বসু বিজ্ঞান মন্দির
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BOSE INSTITUTE

ANNUAL REPORT
2024-25

Bose Institute has achieved recognition, success, and growth under the leadership of its Director, continuing the legacy of Acharya J.C. Bose.

ANNUAL REPORT 2024-25

BOSE INSTITUTE

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बसु विज्ञान मन्दिर
বসু বিজ্ঞান মন্দির
BOSE INSTITUTE
(विज्ञान एवं प्रौद्योगिकी विभाग, भारत सरकार के अधीन एक स्वायत्त संस्था)
(AN AUTONOMOUS INSTITUTE UNDER DEPARTMENT OF SCIENCE & TECHNOLOGY, GOVT. OF INDIA)

From the Director's Desk

It is my privilege to present the Annual Report of Bose Institute for the year 2024–2025. Established in 1917 by Acharya Jagadis Chandra Bose, the Institute continues to advance his vision of pursuing unfettered scientific inquiry and disseminating knowledge for the benefit of society. As an Autonomous Research Institute under the Department of Science & Technology, Government of India, Bose Institute remains committed to addressing fundamental questions of science while simultaneously engaging with contemporary societal challenges.

During the year under review, our scientific community demonstrated sustained productivity and impact. The Institute produced approximately 200 publications in peer-reviewed journals, complemented by 16 book chapters and 15 conference proceedings, yielding an average impact factor of 4.64. In parallel, 34 Ph.D. degrees were awarded, and one patent was filed, reflecting our dual mandate of advancing frontier research and training the next generation of scientists. These outputs are indicative of the Institute's continuing emphasis on quality and relevance in research, despite constraints in resources.

The work of our scientists has been recognized at national and international levels. Notable distinctions include the S. Ramanujan Award 2024 (ARAI, India), the Prof. K.C. Bose Gold Medal Award 2024 (NESA, New Delhi), and the ACCT(i) Excellence in Carbohydrate Research Award 2024 (USA). In addition, a faculty member was selected under the prestigious VAJRA Fellowship (DST–ANRF, Government of India). The Institute's expertise has also contributed to policy-relevant science, with our analysis informing the "Winter Action Plan" for Kolkata, highlighted by the Press Information Bureau, Government of India.

At the international collaborative front, Bose Institute continues to serve as the nodal agency for India's participation in ALICE (CERN) and the FAIR

project. Our scientists are actively engaged in developing prototype detectors for the Compressed Baryonic Matter (CBM) experiment at FAIR, reflecting the Institute's role in advancing high-energy and nuclear physics. A matter of pride was the selection of our Post-Doctoral Fellow in Physical Sciences as Run Manager for the ALICE experiment at CERN (May–June 2024). Equally significant was the hosting of the 42nd FAIR Council Meeting at the Unified Academic Campus, marking the first time this meeting was organized outside Germany.

The Institute has further expanded its global academic engagement by signing an MoU with the Council of Energy, Environment and Water (CEEW) and preparing to host the 23rd International Conference on Bioinformatics (InCoB 2025). Distinguished lectures and symposia, including the 85th Acharya J.C. Bose Memorial Lecture by Prof. Sankar K. Pal, and a two-day conference on Nuclear Magnetic Resonance Spectroscopy at Darjeeling Campus, supported by Velux Stiftung (Switzerland), further enriched the academic environment.

Looking ahead, Bose Institute is focusing on emerging interdisciplinary frontiers. Plans are underway to establish an Interdisciplinary Research Centre with a mandate to integrate artificial intelligence and machine learning into research on energy, climate change, agriculture, healthcare, and drug discovery. The Institute is also prioritizing research in neurodegenerative and pulmonary diseases, as well as mental health disorders, through national missions and international collaborations. These initiatives represent an effort to align our research programmes with societal needs and global scientific priorities.

On the academic front, the Institute is working to expand training opportunities through the introduction of integrated M.Sc.–Ph.D. programmes to complement the existing Ph.D. programme. Outreach initiatives continue to encourage participation of students from underprivileged backgrounds and women in science, thus broadening the base of scientific human resource development.

I take this opportunity to acknowledge the unwavering support of the Department of Science & Technology, Government of India, and to express my appreciation to the faculty, students, and staff of Bose Institute for their dedicated efforts. I also thank the Annual Report Committee for compiling this volume. With our modern infrastructure, global collaborations, and scientific vision, I am confident that Bose Institute will continue to advance the frontiers of knowledge and contribute meaningfully to both national and global science.

Prof. Kaustuv Sanyal
Director

MESSAGE

Dean, Academics

I would like to present a brief overview of the office of the Dean, Academics. This office oversees matters concerning the faculty members of Bose Institute. The annual report provides comprehensive details of their accomplishments; here, I will highlight a few key aspects. I am confident that you will find that we remain committed to the vision of our founder, Acharya J.C. Bose, in our pursuit of science and addressing societal challenges.

Currently, forty faculty members serve across three departments: Physical Sciences, Chemical Sciences, and Biological Sciences. Our research was featured in several DST press releases. The Institute produced nearly 200 publications in peer-reviewed journals, 16 book chapters, and 15 conference proceedings. We awarded 34 PhD degrees and filed one patent, demonstrating our commitment to advancing scientific knowledge and supporting the next generation of researchers.

Our scientists received recognition at both national and international levels, bringing distinction to the Institute. Notable honours included the S. Ramanujan Award 2024 (ARAI, India), the Prof. K.C. Bose Gold Medal Award 2024 (NESA, New Delhi), the ACCT(i) Excellence in Carbohydrate Research Award 2024 (USA), and the VAJRA Fellowship (DST–ANRF, Government of India). Our expertise also informed policy-relevant science. For example, the Institute's analysis contributed to the Winter Action Plan for Kolkata, as highlighted by the Press Information Bureau, Government of India. In terms of international collaboration, Bose Institute continued to serve as India's nodal agency for ALICE (CERN) and the FAIR project. Our scientists contributed to the development of prototype detectors for the Compressed Baryonic Matter (CBM) experiment at FAIR.

While we are proud of our progress, we remain aware of the responsibilities ahead. Finally, I take this opportunity to thank all my colleagues for their efforts in upholding the vision of our founder and contributing towards the growth of Bose Institute.

Prof. Somshubhro Bandyopadhyay
Dean, Academics

MESSAGE

Dean, Research & Development

Greeting from the Office of the Dean, Research & Development!

The office of the Dean R&D oversees the research infrastructures, faculty research grants, collaborations with industries and academic institutions from within the country and abroad, official formalities related to extramural research projects of the faculty members. Bose Institute has an a state-of-the art research facility. Presently, Bose Institute nurtures research programs in all core disciplines of Physical Sciences, Chemical Sciences and Biological Sciences.

It is my pleasure to report productive research activities in the last year (2024-25) by the Faculty members, dedicated and motivated students of the Institute. At present there are permanent Faculty members and researchers who contributed to the 2024-25 research outputs. This year research activities are very impressive in terms of publications, obtaining extra mural grants, scientific collaborations, hosting national and international conferences, workshops, outreach programmes. In the year 2024-25, the total number of papers published were 234 with an average impact factor of 4.64 making Bose Institute among the DST institutes. In the current year, around 25 new extramural projects by various funding agencies were sanctioned in addition to the ongoing projects. This includes three National level Projects funded by MoEFCC and DBT, and international level projects funded by DST & DAE and Velus Stifung from Switzerland and CBM-MUCH. Presently Bose Institute nurtures research in the areas of Physical Sciences (Nuclear & High Energy Physics (FAIR & CERN), Quantum Information and Quantum Gravity, Complex Systems, , Material Science and Environmental Physics and Climate Change (NCAP-WGIII); in the areas of Chemical Sciences (Pollution chemistry Process Chemistry, Medical Chemistry and Drug Discovery) and finally Biological Sciences (Plant response to stress, Systems and Synthetic Biology, Structures and functions of macromolecules and Bioinformatics & Disease Biology).

Significant databases were developed by the scientists of Bose Institute namely- LHSPred-predicts lung health severity; BCSCdb-database of biomarkers of cancer stem cells; mitoPADdb-database of mitochondrial proteins associated

with diseases; SDLDpred- for symptom-based drug prediction of lifestyle-related chronic diseases using unsupervised machine learning techniques. Online resources such as piRNAQuest V.2 (PMID:34965192) and LncRBaseV.2 (PMID: 33112702) were developed by scientists of Bose Institute. Needless to mention the Online tools like 'TbAMLPred' for preliminary detection of Acute Myeloid Leukemia (PMID: 37031648) and 'LncRTPred' for predicting long noncoding RNA-mRNA interaction (https://doi.org/10.1002/iub.2778).

We proudly state that a State-of-the-Art Cryo-EM Facility is being installed in Bose Institute. It is bound to create a great impact in the Eastern region. The research infrastructure is boosted by many important instruments kept in the Central Instrument Facility. A patent was also awarded.

Under the initiative of DST-Media Cell, around 8 no. of outstanding research findings of our scientists in the areas of Physical, Chemical and Biological Sciences have been published in form of 'research stories' by Press Information Bureau (PIB) and DST.

Following the footsteps of our illustrious Founder, Acharya Jagadis Chandra Bose, Bose Institute is constantly engaged in "dissemination of knowledge: through its various outreach programmes. The faculty members attend school, college, university students in popular and technical lectures that follow their standards and demonstrate hands-on-experiments during lab visits. Following the mandate of DST's Scientific Social Responsibility (SSR) programme, our Institute has organized some events. Participation of Bose Institute in Mega Events like IISF 2023 and 2024 and Mega Exhibitions and receiving Outstanding Participation Award and best Pavilion were great accomplishments for the Institute. **Schemes such as DST-VAJRA** has been developed for overseas Scientist to visit research institute to encourage international collaborations that strengthen Indian R&D (Bose Institute has received on DST-VAJRA project to develop novel peptide antibiotics).

Throughout the year, the Institute has organised numerous scientific Seminars, Workshops, colloquia and Webinars. As an integral part of *Azadi ka Amrit Mahotsav*, launched by Hon'ble Prime Minister Shri Narendra Modi to mark 75 years of independence, Bose Institute and Media4 Community Foundation (M4C) produced a series of audio podcasts titled "*Vigyan Ki Awaaz*" under a project. These podcasts enabled Bose Institute laboratories to showcase their cutting-edge research and innovations in the field of science and technology to a national and global audience through the reach of the internet portal I-radiolive.com and extended reach into global portals like Spotify.

The upgradation of the research infrastructure has been possible due to the generous funding received from the Ministry. My sincere wishes and applause for the faculty members who have made notable achievements from their dedicated work in the Institute.

Prof. Shubho Chaudhuri
Dean, R&D

MESSAGE

Dean, Student Affairs

Pursuing a Ph.D. is a profound academic journey that reflects a student's passion for learning and commitment to advancing knowledge in their chosen field. While the path is demanding and requires unwavering dedication, it is equally rewarding. At Bose Institute, our Ph.D. scholars have the unique opportunity to collaborate with leading researchers, engage in cutting-edge scientific inquiry, and cultivate skills that will serve them throughout their careers.

Since its inception, Bose Institute has offered a dynamic and rigorous Ph.D. programme, producing hundreds of scholars who have contributed significantly to nationally and internationally renowned institutions. Many of our alums have further mentored new generations of researchers, thereby enriching the global academic ecosystem.

Currently, we offer Ph.D. programmes across all three major branches of science: Life Sciences, Physical Sciences, and Chemical Sciences. Admissions are conducted through a centralized process, typically held twice a year in alignment with the CSIR-NET results. Candidates with independent fellowships are selected for a five-year programme through a two-stage interview process. During the academic year 2024–25, we recruited 33 new Ph.D. students, bringing the total number of enrolled Ph.D. scholars to 121.

In addition to our Ph.D. cohort, we hosted 12 postdoctoral fellows supported by various national funding agencies, and six project academic staff funded through both external grants and internal resources. It is a matter of pride that several of our students have received prestigious accolades, including best poster awards at national conferences and competitive travel grants.

Bose Institute also runs a vibrant Summer Training Programme for undergraduate and postgraduate students. We welcome talented and motivated students each year for an intensive eight-week research experience. Selection is merit-based, following a public call for applications. This year, 23 students participated, including several Bachelor's students awarded the INSPIRE fellowship. Also, 80 students have been placed through short-term internship programs in different laboratories. These trainees gain hands-on exposure to advanced

research methodologies and technologies while working on fundamental science topics in active laboratories.

Our institution remains deeply committed to supporting students at every stage of their academic journey - through seminars, workshops, collaborative research, or mentorship. With access to state-of-the-art facilities, comprehensive libraries, and a dedicated faculty and staff, students are encouraged to make the most of the opportunities available to them.

Prof. Pallob Kundu
Dean, Student Affairs

MESSAGE

Registrar (Officiating)

It gives me profound satisfaction to share the highlights of another year of accomplishments at Bose Institute, where academic excellence, scientific innovation, and holistic development remain central to our mission.

Bose Institute continues to remain true to its legacy of serving as a beacon of knowledge and a centre for advanced research, steadily expanding its national and international impact. Landmark projects such as FAIR and ALICE, along with prestigious collaborations with premier institutions exemplify our scientific excellence and open new frontiers of discovery. Each year, the Institute contributes to the nation and the world by producing a new generation of Ph.D. scholars, imparting training to generate skilled manpower, and empowering SC/ST beneficiaries through dedicated outreach programmes.

All government-mandated directives—including GeM, Swachhta Mission, Vigilance Awareness Week, PFMS, TSA, LIMBS, CPGRAMS, CCP Portal, ZBSA, and CNA—have been meticulously implemented in both letter and spirit. These protocols and practices have been integrated into our operational framework, ensuring consistent adherence and fostering a culture of regulatory compliance across all levels of activity.

In alignment with the Hon'ble Prime Minister Shri Narendra Modi Ji's vision, the first phase of Mission Karmayogi has been successfully completed by both academic and non-academic staff. Equally noteworthy is the achievement of 90% implementation of Hindi in administrative work, under Section 3(3) of the Official Languages Act, which has earned special recognition from the Department of Science & Technology, Government of India.

The Institute continues to engage with the wider community through consistent and impactful outreach programmes, such as participating regularly in expos and science exhibitions and hosting visits from schools and colleges to cultivate scientific curiosity among young minds. Such activities promote collective growth through effective knowledge sharing and build a sense of belonging between the Institute and the public. A safe and equitable workplace is assured through the Internal Complaints Committee,

while the various sections of the Administration, with expertise in Accounts, Purchase, and Establishment, provide timely and robust support to the scientific community in achieving its goals while ensuring compliance with government rules and directives.

I extend my heartfelt gratitude to the esteemed members of the Council of Bose Institute, the Research Advisory Committee, and Finance Committee for their constructive and unwavering support. Their insightful guidance has been instrumental in shaping the Institute's continued success and growth.

I am especially indebted to the Director for his astute leadership – not only in steering the scientific vision of the Institute but also in implementing transformative changes that have significantly uplifted the morale and motivation of our workforce.

I also wish to express my sincere appreciation to the Department of Science and Technology, with particular thanks to the AI Division, for their timely and effective support. Their responsiveness and guidance have been invaluable whenever we have sought their assistance.

I am equally indebted to our dedicated faculty and administrative colleagues, whose unwavering commitment continues to propel the Institute forward. Their tireless efforts form the backbone of our progress and fosters excellence across all domains of activity.

It is with great pleasure that we welcome seven new members to Bose Institute family. Their arrival marks a new chapter in our journey, and I am confident that their expertise and enthusiasm will enrich our collective pursuit of research excellence. I am especially delighted to welcome the newest cohort of students who have joined our PhD and master's programmes. Their youthful energy and curiosity infuse our academic environment with vibrancy and promise. We look forward to nurturing their growth and witnessing the remarkable contributions they will undoubtedly make. Together, these collective contributions will strengthen the foundation of Bose Institute and propelled us toward a future rich with promise and purpose.

With optimism and confidence, I look forward to sharing the achievements that are presently taking shape – initiatives that, though in their formative stages, hold immense promise. As they come to fruition in the near future, I am certain they will further elevate the stature and impact of our Institute.

Prof. Srimonti Sarkar
Registrar (Officiating)

YEAR AT A GLANCE

AVERAGE IMPACT FACTORS

4.64

PARTICIPATION/ORGANIZATION IN SEMINARS/LECTURES & INVITED TALKS DELIVERED

NEW MEMBERS

07

- Dr. Utpal Nandi, joined as Associate Professor in the Department of Chemical Sciences w.e.f. 30.04.2024.
- Prof. Kaustuv Sanyal, joined as Director w.e.f. 02.05.2024.
- Dr. Amit Kumar Paul, joined as Associate Professor in the Department of Chemical Sciences w.e.f. 29.05.2024.
- Prof. Biswanath Maity, joined as Professor in the Department of Biological Sciences w.e.f. 04.06.2024.
- Mrs. Manisha Chaudhary, joined as Stenographer in the Administration w.e.f. 10.06.2024.
- Mr. Biswajit Chanda, joined as Accountant in the Administration w.e.f. 04.11.2024.
- Mr. Sandip Ghosh, joined as Jr. Mechanic (Mechanical in the Workshop w.e.f. 20.01.2025.

AWARDS & HONOURS

03

MEMBERSHIPS

18

02

FELLOWSHIP

01

BEST POSTER/ORAL PRESENTATION

07

PATENT APPLIED/FILED

01

EXTRA MURAL FUND RECEIVED

Rs. 3,73,54,283/-

DST & DAE	02
ANRF (SERB)	12
CCRH	01
ICMR	02
MoEFCC	01
DBT	04
VELUX STIFTUNG (SWITZERLAND)	01

ON-GOING PROJECTS

2024-25

MAJOR PROJECTS

04

- DST & DAE : India's participation in the construction of the Facility for Antiporton and Ion Research (FAIR) at Darmstadt, Germany.
- DST & DAE: Indian Participation in the ALICE Experiment at CERN
- SERB: Setting up a State-of-the-Art CryoEM Regional/National Facility in Eastern Region at Bose Institute : Transforming the Structure-guided Drug Discovery and Therapeutics Research Landscape in India.
- Velux Stiftung (Switzerland): Rational design and structure-function analysis of antimicrobial peptides tailored to treat fungal Ocular infections.

NO. OF JRFs/SRFs/RAs/Project Scientists/Project Assistants

MANPOWER TRAINED: -

1. **INTERNS -80**
2. **TRAINEES -23**

Ph.D. AWARDED

MANPOWER TRAINED

109

NO. OF BENEFICIARIES OF SC/ST OUTREACH PROGRAMMES

40

INTRODUCTION

Bose Institute is one of the public funded premier research institutes in India with the objective of doing research in basic sciences in the frontiers of areas of contemporary importance all the time for the benefit of the society. It is an autonomous institute, financed by the Department of Science and Technology, Government of India running and is governed by its bylaws, service rules as well as the government rules those become applicable time to time.

The institute was originally founded by Sir Jagadish Chandra Bose 1917, as one of the very first few full time scientific research institutes of Indian and Asia. Bose Institute started its journey from its first and main campus located at Rajabazar, Kolkata, in a building with artistic design. Later in the post-independence era, the institute became a fully professional research institute distributed over multiple campuses, under the leadership of renowned Physicists Debendra Mohan Bose. More about the founder and the history of this institute will be found in a following section.

Currently the institute is centred at its primary and brand new campus in Sector V, Bidhananagar Kolkata, with six other satellite campuses distribute over the entire west Bengal from the extreme of South 24 Parganas to Darjeeling. These satellite campus provides enormous opportunities to carry out various field experiments in different types of climates, soil and clean-air, with scopes of maintaining institutes own experimental facilities over longer time. These stations have also been important in organizing outreach programs in rural areas.

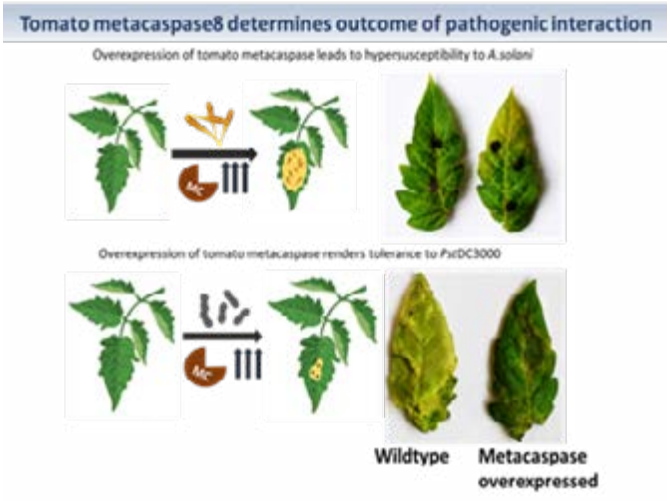
Bose Institute has been well known for its legacy and sustained contributions in some particular areas in science, some of which areas are Biochemistry, Biophysics, Structural Biology, Microbiology, Cancer Biology, Botany and plant sciences, Synthetic organic

Chemistry, Astrophysics, High energy physics, etc. Bose Institute was one of the first few institute which started Bioinformatics Centres in late '80s. This Institute has always encouraged the research in interdisciplinary mode, which was actually the vision of its founder JC Bose, who more than 100 years ago removed the boundary between branches of sciences, e.g. his pioneering works on plants' response on the external stimuli actually combined bioscience and physics, introducing the concept of Biophysics research in India. Over several decades scientists of Bose Institutes made pioneering contributions in these areas, and many of them in recent past have been acknowledged with SS Bhatnagar awards, Science Academy fellowships, and several other prestigious national awards. The currently working scientists have good presence in national and international scientific platforms, though publications, talks, etc. Bose Institute is a partner of the landmark projects such as FAIR and ALICE, along with collaborations with premier institutions including FAIR in Darmstadt, CERN, Velux Stiftung (Switzerland), and others, exemplify our scientific excellence and open new frontiers of discovery.

Right now institute has 46 (approx.) scientists/faculty members of different grades including emeritus scientists, 108 (??) support staffs, 144 research scholars and postdoctoral fellows. While the institute is primarily getting funding from the Department of Science and Technology, Govt of India, the scientist compete in the national and international levels to obtain extramural research funding. Further, most of the research scholars of this institute comes with their own fellowships from various national level funding agencies of the government and thus offsets institute's budget for research-manpower.

As Bose Institute has always prioritized the contemporary needs in science it has always experimented with the structure of the departments, by expanding, splitting and merging. Right now institute has three departments, Physical Sciences, Chemical Sciences and Biological sciences, whereas the underlying structure of research-theme based grouping is still active. The details of the activities and statistics of the achievements made in last one year will found throughout this report.

The institute offers to the society primarily two major products. First, it is the new scientific knowledge and scientific temper which substantially contribute ensure India's presence and glory as one of the leading countries in research and development, that inspires new generations to pursue science in their career. Second, it is the highly trained scientific minds and skilled manpower which after PhD contribute in the various sectors in the society, academia and industry, without which a modern country cannot run and grow in this era. Further, Bose Institute also regularly develops patentable items, copyrightable software/databases, which have the possibilities to earn revenues.



HISTORY

Acharya Jagadis Chandra Bose was a true pioneer of modern science in India. He was the first to demonstrate the wireless transmission of signals - an innovation that laid the foundation for radio communication. Despite this, it was Guglielmo Marconi who received the Nobel Prize for the discovery.

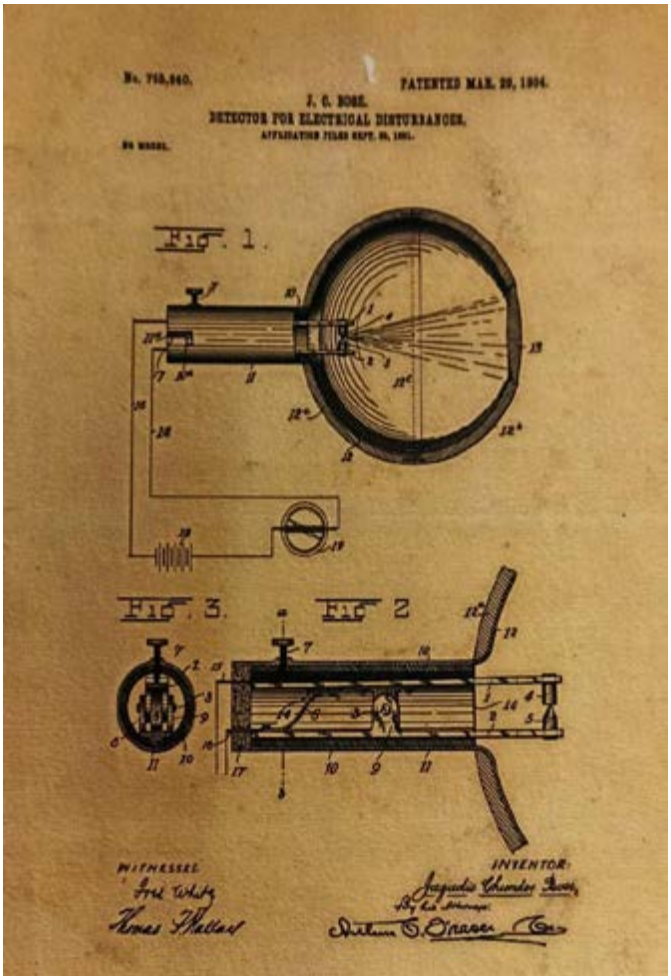
Bose was also the first in the world to use semiconductor technology, a feat achieved decades ahead of its time. Nobel Laureate Sir Neville Mott once remarked that Bose was "sixty years ahead of his time." Additionally, his groundbreaking research in electrophysiology led to the birth of the discipline now known as biophysics.

Despite global acclaim for his wireless transmission, J.C. Bose faced skepticism for his later work on the unity of life and matter. To defend his findings, he crafted ingenious instruments that still impress scientists today. Lacking institutional support, he envisioned a research institute - an idea championed by luminaries like Tagore, Sister Nivedita, Gokhale, and Gandhi - to inspire future generations.

After retirement from Presidency College in Kolkata (then Calcutta), J. C. Bose devoted himself entirely to the establishment of this haven, Bose Institute. He committed the savings of his and his wife Lady Abala, and the inheritances to this task but that were, expectedly inadequate. Many patriots, some of whom named above, helped and contributed for the development of the Institute at that time. J. C. Bose even resorted to giving scientific demonstration-lectures all over India. The organizers charged the admission fees to help found the Institute. Thus, the establishment of Bose Institute is the manifestation of India's hope to establish the nation's self-esteem as an equal to the colonizing west. On 30th November 1917, which coincided with his birthday, J. C. Bose inaugurated Bose Institute at the premises located at 93/1, Upper Circular Road (now A. P. C. Road) adjacent to the Rajabazar Science College.

J.C. Bose inspired his followers to explore the ever-evolving frontiers of science, embracing both life and non-life. He envisioned Bose Institute as a place where knowledge would advance freely and be shared widely - across disciplines, genders, races, and languages. His words, calling for the convergence of physics, physiology, and psychology, were prophetic - championing the spirit of interdisciplinary research long before it became a norm.

