: a review of synthesis methods, properties, recent progress, and challenges. *Mater. Adv.* **2021**, *2* (6), 1821–1871.
- (4) Malik, S.; Muhammad, K.; Waheed, Y. Nanotechnology: a revolution in modern industry. *molecules* **2023**, *28* (2), 661.
- (5) Government of Japan, Cabinet Office. Society 5.0; Science and Technology Policy, Council for Science, Technology and Innovation; https://www8.cao.go.jp/cstp/english/society5_0/index.html (accessed 2021-05-14).(15) Sato, F. Japan's.

Research Highlights

Bimetallic ORR electrocatalyst for zinc air battery application

Ria Deb, Rimpi Gogoi, Vivek Chamlagain, Gitish Kishor Dutta



Figure 2: Schematic representation of zinc air battery towards green energy

Energy is an indispensable need to feed the increasing energy demand. The demand for reliable and affordable energy is an evergreen domain. Therefore, a switch from traditional non-renewable energy sources to renewable energy is crucial for society to sustain the resources and environment. In this regard, energy storage and conversion systems like metal-air batteries, supercapacitors, and fuel cells are of typical use because they can derive energy from renewable sources. Our group focuses on designing electrocatalysts that can speed up the slow kinetics of the cathodic counterpart of metal-air batteries (particularly Zinc-air batteries) and fuel cells. To date, platinum electrocatalysts are the only known catalysts that can boost the cathodic reaction occurring in such devices. However, the cost and low stability of Pt electrocatalysts have always been a bottleneck in their use. An alternative solution to such issues is the metal-free and non-precious metal-based electrocatalysts. Presently, we are working on synthesizing electrocatalysts from earth-abundant metal and using them in zinc-air batteries. We have got appreciable results related to the current density, stability, and methanol tolerance of the synthesized catalysts. Moreover, we have successfully fabricated a homemade stable zinc-air battery using the synthesized catalysts. Also, such electrocatalysts have the potential to be used in fuel cell applications.

Chitosan- α -naphthaldehyde hydrogel film containing pineapple leaf fiber as wound dressing material

A. Mondal, D. L. Nongbri, K. Achariya, M. Haque, K. Aguan, A. Bhattacharya, A. Singha Roy

Engineered composite hydrogel platforms made of a naturally occurring polysaccharide have recently gained significant attention as a promising biomaterial for healthcare therapeutics. This study presents a cost-effective, one-step synthesis of a chitosan- α -naphthal hydrogel film infusion with PLF (Pineapple Leaf Fiber), designed for wound dressing applications. The hydrogel exhibited high encapsulation efficiency for antibiotics like ciprofloxacin and lomefloxacin, allowing controlled drug release and preventing long-term infections. The hydrogel film shows low mechanical strength, and to improve mechanical strength, pineapple leaf fiber (PLF) was infused

into the hydrogel, enhancing its strength to 1.12 ± 0.89 MPa. The PLF-hydrogel showed significant antibacterial activity against *Escherichia coli* and *Staphylococcus aureus*, along with excellent cell viability in human embryonic kidney (HEK-293) cells (**Fig 3**). These results demonstrate the potential application of PLF-Hydrogel film as an effective wound dressing material (WDM).

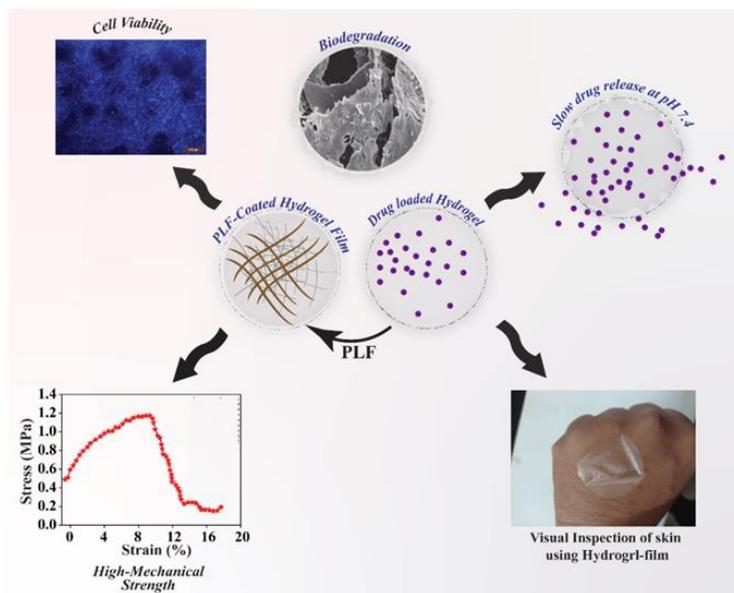


Figure 3: A biodegradable Chitosan- α -Naphthaldehyde-based hydrogel film infusion with PLFs with high mechanical strength, cell-viability (in vitro) and controlled drug release ability as a WDM

Crystal-to-crystal polymorphic phase transition in a cocrystal accompanied by expansion and surface wettability change

Plabon Saikia, Poonam Gupta, Tridip, R. Nath, Naba K. Nath

Heat-responsive crystalline materials exhibit significant structural and functional changes when subjected to thermal stimuli, making them highly valuable in various applications, including smart coatings, thermal sensors, shape-memory materials, and drug delivery systems. The investigation of physical properties such as wettability in single crystals is essential, as thermal-induced changes in crystal structure can directly influence surface interactions with liquids. This is particularly relevant in applications like self-cleaning surfaces and controlled drug release. In our study, the co-crystallization of n-propylparaben with a bipyridine-based azine derivative in a 2:1 stoichiometric ratio revealed a crystal-to-crystal polymorphic phase transformation upon heating. This

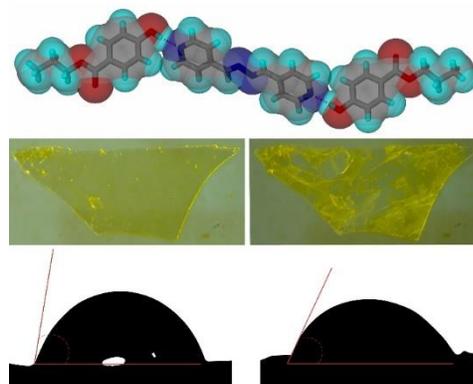


Figure 4: Molecular structure of heat responsive cocrystal, accompanied by expansion and surface wettability changes

transformation was accompanied by visible expansion, cracking, and distinct variations in surface wettability between the two polymorphs, underlying the importance of understanding and controlling physical properties during phase transitions.

Recent Publications

- I. Nazir Uddin, Sudipta Roy, Sayantan Roy, Dipankar Paul, Geetanjali Basumatary, Gitish K Dutta, Paresh Nath Chatterjee, Formation of bis-indolylmethanes from symmetrical triarylmethanes via Brønsted acid catalyzed C-C bond breaking reaction. *ChemistrySelect*, 2024, **9**, e202400574.
- II. Mahabul Haque, Jintu Chutia, Amarjyoti Mondal, Sana Quraishi, Kalpana Kumari, Erica W M Marboh, Kripamoy Aguan, Atanu Singha Roy, Formation of CdTe core and CdTe@ZnTe core-shell quantum dots via hydrothermal approach using dual capping agents: deciphering the food dye sensing and protein binding applications. *Phys. Chem. Chem. Phys.*, 2024, **26**, 22941.
- III. Sadia Nudrat, Bilash Maity, Sana Quraishi, Irungbam Karankumar, Kalpana Kumari, Madhurima Jana, Atanu Singha Roy, Binding interaction of coumarin derivative daphnetin with ovalbumin: molecular insights into the complexation process and effects of metal ions and pH in the binding and antifibrillation studies. *Mol. Pharmaceutics*, 2024, **21**, 4708.
- IV. Amarjyoti Mondal, Dasuklang Lyngdoh Nongbri, Kusumita Achariya, Mahabul Haque, Kripamoy Aguan, Arijit Bhattacharya, Atanu Singha Roy, A chitosan- α -naphthaldehyde hydrogel film containing pineapple leaf fibers for wound dressing applications. *J. Mater. Chem. B*, 2024, DOI <https://doi.org/10.1039/D4TB01318B>