J. C. Bose encouraged his followers to pursue the investigation of the ever-opening problems of developing science. In his own words *"which includes both Life and Non-Life…The advance of science is the principal objective of this Institute and also the diffusion of knowledge. to*



associate the advancement of knowledge with the widest possible civic and public diffusion of it, and this without any academic limitations, henceforth to all races and languages, to both men and women alike, and for all the time coming.. Thus the lines of physics, physiology and psychology converge and merge. And here will assemble those who would seek oneness amidst the manifold". These are indeed prophetic words, motivating the pursuit of seamless science, or inter-disciplinary scientific research, as we call it today.

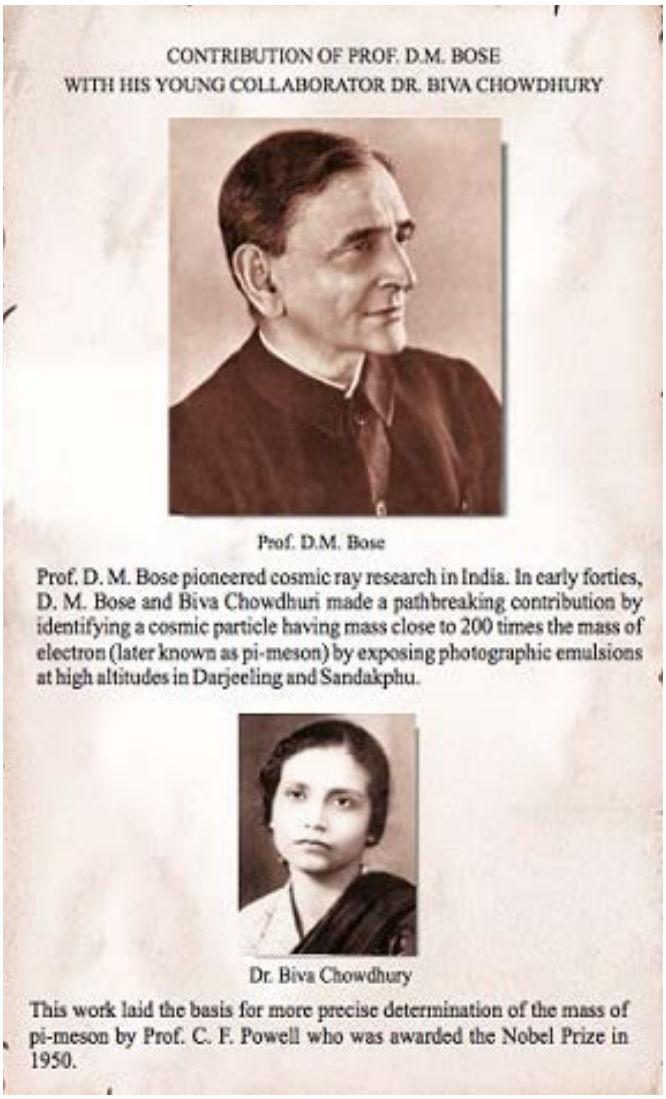
Guided by J.C. Bose's lofty vision, Bose Institute has strived for over a century to uphold his legacy. After his death in 1937, Rabindranath Tagore persuaded his nephew, Dr. D.M. Bose, to lead the Institute. As Director for 30 years, he transformed it into a modern research center. Under his leadership, India's first studies in high-energy and nuclear physics began. He and his student Biva Chowdhury discovered the mu meson using photographic emulsions at high altitudes - a breakthrough that narrowly missed the Nobel Prize due to wartime shortages of higher-resolution film needed to confirm their results.

Meanwhile, C.F. Powell independently confirmed the discovery of the mu meson with the required precision and was awarded the Nobel Prize. In his Nobel Lecture, however, he acknowledged the pioneering work of Bose and Chowdhury. This marked yet another moment when Bose Institute—and India - was denied a well-deserved Nobel recognition.

D. M. Bose transformed Bose Institute into a hub of modern, internationally competitive research by founding India's first Microbiology Department and initiating biochemical studies on plant electrophysiology, building on J. C. Bose's work. He played a key role in laying the foundation for molecular biology in India. A major milestone was the discovery of the cholera endotoxin by Prof. Sambhu Nath De in the institute's Chemistry lab - an achievement Nobel Laureate Joshua Lederberg nominated for the Nobel Prize multiple times, though it ultimately went unawarded.

Successive generations at Bose Institute have upheld its legacy with dedication, contributing significantly to areas such as plant genetics, biotechnology, computational biology, microbiology, systems biology, molecular medicine, physics, and environmental sciences. The institute has also played an active role in international scientific collaborations across both physical and biological sciences.

Staying true to Acharya J. C. Bose's vision, the institute engages in extensive outreach, including rural biotechnology initiatives and hands-on science camps for school students and teachers, particularly from India's North-East. With an integrated MSc-PhD programme and widespread training of doctoral and post-doctoral researchers, Bose Institute spans seven campuses and field stations across West Bengal. It continues to build on its founder's ideals while preparing to explore new frontiers in scientific research.



MANDATE

The Mandate of Bose Institute is basic research in emerging areas of Biology, Physics and Chemistry as well as Rural Biotechnology Programme of direct societal benefit.

MISSION

The core mission of Bose Institute can be summarized in the words of our founder, Acharya J. C. Bose, "The advancement of science and also the diffusion of knowledge are the principal objectives of the Institute". Our mission is to provide a unique platform for cutting edge interdisciplinary scientific research, both basic and applied, its dissemination among the society and human resource development for a modern India. By encouraging interdisciplinary sciences, Bose Institute strives to perform seamless research, as perceived by our founder and the first inter-disciplinary scientist, which could lead to complete and in-depth understanding of scientific problems.

VISION

The vision of Bose Institute is best captured in the declaration of the Acharya J.C. Bose's foundation day speech in November 30, 1917, "I dedicate today this Institute – not merely a laboratory but a temple". Acharya's dream vision was to set up a research institute where Indians could carry out scientific research, the backbone of any modern society, unhindered by the colonial masters. The vision was not only the advancement of science by Indian scientists, but also the diffusion of the generated knowledge among the larger society, to build a self-reliant and modern India.

OBJECTIVES

The objectives of Bose Institute, Kolkata as laid down in the Memorandum of Association are as follows:-

1. Advancement of knowledge by means of research.
2. The diffusion of knowledge by organizing discourses, demonstrations and lectures to be given by original workers in it and thinkers.
3. o do all such things as are incidental or conducive to the attainment of the above objects or any of them.

COMMITTEES OF THE INSTITUTE

Governing Body

1	Prof. S.N. Chatterjee	2	Shri Somnath Sanyal
3	Prof. D. Banerjea	4	Dr. Anutosh Chatterjee
5	Dr. Manish Sekhar Chakraborty	6	Shri D. Mandal
7	Shri Dilip Bhattacharyya	8	Prof. Parul Chakrabarti
9	Prof. Bikash Sinha	10	The Director, Bose Institute – Honarary Secretary

Council

1	Prof. Devang V Khakhar, Department of Chemical Engineering, Indian Institute of Technology Bombay, Powai, Mumbai	Chairman
2	Prof. Sanghamitra Bandyopadhyay, Director, Indian Statistical Institute, 203, B.T. Road, Kolkata	Member
3	Prof. Chandrima Shaha, J C Bose Chair Distinguished Professor, Infectious Diseases and Immunology, CSIR – Indian Institute of Chemical Biology, 4, Raja S. C. Mullick Road, Jadavpur, Kolkata	Member
4	Prof. V. Nagaraja, Professor, Department of Microbiology and Cell Biology, Indian Institute of Science, Bengaluru	Member
5	Prof. S. Ganesh, Professor, Department of Biological Sciences and Bio-Engineering, Indian Institute of Technology Kanpur, Kanpur	Member
6	Secretary, Government of India, Ministry of Science and Technology, Department of Science & Technology, New Delhi	Member
7	Joint Secretary & Financial Adviser to the Government of India, Ministry of Science and Technology, Department of Science & Technology, New Delhi	Member
8	Chief Secretary, Government of West Bengal, Nabanna, Howrah	Member
9	Director, Indian Association for Cultivation of Science, Jadavpur, Kolkata	Member (Ex-officio)
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Dean, Student's Affairs

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Non-Academic Staff: Arindam Basu, Ranjit Das.

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  - Structures and functions of macromolecules
  - Bioinformatics & Disease Biology

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- Ph.D. Coursework
- Training and internships

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- Science Festivals and Book Fairs
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Research Highlights

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National Collaborations: with 15+ organizations
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↓

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- Gene Regulation

Prof. Kaustuv Sanyal
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- Drug resistance mechanisms in fungal pathogens

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- Investigate the role of the vacuole of Saccharomyces cerevisiae in withstanding increasing ethanol concentration during alcoholic fermentation

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Department of Biological Sciences
- Virulence factors and virulence regulators of pathogenic bacteria

BIOLOGY OF MICROBES

SIGNIFICANT PUBLICATIONS

PLOS BIOLOGY

RESEARCH ARTICLE

Autophagy-related protein Atg11 is essential for microtubule-mediated chromosome segregation

Md. Hashim Reza[1], Rashi Aggarwal[1¤], Jigyasa Verma[1¤], Nitesh Kumar Podh[2], Ratul Chowdhury[3], Gunjan Mehta[2], Ravi Manjithaya[4], Kaustuv Sanyal[1,5*]

The FEBS Journal

FEBS PRESS science publishing by scientists

Binary protein interactome mapping of the *Giardia lamblia* proteasome lid reveals extra proteasomal functions of GlRpn11

Ankita Das[1], Atrayee Ray[1], Nibedita Ray Chaudhuri[1], Soumyajit Mukherjee[2], Shubhra Ghosh Dastidar[1], Alok Ghosh[2], Sandipan Ganguly[3], Kuladip Jana[1] and Srimonti Sarkar[1]

1 Department of Biological Sciences, Bose Institute, Kolkata, India
2 Department of Biochemistry, University of Calcutta, Kolkata, India
3 Division of Parasitology, National Institute for Research in Bacterial Infections, Kolkata, India

The FEBS Journal

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Functional diversity in archaeal Hsp60: a molecular mosaic of Group I and Group II chaperonin

Koustav Bhakta, Mousam Roy, Shirsha Samanta and Abhrajyoti Ghosh

Department of Biological Sciences, Bose Institute, Kolkata, India

STRUCTURAL BIOLOGY

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- Medicinal Chemistry
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- G-Quadruplex and i-motif homeostasis
- Thermostable Insulin Formulation
- Interference of regulatory genes in Cancer

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Department of Biological Sciences

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- Allosteric regulations in proteins and in their complexes with others

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- Post-translational modification of proteins
- Structure-function relationships of protein kinases

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Department of Biological Sciences

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- Structural studies: CryoEM and X-ray crystallography
- Chemical Genetics: Exploring the substrate space of protein kinases
- Protein design and directed evolutio

STRUCTURAL BIOLOGY

SIGNIFICANT PUBLICATIONS

NANO · MICRO small

Research Article

Multiscale Materials Engineering via Self-Assembly of Pentapeptide Derivatives from SARS CoV E Protein

Dibakar Sarkar, Aftab Hossain Khan, Sainath Polepalli, Riddhiman Sarkar, Prasanta Kumar Das, Somnath Dutta, Nirakar Sahoo, Anirban Bhunia

First published: 16 July 2024 | https://doi.org/10.1002/smll.202404373

JBC | JOURNAL OF BIOLOGICAL CHEMISTRY

Volume 300, Issue 3, March 2024, 105701

JBC Communication

Host antimicrobial peptide S100A12 disrupts the fungal membrane by direct binding and inhibits growth and biofilm formation of *Fusarium* species

Sanhita Roy [1,2], Bharathi Bhogapurapu [1], Sreyanki Chandra [1,2], Karishma Biswas [3], Priyasha Mishra [1,4], Abhijit Ghosh [1,2], Anirban Bhunia [3]

From the journal:
Chemical Communications

Coomassie brilliant blue G-250 acts as a potential chemical chaperone to stabilize therapeutic insulin†

Check for updates

Ranit Pariary [‡a], Sandip Dolui [‡b], Gourav Shome [‡c], Sk Abdul Mohid [a], Achintya Saha [d], Bhisma N Ratha [af], Amaravadhi Harikishore [e], Kuladip Jana [c], Atin K Mandal [*c], Anirban Bhunia [*a] and Nakul C Maiti [*b]

STRUCTURAL BIOLOGY

SIGNIFICANT PUBLICATIONS

ACS chemical biology

pubs.acs.org/acschemicalbiology Letter

ALTering Cancer by Triggering Telomere Replication Stress through the Stabilization of Promoter G-Quadruplex in *SMARCAL1*

Suman Panda,[‖] Tanaya Roychowdhury,[‖] Anindya Dutta, Sourio Chakraborty, Tanya Das, and Subhrangsu Chatterjee*

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Nano Today

journal homepage: www.elsevier.com/locate/nanotoday

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Review

The logic devices for biomolecular computing: Progress, strategies, and future directions

Debopriya Bose[a,b], Gun Anit Kaur[b], Sapna Balayan[b], Subhrangsu Chatterjee[a,*], Ashutosh Tiwari[b,*]

[a] Department of Biological Sciences, Bose Institute Unified Academic Campus EN 80, Sector 5, Bidhan Nagar (Salt Lake City), Kolkata, WB 700 091, India
[b] Institute of Advanced Materials, Gammalkilsvägen 10, Ulrika 590 53, Sweden

Biochemistry

pubs.acs.org/biochemistry Article

Adaptive Workflows of Machine Learning Illuminate the Sequential Operation Mechanism of the TAK1's Allosteric Network

Nibedita Ray Chaudhuri and Shubhra Ghosh Dastidar*

eLife

Biochemistry and Chemical Biology

Dual-specific autophosphorylation of kinase IKK2 enables phosphorylation of substrate IκBα through a phosphoenzyme intermediate

Reviewed Preprint
v2 • February 10, 2025
Revised by authors

Reviewed Preprint
v1 • June 20, 2024

Prateeka Borar, Tapan Biswas, Ankur Chaudhuri, Pallavi T Rao, Swasti Raychaudhuri, Tom Huxford, Saikat Chakrabarti, Gourisankar Ghosh, Smarajit Polley

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- Metabolic reprogramming
- Epigenetic modifications in cancer

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- Mitochondrial dysfunction in pulmonary diseases
- Machine Learning in multi-omics data and Biological Databases

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- Regulation of ETS transcription factors in refractory cancers

BIOINFORMATICS & DISEASE BIOLOGY

SIGNIFICANT PUBLICATIONS

JBC RESEARCH ARTICLE

14-3-3 interaction with phosphodiesterase 8A sustains PKA signaling and downregulates the MAPK pathway

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https://doi.org/10.1016/j.jbc.2024.105725

Soumita Mukherjee[1], **Somesh Roy**[1], **Shruti Mukherjee**[2], **Amaravadhi Harikishore**[3], **Anirban Bhunia**[2], and **Atin K. Mandal**[1,*]

From the [1]Department of Biological Sciences, and [2]Department of Chemical Sciences, Bose Institute, Kolkata, India; [3]School of Biological Sciences, Nanyang Technological University, Singapore, Singapore

Reviewed by members of the JBC Editorial Board. Edited by Wolfgang Peti

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Redox Biology

journal homepage: www.elsevier.com/locate/redox

FNDC5/irisin mitigates the cardiotoxic impacts of cancer chemotherapeutics by modulating ROS-dependent and -independent mechanisms

Manish Kumar[a,b], Abhishek Singh Sengar[a], Anushree Lye[a,b], Pranesh Kumar[c], Sukhes Mukherjee[d], Dinesh Kumar[a], Priyadip Das[a], Suvro Chatterjee[f], Adele Stewart[g], Biswanath Maity[a,b,*]

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DOI: 10.1039/d4mh00981a

Targeted and precise drug delivery using a glutathione-responsive ultra-short peptide-based injectable hydrogel as a breast cancer cure†

Satyajit Halder,[a] Tanushree Das,[b] Ritvika Kushwaha,[b] Anup Kumar Misra,[a] Kuladip Jana[*a] and Debapratim Das[*b]

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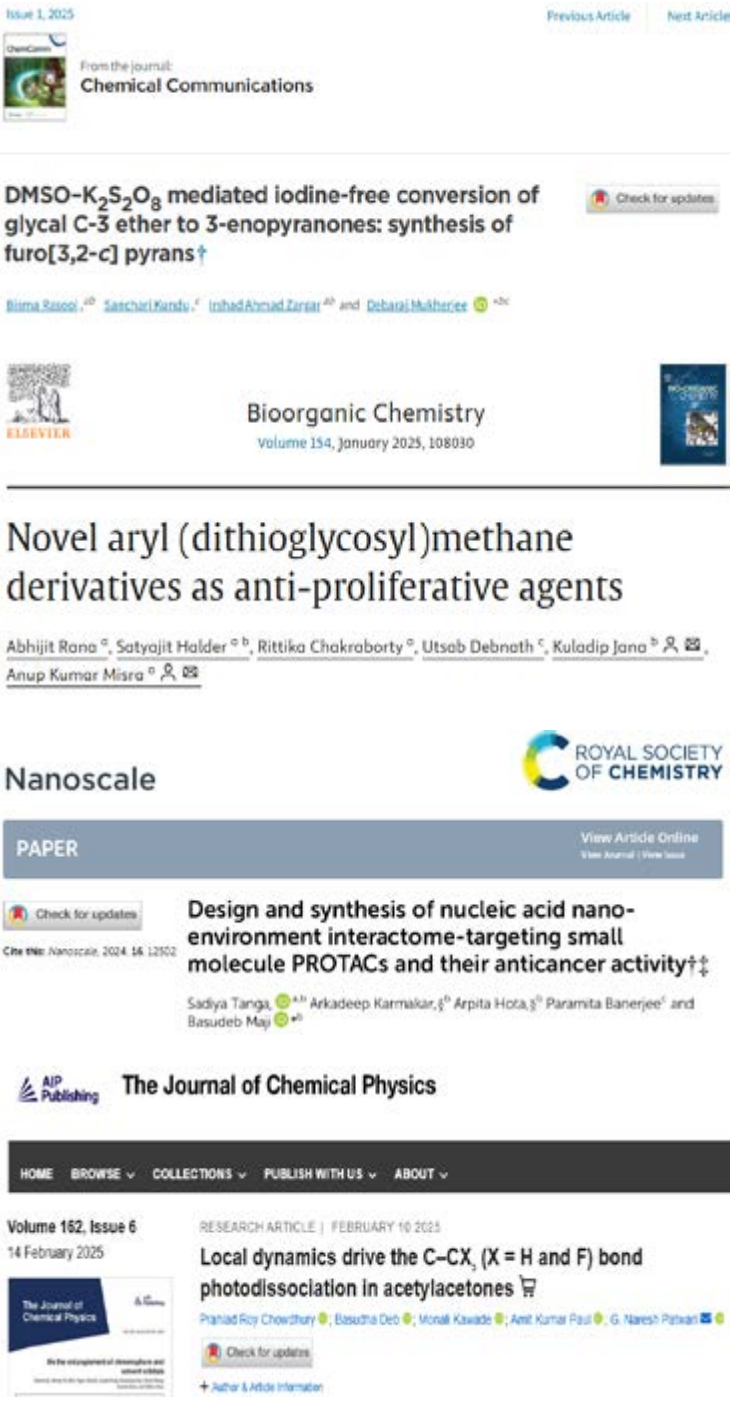

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From the journal: Chemical Communications

DMSO-$K_2S_2O_8$ mediated iodine-free conversion of glycal C-3 ether to 3-enopyranones: synthesis of furo[3,2-*c*] pyrans†

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Bisma Rasool, Sanchari Kandu, Irshad Ahmad Zargar and Debasis Mukherjee

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Bioorganic Chemistry
Volume 154, January 2025, 108030

Novel aryl (dithioglycosyl)methane derivatives as anti-proliferative agents

Abhijit Rana, Satyajit Halder, Rittika Chakraborty, Utsab Debnath, Kuladip Jana, Anup Kumar Misra

Nanoscale

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Cite this: Nanoscale, 2024, 16, 12502

Design and synthesis of nucleic acid nano-environment interactome-targeting small molecule PROTACs and their anticancer activity†‡

Sadiya Tanga, Arkadeep Karmakar, Arpita Hota, Paramita Banerjee and Basudeb Maji

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Volume 162, Issue 6
14 February 2025

RESEARCH ARTICLE | FEBRUARY 10 2025

Local dynamics drive the C–CX_3 (X = H and F) bond photodissociation in acetylacetones

Pranad Roy Chowdhury, Basudha Deb, Monali Kawade, Amit Kumar Paul, G. Naresh Patwari

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- Biotechnology for climate resilient crops

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SIGNIFICANT PUBLICATIONS

Plant Physiology

Plant Physiology, 2024, **196**, 996–1013
https://doi.org/10.1093/plphys/kiae355
Advance access publication 26 June 2024
Research Article

The *Arabidopsis* ARID–HMG DNA-BINDING PROTEIN 15 modulates jasmonic acid signaling by regulating MYC2 during pollen development

Sonal Sachdev, Ruby Biswas, Adrita Roy, Ayantika Nandi, Vishal Roy, Sabini Basu, and Shubho Chaudhuri

Microbial Pathogenesis 195 (2024) 106864

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The anti-quorum sensing and biofilm inhibitory potential of *Piper betle* L. leaf extract and prediction of the roles of the potent phytocompounds

Bratati Sikdar, Sourav Mukherjee, Rupsa Bhattacharya, Adarsha Raj, Alokesh Roy, Debarati Banerjee, Gaurab Gangopadhyay, Sadipta Roy

Plant Molecular Biology (2025) 115:35
https://doi.org/10.1007/s11103-025-01563-z

Tomato miR398 knockout disrupts ROS dynamics during stress conferring heat tolerance but hypersusceptibility to necrotroph infection

Shreya Chowdhury · Ananya Mukherjee · Raghuvir Singh · Sushmita Talukdar · Shrabani Basak · Rohit Das · Sayan Mal · Pallob Kundu

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Environmental and Experimental Botany 223 (2024) 105750

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Environmental and Experimental Botany

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Research paper

ULTRAPETALA 1 regulates the growth and development of rice plants to promote resilience to salinity stress

Jinia Chakrabarty, Rukshar Parveen, Sambit Datta, Byapti Ghosh, Vishal Roy, Zhumur Ghosh, Shubho Chaudhuri

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SIGNIFICANT PUBLICATIONS

Physics Letters B
Volume 853, June 2024, 138673

Letter

Study of the ^{7}Be(d,^{3}He)^{6}Li* reaction at 5 MeV/u

Sk M. Ali [a 1], D. Gupta [a], K. Kundalia [a], S. Maity [a], Swapan K. Saha [a 2], O. Tengblad [b], J.D. Ovejas [b], A. Perea [b], I. Martel [c], J. Cederkall [d], J. Park [d 3], A.M. Moro [e]

Physical Review B

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Optical intensity driven mid-gap transitions in few-layer MoS_2

Tara Shankar Bhattacharya[1,2], Sumanti Patra[3], Shib Shankar Singha[1,4], Sreemanta Mitra[5,*,†], Priya Mahadevan[3,‡], and Achintya Singha[1,§]

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Eur. Phys. J. C (2024) 84:1079
https://doi.org/10.1140/epjc/s10052-024-13228-0

THE EUROPEAN PHYSICAL JOURNAL C

Regular Article - Experimental Physics

Multiplicity dependence of charged-particle intra-jet properties in pp collisions at $\sqrt{s} = 13$ TeV

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CERN, 1211 Geneva 23, Switzerland

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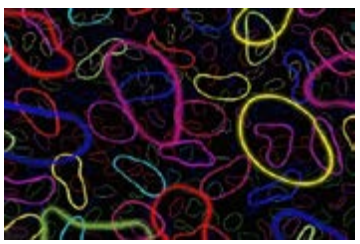
- Global Model Building in String Cosmology
- Classifying the Calabi-Yau Geometries



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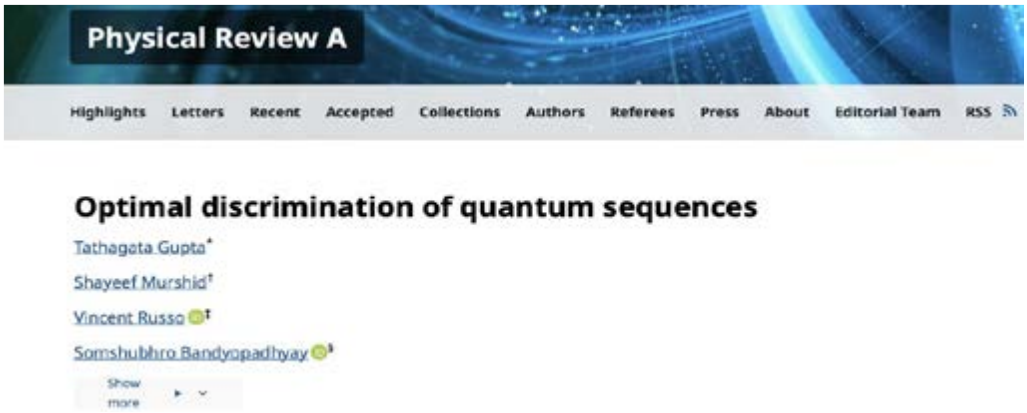

Reading-off the non-geometric scalar potentials with U-dual fluxes

Sayan Biswas,[a] George K. Leontaris[b] and Pramod Shukla[a]
[a]Department of Physical Sciences, Bose Institute,

Global embedding of fiber inflation in a perturbative large volume scenario

Swagata Bera,[1,2] Dibya Chakraborty,[3] George K. Leontaris,[4] and Pramod Shukla[1]
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$PM_{2.5}$ pollution exceeding Indian standard over a semi-urban region at eastern IGP: Chemistry, meteorological impact, and long-range transport

Sauryadeep Mukherjee [a c], Gyanesh Kumar Singh [b], Monami Dutta [a c], Vivek Srivastava [b], Adnan Mateen Qadri [b], Tarun Gupta [b], Abhijit Chatterjee [a]

Volume 10, Issue 4, 29 February 2024, e26370

Research article

Fog caused distinct diversity of airborne bacterial communities enriched with pathogens over central Indo-Gangetic plain in India

Shahina Raushan Saikh [a b], Md Abu Mushtaque [a], Antara Pramanick [a], Jashvant Kumar Prasad [a], Dibakar Roy [c], Sudipto Saha [c], Sanat Kumar Das [a]

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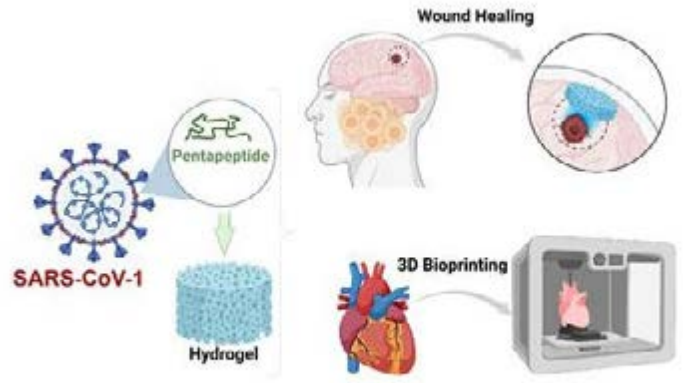
Home >> Magic recipes to create hydrogels from viral protein fragments can improve drug delivery

Magic recipes to create hydrogels from viral protein fragments can improve drug delivery

A new way discovered to create hydrogels using tiny protein fragments of just five amino acids from the SARS-CoV-1 virus, could help improve targeted drug delivery & reduce side effects

Due to the increase in chronic and infectious diseases, researchers are for ever on the lookout for new methods of drug delivery to improve the effectivity of treatments. Hydrogels are known to be suitable for drug delivery because of their swelling behaviour, mechanical strength and biocompatibility.

Short peptide-based hydrogels hold enormous potential for a wide range of applications. However, researchers have found the gelation of these systems very challenging to control. Minor changes in the peptide sequence can significantly influence the self-assembly mechanism and thereby the gelation propensity.



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Home >> Novel experiment to explore the limits of quantum theory for arbitrarily massive objects

Novel experiment to explore the limits of quantum theory for arbitrarily massive objects

Scientists have devised an experiment for testing the domain of validity of quantum theory for objects much more massive than the usual microphysical objects (atoms, molecules etc), beyond which the classical theory has to be necessarily used. This study can also help in developing high precision quantum sensors which are important tools in the cutting-edge quantum technologies.

The principles of Quantum Mechanics replacing that of Newtonian classical mechanics were developed nearly 100 years back. Yet, a number of quantum foundational issues remain problematic. For example, the boundary between the quantum mechanical microworld and the large scale macroscopic classical world of everyday objects obeying Newtonian Laws remains unspecified. The question--up to what level the quantum mechanical principles be valid for macroscopic objects-- continues to be one of the most fundamental open questions in contemporary physics.

Prof. Shubho Chaudhuri

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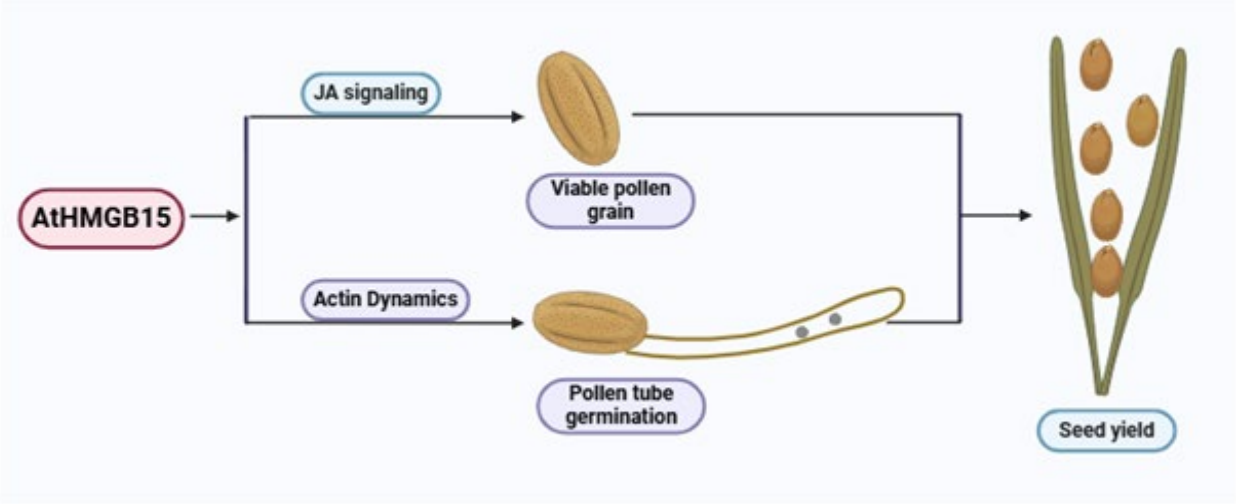
Home >> Architect of pollen development & seed formation identified

Architect of pollen development & seed formation identified

Scientists have identified a novel gene that plays a crucial role in the development of stamens (male reproductive structure) including pollen grain and seed formation, in *Arabidopsis* flowering plants related to cabbage and mustard. The study opens up new possibilities for improving crop fertility and seed production.

Pollen formation represents a very important developmental stage in plant life cycle. It represents the male gametophyte and its role is to deliver the genetic material to the embryo sac. The production and transfer of viable pollen grains to the stigma, germination of the pollen grains, growth of the pollen tubes down the style, and effective fertilization are necessary for the formation of a successful seed set. Thus, understanding the pollen development process not only elucidate the basic mechanism of sexual reproduction of flowering plants but also add valuable information for subsequent manipulation in crop production.



Dr. Abhrajyoti Ghosh

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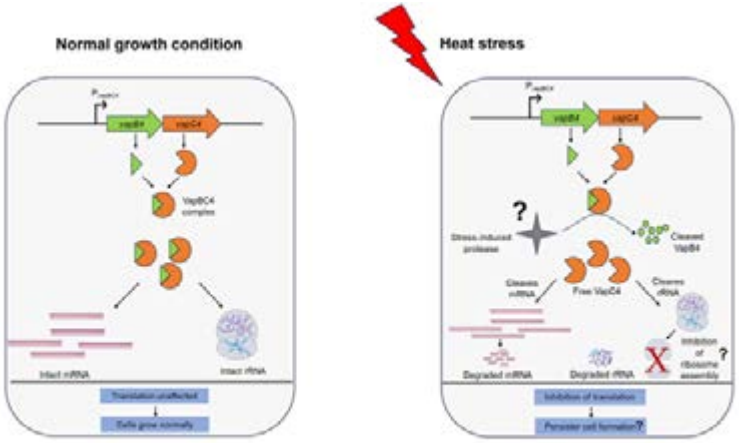
Home >> Scientists revealed the survival strategies of some of the primitive organisms on earth

Scientists revealed the survival strategies of some of the primitive organisms on earth

Study of archaea, a domain of ancient organisms have given scientists clues to survival strategies of microorganisms by adapting to harsh conditions with the help of their toxin-antitoxin (TA) systems.

As the planet's climate changes rapidly, with ocean and surface water temperatures rising, it's becoming more important to understand how some of the earliest heat-loving organisms developed ways to survive in extreme heat. Archaea, which means "ancient things" in Greek, are one of the oldest forms of life on Earth and belong to a group called the third domain of life. Many archaea live in some of the harshest environments on Earth, which makes them ideal for studying how life can survive in tough conditions.

Dr. Abhrajyoti Ghosh and his team at the Department of Biological Sciences at Bose Institute, an autonomous institute of the Department of Science and Technology (DST) sought to explore how certain archaea toxin-antitoxin (TA) systems help these organisms cope with high temperatures. Unlike the cell death processes in more complex organisms, archaea use different TA systems to help them survive stress from other living things and environmental factors. TA systems are found in many bacteria and archaea, which suggests they are important for evolution. However, we still do not fully understand what they do in archaea.



Proposed model showing the mode of action of the VapBC4 TA system during heat stress.

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Home >> New Microbe reverting sesame flowers to vegetative state identified

New Microbe reverting sesame flowers to vegetative state identified

Researchers have identified a new microbe responsible for an unusual disease affecting the sesame fields of Midnapore in West Bengal.

Sesame, the Queen of Oil, is a primordial oilseed crop since the remnants of sesame seeds were discovered at Harappa and Mohenjodaro. Sesame oil is excellent from a medicinal point of view. It contains antioxidants, and beneficial for heart patients. Unfortunately, we do not use it as the principal edible oil. The Indian sesame varieties need significant improvement so that their benefits can be harnessed.

Prof. Gaurab Gangopadhyay, and his group at the Department of Biological Sciences, Bose Institute, an autonomous institute of the Department of Science and Technology worked on this aspect of the queen of oil for more than a decade and they have successfully developed a few improved varieties of sesame through molecular marker-assisted breeding.

However, in the last few years, Prof. Gangopadhyay and his group found an unusual disease in the sesame fields of Midnapore, West Bengal farmers' plots during their visits to East and West Midnapore districts. After attaining the flowering and fruiting stage, the infected sesame plants are reverting to their vegetative stage and the white flowers with pinkish tinges turn green.

Prof. Anirban Bhunia

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Home >> Ayurveda provide new hope for Alzheimer's Disease

Ayurveda provide new hope for Alzheimer's Disease

A new study that provides a multipronged approach to treatment of several neurodegenerative diseases, offers hope for Alzheimer's Disease, Dementia, and related diseases.

Amyloid proteins and peptides play a pivotal role in various neurodegenerative diseases, including Alzheimer's disease (AD). Synthetically designed small molecules/ show promise towards inhibition of various kinds of amyloidosis.

Professor Anirban Bhunia and his team at the Bose Institute in Kolkata, an autonomous institute of Department of Science and Technology, employed two distinct strategies. First, they utilize chemically synthesized peptides to combat amyloid beta aggregation. Second, they repurpose a drug called Lasunadya Ghrita (LG) from Ayurveda, the ancient traditional Indian medicine, which has previously shown efficacy in treating depression-related mental illnesses.

Dr. Saikat Biswas

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Home >> New milestone in indigenous development of gaseous detector important for mega science FAIR project in Germany

New milestone in indigenous development of gaseous detector important for mega science FAIR project in Germany

Researchers have developed an innovative technique using a radioactive source that can simplify the study of radiation effects on Gas Electron Multiplier (GEM) detectors, a crucial step in nuclear and particle physics experiments.

Gas Electron Multiplier (GEM) detector are particle detectors used as tracking devices in high-energy physics experiments that utilizes a thin, perforated foil with a high electric field to amplify particles produced by ionizing radiation, allowing for precise detection of particles like muons by significantly multiplying the initial signal generated by the particle's interaction with the gas within the detector.

They are also strong candidates for diagnostic applications in medical technology because of their good position resolution. First introduced by Prof. Fabio Sauli in 1997. GEM detectors consist of a 50 µm thick Kapton foil, with 5 µm copper cladding on both sides.

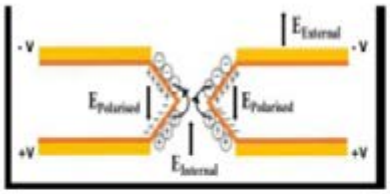

Fig 1: Schematic of the charge accumulation on the Kapton foil inside GEM hole. The dynamical accumulation of the charges on the surface of the Kapton increases the electric field thence the gain of the chamber.

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29. **Chumki Nayak** (University of Calcutta); Title of the Thesis: Light-Matter Interactions in Two-Dimensional Transition Metal Dichalcogenide Alloy MoSSe: Valley Physics, Exciton - Plasmon Coupling, and Optoelectronic Applications; Supervisor: Prof. Achintya Singha.
30. **Suvadip Masanta** (University of Calcutta); Title of the Thesis: Optical and Vibrational Properties of Transition-Metal Dichalcogenide-Based Nanostructures and Applications. Supervisor: Prof. Achintya Singha.
31. **Abhi Modak** (University of Calcutta); Title of the Thesis: Inclusive photon and charged particle production in proton-proton and proton-lead collisions at LHC energies with ALICE; Supervisor: Dr. Sidharth Kr. Prasad.
32. **Debjani Banerjee** (University of Calcutta); Title of the Thesis: Study of Jet Production In Proton-Proton and Nucleus-Nucleus Collisions Using The ALICE Experiment; Supervisor: Dr. Sidharth Kr. Prasad.
33. **Prottoy Das** (University of Calcutta); Title of the Thesis: Measurements of Jet Properties In Small Collision Systems at LHC With ALICE; Supervisor: Dr. Sidharth Kr. Prasad.
34. **Deep Nath** (University of Calcutta); Title of the Thesis: Information, games and graphs. Supervisor: Prof. Soumen Roy.

AWARDS/HONOURS/ MEMBERSHIPS

Prof. Kaushik Biswas

(i) Acted as nominated member of the Academic Research and Program Advisory Committee (ARPAC) for SNBNCBS. (ii) Acted as nominated member of the Academic Program Development Committee (APDC) and Research Council (RC) of NIPER-Kolkata.

Prof. Atin Kumar Mandal

Member of Internal Quality Assurance Cell (IQAC) of Saha Institute of Nuclear Physics, Kolkata.

Prof.Wriddhiman Ghosh

Conferred honorary membership of the European Association of Geochemistry in August 2024.

Prof. Zhumur Ghosh

(i) Editorial Board Member, Current Bioinformatics; (ii) Member of the National Academy of Science; (iii) Associate Editor, Molecular Plant-Microbe Interactions.

Prof. Biswanath Maiti

Selected as 'INSA Associate Fellow' 2024.

Dr. Abhrajyoti Ghosh

(i) Member of Subject Expert Committee (SEC) of Bioscience & Biotechnology of the INSPIRE fellowship by the Department of Science and Technology, Govt of India. (ii) Acting as the DBT-nominee in the Institutional Biosafety Committee (IBSC) of Sister Nivedita University (SNU), Kolkata. (iii) Member of the Institutional Biosafety Committee (IBSC) of the Indian Association for Cultivation of Science (IACS), Kolkata. (iv) Member of the Board of Studies (BoS) of the Department of Microbiology, St. Xavier's University, Kolkata; Department of Biotechnology, Neotia University; Department of Biotechnology, Amity University, Kolkata.

Dr. Sudipto Saha

(i) Received a project grant from Osaka University of 500,000 JPY for short-term visits (2025-2026). (ii) Received an International Travel Award from Asia Pacific Bioinformatics Network (APBioNET) to attend Asia & Pacific Bioinformatics Joint Conference (APBJC), 2024 in Okinawa, Japan.

Sounak Banerjee student of Prof. Kaushik Biswas (i) received Best Poster Presentation Award at the 22nd "Transcription Assembly Meeting 2025" during 19-21 March 2025. (ii) Received Best Oral Presentation Award at the 1st "ANUSANDHAN 2025" during 7-8 March 2025.

Prateeka Borar student of Dr. Smarajit Polley awarded ITS grant from SERB to present a poster and a flash talk at the Protein Phosphorylation in Health and Disease, FASEB Science Research Conferences held during 4 August to 8 August 2024 at Grand Hotel, Malahide, Ireland.

Samrat Mitra student of Dr. Smarajit Polley recognized as "best oral presentation" in the Annual Symposium 2024 held in Bose institute.

Dr. Kuladip Jana

1. Fellow of the Association of Researchers & Academicians, India, 2024 (FARAI).
2. Fellow of the Indian Academic Researchers Association, India, 2024 (FIARA).
3. S Ramanujan Award 2024 for Outstanding Scientists from ARAI, India.
4. Prof. K. C. Bose Gold Medal Award, 2024 from National Environmental Science Academy (NESA), New Delhi.

Dr. Anirban Bhunia

Received Visiting Advanced Joint Research (VAJRA) scheme, a prestigious initiative supported by the Anusandhan National Research Foundation (ANRF) under the Department of Science and Technology (DST), Government of India.

Dr. Aritreyee Datta (Student of Dr. Anirban Bhunia) received the best poster award in NMRS, 2024 held in CBMR Lucknow.

Karishma Biswas (Student of Dr. Anirban Bhunia) (i) received the award for best poster presentation in 10th Indian Peptide Symposium held in IISER Pune (ii) received best oral presentation in Bose Institute Annual Symposium 2024.

Prof. Debaraj Mukherjee

1. Received ACCT(I) Excellence in Carbohydrate Research Award-2024 sponsored by PfP, Houston, Texas, USA for outstanding contribution to the area of synthetic carbohydrate chemistry.

2. Selected and participated in the Leadership Development Programme in Science and Technology (LEADS) organized by Indian National Science Academy and National Centre for Good Governance at INSA, New Delhi, July, 2024.

Prof Abhijit Chatterjee and his team have introduced a "Toxicity Standard" of PM2.5 pollutant in Kolkata. They have shown that the threshold level of PM2.5 in Kolkata is 70 micrograms per volume of air (m3), below which the level of toxicity (oxidative stress) remains low and above which the toxicity increases rapidly. They have identified major sources for such a high toxicity level. Accordingly, Prof Chatterjee made a "Winter Action Plan" for Kolkata and submitted it to the Government of West Bengal. The Press Information Bureau of the GoI has shared this remarkable research.

Dr. Utpal Nandi

1. Member, The National Academy of Sciences, India (NASI).
2. American Society for Pharmacology and Experimental Therapeutics (ASPET).

Dr. Amit Kumar Paul

1. Editorial Board Member of the International Journal of Chemical Kinetics.
2. Guest Editor of Advanced Theory and Simulations in the special edition of Anusandhan.
3. Best Poster award by Group Members: 1. Manju Yadav in SoPhyC 2024 (IIT Bombay), 2. Basudha Deb in PCAMC 2024 (IISER Kolkata), 3. Manju Yadav and 4. Krishnandu Dey in Anusandhan 2025 (Bose Institute).

Prof. Dhruba Gupta

1. Ritankar Mitra (student of Prof. Dhruba Gupta) (i) attended "Euroschool on Exotic Beams 2024" at Jyväskylä, Finland during 25 - 31 August 2024. He presented his research work titled "Direct and Sequential Breakup of ^{7}Be on ^{12}C at 5 MeV/u" through oral and poster presentation. His travel expenses were funded by Euroschool. (ii) Attended "International School of Trigger and Data Acquisition (ISOTDAQ 2024)" at University of Science and Technology (USTC), Hefei, China. He received full financial support from CERN to participate in the school.

Prof. Achintya Singha

1. Member of the Expert Committee (PAC) of Teachers Associateship for Research Excellence (EC-TARE), Science and Engineering Research Board (SERB), Government of India (2021 to 2024).
2. Member of the Board of Studies (PG), Department of Physics, Midnapore College, from 15 February 2020 to present.

Prof. Soumen Roy

1. Editorial Board member of: (1) PLOS ONE, (2) Indian Journal of Physics (Springer), (3) Frontiers in Physics.

Dr. Saikat Biswas

1. Chaired a session on Future Experiment and Detector Development in the XXVI DAE-BRNS High Energy Physics Symposium 2024, held from 19-23 December 2024, at BHU, Varanasi.
2. Worked as a member of the judges to evaluate the Oral and Posters of Physics in Anusandhan 2025, 7-8 March 2025 at Bose Institute.
3. Subir Mandal (Student of Dr. Saikat Biswas) attended the prestigious DRD1 Gaseous Detector School at CERN, Switzerland, from 27 November to 06 December 2024 as one of the members among 35 candidates all over the world.

Dr. Sidharth Kr. Prasad

1. Served as the Deputy Spokesperson of the India-ALICE-STAR Collaboration (January 2023 – December 2024).
2. Serving as the Chairman of the Physics Board of India-ALICE-STAR Collaboration (January 2025 – till date).
3. Served as one of the conveners of the Physics Analysis Working Group – Jet substructure (PAG-JSUB) in the ALICE Collaboration at CERN (October 2023 – till date).

4. Served as one of the Internal Review Committee (IRC) members for reviewing the analysis entitled "Medium-induced modification of the groomed and ungroomed jet mass and angularities in Pb-Pb and pp collisions at 5.02 TeV" in the ALICE Collaboration.
5. Served as one of the Internal Review Committee (IRC) members in the ALICE experiment for reviewing the ALICE paper "Jet substructure correlation of the Soft Drop Rg and Zg in pp and Pb--Pb collisions".

Dr. Pramod Kumar Shukla

1. Chair of the morning session of the talks on 13 December 2024 at National String Meeting NSM-2024 at IIT Ropar.
2. One of the judges to evaluate the Oral and Posters of the participants in the event "Anusandhan 2025" held during 7-8 March 2025 at Bose Institute.
3. Financial support from ICTP (UNESCO) Trieste, Italy for participation in the annual "String-Math" conference held during 10-14 June 2024.

Student of Dr. Sanat Kumar Das

1. Shaina R. Saikh, SRF received 'Swami Vivekanand Excellence Award 2025' on 12th January 2025 at Birla Industrial and Technological Museum (BITM), Kolkata.
2. Shaina R. Saikh, SRF received best oral award in Bose Institute annual Symposium 2024.
3. Antara Paramanick, SRF received 2nd Best Lightening Presentation IASTA National Aerosol Conference (17-20 December 2024) at Doon University, Dehradun.
4. Shaina R. Saikh, SRF received ANRF-ITS fund for attending European Geosciences Union (EGU) annual meeting 2025 at Vienna, Australia holding on 27 April-2 May 2025.
5. Md. Abu Mustaque received financial support and complete registration fees waver to attend European Geosciences Union (EGU) annual meeting 2025 at Vienna, Australia holding on 27 April-2 May 2025.

ORGANIZATION/PARTICIPATION IN CONFERENCES, SEMINARS, WORKSHOPS, WEBINARS AND TALKS DELIVERED

DEPARTMENT OF BIOLOGICAL SCIENCES

Prof. Subrata Sau

1. A poster entitled "Studies on a staphylococcal anti-sigma factor to identify regions and residues involved in self-association and interaction with cognate proteins" was presented in Bose Institute Annual Symposium (BIAS, 2024) held at Bose Institute Unified Academic Campus from 27 to 29 November 2024.
2. A poster entitled "Genetic studies on a staphylococcal anti-sigma factor and cognate proteins" was presented in 22nd Transcription Assembly Meeting (TAM 2025) held at Bose Institute Unified Academic Campus from 19 to 21 March 2025.

Prof. Srimonti Sarkar

1. Plenary Speaker in BIO NEXUS 2024: Unveiling the Wonders of Modern Biotechnology, The Neotia University.
2. Invited Speaker at the XXXV Annual Conference of the Physiological Society of India, University of Tripura.

Prof. Shubho Chaudhuri

1. Sonal Sachdev and Shubho Chaudhuri. Oral Presentation at Society of Experimental Biology Annual Conference, Prague, Czech Republic 2024, 2-5 July 2024 (doi.org/10.48448/rpy5-a375).
2. Sonal Sachdev and Shubho Chaudhuri. Oral and Poster Presentation at 34th International Conference on Arabidopsis Research (ICAR 2024), University of California San 2024 Diego, USA 15-9 July 2024.

Prof. Gaurab Gangopadhyay

1. Delivered a invited talk on "The Discovery of DNA: A tribute of a plant scientist" on the occasion of "International DNA Day," celebrated by the Department of Biotechnology, Techno India University on 25.04.2024.
2. Invited as the Chief Guest of the Science Exhibition at the WB Govt. Model School, Nakashipara, Bethuadahari, Nadia on 11.11.2024.
3. Delivered a invited talk on "The legacy of Acharya J C Bose: A Glimpse into his Plant Science Research" in the celebration of the 166th birth anniversary of Sir Jagadish Chandra Bose at the Department of Botany, University of Kalyani on 06.12.2024.
4. Invited to act as an academic expert in the BOS meeting of Biotechnology Department, Techno India University on 17.01.2025.
5. Invited by the Department of Posts, Chief Postmaster General, WB Circle to participate in a podcast session on 25.02.2025 to act as an expert to explore the intersection of Botany and Philately, highlighting the rich heritage of flora themed stamps and their scientific significance.
6. Invited to Chair a session, "Women in innovations" in the One day seminar entitled "Women in Science, Technology and Innovations: Challenges and prospects" organised by Kolkata Nivedita Shakti at the Sister Nivedita University, New Town, Kolkata on 27.08.2024.
7. Invited to deliver a 'keynote lecture' on "Sesame oil for a healthier tomorrow: My research on improvement of Indian sesame varieties" in the International Seminar on "Bio-interventions for a healthier tomorrow: Combating lifestyle hazards through innovation" organized by Sabang Sajanikanta Mahavidyalaya, Medinipore (W), WB on 18.02.2025.

Prof. Pallob Kundu

1. Delivered an invited lecture on 'Exploiting the Mechanism of Membrane-Bound NAC Transcription Factor Activation for Stress-Inducible Gene Regulation in Tomato' in One Day Symposium entitled "1st Symposium on Emerging Frontiers of Biotechnology" held on 30 January 2025 at Jadavpur University.
2. Delivered an invited lecture on 'Regulatory Small RNAs: Biogenesis and Biological Impact' at the Department of Biotechnology, National Institute of Technology Durgapur on 28 October 2024.
3. Delivered an invited lecture on 'Creating in-vivo and in-vitro mutations in Plant Genome' at the Department of Genetics, University of Calcutta on 11 September 2024.

Prof. Kaushik Biswas

1. Participated as an organizing member of the 22nd Transcriptional Assembly Meeting held during 19-21 March 2025 at the Unified Academic Campus (UAC) in Bose Institute, Kolkata.
2. Acted as the Chairman of the Organizing Committee for a One Day Symposium titled "Interdisciplinary Approaches to Modern Biology" organized by the Department of Biological Sciences, Bose Institute, Kolkata on 21 June 2024.
3. Delivered an invited Lecture at the 22nd Transcriptional Assembly Meeting held during March 19-21, 2025 at the Unified Academic Campus (UAC) in Bose Institute, Kolkata.
4. Delivered an invited lecture titled "Transcriptional Control of the GM2-synthase gene in Cancer: The SP1-HDAC1-p300 Enigma" in the 44th Annual Meeting of the Indian Association for Cancer Research (IACR), held at Biswa Bangla Convention Center, Kolkata during 16-18 January 2025.
5. Acted as the Co-Chair for the scientific session in the National Symposium titled "Symphony of Cellular Signals in Metabolism and Immune Response" under the event "SNU BioTalk 2025" organized by the Dept. of Biotechnology, Sister Nivedita University (SNU), Kolkata on 17 January 2025.

Prof. Atin Kumar Mandal

1. Participated XLII Annual Conference of Indian Academy of Neurosciences at NIMHANS, Bengaluru, 11-14 November 2024.

Prof. Shubhra Ghosh Dastidar

1. Chairing session at the 2 days symposium of SBC(I), Kolkata chapter, held during 6-8 April 2024 at Shankarpur.
2. Shubhra Ghosh Dastidar (i) delivered a lecture and also (ii) chaired a session, at NATIONAL CONFERENCE ON OMICS IN REDEFINING HEALTHCARE, at Trissur during 23 & 24 August 2024.
3. Plenary lecture at a workshop on "Biomolecular Interactions" held at the Department of Bioscience and Biotechnology, Banasthali Vidyapith, Rajasthan during September 14-15, 2024
4. Invited talk in a one day meeting in statistical mechanics at SN Bose Centre held on 27th September, 2024, Singapore.
5. Invited talk at the one day meeting of the Society of Physical Chemistry, SoPhyC 2024-Kolkata Chapter on 3rd December, 2024
6. Invited talk at the Workshop on Computational Oncology during 17-18 December 2024, at IIT (BHU) Varanasi.
7. Invited talk at the international conference GTHTM-2025, during 15-17 February 2025, held at Ramanagar, Uttarakhand.

8. Invited talk at the Workshop on Computational Oncology during 17-18 December 2024, at IIT (BHU) Varanasi.
9. Invited talk at the international conference GTHTM-2025, during 15-17 February 2025, held at Ramanagar, Uttarakhand.
10. Invited talk at the conference on "Drug Discovery 2025: Emerging Trends and Future Prospects," held during 24-26 February 2025, at the Jamia Millia Islamia, New Delhi.
11. Invited talk at the conference on "Advances in Computer Simulations in Structural Biology and Biophysics" held during 28 February -01 March 2025 at JNU, New Delhi.
12. Invited talk in a one day seminar on "Recent Trends in Drug Discovery - Computational and Experimental Approach" held 6 March 2025, organized by the Krishnanagar College, Nadia, West Bengal.