Achievements

- I. Financial assistance granted to Ms. Kakali Baruah from Dr. Atanu Singha Roy's research group for participation in the 'ACS Fall 2024: Elevating Chemistry Meeting,' organized by the American Chemical Society and held at the Colorado Convention Center, Denver, USA, from August 18th to 22nd, 2024. The support was provided under the Science & Engineering Research Board (SERB) International Travel Support (ITS) Scheme by the Anusandhan National Research Foundation (ANRF), a statutory body established by the ANRF Act, 2023.
- II. Amarjyoti Mondal from Dr. Atanu Singha Roy's research group secured the third position in the poster competition at the International Symposium on Current Trends in Advanced Materials (CTAM-24), organized by the Department of Chemistry, School of Advanced Sciences, VIT-AP University, in association with the American Chemical Society, held from August 26th to 31st, 2024.

Student Contributions

Kakali Baruah from Dr. Atanu Singha Roy's research group participated in the ACS Fall 2024: Elevating Chemistry meeting, organized by the American Chemical Society and held at the Colorado Convention Centre, Denver, USA, from August 18th to 22nd, 2024, where she presented her research on the interpretation of protein-corona formation and the inhibition of fibrillation by polyphenol-capped gold nanoparticles.

Alumni Corner



One of my most cherished memories is the day I got selected into NIT Meghalaya for my M.Sc. It felt like a dream come true. The welcoming atmosphere, supportive seniors, and excellent faculty made every moment special. Our chemistry lab was a place of discovery, with seniors guiding us through every challenge. NIT wasn't just about academics; the extracurricular activities allowed me to explore new talents. The guidance I received from my professors shaped my future, and I will always be grateful to NIT Meghalaya for making me who I am today.

-Prasitaditya Kuri (NITM/M.Sc. 2019-21), currently pursuing Ph.D. at CSIR- Indian institute of Chemical Technology, India



Looking back, my time at the Department of Chemical and Biological Sciences at NIT Meghalaya was more than just a steppingstone — it was the launchpad for everything that's come since. Even though we were just Master's students but those extra hours in the lab, the one-on-one interaction with the incredible set of Professors who went above and beyond in guiding us, and of course my cohort, I couldn't have asked for a better group of people to learn and grow with, made me feel like we were part of something much big which pushed me to think bigger. What I learned there wasn't just science — it was resilience, curiosity, and the power of pushing limits. So far, I can proudly say those two years were hands down the best of my academic journey. It wasn't just about learning in the classroom — I grew in every way possible. I threw myself into everything, from cultural events to academic challenges, and somehow, I always had more energy to keep going. My heart was constantly full, and that's the magic of my alma mater. NIT Meghalaya didn't just give me knowledge; it gave me a sense of belonging and purpose that I'll carry with me forever. For the current students: Opportunities don't just knock — you have to knock on the door yourself. Thereby, dive in fearlessly. Experiment, ask bold questions, and don't be afraid to make mistakes — that's where the real learning happens. We are not just studying for exams, we are preparing for the future, and trust me, it's full of exciting possibilities. Your time

at NIT Meghalaya is just one step in a larger journey, so make the most of it. I am excitedly looking forward to the other contents of the issue. Let's keep the connection between alumni and the department strong — we're all part of something bigger, and together, we'll keep raising the bar.