Prof. Wriddhiman Ghosh

1. Co-convened and Co-chaired Session 9g: From extremophiles to biogeochemical cycles: Exploring their implications in Earth's habitability and astrobiology in the Goldschmidt Conference 2024 held at Chicago, USA, between 18 and 23 August 2024, and also presented the following paper in the same conference.
2. Jagannath Sarkar, Sabyasachi Bhattacharya, Aditya Peketi, Ranadhir Chakraborty, Aninda Mazumdar and Wriddhiman Ghosh (2024) Metabolically-active obligate aerobes in the sulfidic sediments of a marine hypoxic zone: sustenance and potential role in Carbon-Sulfur cycling. https://conf.goldschmidt.info/goldschmidt/2024/meetingapp.cgi/Paper/21301.
3. Goldschmidt is the foremost annual conference on geochemistry and related subjects, organized by the European Association of Geochemistry and the Geochemical Society (USA).

Prof. Zhumur Ghosh

1. Selected as one of the distinguished Participants for the 2nd batch of the INSA-NCGG Leadership Development in Science & Technology (LEADS) 2024 Programme organized by Indian National Science Academy and National Centre for Good Governance at INSA, from 1-7 April 2024, at INSA, New Delhi.
2. Delivered an invited talk entitled "Regulatory Noncoding RNomics –Orchestrating the journey across pre- and post- fertilization stages" at the 12th RNA Group Meeting at IIT Guwahati from 22 May to 24 May 2024.
3. Delivered an invited talk entitled "Predictive Approaches involving Noncoding RNomics - orchestrating disease biology" at "BDBio 2024 - Symposium on Big Data Algorithms for Biology" on 31 May and 01 June 2024 at IISc Bangalore and also participated in the panel discussion on "Grand Challenges in Computational Biology".
4. Delivered a talk entitled "Parental Noncoding RNAs –Orchestrates the pre- and post-fertilization events" at the Workshop on "MOLECULAR AND GENOMIC TECHNIQUES IN CELLULAR STUDIES (MAGTICS-2024)" during 2-6 September 2024 organised by Department of Life Science, National Institute of Technology Rourkela, Odisha.
5. Organised a one day workshop on 'Microbiome informatics" during 24 and 25 September 2024.
6. Delivered a talk entitled "Noncoding RNomics integrated Predictive approaches shapes modern day therapeutics" at the symposium on Computational Oncology - Systems and Advanced Omics Approaches in Cancer Biology at IISER Behrampur from 27 February to 01 March 2025.
7. Organised 22nd Transcription Assembly Meeting during 19-21 March 2025.

Prof. Biswanath Maity

1. Delivered invited talk at 'Emerging Frontiers of Biotechnology', Jadavpur University, January 30, 2025.
2. Session Chair at the national Seminar 'Trends in Biochemistry' by Department of Biochemistry, University of Calcutta, 12 February 2025.
3. Organized symposium 'Anusandhan 2025' at the Bose Institute as 'Organizing Secretary', 7-8 March 2025.

Dr. Abhrajyoti Ghosh

1. Joined as a panelist in the Panel Discussion on "Cracking protein complex structure using AI and other computational tools" on 16th January 2025 at the SNU-BioTalk 2025 International Conference, themed "Symphony of Cellular Signals in Metabolism and Immune Response," during 16-17 January 2025, at Sister Nivedita University.
2. Organized "National Science Day 2025" at Bose Institute, Unified Academic Campus, Kolkata on 28 February 2025.
3. Organized two-day "National Workshop on Microbiome Informatics" organized by the DBT-funded Bioinformatics Centre at Bose Institute at the Unified Academic campus of Bose Institute, Kolkata during 24-25 September 2024.
4. Delivered an invited lecture entitled "Bacterial diversity in the freshwater sponges of Sundarban & their potential role in biomonitoring toxic element pollution" at the Department of Microbiology, Goa University, Goa, India on 17 March 2025.
5. Delivered an invited lecture entitled "Biotechnological Advances in Remediation of Heavy Metal: A direction of Resilient Agriculture" in the "Faculty Development Program: Microbial Biotechnology: A Significant Biological Axis for the Sustainable Management of Opportunities in the 21st Century" organized by the Department of Biotechnology, The Neotia University, WB, India on 26 February 2025.
6. Delivered an invited lecture entitled "Regulation of the Fight-or-Flight Response in Ancient Archaea by the VapBC4 Toxin-Antitoxin System" at the 4th international symposium on "Interdisciplinary Approach to Biological Sciences-2025" (IABS-2025) organized at the Indian Association for The Cultivation of Science (IACS), Kolkata, India during 6-8 February 2025.
7. Delivered an invited lecture entitled "Heavy metal bioremediation: a step forward towards sustainable agriculture" at the International Symposium on Microbiomes for Climate Resilient Agriculture organized under the aegis of SPARC (Scheme for Promotion of Academic and Research Collaboration), Govt. of India at IIT Delhi on 4 October 2024.
8. Delivered an invited lecture entitled "Stress Warriors: How Archaea Combat Stress with Heat Shock Proteins and Toxin-Antitoxin Systems" in the seminar series of the Department of Biochemical Engineering and Biotechnology, IIT Delhi on 3 October 2024.
9. Delivered an invited lecture entitled "Archaeal type II toxin-antitoxin systems determine the cellular fate under stress" in a workshop to celebrate International Microorganism Day within the umbrella of the new workshop series "SPIN" outreach program in Microbiology organized by Adamas University in collaboration with the Microbiology Society, UK on 17 September 2024.
10. Delivered an invited lecture entitled "Stay or Fight: Role of archaeal VapBC4 Toxin-antitoxin in determining persister cells formation" in the monthly seminar series of the Society of Biological Chemists (India), Kolkata Chapter on 12 September 2024.

11. Delivered an invited lecture entitled "Mangrove microbiome: the good, the bad and the ugly" in the "Faculty Development Program: Emerging Areas in Biotechnology" organized by Amity Institute of Biotechnology, Amity University, Kolkata, India on 24 July 2024.
12. Delivered an invited lecture entitled "Welcome to the World of Biotechnology" at the Induction & Orientation Program for 2024 batch B.Tech. 1st-year Institute of Engineering & Management (IEM) students, organized by the Department of Basic Science and Humanities, Institute of Engineering & Management, Kolkata, India during 01-30 July 2024.

Dr. Sudipto Saha

1. Organized a national workshop in Bose Institute on Bioinformatics: AI in Healthcare on 16 January 2024.
2. Organized a national workshop in Bose Institute on Microbiome Informatics during 24-25 September 2024.
3. Attended and gave an invited talk at the National Conference on "Exploring the Bioresources of India to fight against Antimicrobial Resistance (AMR)" at Science City Kolkata on "Exploring microbial genes associated with antimicrobial resistance in the lung microbiome of respiratory disease patients", on 05 April 2024.
4. Attended and presented a poster on " Explainable AI-enabled classification of Asthma and COPD using 16s amplicon sequencing of airway microbiome" at the 1st Asia Pacific Bioinformatics Joint Congress, Okinawa, Japan on 23 October 2024.
5. Gave an invited talk at Research Institute for Microbial Diseases, Osaka University, Japan on "AI-enabled identification of Antibiotic Resistance Bacteria (ARB) and Antibiotic Resistance Genes (ARGs) from the sputum at the genome and metagenome levels" on 28 October 2024.
6. Conducted 3 days of Non-Communicable Disease Screening Camp in tribal communities at Kochabari, Kismat Altapur, and Bajargoan Health Wellness Centre, Karandighi, Uttar Dinajpur, West Bengal from 10-12 February 2025 with Raiganj University as a part of the ICMR-funded project (BMI/12(28)/2022, ID No. 2021-12937).

Dr. Anupama Ghosh

1. Delivered an invited lecture titled 'Ustilago maydis small heat shock protein Hsp20 regulates multiple cellular pathways leading to pathogenic development of the fungus.' on 08 March 2025 in Anusandhan 2025 organized by Bose Institute to celebrate the cause of 'Women steering S&T in India' on the occasion of International Women's Day.
2. Presented a talk entitled 'Small heat shock proteins in Ustilago maydis function at the cross road of multiple cellular pathways leading to pathogenic development of the fungus' in an International webinar series with focus on Microbiology and Biochemistry organized by Department of Biological Sciences, Adamas University in collaboration with Microbiology Society, UK to celebrate International Microorganism Day on 17 September 2024.
3. Research visit to Indiana University, Bloomington during 01 August 2024 to 31 October 2024 funded by Fulbright Nehru Academic and Professional Excellence Fellowship.

Dr. Smarajit Polley

1. Invited talk at the 22nd Transcription Assembly Meeting (TAM 2025) organized by Bose Institute, Kolkata during 19-21 March 2025.
2. Invited talk at the 1st International Symposium on Cryo-Electron Microscopy organized by the SERB National Facility for Cryo-Electron Microscopy at IIT Madras, Chennai during 09-10 August 2024.

3. Participated and chaired session in the EMBO Practical Course on Cryo electron microscopy and 3D image processing (CEM3DIP) in IISc Bangalore, India during 30 June – 07 July 2024.
4. Invited talk at the "Kolkata Biophysics Meet 2024" organized by Saha Institute of Nuclear Physics, Kolkata on 02 April 2024.
5. Invited and organized research seminar by Dr. Swasti Raychaudhuri, Principal Scientist and Group Leader, CSIR-CCMB, Hyderabad on 07 October 2024 at UAC, BI. Title of the talk: Synergistic evolution of lipids and proteins towards successful molecular machines.
6. Organized the 22nd Transcription Assembly Meeting 2025 (TAM 2025) at Bose Institute during 19-21 March 2025.

Dr. Nirmalya Sen

1. Organizing member (Convenor) in house symposium- 'Interdisciplinary Approaches to Modern Biology' at Bose Institute, 21 June 2024.
2. Organizing member in-house student symposium 2024 held from 27 to 29 November 2024.
3. Organizing member of symposium : Anusandhan 2025 during 7-8 March 2025 at Bose institute
4. Organising member and speaker: 22nd Transcription Assembly Meeting during 19-21 March 2025.

Dr. Subhash Haldar

1. Delivered a lecture as an invited speaker in International Conference on "Sustainable Health: Translational Research from Molecules to Behavioural Aspects" at Vidyasagar University West Bengal, India on 28 February 2025.
2. Organizing committee member of conference:
   a) Anusandhan 2025 (7-8 March) in Bose Institute.
   b) Bose Institute Annual Symposium 2024 (BIAS 2024).
   c) One day symposium on " Interdisciplinary Approaches to Modern Biology" 21 June 2024, in Bose Institute.

Dr. Basudeb Maji

Organized Workshops:

1. The Wiley Authors Workshop (06 November 2025) guided researchers on academic publishing, featuring expert insights from Wiley editors.
2. The Scientific Entrepreneurship Workshop (22 November 2025) by RISE Foundation IISER Kolkata encouraged researchers to commercialize innovations, involving industry leaders like Premas Biotech.
3. The Industry-Academia Meet (27 November 2025) facilitated discussions on research-industry collaboration, partnering with Emami Ltd and TCG Life Science.

Organized Symposiums/Conference:

1. Bose Institute Annual Symposium 2024 (BIAS 2024) was held from 27 to 29 November 2024, bringing together researchers, students, and industry professionals to enrich knowledge and ideas.

2. Anusandhan 2025 was organized at Bose Institute, Kolkata on 7-8 March 2025. This interdisciplinary event brought together leading researchers, innovators, and academicians from across the country to present advances in life sciences, physical sciences, chemistry, and interdisciplinary.
3. The 22nd edition of the Transcription Assembly Meeting (TAM 2025) was held at Bose Institute, Kolkata (19-21 March 2025), bringing together a dynamic group of researchers working on the molecular mechanisms of gene regulation, chromatin dynamics, epigenetics, and RNA biology.

Participated and delivered in seminars:

1. Dr. Tanmoy Saha from Harvard Medical School and Brigham Women's Hospital, Boston delivered a seminar on Harnessing cellular communication for introducing next-generation therapeutics. t Bose Institute on 17 October 2024.
2. Prof. Avinash Bajaj delivered a seminar on the topic "Targeting of Triangular Neuron-Cancer Cell-Immune Cross-talk as a Potential Cancer Immunotherapy Strategy" at Bose Institute on 14 February 2025.

DEPARTMENT OF CHEMICAL SCIENCES

Prof. Suman Kumar Banik

1. Invited lecture in “International Conference on Systems Biology (ICSB 2024)” at IIT Bombay (30 November – 05 December, 2024).

Prof. Jayanta Mukhopadhyay

1. Updates on transcription assembly, 22nd Transcription Assembly Meeting, 21-24 March 2023, Bose Institute, Kolkata.

Prof. Anirban Bhunia

1. Four students attended NMRS conference, which was held at CBMR Lucknow.
2. Two students attended Indian Peptide Symposium held in IISER Pune.
3. Convener of an in-house symposium titled “Microbes and Microbe-Host Interactions”.

Prof. Debaraj Mukherjee

1. Delivered Popular scientific lecture on “Bridging bioactive natural products with drugs via biotechnological toolbox” in IISF -2024 Curtain Raser Event at Bose Institute.

Prof Debaraj Mukherjee of Department of Chemical Sciences discussed "Bridging bioactive natural products with drugs via biotechnological toolbox"

2. Vigyan -Jyoti program of DST: Interacted with students who came from Paschim Medinipur of Navodaya schools at Bose Institute and explained to them the importance of studying Chemistry and future prospects.

3. Organized a successful outreach program on 14.01.2025 for undergraduate Chemistry students from own EMR project. Thirty-five students from St. Xavier's College, Kolkata, Victoria Institution (College), Rammohan College and Vidyasagar College for Women participated enthusiastically in this one-day-long program.

4. Organized a talk delivered by Dr. Vladimir F. Lazarevfrom Institute of Cytology (Russian Academy of Sciences) on Chaperone-associated small molecule inhibitors as anticancer drugs on 15 January 2025.

Prof. Abhijit Chatterjee

1. Nine (09) invited lectures in national conferences and workshops.
2. Lectures (02) as resource person for the Refresher Course under UGC-HRDC (Environmental Sciences) organized by University of Calcutta.
3. Lectures as resource person in three (03) workshops on Air Quality Management (organized by WBPCB, KMC and MoEFCC, GoI).

Dr. Utpal Nandy

1. Organising Committee member of BIAS-2024.
2. Organising Committee member of Anusandhan-2025.

Dr. Amit Kumar Paul

1. Invited talk at FICS 2024 at IIT Guwahati during 2-4 December 2024.
2. Invited talk at PCAMC 2024 at IISER-Kolkata during 11-14 December 2024.
3. Invited talk at Dept. of Chemistry, SVNIT, Surat. Organized by Chemshashtra student chapter on 8 February 2025.
4. Invited talk at the Dept. of Chemistry, IIT Bombay on 4 March 2025.
5. Invited talk at NSRSSOF 2025 at Alipurduar University on 25 March 2025.
6. Invited talk at the Dept. of Chemistry, University of North Bengal on 26 March 2025.
7. Invited talk at Symposium on Recent Advances in Physical Chemistry Research (SRAPCR 2025), IACS during 10-13 April 2025.

DEPARTMENT OF PHYSICAL SCIENCES

Prof. Dhruba Gupta

1. Delivered a talk (online) on "Projectile Breakup of ^{7}Be on ^{12}C at 5 MeV/u" at the ISOLDE Workshop and Users Meeting, CERN, Switzerland, 27-29 November 2024.
2. Delivered an invited plenary talk on "Nuclear Astrophysics with Rare Isotope Beams" at the International Conference on Advanced Physics, IEM, Kolkata, 25-27 October 2024.
3. Delivered an invited plenary talk on "Nuclear Astrophysics at Bose Institute" at the Workshop on Ion Beam Experiments using High Current Injector, IUAC, New Delhi, 20-21 August 2024.
4. Delivered an invited plenary talk (online) on "Nuclear Astrophysics with Rare Isotope Beams" at the National Seminar on Recent Advancement in Nuclear & Chemical Sciences, Berhampore Girls College, Murshidabad, 13 November 2024.
5. Conducted 14 seminars at the Department of Physical Sciences, Bose Institute, Kolkata, http://www.jcbose.ac.in/physics-seminars.
6. *Students' participation:*
   A. Sayan Samanta (JRF) and Niloy Ghosh (JRF) attended the "68th DAE Symposium on Nuclear Physics 2024" at IIT Roorkee, Uttarakhand during 6 – 11 December 2024. Sayan gave a poster presentation titled "Study of ^{7}Be(d, α)^{5}Li(p α) and ^{7}Be(d, p)^{8}Be*(p ^{7}Li) reactions at 5 MeV/u". Niloy gave an oral presentation titled "Neutron and α-transfer reaction ^{12}C(^{7}Be, ^{8}Be)^{11}C* at 5 MeV/u". Nilay and Sayan presented a poster titled "Pixel Calibration of Double-Sided Silicon Strip Detectors" on behalf of Ritankar Mitra (SRF).
   B. Sayan Samanta (JRF) gave an oral presentation titled "Transfer-Breakup Reactions from ^{7}Be + d at 5 MeV/u" at the "Bose Institute Students' Symposium 2024 (BIAS 2024)", Bose Institute, Kolkata during 27-29 November 2024.
   C. Sayan Samanta (JRF) attended International Conference on Nuclear Physics and Applications (ICNPA - 2024) at University of Delhi during October 21 - 25, 2024, and delivered a talk titled "The ^{7}Be(d,p)^{8}Be(p ^{7}Li) and ^{7}Be(d,α)^{5}Li(p α) reactions at 5 MeV/u".

Prof. Achintya Singha

1. Delivered an invited popular lecture to the Junior scholars of Jagadis Bose National Science Talent Search (JBNSTS) on 27 March 2025 at JBNSTS.
2. Delivered an invited talk at Frontiers of Material Science and Photonics: Issues and Developments (NCFMSP-2024), held on 13–14 November 2024 at Sidho-Kanho-Birsha University, Purulia.
3. Delivered an invited talk at the International Conference on Advanced Physics (IEMPHYS-24), held on 25-27 October 2024 at the Institute of Engineering and Management, Kolkata.
4. Delivered a colloquium at an In-House Meet, held on 24–25 September 2024 in the Department of Physics, Calcutta University.
5. Delivered an invited talk at the SPARC Workshop on 2D Materials, held on 24–25 August 2024 in the Department of Physics, IIT Kharagpur.

Prof. Supriya Das

1. Presented a talk on 'Astrophysics in Laboratory: Compressed Baryonic Matter (CBM) Experimnent in the 10th Asian Triangle Heavy-Ion Conference (ATHIC2025), held in IISER Behrampur, Odisha during 13-16 January 2025.
2. **Ms. Rudrapriya Das** presented a plenary talk on "Particle production and net-proton, net-kaon fluctuations in PHQMD model" in 44th. CBM Collaboration meeting at Prague on 19 September 2024 (online mode).
3. **Ms. Rudrapriya Das** presented a talk on "Particle production and fluctuations at FAIR energies by using PHQMD model" in 24th. Zimanyi School on Heavy Ion Physics on 02 December 2024 at Budapest, Hungary.
4. **Ms. Rudrapriya Das** attended "QCD at FAIR " workshop during 11-14 November 2024 at GSI, Darmstadt, Germany.

Prof. Soumen Roy

1. Delivered invited lecture at the GN Ramachandran Lecture Series on Bioinformatics and Computational Biology, Indian Institute of Technology, Kharagpur on 18 December 2024.
2. Delivered invited lecture at the Statistical Mechanics Meeting, Kolkata at SN Bose National Centre for Basic Sciences, Kolkata on 27 September 2024.
3. Delivered invited lecture at the meeting titled “From cell to organism”, Indian Institute of Technology, Madras on 12 July 2024.

Dr. Sidharth Kr. Prasad

1. Served as one of the members of the Program Advisory Committee of the conference “Physics in Hadronic and Nuclear Collisions 2025” organized by TIFR during 27-30 March 2025.
2. Served as one of the members, of Program Committee of ALICE-STAR-India Collaboration meeting, 24 April- 27 June 2024, IOP, Bhubaneswar.
3. Served as the Chairman of the Program Committee of ALICE-STAR-India Collaboration Meeting cum International Workshop on QGP Physics, 25-29 November 2024, AMU, Aligarh.
4. Served as one of the members of the organizing Committee of 42nd FAIR Council Meet at Bose Institute, 03-04 December 2024.
5. **Mr. Mintu Haldar** (working under Dr. Sidharth Kr. Prasad) presented updates on analysis “study of two particle azimuthal correlation in pp and pPb collisions at 5.02 TeV in ALICE” in the ALICE-STAR-India collaboration meeting at IOP on 24 June 2024.
6. **Mr. Prottoy Das** (worked under Dr. Sidharth Kr. Prasad) delivered a multi-experiment talk entitled “Jet fragmentation and hadronchemistry” on behalf of the ALICE,ATLAS,CMS and LHCb collaborations at the LHCP 2024 conference in Boston, US during 3-7 June 2024.

Dr. Saikat Biswas

1. Presented a talk in 2nd DRD1 Collaboration Meeting & Topical Workshop on Electronics for Gaseous Detectors held during 17-21 June 2024, CERN. Title of the presentation was: “Stability study of GEM detector and Performance study of a new RPC prototype”.
2. Delivered a lecture on “Bose Institute's contribution to the European Organisation for Nuclear Research (CERN)” in an outreach program to a group of students and teachers of Calcutta International School on 18 June 2024.

3. Organised an outreach program at UAC, Bose Institute to a group of students and teachers of Calcutta International School on 18 June 2024.
4. Presented a talk in the 41st FAIR Council meeting at FAIR, Germany on 9 July 2024 to welcome the FAIR Council to Kolkata for the "42nd FAIR Council meeting in Kolkata during 3-4 December 2024".
5. Presented the status of Indian in-kind contribution to FAIR, Germany in the Bose Institute-FAIR Steering committee meeting in FAIR, Germany on 09 July 2024.
6. Presented talk on "Straw tube detector for CBM-MuCh" in the 44th CBM Collaboration meeting at Prague on 17 September 2024 (online mode).
7. Presented talk on "Performance study of a new type of bakelite RPC for future High-Energy Physics Experiments" in XXVI DAE-BRNS High Energy Physics Symposium 2024 held in Banaras Hindu University, Varanasi during 19-23 December 2024.
8. Took part in the organization of the 42nd FAIR Council Meeting at Bose Institute Kolkata during 3-4 December 2024.
9. Delivered an invited plenary talk on "Indian participation in the construction of the Facility for Antiproton and Ion Research (FAIR)" in the 10th Asian Triangle Heavy-Ion Conference (ATHIC2025), held in IISER Behrampur, Odisha during 13-16 January 2025.
10. Attended the Bose Institute – FAIR steering committee meeting on 11 February 2025 and presented the status of Indian in-kind contribution to FAIR.
11. Worked as the co-convenor of the National Science Day 2025 program at Bose Institute on 28 February 2025.
12. Subir Mandal and his group presented their DRD1 School lab exercise at the DRD1 (WG8) Collaboration Meeting on December 13, 2024. The presentation was titled "Characterization of THGEM Detector: A Member of the MPGD Family.
13. Subir Mandal presented poster on "Observation on the effect of prolonged irradiation on GEM detector" in XXVI DAE-BRNS High Energy Physics Symposium 2024 held in Banaras Hindu University, Varanasi during 19-23 December 2024.
14. Subir Mandal presented talk on "Performance study of Gas Electron Multiplier chamber for future heavy ion experiment" in the 10th Asian Triangle Heavy-Ion Conference (ATHIC 2025) held in IISER Berhampur, Odisha during 13-16 January 2025.
15. Subir Mandal worked as co-ordinator for the HEP Detector laboratory for the students of different universities/colleges on the program of National Science Day 2025 at Bose Institute on 28 February 2025.
16. Somen Gope presented a talk on "Study of strangeness production at top SIS100 energy" in XXVI DAE-BRNS Symposium 2024 held in Banaras Hindu University, Varanasi during 19-23 December 2024.
17. Somen Gope presented talk on "An investigation of forward-backward correlations in hybrid UrQMD-hydro generated data" in the 10th Asian Triangle Heavy-Ion Conference (ATHIC2025), held in IISER Behrampur, Odisha during 13-16 January 2025.
18. Somen Gope presented talk on "A brief study of forward-backward correlations using UrQMD-hydro generated data" in the 45th CBM Collaboration meeting, held in GSI, Darmstadt, Germany, during 16-21 February 2025 (in virtual mode).
19. Somen Gope worked as coordinators for the HEP Detector laboratory for the students of different universities/colleges on the program of National Science Day 2025 at Bose Institute on 28 February 2025.
20. Anjali Sharma presented a talk for college students on "Introduction to high-energy physics experiments" at an outreach program organised at Bose Institute, Kolkata, on 26.06.2024.

21. Anjali Sharma presented "Updates of the simulation of straw tube detector for 3rd and 4th station of CBM-MuCh" in the 44th CBM Collaboration meeting at Prague on 17 September 2024 (online mode).
22. Anjali Sharma presented poster on "Study of net-kaon fluctuations in FAIR energies using the PHQMD model" in XXVI DAE-BRNS High Energy Physics Symposium 2024 held in Banaras Hindu University, Varanasi during 19-23 December 2024.
23. Anjali Sharma presented talk on "Proton Intermittency analysis in Au + Au Collisions: Exploring Critical Behavior in the FAIR Energy Range" in The 10th Asian Triangle Heavy-Ion Conference (ATHIC 2025) held in IISER Berhampur, Odisha during January 13-16, 2025.
24. Anjali Sharma has presented "Performance studies of Moulded cooling plate" in MuCh session of 45th CBM Collaboration Meeting on 18 February 2025.
25. Anjali Sharma represented, and show cased the activities of the cooling lab to the students of different universities/colleges on the program of National Science Day 2025 at Bose Institute on 28 February 2025.

Dr. Sanat Kumar Das

1. Delivered an invited talk on "Winter-time airborne bacterial communities enriched with pathogens in Urban Atmosphere: A study over New Delhi, India" in Aakash International Meeting 2024 during 26-30 August 2024, Research Institute for Humanity and Nature (RIHN), Kyoto, Japan, fully sponsored by Japan Society for the Promotion of Science (JSPS), Japan.
2. Delivered an invited popular lecture to school students at Bedibhawan Rabitirtha Vidyalaya at Nadia, a rural district in West Bengal on 09 August 2024.
3. Delivered popular lecture in Hindi on Antarctica expedition at Bose Institute titled as "अंटार्कटिका अभियान" .
4. Delivered a lecture in orientation program for PhD students at Bose Institute.
5. Session Judge for the technical session "Environmental Sciences Including Climate Change" at the 7th Regional Science Congress 2025 at Department of Geography, Main Building (2nd Floor), Presidency University, Main Campus during 17-18 January 2025.
6. Representing Institute of Repute (IoR) under the National Clean Air Mission, the Ministry of Environment, Forest and Climate Change; and Central Pollution Control Board.

Dr. Pramod Kumar Shukla

1. Presented a short review talk titled "On Model Building in String Phenomenology: A very limited sketch" on 28 November 2024 during the "Bose Institute Annual Symposium" BIAS-2024, 27-29 November 2024 at Bose Institute.
2. Delivered a talk titled "On seeing the world through Mathematical Principles" during IISF-Curtain Raiser Event held on 08 November 2024 at Bose Institute.
3. Participated and presented a poster titled "On attempts to find the "right" Calabi Yau for string model building" in the "String-Math 2024" held at ICTP (UNESCO) Trieste, Italy during 10-14 June 2024. This visit was financially supported by the ICTP (UNESCO) Trieste, Italy.
4. One of the organizers of Joint Entrance Screening Test (JEST) 2025:
   Note: JEST is an all India level exam for screening the students in the discipline of Physics and Theoretical Computer Science for the purpose of admission in the Int-PhD and PhD programs at various institutes: (See more on https://www.jest.org.in/).
5. One of the organizers of Bose Institute Annual Symposium BIAS 2024 held during 27-29 November 2024 at Bose Institute.
6. Assisted in organizing various Hindi Events such as activities during Hindi Pakhawada at Bose Institute, 13-29 September 2024, with a popular lecture delivered on 20 September 2024.

EVENTS

National Science Day 2025

To commemorate the revolutionary discovery of the Raman Effect

on 28 February, 2025 at 10 am

Venue: Unified Academic Campus, Bose Institute, EN 80, Sec V, Salt Lake, Kolkata 700091

Theme: Empowering Indian Youth for Global Leadership in Science and Innovation for VIKSIT BHARAT

Lecture Delivered by:

Prof. Sibaji Raha
former Director, Bose Institute
on Physical Sciences

Prof. Sujoy K Das Gupta
former Professor, Bose Institute
on Biological Sciences

Prof. Ranjit Biswas
Professor, S.N. Bose NCBS
on Chemical Sciences

It was a pleasure for Bose Institute to be invited to attend the Post-Budget Webinar on the theme "Investing in Innovation", on Virtual mode on 05 March 2025. The objective of the Webinar was to discuss the implementation strategy of the Sub-theme-Research, Development & Innovation (RDI) and Deep Tech Fund of Funds with relevant stakeholders. The Hon'ble Prime Minister, Shri Narendra Modi addressed the session, followed by panel discussion with eminent industrialists. The session begun after Opening remarks by the Secretary, DST. The Director, Bose Institute alongwith Registrar (O), all Deans, Chairpersons and Faculty Members of the Institute attended the discussion. The concluding session was chaired by Hon'ble Union Minister of Science & Technology, Dr. Jitendra Singh.

Ms. Saptadipa Banerjee (UGC-SRF), working with Prof Gaurab Gangopadhyay, Department of Biological Sciences received 'outstanding paper award' (first prize) in the subject category Botany in the 32nd West Bengal Science and Technology Congress, held at Biswa Bangla Convention Centre, Kolkata during 28th February to 2nd March 2025..

Bose Institute actively participated in the 27th National Science Exhibition on the theme “India: Developed Nation by 2047” held in September 2024 at Science City, Kolkata. The exhibition was organized by Central Calcutta Science & Culture Organization for Youth. The panels of the stall displayed the history of Bose Institute, discoveries by our Founder Director Acharya Jagadis Chandra Bose, Prof. D.M. Bose, as well as the current researches of Bose Institute in the areas of Physical, Chemical and Biological Sciences. Students from various schools visited our Stall with great enthusiasm.

As a part of commemoration of National Space Day, Bose Institute organised a Lecture by Dr. Debiprosad Duari, Former Director, Research & Academic, M.P. Birla Institute of Fundamental Research, M.P. Birla Planetarium, Kolkata on the Topic "Indian Space Programme: A Triumphant Progress". On August 20, 2024, the Director of Bose Institute delivered a televised talk on DD Bangla to commemorate the day.

Students from La Martiniere for Girls (Class-XII Science stream), Kolkata alongwith their teachers visited Acharya J.C. Bose Museum at Bose Institute (Main Campus), Rajabazar on July 31, 2024. Prof. Gaurab Gangopadhyay, Dept. of Biological Sciences, Bose Institute addressed the students in the Lecture Hall. Following a documentary on Acharya J.C. Bose's contribution in the field of Physics and Biological Science, the students were guided around Main Campus, Samadhi of Acharya J.C. Bose and finally the Museum. They were fascinated to see the Campus as well as innumerable exhibits and archival matters of Acharya J.C. Bose.

Prof. Debaraj Mukherjee and Dr. Amit Kumar Paul from the Department of Chemical Sciences organized a successful outreach program on 14.01.2025 for undergraduate Chemistry students. Thirty-five students from St. Xavier's College, Kolkata, Victoria Institution (College), Rammohan College and Vidyasagar College for Women participated enthusiastically in this one-day-long program. The students visited the Main Campus and the J C Bose Museum in the morning. They attended two fascinating lectures by Prof. Anirban Bhunia and Prof. Shubhra Ghosh Dastidar at the UAC. The visit to the state-of-the-art instruments of the CIF, especially the NMR, was an added attraction to the students. The students returned with an ambition to pursue higher studies and frontier areas of research. The entire program was an initiative of the two sponsored ANRF (Anusandhan National Research Foundation) grants of Prof. Debaraj Mukherjee and Dr Amit Kumar Paul to fulfil the mandate of Social Scientific Responsibility (SSR) of DST, Govt. of India.

Bose Institute Annual Symposium 2024 (BIAS 2024) was successfully held during 27 to 29 November 2024, bringing together researchers, students, and industry professionals to enrich knowledge and ideas.

Day 1 & Day 2 (27-28 November): Unified Academic Campus (UAC)
The Symposium was inaugurated by Prof. Kaustuv Sanyal, Director, Bose Institute and Prof. Pallob Kundu, Dean of Student Affairs. Dr. Basudeb Maji, the Convenor, presented the overview of the symposium. The first two days, held at the Unified Academic Campus, featured a blend of academic and industry-focused sessions:

- Industry-Academia Meet: Engaging discussions explored opportunities for collaboration and innovation between academic research and industry applications. There were industrial representatives from Emami Ltd and TCG Life Science.
- Talk Sessions: The program included a mix of in-house presentations by Bose Institute researchers and invited talks by eminent scientists, Prof. Dibyendu Das and Prof. Pradeep K. Mohanty from IISER-Kolkata and Prof. Sangram Bagh from SINP-Kolkata, covering diverse and cutting-edge scientific topics.
- Poster Presentations: A vibrant poster session allowed participants to showcase their research and facilitated lively discussions.

Day 3 (29 November): Bose Institute Main Campus.
The final day, hosted at the historic Rajabazar campus, focused on:

- In-house Talks: More in-depth presentations by institute researchers emphasized ongoing projects and new findings.
- Concluding Session: The event was concluded with value added scientific discussions for further collaborations.
- The symposium served as a platform for fostering industry-academia partnerships. High-quality research presentations and posters encouraged academic discussions and exchange of ideas. The event was well-attended, with active participation from faculty, students, and external collaborators.

As part of the Vigyan-Jyoti programme of DST, around 43 Class X–XII girls from Navodaya schools in Paschim Medinipur visited the Unified Academic Campus of Bose Institute on 18 September 2024.

An interview to DD Bangla on Computer, Biotechnology and related subjects for the students by Prof. Shubhra Ghosh Dastidar, Department of Biological Sciences, Bose Institute.

Dr Pramod Shukla from the Department of Physical Sciences spoke on "Seeing the world through mathematical principles"

Prof Debaraj Mukherjee of Department of Chemical Sciences discussed "Bridging bioactive natural products with drugs via biotechnological toolbox"

Prof Biswanath Maity of Department of Biological Sciences delivered a lecture on "Disease, diversity and discovery"

IISF-2024 Curtain Raiser Event at Bose Institute, Kolkata, to disseminate the theme of the India International Science Festival 2024, held at Guwahati from 30 November to 03 December 2024 among the students, research personnel, scientists and staff members, Bose Institute, Kolkata, organized a befitting event of Curtain Raiser on 08.11.2024.

India International Science Festival (IISF) is a grand celebration of India's achievements in Science and Technology. The 10th International Science Festival (IISF) was held at IIT Guwahati from November 30 to 03 December 2024, on the theme '**Transforming India into an S&T-driven global manufacturing hub**'. Like every year, Bose Institute participated in the Viksit Bharat 2047, Sci-Tech Expo, Science-Technology-Defense-Space Exhibition..

Interview on Doordarshan (DD Bangla)- Discussion on the 2024 Nobel Prize in Physics (Neural Networks and Machine Learning) by Prof. Soumen Roy was broadcast live on DD Bangla on 5 December 2024.

Bose Institute participated in the Mega Exhibition "Aspiring Odisha" at Baripada, Mayurbhanj, from 12 to 14 December 2024. Besides showcasing our research achievements through scientific posters, the attraction of this exhibition was the 3-D graphics generated by scientific models of DNA and proteins. The Physics models especially signal transmission through electromagnetic waves and the Plasma Ball were the center of attraction for the kids and the high school students. Bose Institute received the 'Outstanding Participation' award for their stall and scientific demonstration.

Dr. Praveen Kumar Somasundaram, Head, International Cooperation division, DST visited Unified Academic Campus of Bose Institute on 30 December 2024 for a discussion on the FAIR project. He interacted with the students and post-doctoral fellows of Bose institute working in FAIR and ALICE experiments. He also visited the library and some laboratories in the Unified Academic Campus.

Botany (B.Sc. Hons.) students of Shri Shikshyatan College, Kolkata, made an academic visit to the UAC, Bose Institute on 07.01.2025. Following the syllabus of the University of Calcutta, they attended a lecture on plant tissue culture. They visited a few laboratories and plant tissue culture facilities of the Department of Biological Sciences.

A group of M.Sc 3rd Semester Biotechnology students of St. Anthony's College, Shillong, visited the Unified Academic Campus of Bose Institute as a part of their Institutional Study Tour on 08.01.2025. It was a DST Scientific Social Responsibility (SSR) initiative for two SERB projects presently running at BI. The students attended two lectures on Cancer Therapy and Plant Epigenetics by Prof Kaushik Biswas and Prof Shubho Chaudhuri, respectively. They also visited a few laboratories and the Central Instrumentation Facility of Bose Institute.

A team of students and faculty members from the Department of Statistics, North-Eastern Hill University (NEHU), Shillong, visited our Darjeeling campus on 13 January 2025. Prof. Bishal Gurung led the team, who expressed their gratitude for the opportunity to explore the Institute.

Participation of the Department of Physical Sciences, Bose Institute, Kolkata in the XXVI DAE-BRNS High Energy Physics Symposium at BHU, Varanasi

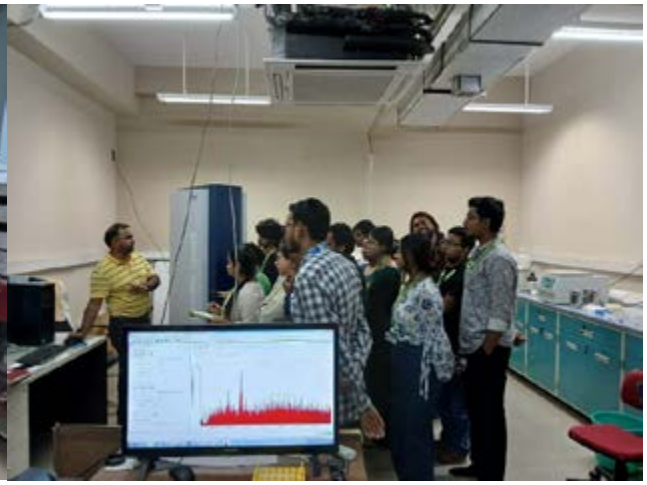
The High-Energy Physics Group of Department of Physical Sciences at Bose Institute, Kolkata, participated in the prestigious XXVI DAE-BRNS High Energy Physics (HEP) Symposium held during 19-23 December 2024, at Banaras Hindu University (BHU), Varanasi. This renowned symposium, sponsored by the Board of Research in Nuclear Sciences (BRNS) under the Department of Atomic Energy (DAE), brought together leading researchers and academics from across the nation as well as from abroad.

Prof. Peter Coveney delivered the Bose Institute Colloquium on 16 January 2025. The title of the talk was "Digital You: The Virtual Future of Medicine". It was a scintillating talk, as Prof. Coveney introduced us to "digital twin". The talk was organised in collaboration with the British Council.

A group of M.Sc 4th semester students from the Biotechnology Department, Gauhati University, made an academic visit to the UAC, Bose Institute on 07.02.2025. Prof Pallob Kundu delivered an intense lecture about gene silencing, miRNA and siRNA technology. Prof. Shubhra Ghosh Dastidar and his group enthralled the students with his theoretical and practical demonstration of bioinformatics and modelling basics. The students were excited to meet Prof. Zhumur Ghosh, the author of the Bioinformatics textbook since they followed her book. They also visited the CIF facility of Bose Institute and were particularly encouraged to see how the NMR, MALDI, and LC-MS instruments work. Prof Gaurab Gangopadhyay, the Chairman of the Public Relations Committee at Bose Institute, coordinated the programme.

Bose Institute participated in the mega exhibition 'Radiant Jharkhand' at Jamshedpur from 20 to 22 February 2025. The students thronged our stall, excited to see living cells under a microscope. The experiments on Photosynthesis and Transpiration were also a big attraction to them. Prof Saikat Biswas's 'Plasma Ball' demonstration was another crowd-puller.

Bose Institute has been awarded the trophy for outstanding performance.



It was our great privilege to host a group of students from the Biotechnology Department of Adamas University for their visit the Central Instrument Facility of Bose Institute on 03 March 2025. The Chairman of CIF addressed them and delivered a lecture.

Bose Institute organized symposium Anusandhan-2025 during March 07-08, 2025.

LIST OF ONGOING PROJECTS

SL. NO.	FUNDING AUTHORITY	FINANCIAL YEAR OF COMMEN-CEMENT	FINANCIAL YEAR OF TERMINATION	DATE OF COMMENC-EMENT	DATE OF TERMINATION	PRINCIPAL INVESTIGATOR	TITLE OF THE PROJECTS
1	SERB	2020-21	2024-25	18-Dec-20	17-Dec-25	Dr. Smarajit Polley Prof. Atin Kumar Mandal Prof. Jayanta Mukhopadhyay	Setting up a State-of-the-Art CryoEM Regional/National Facility in Eastern Region at Bose Institute : Transforming the Structure-guided Drug Discovery and Therapeutics Research Landscape in India
2	SERB	2021-22	2024-25	21-Jan-22	20-Jan-25	Prof. Kaushik Biswas	Mechanism of ganglioside GM2-mediated regulation of miR-615-5p in targeting oncogenic ID1 to mediate tumorigenesis
3	SERB	2021-22	2024-25	24-Jan-22	23-Jan-25	Dr. Anupama Ghosh	Investigating the role of HSP20 in the pathogenic development of Ustilago maydis
4	DBT	2021-22	2026-27	23-Mar-22	22-Mar-27	Prof. Shubhra Ghosh Dastidar Dr. Zhumur Ghosh	Continuation of the existing Centre of Excellence in Bioinformatics and expanding it as a datacenter involving newer direction of research to address the healthcare and environmental issues of national need - BIC at Bose Institute, Kolkata
5	DBT	2023-24	2029-30	25-Jan-24	24-Jan-29	Prof. Shubhra Ghosh Dastidar Dr. Zhumur Ghosh	National Network Project of Bose Institute with Indian Statistical Institute and Vidyasagar University
6	DST & DAE	2021-22	2026-27	22-Dec-21	31-Oct-26	Prof. Supriya Das	Indian Participation in the ALICE Experiment at CERN
7	SERB(CRG)	2021-22	2024-25	25-Mar-22	24-Mar-25	Dr. Sanat Kr. Das	Revealing bioaerosol movements within the area spanning eastern Himalayas and coastal Bay of Bengal
8	ICMR	2023-24	2025-26	01-Apr-23	31-Mar-26	Dr. Sudipto Saha	Epidemiological Survey on Tribal Communities of Binajpur District in North Bengal to Develop a Knowledgebase on Disease Predisposition for Estimating Disease Etiology
9	DST & DAE		2025-26	28-Jun-23	31-Mar-26	DIRECTOR, BOSE INSTITUTE	India's participation in the construction of the Facility for Antiporton and Ion Research (FAIR) at Darmstadt, Germany
10	CBM-MUCH					Dr. Saikat Biswas	Research and Development of micro-pattern gaseous detectors (MPGD) for the CBM experiment at FAIR.

SL. NO.	FUNDING AUTHORITY	FINANCIAL YEAR OF COMMENC-EMENT	FINANCIAL YEAR OF TERMINATION	DATE OF COMMENC-EMENT	DATE OF TERMINATION	PRINCIPAL INVESTIGATOR	TITLE OF THE PROJECTS
11	SERB	2023-24	2026-27	28-Jun-23	27-Jun-26	Prof. Shubho Chaudhuri	Molecular characterization of factor(s) regulation transcription of MYB21 and MYB24 genes in Jasmonic acid signaling pathway during pollen development
12	Velux Stiftung (Switzerland)	2023-24		01-Aug-23	31-Mar-27	Prof. Anirban Bhunia	Rational design and structure-function analysis of antimicrobial peptides tailored to treat fungal Ocular infections
13	SERB	2023-24	2026-27	10-Oct-23	09-Oct-26	Prof. Srimonti Sarkar	Deciphering the cellular functions of the multiple paralogues of GINSF and GlaSNAPs of Giardia lamblia
14	DBT	2023-24	2026-27	29-Sep-23	28-Sep-27	Prof. Subhrangsu Chatterjee	Transcriptional regulation of human Telomerase (hTERT) by chromatin remodeling protein SMAR1
15	SERB	2023-24	2026-27	02-Mar-24	01-Mar-27	Prof. Atin Kumar Mandal	A proteome centric view of Prajal ubiquitin ligase in proteostasis decline and disease manifestation
16	SERB	2024-25	2027-28	21-May-24	20-May-27	Prof. Pallob Kundu	Coordinated molecular events in stress sensing, activation, and performance of SINACMTF3 for shaping the stress response in tomato"
17	SERB	2022-23	2025-26		29-Dec-25	Dr. Amit Kumar Paul	On-the-Fly Chemical Dynamics Simulations in Gas and Condensed Phase Molecular Systems Using Machine Learning Approach
18	ICMR	2024-25	2027-28	02-Apr-24	01-Apr-27	Prof. Biswanath Maity	FNDC-CaMKII complex facilitate cardiac T-tubule synchronization through mitigating intercommunication of myocyte-endothelia cells in chemo-induced cardiac pathologies
19	SERB	2024-25	2027-28	08-Oct-24	07-Oct-27	Dr. Subhash Haldar	Role of NLRP3 mediated inflammosome in chemotherapy drug resistant prostate cancer
20	DBT	2024-25	2027-28	18-Sep-24	17-Sep-27	Dr. Abhrajyoti Ghosh	Microplastics in ballast water as an emerging vector for bacterial pathogens and Harmful Algal Bloom species: a potential risk to the marine environment and human health

LIST OF PUBLICATIONS

Sl. No.	Publication Name	Publication Details	Impact Factor
1	Acharya, S., Adamová, D., Adler, A., Aglieri Rinella, G., Agnello, M., Agrawal, N., . . . Zurlo, N. (2024). First Measurement of the |t | Dependence of Incoherent J/ψ Photonuclear Production.	*Physical Review Letters, 132*(16). doi:10.1103/PhysRevLett.132.162302 Publication Date: 19 April 2024	8.6
2	Acharya, S., Adamová, D., Adler, A., Aglieri Rinella, G., Agnello, M., Agrawal, N., . . . Zurlo, N. (2024). Measurement of the fraction of jet longitudinal momentum carried by Λc+ baryons in pp collisions.	*Physical Review D, 109*(7). doi:10.1103/PhysRevD.109.072005 Publication Date: 5 April 2024	5.0
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11	Najar, M. A., & Gangophadhay, G. (2024). Identification and validation of defense related candidate genes in Sesamum under artificial inoculation of Macrophomina phaseolina.	Nucleus (India). doi:10.1007/s13237-024-00490-6 Published 20 April 2024	1.8
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2	Haldar, S., & Ghosh, A. (2025). An Insight into the Role of the Rhizosphere Microbiome in the Sustainability of Plant Health.	In *Rhizosphere Engineering and Stress Resilience in Plants Concepts and Applications* (pp. 40-59).
3	Saha, K. K., Barman, A., & Mandal, N. C. (2024). Anti-inflammatory and anti-arthritis properties of Ganoderma.	In *Ganoderma: Cultivation, Chemistry and Medicinal Applications* (Vol. 1, pp. 147-167): CRC Press. Publication Date: 2024.
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10	Halder, S., Majumder, C., Manna, A., Sarkar, S., Bhattachrya, A., & Jana, K. (2024). Targeting Reactive Oxygen Species (ROS) in the Prevention of Non-Communicable Diseases: The Promise and Limitations of Antioxidant Therapy.	In The Role of Reactive Oxygen Species in Health and Disease (pp. 89-104).
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2	Haldar, S, Ghosh, A. (2024) Plant-Microbe Interactions in Extreme Environment: Insight and Prospects in Sustainable Agriculture. In Plant-Microbial Interactions for Sustainable Agriculture.	Edited by Arvind Kumar Rai et al. (ISBN: 978-1-0364-1169-5; ISBN (Ebook): 978-1-0364-1170-1)
3	Jana K. (Editor) Apoptosis and Human Health: Understanding Mechanistic and Therapeutic Potential.	Springer Nature, Singapore, 2024.ISBN: 9819779049.

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2	Moulick, S., Mukherjee, S., Raha, S., Singha, A., & Pal, A. N. (2024).	*G phonon mode splitting in doped bilayer graphene probed by in-situ transport measurement and Raman spectroscopy.* Paper presented at the AIP Conference Proceedings. Published 3 April 2024
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6	Das, P. (2024). *Measurement of Leading Charged-Particle Jet Properties in p–Pb Collisions at sNN = 5.02 TeV with ALICE.*	Paper presented at the Springer Proceedings in Physics.
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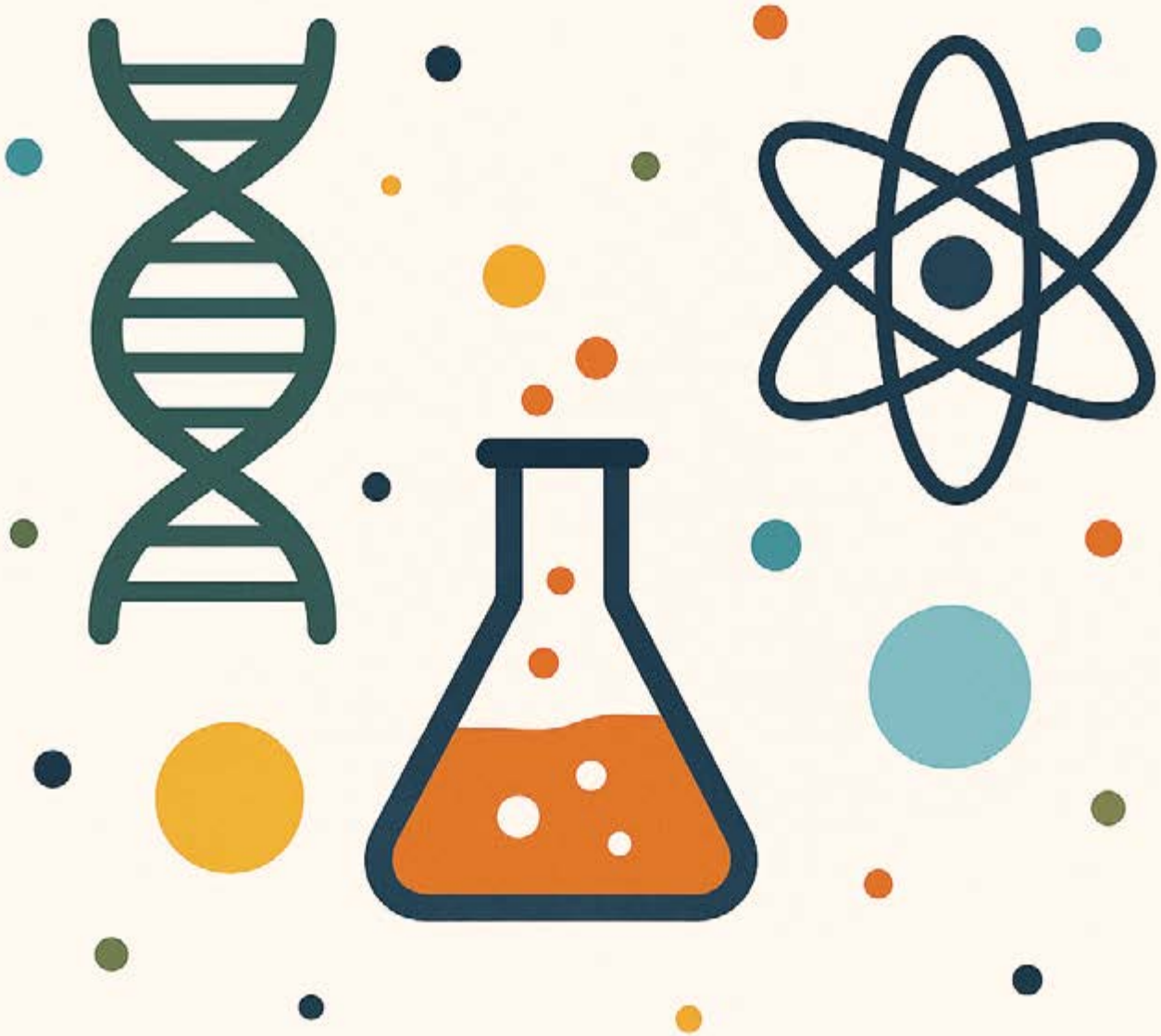
10	Gupta D (2024) *Nuclear Astrophysics at Bose Institute*. PJ Web Conf 297: 01005. doi: 10.1051/epjconf/202429701005.	Paper presented at the "International Symposium on Nuclear Astrophysics (ISNA 2023)" at Manipal Academy of Higher Education (MAHE), Manipal, Karnataka.
11	Mitra R, Gupta D, Maity S, Samanta S, Kundalia K, Ali SM, Saha SK, Tengblad O, Perea A, Martel I, Cederkall J (2024) *Breakup reactions from ^{7}Be + ^{12}C at 5 MeV/u. EPJ Web Conf* 297: 02005. doi: 10.1051/epjconf/202429702005.	Paper presented at the "International Symposium on Nuclear Astrophysics (ISNA 2023)" at Manipal Academy of Higher Education (MAHE), Manipal, Karnataka.
12	Gupta D on behalf of IS 554 collaboration (2024) Breakup reactions of ^{7}Be on ^{12}C at 5 MeV/u	ISOLDE Workshop and Users Meeting, CERN, Geneva, Switzerland
13	R. Mitra, D. Gupta, N. Ghosh, S. Samanta, K. Kundalia, Sk M. Ali, S. Maity, Swapan K. Saha (2024)	Pixel Calibration of Double-Sided Silicon Strip Detectors; Proceedings of the DAE Symposium on Nuclear Physics 68, 1175 ISBN 978-81-967453-5-6
14	N. Ghosh, D. Gupta, S. Samanta, R. Mitra, K. Kundalia, Sk M. Ali, S. Maity, Swapan K. Saha, O. Tengblad, A. Perea, I. Martel, J. Cederkall (2024)	*Neutron and α-transfer reaction ^{12}C(^{7}Be,^{8}Be)^{11}C* at 5 MeV/u* Proceedings of the DAE Symposium on Nuclear Physics 68, 383 ISBN 978-81-967453-5-6
15	S. Samanta, D. Gupta, Sk M. Ali, R. Mitra, K. Kundalia, S. Maity, N. Ghosh, Swapan K. Saha, O. Tengblad, A. Perea, I. Martel, J. Cederkall (2024)	Study of ^{7}Be(d, α)^{5}Li(p α) and ^{7}Be(d, p)^{8}Be* (p ^{7}Li) reactions at 5 MeV/u Proceedings of the DAE Symposium on Nuclear Physics 68, 813 ISBN 978-81-967453-5-6

RECENT RESEARCH IN

BIOLOGICAL, CHEMICAL AND PHYSICAL SCIENCES



DEPARTMENT OF BIOLOGICAL SCIENCES

DEPARTMENT OF BIOLOGICAL SCIENCES

Overview:

Bose Institute has a storied history of making seminal contributions in diverse areas of life sciences, starting with our founder, Acharya Jagadish Chandra Bose. To enable better resource management and foster a strong collaborative environment, seven erstwhile departments engaged in life sciences research were amalgamated to create the Department of Biological Sciences.