-Prerana Bakli (NITM/MSc 2020-23), currently pursuing PhD from University of Hawai'i at Manoa, USA



Hello, I am Aneesha S L. I am very excited and grateful for the opportunity to pursue my master's degree at NITM. The first thing that comes to my mind is the excellent professors and the beautiful location of Meghalaya-Shillong. Having experienced, supportive professors is crucial for a master's program. For all the juniors out there, this is the time to carefully consider and make decisions about your future studies or career. Fortunately, you are in the right place and will receive the perfect guidance and assistance for the next phase of your life. Regarding my experience at NITM, I am extremely delighted to have had such amazing professors during my master's program. They are so understanding to all the students, and we could discuss our difficulties and concerns with them. They share many of their experiences and achievements from research, and their words are powerful enough to motivate anyone to do anything, not just research, to be independent, self-sufficient, and satisfied with the work we do with complete dedication. I still follow one of my professor's (ASR) words "read at least 4 hours a day". Because the only way we can grow is by reading, and only when we experience reading will we understand the power of reading. I hope my juniors will have a good future, read as much as possible, whatever you like, anything that you need to achieve.

-Aneesha S L (NITM/M.Sc. 2021-2023), currently pursuing PhD in Hokkaido University, Japan

Career Guidance

Opportunities with the DST INSPIRE fellowship for doctoral research

Dr. Harshit Joshi (this note is an adaptation of a dialogue with Dr. Atanu Singha Roy)

For those aspiring to pursue a career in scientific research, obtaining a prestigious fellowship can provide not only financial support but also a platform for academic recognition and professional growth. One such opportunity is the DST INSPIRE Fellowship (Innovation in Science Pursuit for Inspired Research) offered by the Department of Science and Technology (DST), Government of India. This fellowship is designed to support and encourage bright students to engage in cutting-edge doctoral research across diverse scientific disciplines, including chemical and biological sciences.

What is the DST INSPIRE fellowship?

The DST INSPIRE Fellowship aims to nurture young talents by providing them with the necessary resources and mentorship to embark on their research journeys. The fellowship is targeted at students who have secured first rank or high academic standing in their master's degree (M.Sc./M.S./M.Tech.) and are keen to undertake doctoral research in a recognized university or research institution in India.

Key features of the fellowship:

Financial support: The fellowship provides a monthly stipend of ₹37,000 for the first two years (JRF) and ₹42,000 (SRF) for the subsequent three years, along with an annual contingency grant of ₹20,000. This financial support is crucial for scholars to focus on their research without the burden of external financial constraints.

Research independence: The INSPIRE Fellowship offers a significant degree of research autonomy, allowing scholars to choose their research topics, supervisors, and institutions, fostering a conducive environment for independent research.

Academic networking: Being part of the INSPIRE community provides opportunities for academic networking with fellow researchers, attendance at national and international conferences, and collaboration with leading experts in various scientific fields.

Mentorship and guidance: Fellows receive guidance from experienced faculty members and researchers, helping them navigate the complexities of scientific inquiry and hone their research skills.

Eligibility criteria:

- Candidates must have secured a first rank in their university or institute at the postgraduate level.
- They must have completed their master's degree in natural and basic sciences, engineering, or medicine.
- Candidates must be in the age group of 22-27 years at the time of applying.
- INSPIRE-SHE Scholars with 70% marks in M.Sc. are also eligible to apply.

Application process:

The application process is straightforward and involves submitting a detailed research proposal, academic transcripts, and letters of recommendation through the online portal of the DST. The selection is based on academic merit, research proposal quality, and the potential impact of the proposed research.

Why apply?

For students in the Chemical and Biological Sciences department at NIT Meghalaya, the DST INSPIRE Fellowship represents an excellent opportunity to advance their academic careers and contribute to scientific knowledge. It not only provides financial stability but also a structured

framework to pursue innovative research that can address societal challenges and contribute to national development.

I encourage all eligible students to explore this fellowship and take advantage of the opportunity to be part of India's scientific growth story. For further details and guidance on the application process, visit the DST INSPIRE Fellowship website (<https://dst.gov.in/inspire-scheme-innovation-science-pursuit-inspired-research>).

Best of luck with your research endeavors!