The Department commenced its journey on the 15th of May, 2023, bringing together faculty members having diverse research interests and expertise. There is extensive collaboration between members, resulting in the emergence of creative problem-solving approaches towards finding solutions for various challenges faced by our nation. The faculty's interest can be broadly classified into four research domains: (i) Disease Biology, (ii) Microbiology, (iii) Plant Biology, and (iv) Structural Biology.

The Disease Biology team has adopted a concerted, multidimensional approach towards understanding several human diseases, including cancer, asthma, neurodegeneration, infectious diseases and infertility. Team members use synthetic biology approaches for designing therapeutic interventions and finding markers that will enable early detection of these conditions. They are also implementing computational approaches for designing better healthcare delivery systems.

The Microbiology team's interest encompasses all three domains of life: bacteria, archaea and eukarya. The initiatives include finding solutions to microbial diseases relevant to the Indian context, exploring biogeochemically important microbes towards solving environmental problems, and investigating how microbes sense environmental cues and what adaptation strategies they adopt to respond to these signals.

The mission of the Plant Biology team is to achieve fundamental knowledge in plant stress biology, plant-pathogen interaction, development biology, and genomics-assisted molecular breeding. They work on cereals, vegetables and oil seed crops, following the mandate of the National Action Plan on Climate Change (NAPCC), which aims to evolve and implement strategies to make Indian agriculture more resilient to climate change.

The Structural Biology team has expertise in experimental and computational approaches, and they aim to tease out details of the general principles governing life functions and system-specific nuances. They use cross-disciplinary techniques like cryo-electron and light microscopy, spectroscopy, X-ray crystallography, mass spectrometry, simulations and thermodynamic calculations, and other quantitative techniques to gain insights into the structural aspects of various cellular machinery and pathways as well as pathologies related to dysregulation of those systems.

The department proudly hosts two national network projects that unite members with diverse competencies. These are:

National CryoEM Facility: Cryo-EM has emerged as the preferred method for determining the shape and conformational details of macromolecules and their assemblages, close to their native states (hydrated state). Bose Institute is proud to be one of the four centres chosen through a competitive

IRHPA scheme by the erstwhile DST-SERB (ANRF) to establish a National CryoEM Facility in India. This centre will foster complementary collaborative research to transform the structure-guided drug discovery and therapeutics research landscape in India. It will also enable researchers to seek answers to fundamental questions in biology, which cannot be addressed with any other technique.

Bioinformatics Centre: Bioinformatics is a theoretical and computational approach that adopts data-driven prediction methods to provide rapid and targeted solutions in diverse domains of biology, often complementing experimental methods. Bose Institute has been a pioneer in this research area since 1989, which continues with two DBT-funded projects to support the current initiatives. One is a multi-institutional National Network Project and another supports the core Bioinformatics Centre Facility. Researchers are adopting data analytical prediction method development and translating them into web-based applications with therapeutic relevance using upcoming methods like machine learning. The objective is to offer more precise and personalized therapeutic strategies. With the help of computer simulations, they are also analysing 'molecules in action' in atomistic detail towards developing strategies to modulate the functions of biomolecules for developing biotechnological solutions for national needs.

DR. SUBRATA SAU
Professor
Department of Biological Sciences

Group Members:

Debasmita Sinha, SRF

Summary of Research:

Staphylococcus aureus, a pathogenic bacterium, has become resistant to multiple antibiotics and there is no vaccine against this microbe. With an objective to stop the staphylococcal infections, S. aureus-encoded capsule-producing enzyme CapG, alternative sigma factor σB, anti-σB factor RsbW, and anti-anti-sigma factor RsbV have been studied at length.

Field of Research:

- Virulence factors/regulators of *Staphylococcus aureus*.

Focused Areas of Research:

- Genetic studies on a staphylococcal anti-sigma factor and cognate proteins.
- Purification and characterization of a staphylococcal capsule-producing enzyme.

Highlights of Research:

- CapG, one of the *Staphylococcus aureus*-encoded enzymes, is involved in the synthesis of capsule, a virulence factor. We have purified a recombinant CapG (rCapG) and shown that it primarily remains as a mixture of different oligomers at 5-100 μM concentrations. Of the oligomers, trimers appeared to be the most predominant forms in the aqueous solution. Interestingly, a fraction of rCapG also exists as the monomers at hundred nanomolar concentrations. In addition, unfolding of rCapG in the presence of urea occurred via the formation of three structurally distinct intermediates. Thus, the study has not only shown the solution-form but also provided clues about the folding mechanism of CapG, which may be useful for screening new inhibitors of *S. aureus* in the future.
- *Staphylococcus aureus* synthesizes an alternative sigma factor σB for adapting hostile environment and causing diseases. The transcription initiation activity of σB is blocked by

RsbW, an anti-sigma factor. RsbW also binds and phosphorylates RsbV, an anti-anti-sigma factor. Modeling studies previously revealed that the dimerization region at the N-terminal end of RsbW binds σ^{B3}, the domain 3 of σ^{B}. In opposition, nearly the entire RsbW is involved in binding RsbV. Besides, some Lys/Arg residues of RsbW that primarily participate in binding σ^{B3} are Arg 23, Arg 32, and Lys 44. Interestingly, Arg 23 and Lys 44 were also found to bind RsbV. Additionally, Arg 11, Arg 32, and many other non-basic amino acid residues are involved in the dimerization of RsbW. Using an Ala-substituted mutant of RsbW, we earlier showed that Arg 23 is required to preserve the structure, phosphorylation ability, and stability of RsbW. Similar genetic studies have shown that Arg 11 and Lys 44 are needed to maintain the structure, phosphorylation ability, and RsbV/ σ^{B3} binding activity of RsbW. Both Agr 11 and Agr 32 also differently contributed to the dimerization of RsbW. Additional genetic investigations have revealed that Glu 21 and Asp 23 of RsbV, two Arg 23 binding residues, are required to maintain the structure and RsbW binding affinity of RsbV. Further, Asp 23 is also essential for the RsbW-mediated phosphorylation of RsbV. Jointly, the above genetic data could be exploited in the designing of new anti-staphylococcal inhibitors in the future.

Notable Achievement/Event:

- Genetic studies on the staphylococcocal anti-sigma factor and cognate proteins have partly shown the ways these molecules interact each other.
- The studies on the CapG, anti-sigma factor and cognate protein may help to screen/design new anti-staphylococcal compounds in the future.

DR. SRIMONTI SARKAR
Professor
Department of Biological Sciences

Ankita Das, INSPIRE Fellow-SRF
Nabanita Patra, CSIR Fellow-SRF
Avishikta Chatterjee, INSPIRE Fellow-SRF
Pritha Mandal, CSIR Fellow-SRF
Trisha Ghosh, UGC Fellow-SRF
Anurupa Sett, UGC Fellow- SRF
Babai Hazra, UGC Fellow-SRF

Summary of Research:

Giardiasis, caused by the unicellular parasite *Giardia lamblia* (syn. *G. intestinalis*, *G. duodenalis*), is a common parasitic gastroenteric disease in India and other developing countries. It is prevalent in communities with poor sanitary conditions and having limited access to safe drinking water. Since the parasite causes nutrient malabsorption in the gut, it is a major contributor to childhood malnutrition. It spreads via the faecal-oral route as infected individuals shed cysts that contaminate food and water. Besides being a public health concern, the parasite has a wider economic impact as it infects livestock and pets. Current treatment options for giardiasis include nitroimidazole group of drugs, quinacrine and benzimidazoles. But rising incidences of persistent giardiasis indicate emergence of drug resistance strains. Another underlying factor for persistent giardiasis is the high endemicity of the parasite, which causes reinfection. To break this cycle of reinfection, it is necessary to look for new therapeutic targets that prevent cyst formation as this is the only form of the parasite that can survive in the open environment. Towards this, my laboratory studies cellular processes of *Giardia* that are key contributors to its persistence within the host gut and transmission to new host. These include (1) vesicular targeting, particularly the machinery for vesicle tethering and subsequent fusion to target membrane, (2) membrane remodeling by the ESCRT complexes, and (3) the proteasome assembly. Vesicular targeting is important for cyst formation as this machinery transports cyst wall materials to the cell surface. The ESCRT machinery is vital for the membrane dynamics of peripheral vesicles, which are the compartments through which the parasite derives nutrition from the host gut. The proteasome plays a key role in the transition from one morphological state to another, and its inhibition is known to affect encystation. Using molecular genetic techniques and high-resolution microscopy, we aim to identify novel, parasite-specific features of the components driving these processes.

Highlights:

Our characterizations of the complex serving as guanine nucleotide exchange factor of Rab1a and Rab11 of *Giardia* indicates that in addition to participating in membrane trafficking, it is likely to discharge a non-canonical function as it localizes to areas of the cell where the plasma membrane makes acute positive curvatures, such as the periphery of the ventral disc and the ventrolateral flanges that extrude from the cell (Figure 1). Since the ventral disc and ventrolateral flanges are vital for parasite attachment to the host gut wall, selective inhibition of this complex is likely to adversely affect the ability of this parasite to persist within the host.

We have performed comparative analysis of binary interaction affinities within homologous multisubunit protein complexes from yeast and *Giardia*, which revealed that certain inter-subunit interactions are conserved across evolution. This comparison has helped in identifying the subset of inter-subunit interactions that are likely to perform fundamental structural roles in complex assembly.

Unlike most eukaryotes, *Giardia* has a minimal vesicular trafficking machinery. We have uncovered a rare exception to this minimalism wherein two NSF paralogues are present in this parasite. Localization studies indicate that these highly homologous paralogues likely function independently under various stress conditions as GlNSF$_{112681}$ remains at peripheral vesicles, while the major pool of GlNSF$_{114776}$ redistributes to anterior flagella-associated structures. These paralogues also exhibit selective affinity for the Glα-SNAPs. This selectivity stems from sequence divergences near their N-termini. The two GlNSFs colocalize and coimmunoprecipitate, indicating the presence of a heterohexameric 20S complex in trophozoites.

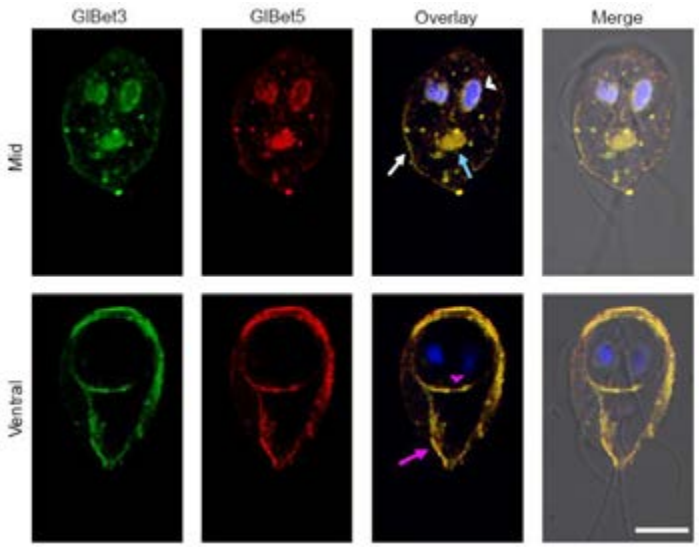


Figure 1: Immunofluorescence localization of GlBet3 and GlBet5 was performed in trophozoites using polyclonal antibodies against each. Two representative z-sections, one from the middle and one from the ventral surface of the same *Giardia* trophozoite, show the distribution of each protein at different cellular locations. The white arrowhead marks the perinuclear membrane; the white arrow marks the peripheral vesicles; the cyan arrow marks the median body; the magenta arrow marks the flange; and the magenta arrowhead marks the ventral disc periphery. DAPI marks the position of the nucleus, and the three fluorescent signals are overlayed on a DIC image.

DR. SHUBHO CHAUDHURI
Professor
Department of Biological Sciences

Group Members:

Jinia Chakrabarty, SRF
Sonal Sachdev, SRF
Ruby Biswas, SRF
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Sabini Basu, SRF
Ayantika Nandi, SRF
Rukshar Parveen, SRF
Deyashini Chakraborty, JRF

Summary of Research:

Plants being sessile organisms constantly modify their physiological and developmental processes in response to various environmental cues for stress adaptation. The stress signal promotes the transcription of plethora of stress responsive genes by inducing changes in chromatin structure to generate 'open' or 'closed' chromatin configuration inside the cell. The accessibility of highly complex chromatin structure to initiate transcription is achieved through post-translation modification of histones (epigenetic mark) or through active chromatin remodelling guided by ATP dependent chromatin remodeler or histone chaperones. The focus of my research is to study the mechanism of chromatin remodelling in plants to understand the transcription regulation during plant development and stress response. The research is divided into two big projects:

Project1: Role of plant specific chromatin architectural protein in pollen development. Pollen formation represents a very important developmental stage in plant life cycle. It represents the male gametophyte and its role is to deliver the genetic material to the embryo sac. The production and transfer of viable pollen grains to the stigma, germination of the pollen grains, growth of the pollen tubes down the style, and effective fertilization are necessary for the formation of a successful seed set. Thus, understanding the pollen development process not only elucidate the basic mechanism of sexual reproduction of flowering plants but also add valuable information for subsequent manipulation in crop production. Recent work from our group indicated

- Chromatin architectural protein AtHMGB15 regulate pollen development and pollen viability in Arabidopsis.

- AtHMGB15 acts as transcription activator to regulate Jasmonic acid signaling during pollen development by modulating MYC2 transcription factor activity.
- Deletion of AtHMGB15 causes delayed Programmed Cell Death for the tapetal cell degradation causing defect in pollen cell wall development and viability.
- AtHMGB15 interacts with many stamen specific factors viz. TOPLESS, Histone acetyltransferase, Histone deacetylase, suggesting their role in JA signaling during pollen development

Project 2: Understanding the epigenetic regulation involved in the transcription of abiotic stress induced genes in rice. Rice, one of the most important agronomically crops, when challenged by environmental stressed condition especially high salinity, drought or cold, can affect its growth at the seedling stage and reproductive phase. Thus, investigating the intricate molecular mechanisms of stress response and its developmental process throughout its life cycle is essential for better stress resilience. Recent research indicated the importance of "Plant stress memory" in developing strategies for crop improvement with enhanced stress adaptability. In molecular terms, plants exposed to stress for the first time (stress-primed), acquire stress memory by changing epigenetic codes, post-transcriptional or translational modifications or hormone signalling. This project deals with different epigenetic regulators that regulate developmental reprogramming and stress resilience in plants by modulating chromatin. Recent work from our group indicated

- Plant chromatin regulator ULTRAPETALA promote development reprogramming for stress resilience in rice
- Molecular characterization of a cold tolerant *indica* landrace CB1 to gain a deeper understanding of the cold tolerance mechanism in rice.

DR. GAURAB GANGOPADHYAY

Professor
Department of Biological Sciences

Group Members:

Mushtaq Ahmad Najar - SRF (CSIR, Adhoc Fellow)
Saptadipa Banerjee - SRF (UGC, Adhoc Fellow)
Dr. Bratati Sikdar - Senior Project Associate (Intramural)
Dr. Argha Chakraborty - Senior Project Associate (Intramural)

Summary of Research:

The current focuses of my research group are to understand:

- Phytoplasma-associated Retrograde Metamorphosis in Sesame, the emerging oilseed crop
- Endophytic microbes in Sesame for fungal pathogen tolerance
- The potential of Epigallocatechin gallate (EGCG) to disrupt the quorum-sensing machinery of *Chromobacterium violaceum*.

Notable Achievement/Event:

- Research success story entitled "New Microbe reverting sesame flowers to vegetative state identified" was published in the DST Newsletter STRIDES (Vol 5, Issue 6, Page 3, 2024). (https://dst.gov.in/new-microbe-reverting-sesame-flowers-vegetative-state-identified).
- Dr. Bratati Sikdar (Senior Project Associate, BI intramural project), Mr. Mushtaq Ahmad Najar (CSIR-SRF), and Ms. Saptadipa Banerjee (UGC-SRF), working with Prof Gaurab Gangopadhyay, Department of Biological Sciences received 'outstanding paper' awards in their respective category in the 7th Regional Science & Technology Congress, WB, 2024-25 (14.01.2025-18.01.2025).
- Ms. Saptadipa Banerjee (UGC-SRF), working with Prof Gaurab Gangopadhyay, Department of Biological Sciences received 'outstanding paper award' (first prize) in the subject category Botany in the 32nd West Bengal Science and Technology Congress, held at Biswa Bangla Convention Centre, Kolkata during 28th February to 2nd March 2025.

DR. PALLOB KUNDU
Professor
Department of Biological Sciences

Group Members:

Sayan Mal, SRF
Ananya Mukherjee, SRF
Raghubir Singh, SRF
Sushmita Talukdar, SRF
Riya Bajani, JRF
Sweta Mukherjee, JRF
Dr. Shuddhanjali Roy, DBT RA

Summary of Research:

Topic of Research: Exploring the multidimensional nature of the interactions between tomato plants, pathogens, and the environment for biotechnological applications

Brief description of research topic: Our research aims to understand genetic factors that affect tomato plants' stress resilience and means for altering the expression of these factors to bestow robust resistance against stress. Plants respond differently at the molecular level when exposed to a single stressful situation compared to multiple stresses simultaneously. Thus, studying the plant's response against multiple adverse conditions, as often they encounter in a cultivation field, will reveal the exact role of a factor in stress responses. Using functional genomics approaches, we are investigating global changes in tomato transcriptome and regulation during different stresses. Our wholesome approaches are directed to unravel the role of specific factors in tomatoes' response against multiple stresses and possible means for biotechnological intervention for robust stress resilience.

We are studying tomato's response to a necrotrophic pathogen, Alternaria solani, which inflicts early blight disease and hemi/biotrophic pathogens Pseudomonas syringae and Xanthomonas campestris. Besides, the effect of thermal stress alone or combined with the biotic stresses on tomato stress physiology is explored.

We use genomics, molecular biology, and plant biotechnology tools. Currently we are working on the following projects:

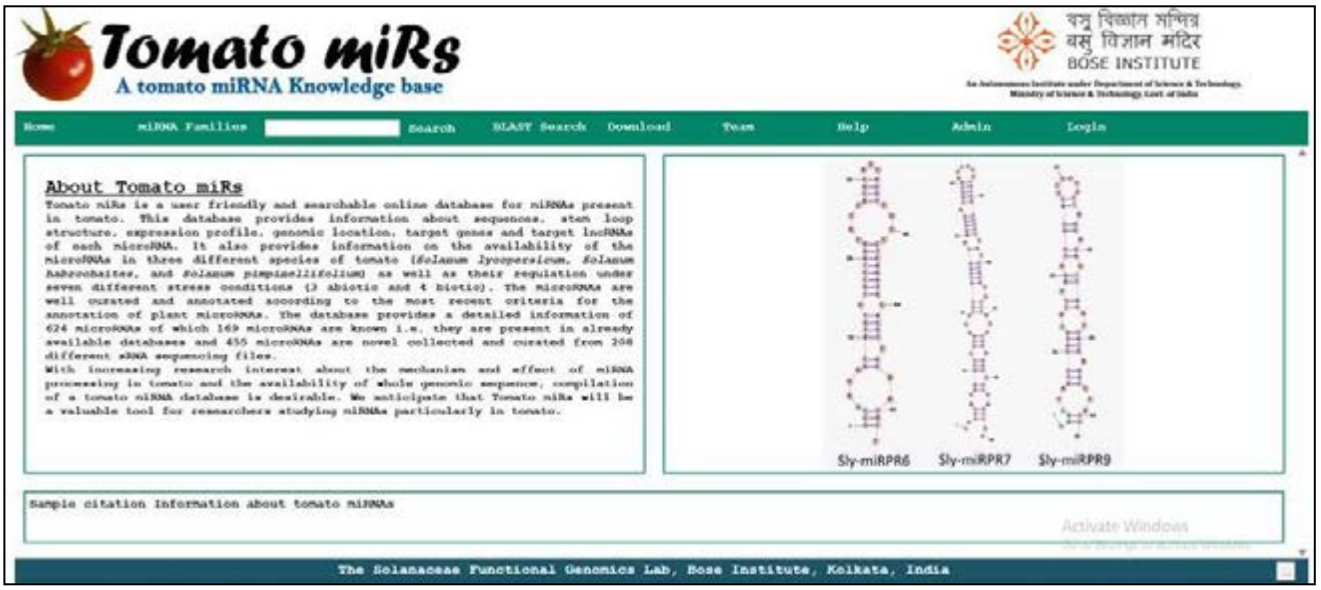
- Role of mediators of cell death, such as NB-LRRs and metacaspases, in early blight disease development.
- Roles of miRNAs in shaping tomato thermal and pathogen stress-response

- Mechanisms of signal perception, regulation of expression, and biological functions of membrane-bound NAC transcription factors in tomato (NAC MTFs).
- Generation of stress-resilient crops of the future by biotechnological approaches.

Major Findings:

- We have proved a low pH-activable tomato metacaspase (SlMC8) is involved in hypersensitive response and programmed cell death. (Plant Physiology and Biochemistry, 2024).
- Reactive oxygen species (ROS) are crucial components of plant stress response against pathogens. We have shown that, regulation of superoxide dismutases' expression via microRNA398 plays a significant role in ROS regulation during pathogen stress in tomato. miR398 null lines depict altered response to different stresses. (Plant Molecular Biology, 2025)
- We have developed a tomato comprehensive miRNA-database by curating data from all publicly available sources and literature. Database web interface is now available.
- We have unveiled the mechansim of stress-dependent activation of a membrane bound NAC transcription factor, SlNACMTF3. We show that heat stress-dependent structural alteration ensures interaction between rhomboid proteases and SlNACMTF3 on membrane leading to SlNACMTF3 liberation.The preferable DNA-binding sites for SlNACMTF3 has also been identified by SELEX analysis. We have characterized tomato rhomboids. Now we are investigating the mechanism of stress-dependent association between the protease and transcription factor in the plasmamembrane (Int J Biol Macromol. 2024).

Developed a tomato comprehensive miRNA-database



DR. KAUSHIK BISWAS
Professor
Department of Biological Sciences

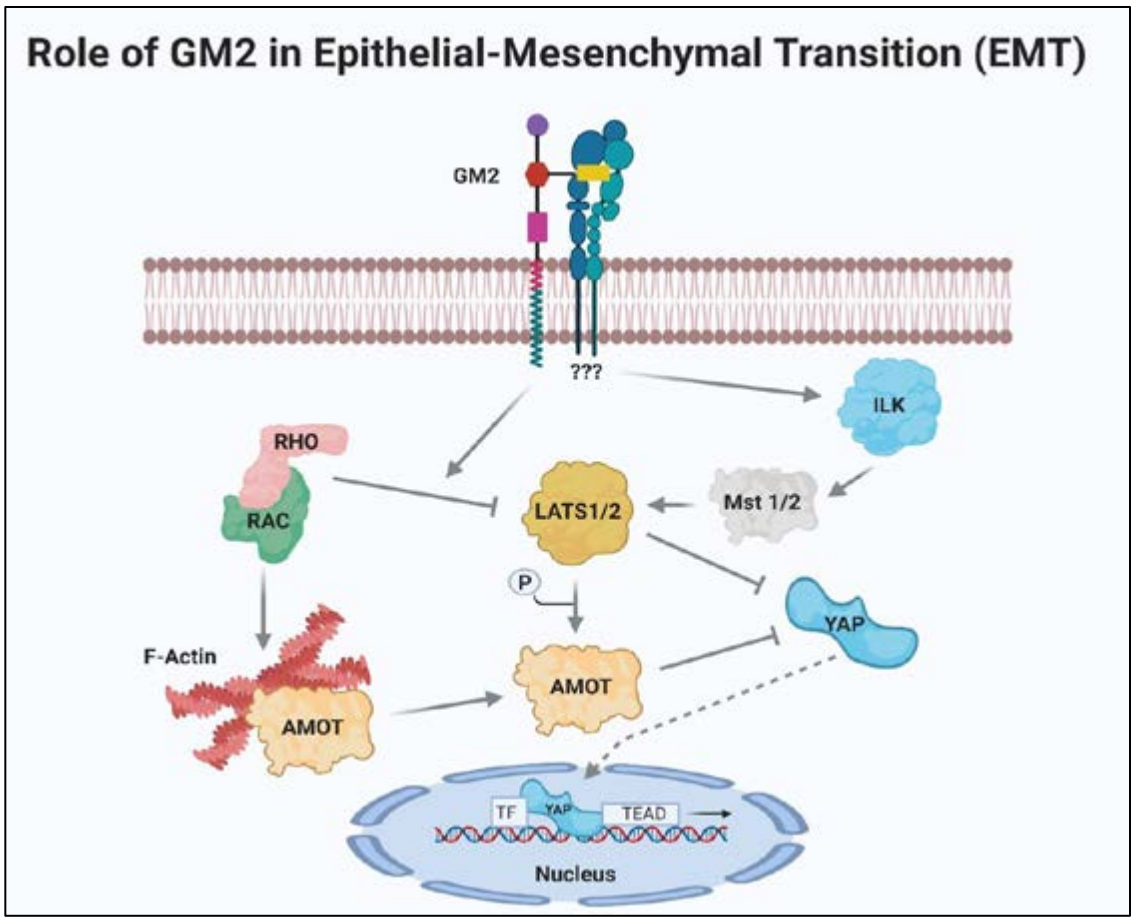
Group Members:

Dr. Dipanwita Mukherjee, PhD (SERB-NPDF)
Abhisek Banerjee (DST-SERB Project Associate)
Elora Khamrui (CSIR, SRF)
Sounak Banerjee (UGC, SRF)
Subha Ray (UGC, SRF)
Aishwarya Ray (UGC, SRF)
Sanchari Chatterjee (UGC, SRF)

Summary of Research:

Our Laboratory focusses in understanding how tumor derived glycolipids, specially gangliosides influence the process of tumorigenesis. With that goal in mind, we ask two basic questions – What's the consequence of over-expression of some of these gangliosides in tumor growth, progression and metastasis; and What is the basis of over-expression of these gangliosides in some tumors? In the last few years, we have demonstrated a pro-tumorigenic ability of the ganglioside GM2, which is over-expressed in several cancers, including but not limited to GBM, RCC and Lung Cancer. We have also discovered that GM2-synthase, the gene primarily involved in synthesis of GM2 is epigenetically regulated in RCC at the level of transcription. During the last year, we have progressed in standardizing the protocol for immuno-precipitation of the proteome associated with the TSS of the GM2-synthase gene using a dCas9-guided "enChIP" method. We have also uncovered two distinct signaling axis regulated by GM2 through it imparts EMT and metastasis. Significant progress has also been achieved in our understanding how ganglioside GM2 modulates the tumor micro-environment through its effect on fibroblasts in the process of tumorigenesis. On a different note, we have identified a novel miRNA-mRNA axis and are trying to understand its role in cancer. In an effort to understand how Eriodictyol, a plant derived flavonoid which has been shown from our laboratory to display selective cytotoxicity towards cancer cells, we are now trying to understand its anti-metastatic mechanism in addition to increasing its bio-availability inside cells and its mode of uptake through chemical modifications and nano-formulations.

Unravelling the signaling crosstalk employed by ganglioside GM2 in EMT and metastasis : Our laboratory have identified ganglioside GM2 to play a novel role in tumor cell migration and invasion, as well as in inducing epithelial-mesenchymal transition (EMT) and metastasis through distinct mechanisms. We ask "HOW" GM2 over-expression influences the process of carcinogenesis, and "WHY" ganglioside GM2 is at all over-expressed in cancer ? To address the first question, we demonstrated that GM2-mediated tumor cell migration and invasion were found to involve the

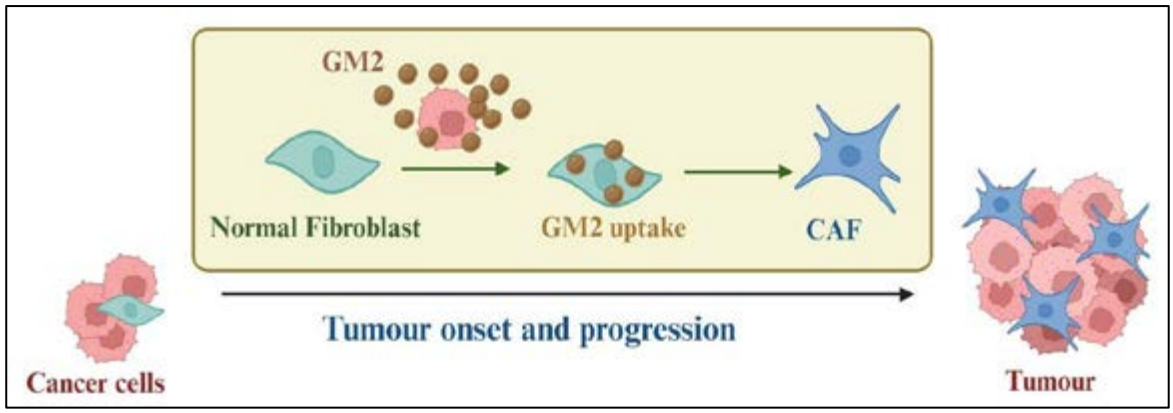


Unravelling the Signaling underlying ganglioside GM2-mediated EMT and metastasis. GM2 exhibits its pro-tumorigenic effect through modulation of multiple signaling axis. Here we have uncovered that GM2 deactivates the tumor suppressor HIPPO signaling which results in inactivation of the kinases, and consequent dephosphorylation-mediated nuclear translocation of oncogenic YAP/TAZ. This project involves delineating the entire signaling starting from the membrane level down to the nuclear functions in response to GM2 and its functional relevance from the context of EMT and metastasis.

activation of downstream integrin signaling relaying the signals to converge in modulation of actin cytoskeleton causing increased migration and invasion in tumors. Additionally, GM2-mediated EMT changes were found to involve the HIPPO-YAP/TAZ signaling. Present study aims in defining the role of gangliosides in EMT and metastasis and uncover its mechanism.

To this end, during the last three years, a global transcriptomic analysis and their validation from cells treated with exogenous GM2 revealed that GM2 modulates Hippo transducer YAP-TAZ dependent gene transcription. Additionally, data shows that, GM2 promotes dephosphorylation, expression and nuclear localization of YAP-TAZ. Addback of exogenous GM2 to GM2-syn KO cells reversed suppression and upregulated YAP/TAZ-target gene expression, confirming that YAP/TAZ-target gene expression is GM2-dependent. We also demonstrated that GM2 caused time-dependent F-actin formation, while F-actin/G-actin ratio decreases in Renca-vGM2-syn KO cells, suggesting a role of

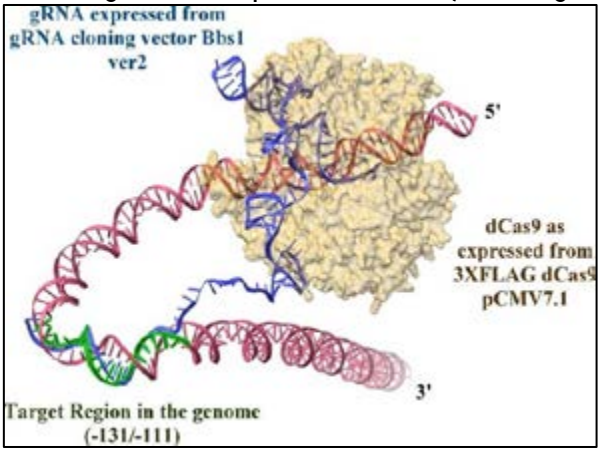
F-actin in GM2-mediated HIPPO-YAP/TAZ signaling. Further, Latranculin, an F-actin disruptor blocks GM2-mediated YAP/TAZ target gene expression, confirming the above hypothesis. Additionally, we show that Verteporfin, an inhibitor of YAP/TAZ-TEAD interaction blocks GM2-mediated induction of ctgf and cyr61, confirming that GM2-mediated induction of EMT genes is YAP/TAZ-dependent. siRNA-mediated knockdown of YAP as well as TAZ led to significant reduction in migration of Hela cells, confirming that GM2-mediated induction of migration and possibly EMT is YAP/TAZ-dependent. Further studies are under way to map the signaling events and mediators that leads to GM2-mediated de-activation of the HIPPO signaling and consequent activation of YAP/TAZ. To explore the upstream events, particularly how GM2 leads to HIPPO de-activation which might involve specific receptors, mechano-sensing events, we are exploring both inhibitor as well as siRNA based approaches to either block or down-regulate expression of key receptors, such as TRKs, INTBs and muscarinic receptors. For identification of possible GPCRs, if any, we have initiated pooled CRISPR-Cas based screening system using a ctgf-Reporter HeLa cell line. We have also found that GM2 modulates the ERK-EGR1 axis in modulating tumorigenesis, as Erk1/2 as well as EGR1 KO cells reduced GM2-mediated invasion of tumor cells.



Ganglioside GM2-mediated modulation of the tumor micro-environment. Previous evidenced clearly demonstrated that gangliosides, actively shed from the tumor modulate the tumor microenvironment to their advantage, either by causing defective antigen presentation or by immune suppression. Here, we hypothesize that actively shed tumor derived GM2 modulates the microenvironment through transforming normal quiescent fibroblasts to cancer associated fibroblasts or CAFs. This project deals with understanding whether GM2 induce CAFs, how it does so and if so, what's the functional relevance in vitro and in vivo.

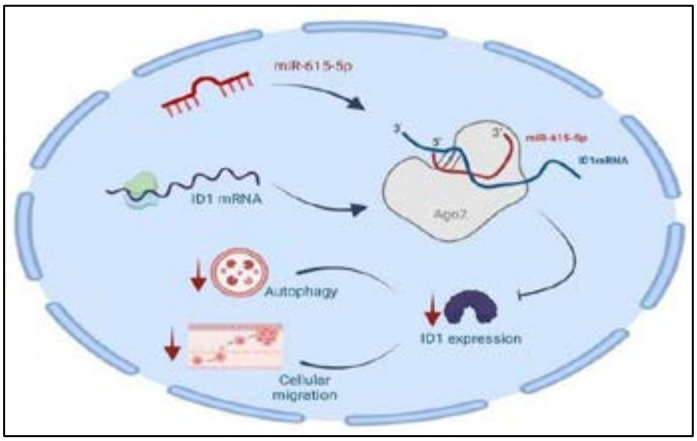
GM2-mediated modulation of the tumor stroma, specifically fibroblasts in promotion of cancer metastasis : For the last few years our laboratory has mostly focused in how ganglioside GM2 influences pro-tumorigenic behavior and how it does that. However, the process of carcinogenesis does not depend only on the tumor themselves, in fact, the dynamic crosstalk between the tumor cells and the stromal cells (consisting primarily of fibroblasts) play a crucial role. We have just begun to understand how tumor secreted gangliosides, particularly GM2 modulate the process of tumorigenesis. The first step in understanding that is to define signature gene expression profiles that distinguish fibroblasts from cancer associated fibroblasts (CAFs). Our laboratory is presently trying to define CAFs from mouse primary tumors, using gene expression profiling by next generation sequencing. So far, we have been able to successfully isolate and purify with reasonable homogeneity primary mouse fibroblasts.

Unravelling the proteome associated with the TSS of GM2-synthase gene in an effort to understand the transcriptional regulation of GM2-synthase in Cancer : Previously, we demonstrated that increased acetylation of the chromatin environment near the TSS of the GM2-synthase gene in cancer, leads to acetylation of the transcriptional repressor Sp1 resulting in its proteasomal degradation and consequent decreased binding of the repressor HDAC1, leading to overall de-repression of the GM2-synthase transcription in RCC. In the present year, we have successfully identified the proteome associated with the TSS of the GM2-synthase gene, which influence GM2-synthase transcription. For this we have adopted a CRISPR-dCas9-based enChIP assay, followed by mass spectrometric identification of the players involved. From a detailed analysis of the enChIP data and further validation using CLASP, we hope to identify critical players involved in the transcriptional regulation of GM2-synthase gene.



Identification of the proteome associated with the GM2-synthase TSS. We used a CRISPR-dCas9-based enChIP technique to pull down the chromatin associated with the GM2-syn TSS. For this, we overexpressed FLAG-tagged dCas9 along with gRNA (targeting GM2-syn TSS), and used anti-FLAG to enrich the locii. Mass spectrometric detection followed by downstream analysis helped us to screen and identify the proteome associated with the site and provide us with a clear understanding of the mechanism underlying GM2-synthase transcription

Identification of a novel axis, miR-615-5p/ID1 in tumorigenesis : Over the last two years, we have identified a novel miR-615-5p/ID1 axis in regulating carcinogenesis, and established ID1 as a novel target for the tumor suppressor miR-615-5p. Although, miR-615-5p was known as a tumour-suppressor miR, and ID1 as an oncogene, that ID1 is a potential target of miR-615-5p is unknown. Overexpression of ID1 is reported in several cancer types including early and late-stage breast cancer, pancreatic ductal adeno carcinoma (PAAD), melanoma, and small cell lung cancer (SCLC). The high expression of ID1 is associated with poor prognosis and survival in glioblastoma, breast as well as in lung cancer patients. Transcriptional regulation of ID1 in tumorigenesis is well studied but only few papers addressed the post transcriptional regulation of ID1 in tumorigenesis. *In-silico* analysis of the ID1 predicted 3' UTR of ID1 as a putative target for a microRNA miR-615-5p, a well reported tumour suppressor microRNA in PAAD. The microRNAs are small regulatory noncoding RNAs that regulate gene expression post transcriptionally by binding to the 3' UTR of the target genes. The present study focuses on the identification of miR-615-5p as a novel regulator of oncogenic ID1 and to find out the functional implications of such an association in tumorigenesis. The regulatory role of miR-615-5p over ID1 gene expression was assessed by modulating the microRNA expression ex vivo. ID1 expression was assessed in both overexpression as well as microRNA knockdown model. Ectopic overexpression of miR-615-5p using miR mimic resulted in the down regulation of the ID1 gene expression whereas knocking down resulted in its upregulation, which suggested a regulatory role of miR-615-5p over ID1 gene expression. To assess the functional binding of miR-615-5p with the 3' UTR of the ID1, luciferase assay was performed where the wild type UTR region of ID1 gene was cloned at the luciferase 3' region and co-expressed with miR-615-5p mimic. The overexpression resulted in a significant down regulation of luciferase gene expression which is reversed upon mutation of the miR seed sequence in the UTR, which confirms that binding of miR-615-5p with the ID1 3' UTR results in downregulation of its transcript.



Identification of a novel miR-615-5p/ID1 axis in PDAC. We have got interesting results uncovering a yet unknown interaction between the tumor suppressor miR-615-5p and the oncogene ID1 axis in the pathogenesis of pancreatic ductal adenocarcinoma (PDAC). Here, we intend to prove that miR-615-5p binds to the 3'-UTR of the ID1 gene, and this interaction functionally translates to downregulation of pro-tumorigenic functions.

Research Highlight/Accomplishment:

- Identified oncogenic ID1 as a putative target for the tumor suppressor miR-615-5p in tumorigenesis.
- Successfully identified the proteome associated with the transcription start site of the GM2-synthase gene, which is critical in understanding its transcriptional de-regulation in cancer.
- GM2 mediated ERK-EGR1 axis is critical for promoting invasion and inducing EMT in tumor cells.

DR. ATIN KUMAR MANDAL
Professor
Department of Biological Sciences

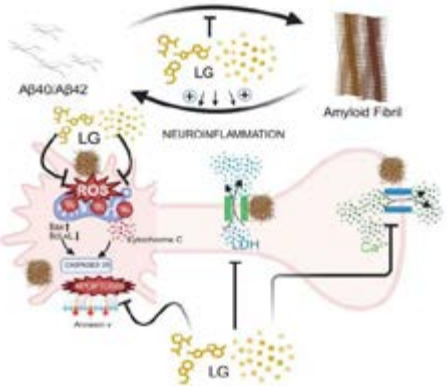
Group Members:

Pramit Bhattacharjee, SRF
Somesh Roy, SRF
Madhuparna Chakraborty, SRF
Dhiman Saha, CSIR-SRF
Upama Chowdhury, UGC-SRF
Gourav Some, CSIR-SRF
Alapan Maity, CSIR-JRF
Kunjani Rai, CSIR-JRF

Summary of Research:

Altered proteostasis is found in many diseases including cancer, hypertrophic cardiomyopathy and late onset neurodegenerative disorders. We want to elucidate the mechanism how proteostasis is declined in disease conditions and the role of chaperones and ubiquitin ligases in this process to identify alternative drug targets to mitigate these disorders.

Research Highlight/Accomplishment:



USP7 acts as deubiquitinase of PJA1 ubiquitin ligase- Interactome analysis of PJA1 ligase in mouse neuroblastoma cell line, Neuro2A indicates that PJA1 ligase is involved in multiple cellular processes, including autophagic clearance, cell cycle regulation, cell proliferation, and chromatin dynamics. Notably, USP7 (HAUSP/Ubiquitin-Specific Protease 7), a deubiquitinating enzyme that regulates protein stability by removing ubiquitin from target proteins, was identified as interactor of PJA1 through immunoprecipitation, which stabilizes PJA1 by deubiquitination. Additionally, Sequestosome-1 (p62/SQSTM1) was identified as potential interactor of PJA1 which is involved in selective autophagy, targeting ubiquitinated proteins and organelles for degradation via autophagy. These results suggest a potential role for PJA1 in autophagy signaling and cellular proteostasis.

- Modulation of amyloid-β aggregates by natural products- Intrinsically disorder proteins amyloid-β is prone to misfold and form amyloid like toxic aggregates inside the cells and generate amyloidosis. We have found that water extract of Lasunadya Ghrita (LG) an Ayurveda formulation, has lasun (garlic) and ghrita (clarified butter) as its primary components have potential role in modulating Aβ40/Aβ42 aggregates and rescues Aβ toxicity in neuronal SH-SY5Y cells by decreasing ROS generation, membrane leakage, and cellular apoptosis.

DR. SHUBHRA GHOSH DASTIDAR
Professor
Department of Biological Sciences

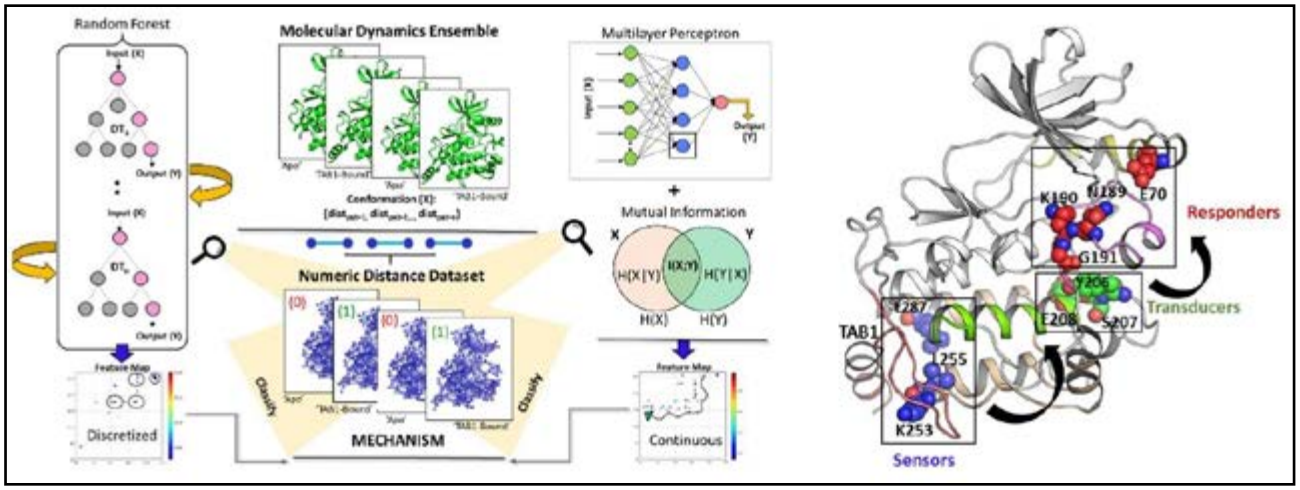
Group Members:

Dr. Debarati Paul, Project Scientist-I
DBT funded
Dr. Byapti Ghosh, Project Scientist-I
DBT funded
Nibedita Ray Chaudhuri, SRF, CSIR-NET
Premananda Basak, SRF, CSIR-NET
Megha Ghosh, JRF, Inspire Fellow, DST
Avibrata Dutta, JRF, CSIR-NET
Payel Bhanja, JRF, CSIR-NET
Munmun Dey, Scientific/Administrative Assistant (DBT-funded)

Summary of Research:

The basic working principles acting behind any biochemical or biological process is actually coded in their molecular level descriptions. While experimental methods can identify the shapes of the molecular structures with its all-atom description, the computational methods can facilitate to visualize and witness the changes occurring at the molecular level to meet the functions. It requires high end computing in substantially large and parallel computing facilities that can simulate the molecular events implementing the fundamental principles of Chemistry, Physics, Mathematics, Statistics, Life sciences through computer programming. Our groups work on interactions between biological macromolecules and macromolecules-drugs to elucidate the structural and thermodynamic basis of such dynamic interactions to identify the possible ways to combat diseases at the molecular level.

While our group has been working on several molecular systems, such as Tubulin-microtubules, Bcl2 family of proteins for more than a decade, our recent interests have been largely focused on the allosteric regulations of proteins particularly in kinases. Developing computational methodologies to capture the intricate details of an allosteric machinery is a challenge to the theoretical and computational biologists. While in the last year we discovered the thermodynamic basis of the TAB1 induced allostery of TAK1 kinases (taking TAK1-TAB1 system as a model), this year we have explored the machine learning methods to offer a computational pipeline to identify the allosteric hotspots on the molecular architecture. The work has been published in the article having reference Biochemistry. 2024 ;63(11):1474-1492. A glimpse of the work is presented in a graphic art, as the following, whose further details would be available in the full article.



Notable Achievement/Event:

Invited twice, to the talk shows of TV channel Doordarshan-Bangla (Prasar Bharati) on popularizing since in local language (Bengali).

DR. AJIT BIKRAM DATTA
Professor
Department of Biological Sciences

Summary of Research:

Our laboratory primarily focusses on understanding specificity and plasticity in the interactions of various proteins involved in ubiquitination, namely ubiquitin activating enzyme E1, conjugating E2s and ubiquitin E3 ligases. Last year, most of our research work was directed towards understanding the E2 specificity of non-canonical vertebrate E1 known as Uba6. Uba6 had been found to transfer the activated ubiquitin moiety to a subset of E2s some of which were also recognized by Uba1. We alleviated the hurdles in purification of recombinant human Uba6 by employing a synthetic gene approach and also deleted a small region of the protein that does not seem to have any functional role. We also obtained the second UbL FAT10 that is activated by the Uba6 in sufficient quantity and purity. We have also started investigating on the ubiquitin chain building preference of E2s, which appears to be an intrinsic property of the Ubc domains. Work on obtaining residue level understanding is ongoing.

Focused Areas of Research:

- Structural basis of plasticity and specificity in protein-protein recognition.
- Understanding post-translational modification of proteins with ubiquitin.
- Determination of crystal structure of proteins and their complexes.

Highlights of Research:

The insights obtained through our research are summarized below.

i) Intramolecular ubiquitination acts as a regulatory mechanism and is a common feature in E2s with extended tails.

Background: We previously reported that Ube2E class of E2s undergo intramolecular auto-ubiquitination at their N-terminal extensions and this self-modification attenuate substrate and E3 ubiquitination activities of Ube2E class of E2s, unlike their close cousins, Ube2Ds. We extended this study to include other E2s with extended tails such as Ube2T and Ube2C.

Background: We previously reported that Ube2E class of E2s undergo intramolecular auto-ubiquitination at their N-terminal extensions and this self-modification attenuate substrate and E3 ubiquitination activities of Ube2E class of E2s, unlike their close cousins, Ube2Ds. We extended this study to include other E2s with extended tails such as Ube2T and Ube2C.

Achievements: We find that Ube2T also undergoes intramolecular ubiquitination at its C-terminal. However, unlike Ube2E, Ube2T only efficiently mono-/multimono-ubiquitinates itself. Thus, there also exists a fundamental difference between Ube2Ts and Ube2E/Ds that precludes the former from using ubiquitin itself as the acceptor.

ii) Understanding the molecular basis of high-affinity interaction between ZNRF1 and Ube2N

Background: RING E3 ligase ZNRF1 contains an unusual H2-type RING domain where two Zn2+ chelating residues are swapped apart from containing a zinc-finger domain. To understand its E2 specificity and affinity we carried out biochemical assays as well as binding studies using isothermal titration calorimetry. Binding studies revealed that ZNRF1 binds Ube2N with a dissociation constant of ~40 nM at 25°C unforeseen for any E3-E2 pairs.

Achievements: We determined the crystal structure of ZNRF1 in complex with Ube2N at 1.47Å. The structure, supplemented with systematic mutational studies, established that (i) ZNRF1 engages Ube2N via its RING domain similar to most RING E3 ligases and (ii) the electrostatic interaction between Arg14 of Ube2N and Glu183 of ZNRF1 is primarily responsible for imparting such an high affinity between this E3 and the E2. We also carried out binding measurements to obtain the change in the heat capacity upon binding. A comparison of the measured heat capacity with that from the theoretical calculation highlighted the importance of the water molecules observed in the protein-protein interface in our crystals.

iii) Importance of the conserved tryptophan residue in imparting ligase activity in monomeric RING E3 ligases

Background: Many of the RING E3s were found to contain a conserved tryptophan that was crucial for their ligase activity while many other E3s lacked that residue yet showed robust activity. We systematically probed into this by using sequence analysis, biochemical data and literature mining.

Achievement: Employing multiple E3s as models along with their mutants we show that the tryptophan is absolutely essential for monomeric E3s while dimeric do not essentially require it. On the other hand, introduction of the tryptophan in dimeric RING E3s results in hyperactivity and makes dimerization redundant for their ligase activity. This data established that the oligomerization mediated control of ligase activity is critically dependent on the absence of the tryptophan justifying the absence of this residue from most of the dimeric E3s.

iv) Elucidation of the structure of the Ufd domain from the non-canonical E1, Uba6

Background: Vertebrates including humans contain two ubiquitin activating enzymes, namely Uba1 and Uba6. Out of these, non-canonical Uba6, is unique as it can activate a second UbL protein, FAT10, apart from the ubiquitin. Uba6 also transfers its ubiquitin to only a subset of E2s and is specific for Ube2Z. Experiments had revealed that the E2 specificity of Uba6 is predominantly dictated by its C-terminal Ufd domain.

Achievements: We have successfully crystallized and determined the structure of Uba6-Ufd domain. The structure depicted differences with the corresponding domain from Uba1. Studies are now underway to understand residue-specific roles of various Ufd domain residues in determining E2 specificity.

v) Molecular determinants of E2 specificity of non-canonical vertebrate E1, Uba6.

Background: Ubiquitin itself and all other ubiquitin-like proteins (UbLs) are activated by large mono or multimeric proteins known as UbL activating E1 enzymes. All these E1s, irrespective of their oligomeric organization or UbL specificity, are remarkably similar in terms of their domain organization and structure. For ubiquitin, the E1s are monomeric proteins that activate the ubiquitin in two chemically distinct steps and subsequently transfers the activated ubiquitin to a conjugating E2 enzyme. To begin with, E1 binds the ubiquitin and a molecule of ATP in its adenylation domain resulting in the formation of Ub-AMP intermediate and releases a pyrophosphate moiety. Subsequently, the Ub-AMP intermediate reacts with the catalytic cysteine residue of the E1 present in one of its half-catalytic domains leading to the formation of E1~Ub thioester and release of the AMP moiety. Finally, E1s engage with conjugating E2s via their C- terminal ~100 residue long Ufd domains to release E2~Ub conjugates formed through trans-thioesterification reactions. Uba6, the non-canonical E1 found in vertebrates, is unique amongst all UbL E1s as it can also activate a second Ubiquitin-like (UbL) protein called FAT10. It was also reported that Uba6 not only interacts exclusively with Ube2Z but it can also interact and transfer the activated Ub moiety to a few but not all of the E2s that are also recognized by Uba1.

Achievements: As we could successfully express and purify recombinant human Uba6 last year from using prokaryotic expression systems, this year we concentrated on carrying out biochemical experiments with Uba6 and compare its E2 interaction with that of Uba1. As previously reported, we also found that Uba6 could not transfer the activated the Ub moiety onto any of the wt Ube2Es (Ube2E1, Ube2E2 and Ube2E3) but could efficiently charge Ube2D2, which shares more than 70% similarity with the Ube2Es in their catalytic Ubc core. We therefore prepared three truncated version of the Ube2Es by deleting their N- terminal flexible regions and observed that these truncated constructs are efficiently charged by Uba6 unlike their full-length versions. We also tested a chimeric Ube2D2 that contained the Ube2D2 core with the N-terminal extension of Ube2E1 and observed that the addition of the N-terminal tail reduced the Ub transfer efficiency of Uba6. These results conclusively show that the N-terminal flexible regions present in Ube2Es impart their E1 selectivity. We now plan to look into the Uba6 domains/regions that might be responsible for this E2 differentiation.

DR. SUBHRANGSU CHATTERJEE

Professor

Department of Biological Sciences

Group Members:

Ananya Roy
Laboni Roy
Dr.Trina Sengupta
Debopriya Bose
Oishika Chatterjee
Dr.Anindya Dutta
Dr.Suman Panda
Dr.Priyanka Bhadra
Rebanta Roy
Soushruti Sarkar

Summary of Research:

Our laboratory is committed to advancing the understanding of non-canonical DNA secondary structures, such as G-quadruplexes (G4s) and i-motifs (iMs), and their multifaceted roles in the regulation of gene expression, chromatin architecture, and signal transduction pathways in cancer. We aim to decipher the structural biology of these DNA elements and exploit them as novel molecular targets for therapeutic intervention in oncogenesis and disease progression. Our long-term vision is to establish a framework wherein DNA secondary structure landscapes serve as both diagnostic biomarkers and actionable drug targets.

Field of Research:

Our interdisciplinary research program integrates **molecular oncology, structural biology, chemical biology, bioinformatics, and biophysics**. Central to our work is the exploration of how structural conformations in DNA—especially G4s and iMs—govern transcriptional regulation, modulate signaling pathways, and contribute to disease phenotypes. We combine **in vitro structural elucidation, in silico ligand design**, and **in vivo functional assays** to develop structure-based gene regulatory strategies.

Elaborated Research Areas:

1. Structural Biology of Promoter-Embedded DNA Secondary Structures

We investigate the formation, topology, and stability of G-quadruplexes and i-motifs in gene promoter regions. Using high-resolution NMR spectroscopy, circular dichroism, DMS and bromine footprinting, and chromatin immunoprecipitation (ChIP), we characterize their conformations, protein interactomes, and transcriptional roles. Promoters of key genes such as SMO, VEGF-A, ORAI1, and hnRNP K have been shown to harbor stable G4/iM motifs with regulatory potential.

2. Molecular Basis of Transcriptional Regulation via G4/iM Motifs

We elucidate how these DNA secondary structures act as molecular switches to regulate transcriptional initiation and elongation. For example, the SMO promoter *G-quadruplex* facilitates transcription factor binding (Sp1, NCL, CNBP), while the complementary i-motif interacts with ligands such as mitoxantrone and the i-mab antibody. In ORAI1, a G4 motif containing an E-box serves as a putative Zeb1 binding site, impacting calcium signaling in TNBC.

3. Pathway-Specific Regulatory Mechanisms

Our work targets transcriptional nodes within key oncogenic signaling cascades:

Hedgehog pathway (via SMO): Implicated in metastasis and therapeutic resistance.

Calcium signaling (via ORAI1): Dysregulated in aggressive cancers such as TNBC.

Angiogenesis (via VEGF-A): Promotes tumor vascularization and progression.

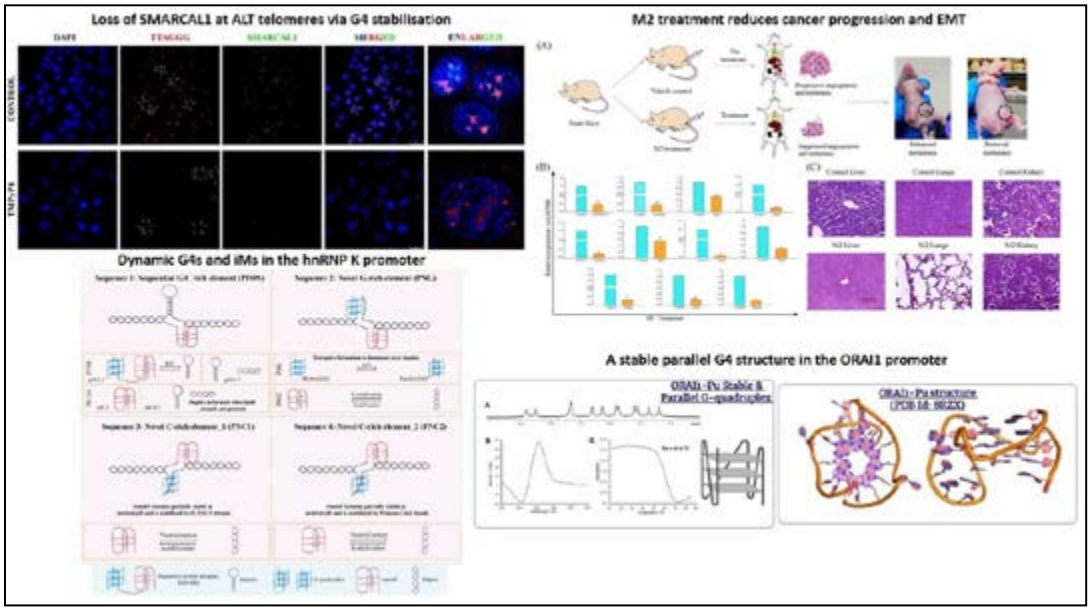
By dissecting the DNA structure-mediated regulation of these genes, we reveal how G4/iM elements influence broader cellular phenotypes such as proliferation, migration, and angiogenesis.

4. Design and Application of Targeted Ligands

Utilizing structure-guided design and computational modeling, we develop small molecules, peptides (RK9, RK15), and emerging aptamers that selectively bind to G4/iM structures to stabilize or disrupt their function. These agents have shown efficacy in modulating gene expression and attenuating downstream oncogenic signaling both in vitro and in vivo. Our recent peptide work demonstrates that peptide length inversely correlates with structural stability and therapeutic efficacy, providing a platform for rational optimization.

5. Computational Biology and Rational Drug Design

We employ molecular dynamics simulations, docking algorithms, and machine learning-based peptide prediction tools to model G4/ligand interactions at atomic resolution. These computational strategies are critical for expanding our ligand library and enhancing specificity toward targeted promoter *G-quadruplexes*.



Highlights of Research:

- SMO Promoter: Identified a parallel G-quadruplex (-326 to -301) and its complementary i-motif; both influence transcription via ligand and protein interactions.
- VEGF-A Promoter: Targeted G4 using in silico-designed peptides RK9 and RK15; downregulated VEGF-A expression and inhibited angiogenesis in cancer models.
- ORAI1 Promoter: Elucidated a parallel G4 with a unique 8-nt loop containing an E-box; ligand stabilization suppressed calcium influx in TNBC cells.
- hnRNP K Promoter: Identified multiple G4/iM structures governing autoregulatory expression; highlighted as a quadruplex hotspot with implications in cancer and viral infection (JBSD, doi:10.1080/07391102.2024.2303378; ChemBioChem, doi:10.1002/cbic.202400941).
- Therapeutic Relevance: Demonstrated the in vivo modulation of gene expression through structure-targeting ligands; highlighted new avenues for anti-cancer and antiviral drug development.

Future Directions:

- Live-Cell Structural Imaging: Employ advanced technologies (e.g., FRET, super-resolution microscopy) to study real-time dynamics of G4/iM structures in living cells.
- Therapeutic Optimization: Expand our repertoire of synthetic ligands and aptamers; enhance binding affinity, selectivity, and pharmacokinetics for clinical translation.
- Quadruplex Signature Mapping: Define cell- and tissue-specific "quadruplexomes" to understand the regulatory genome under physiological and pathological conditions.
- Network-Level Insights: Integrate G4/iM-mediated regulation with epigenetic modifications and 3D genome organization to reveal higher-order transcriptional logic.
- Preclinical Validation: Conduct efficacy and toxicity studies in murine models to evaluate therapeutic potential of G4/iM-targeting agents in cancer and viral infections.

This unified and comprehensive program aims to establish DNA secondary structures as a central axis of gene regulation and drug discovery, providing both fundamental insights and translational impact in the fight against cancer and other diseases.

DR. WRIDDHIMAN GHOSH
Professor
Department of Biological Sciences

Group Members:

Sumit Chatterjee (Senior Research Fellow)
Subhajit Dutta (Senior Research Fellow)
Mahamadul Mondal (Senior Research Fellow)
Jit Ghosh (Senior Research Fellow)
Swapneel Saha (Junior Research Fellow)

Summary of Research:

Our Geomicrobiology laboratory explores the biogeochemical and biophysical windows of opportunity that sustain life at the entropic and bioenergetic extremities of the Earth's biosphere. In doing so, we have recently explored microbiomes across a Trans-Himalayan desert-lake ecosystem, and contrived ways of using the native psychrophilic and cryophilic microorganisms as geothermometers of environmental warming, mitigators of habitat perturbation, and candidates for biodegradation to solve the waste management problems of the high-altitude, cold/frigid territories of India.

DR. ZHUMUR GHOSH

Professor
Department of Biological Sciences

Group Members:

Troyee Das, CSIR-SRF
Byapti Ghosh, DST Inspire Fellow
Gourab Das, ICMR SRF
Pritha Sengupta, UGC SRF
Satakshi Bagchi, UGC SRF
Soumya Mal, ICMR SRF
Sagar Sharma, DBT JRF
Dharmesh Kishorbhai Tanna, UGC JRF

Summary of Research:

(A) Our lab has the main focus to understand the role of regulatory noncoding RNAs in cancer and early embryonic development where stem cell plays a crucial role. We are also looking into the role of noncoding RNAs in neurodegeneration.

- Exploring the role of long non coding RNAs in (a) Gradual neurodegeneration i.e. Alzheimers Disease(AD) and (b) Sudden neurodegeneration i.e Traumatic Brain Injury in mouse models and human
- Association of AD with other lifestyle diseases
- Elucidating the role of miRNAs towards inducing oncogenicity in stem cell derivatives
- Deciphering the role of SNPs present with the lncRNA loci towards cancer risk prediction in case of patients having abnormal breast or ovary conditions that increases the risk of getting breast or ovarian cancer

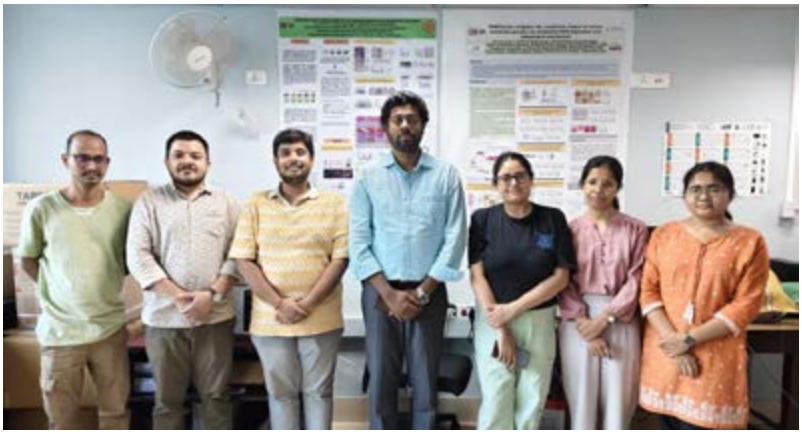
(B) Our lab's vision is to develop relevant tools and databases (aligned to our lab's research focus) which will boost nation-wide implementation of omics facilities in clinical settings by efficient big data management so as to promote personalized therapy in India.

- We have developed a machine learning (ML) based lncRNA target prediction tool named LncPTPred (Web server link: (http://bicresources.jcbose.ac.in/zhumur/lncptpred/). Github Link: Github Link: https://github.com/zglabDIB/lncptpred.git). This tool predicts lncRNA-protein interactions.

Notable Achievement/Event:

Development of a tool named LncPTPred (Web server link: (http://bicresources.jcbose.ac.in/zhumur/lncptpred/). Github Link: Github Link: https://github.com/zglabDIB/lncptpred.git) to predict lncRNA-protein interactions.

DR. BISWANATH MAITY
Professor
Department of Biological Sciences

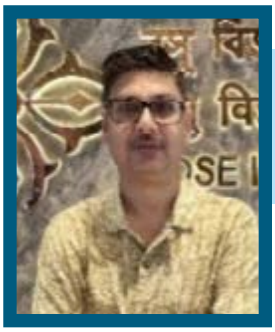


Group Members:

Arghya Acharya
Pallobi Khatua
Anushree Lye
Chetna Rai
Manish Kumar
Tarun Mahata

Summary of Research:

We are focused to understand how GPCRs and its modulators are can influence broad range of physiological processes mostly cardiac and liver functions. G-proteins are the largest group of receptors targeted for therapeutics. Its mediators like RGS and AGS proteins function as GTPase-activating proteins and thereby enhancing the shut-off mechanism for G protein signaling. We are studying the impact of RGS and AGS proteins towards stress-induced physiology and dissect the intricacies associated to it especially on the impact on different vital organs like heart and liver and inter-organ communication. Major focus of our laboratory is to understand the physiology of 'onco-cardiology' and 'diabetic cardiomyopathy'. Both are highly relevant clinical issue worldwide. We have identified several RGS proteins both necessary and sufficient to facilitate stress-dependent cytotoxicity and hepatotoxicity. We are currently putting effort to understand the impact of these proteins at the genomics level and trying to identify their binding partners impacting the physiology together using varied kind of biochemical, physiological, CRISPR, in vivo related approaches.



DR. ABHRAJYOTI GHOSH
Associate Professor
Department of Biological Sciences

Group Members:

Sangita Mondal, UGC-Adhoc
Jagriti Das, DBT-JRF
Agnita Acharya, INSPIRE Fellow
Shirsha Samanta, UGC-Fellow
Sriparna Mondal, UGC-Fellow
Saheli Majumder, UGC-Fellow
Dr. Sritama Baag, DBT-RA

Summary of Research:

The primary focus of the laboratory is to understand microbial adaptation under stress conditions. A changing environment creates conditions that can be stressful for microorganisms. To cope with environmental stress, microbes have a variety of evolutionary adaptations and physiological acclimatization mechanisms. Such adaptation and acclimatization strategies allow them to survive and remain metabolically active even when exposed to varied environmental stress. However, not all microorganisms are equally equipped with the necessary arsenals to adapt to the changing environment, and therefore a shift in microbial community composition is often documented under stress conditions. It is believed to be mainly due to a change in ecosystem-level carbon, energy, and nutrient flows that drive alteration in microbial dynamics. In contrast to conventional strategies of understanding specific organismal responses to environmental stress, our approach aims at developing a more reliable connection between microbial and ecosystem ecology. At Bose Institute, we study microbial stress response and adaptation strategies both at the organism level as well as at the microbial community or ecosystem level. We use a variety of techniques including biochemistry, microbiology, and genomics, to unravel the molecular players important in the adaptation and evolution of microorganisms under stress conditions.

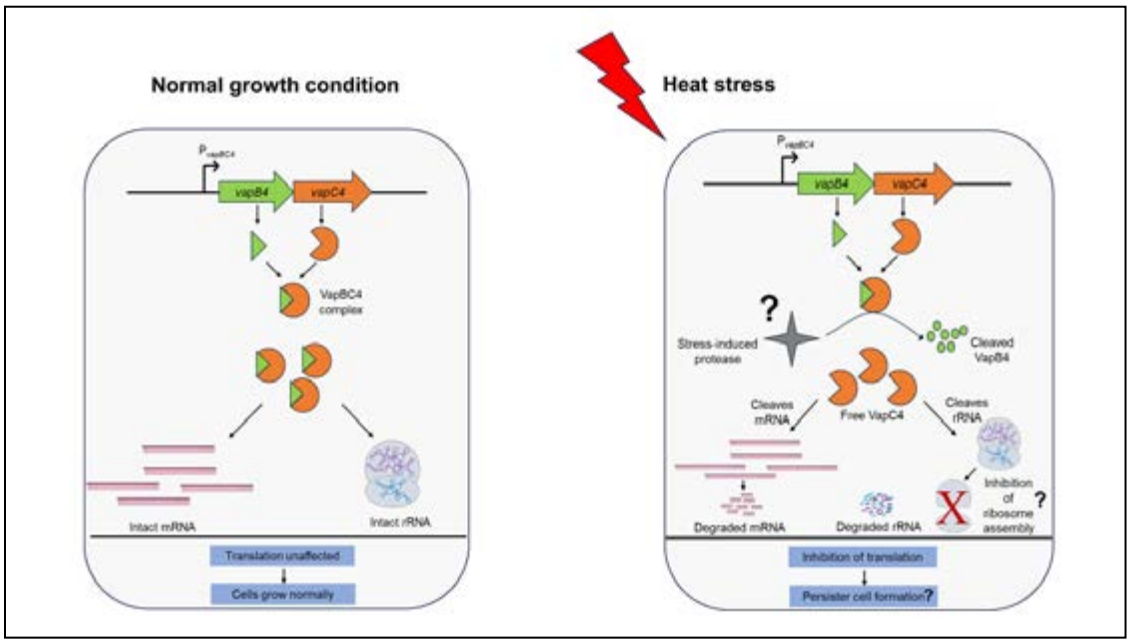
Research Highlights/Accomplishments:

Highlights:

1. Understanding stress adaptation in thermoacidophilic and halophilic archaea.
2. Functional characterization of archaeal VapBC-type II toxin-antitoxin modules.
3. Dissecting the cross-talk of minimal heat shock machinery in archaea.
4. Exploring cell-cell communication between organisms in natural environments.

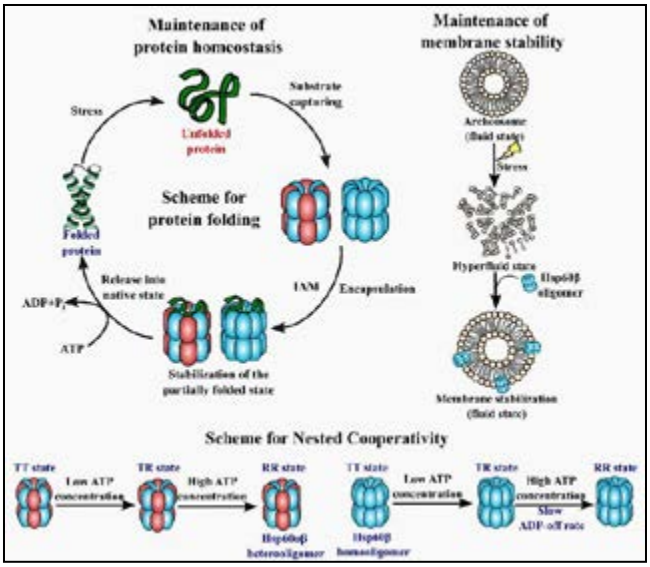
Accomplishments:

Role of VapBC4 toxin-antitoxin system of *Sulfolobus acidocaldarius* in heat stress adaptation



This research enhances our knowledge of toxin-antitoxin (TA) systems in archaea, specifically in the thermoacidophilic archaeon *Sulfolobus acidocaldarius*. TA systems are widespread in both bacterial and archaeal genomes, indicating their evolutionary importance. However, their exact functions in archaeal cellular physiology are still not well understood. This study sheds light on the complex roles of TA systems and their critical involvement in archaeal stress adaptation, including persistence and biofilm formation. By focusing on S. acidocaldarius, which lives in habitats with fluctuatfluctuating temperatures that can reach up to 90°C, the study reveals the unique challenges and survival mechanisms of this organism. The detailed biochemical analysis of the VapBC4 TA system, and its crucial role during heat stress, provides insights into how extremophiles can survive in harsh conditions. The findings of this study show the various functions of the VapC4 toxin, including inhibiting translation, inducing persister-like cell formation, and regulating biofilm formation. This knowledge improves our understanding of TA systems in thermoacidophiles and has broader implications for understanding how microorganisms adapt to extreme environments. [Bhowmick et al., mBio, 2024, 0:e02753-24. https://doi.org/10.1128/mbio.02753-24].

Functional diversity in archaeal Hsp60: a molecular mosaic of Group I and Group II chaperonin



External stress disrupts the balance of protein homeostasis, necessitating the involvement of heat shock proteins (Hsps) in restoring equilibrium and ensuring cellular survival. The thermoacidophilic crenarchaeon Sulfolobus acidocaldarius, lacks the conventional Hsp100, Hsp90, and Hsp70, relying solely on a single ATP-dependent Group II chaperonin, Hsp60, comprising three distinct subunits (α, β and γ) to refold unfolded substrates and maintain protein homeostasis. Hsp60 forms three different complexes, namely Hsp60αβ, Hsp60βand Hsp60βat temperatures of 60 °C, 75 °C, and 90 °C, respectively. This study delves into the intricacies of Hsp60 complexes in S. acidocaldarius, uncovering their ability to form oligomeric structures in the presence of ATP. The recognition of substrates by Hsp60 involves hydrophobic interactions, and the subsequent refolding process occurs in an ATP-dependent manner through charge-driven interactions. Furthermore, the Hsp60βhomo-oligomeric complex can protect the archaeal and eukaryotic membranes from stress-induced damage. Hsp60 demonstrates nested cooperativity in ATP hydrolysis activity, where MWC-type cooperativity is nested within KNF-type cooperativity. Remarkably, during ATP hydrolysis, Hsp60βand Hsp60βcomplexes exhibit a mosaic behavior, aligning with characteristics observed in both Group I and Group II chaperonins, adding a layer of complexity to their functionality. [Bhakta et al., FEBS Journal, 2024, 291(19): 4323-4348. https://doi.org/10.1101/2024.01.14.575554]

Future Plans:

1. Role of archaeal prefoldin and C-terminal domain of Hsp60 in protein folding.
2. Regulation of archaeal heat shock proteins and type-II toxin-antitoxin systems.
3. Understanding the cellular communication between microbes in the environment and their hosts in natural and managed ecosystems.

DR. SUDIPTO SAHA
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Group Members:

Shazia Firdous, SRF, UGC
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Summary of Research:

iMy research focuses on studying lung microbiome dysbiosis and lung mitochondrial dysfunction, which cause chronic asthma, COPD, and interstitial lung diseases (ILD). The major research focus is to get insight into the complex interplay of microbiota, mainly the microbial metabolites, in pulmonary diseases. We develop databases and prediction tools using machine learning tools to address and understand respiratory diseases. Developed a database of mitochondrial proteins associated with diseases (mitoPADdb), which can be a valuable resource for investigating mitochondrial dysfunction related to diseases (Das et al., Mitochondrion. 2024). A symptom-based drug prediction of lifestyle-related diseases (LSDs) was developed using unsupervised machine learning (ML) techniques. This ML-based prediction can provide a second opinion to clinicians to aid their decision-making for the early treatment of LSD patients and can be a part of a digital health initiative (Bhattacharjee et al., Comput Biol Med. 2024).

DR. ANUPAMA GHOSH
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Summary of Research:

Our research delves into the intricacies of molecular interactions between host plant Zea mays and one of its pathogens *Ustilago maydis* that establishes a biotrophic relationship between the two. While on one hand we investigate *U. maydis* proteins that exhibit a potential to regulate infection, on the other hand we are interested in the molecular response from host plant. We have been characterizing some of the proteins from *U. maydis* that exhibit an involvement in the pathogenesis of the fungus. This group of proteins includes some secreted ones like few ribonucleases, a lipase and few proteases as well as intracellular stress proteins like small heat shock proteins. Our studies till date have demonstrated both virulence function as well as involvement in in-planta nutrient acquisition for some of the *U. maydis* proteins investigated so far. Besides the pathogen we have been investigating the potential defense proteins that are secreted within the apoplast of infected maize. Very recently we have also initiated studies aimed at assessing the contribution of extracellular vesicles in the host microbe communication through apoplast. A part of our research is also directed towards understanding the molecular communication between host plant and plant growth promoting beneficial microbes.

Research Highlight/Accomplishment:

A small heat shock protein Hsp20 has been shown to be involved in the pathogenic development of *U.maydis*. In the absence of the protein the fungal sporidia have been demonstrated to form filaments with significantly reduced efficiency. Besides the protein has also been found to be involved in the regulation of other key cellular functions including endocytosis, determining cell polarity during budding and changes in actin dynamics. A detailed investigation on the molecular mechanism of functioning of Hsp20 in relation to its biological function led to the finding that Hsp20 can form higher order oligomer and exhibit liquid liquid phase separation. Furthermore the protein was found to interact with different cytoskeletal proteins like actin and septin and controls the polymerization dynamics of these proteins.

In a separate study we explored the virulence function of a secreted lipase, Lip3 from *U. maydis*. Lip3 has been found to specifically target phosphatidyserine (PS) and phosphatidic acid (PA). lip3 deletion mutant shows considerable delay in the progression of pathogenic lifecycle of the fungus. On detailed investigation we also found that Lip3 can regulate the apoplastic pH of infected plants by controlling the activities of plasma membrane H+ ATPases through PS levels in the biotrophic interfacial membranes.

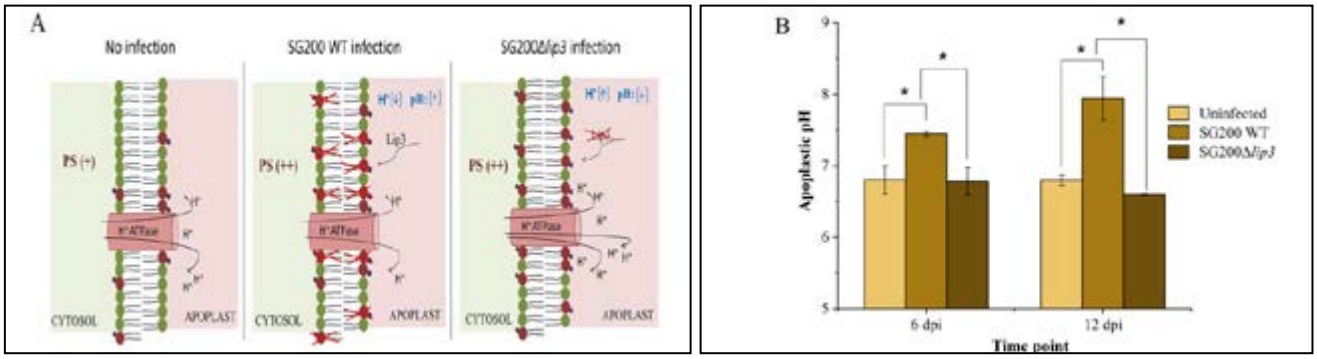

Figure: Apoplastic pH levels of maize plants during infection with SG200 WT and SG200Δlip3 relative to uninfected plants. (A) Model depicting regulation of apoplastic pH of maize during U. maydis infection through Lip3 activity. Upon infection of maize plants with SG200 WT, due to the presence of lipases including Lip3, the distribution of PS decreases along the biotrophic interface, consisting of plant and fungal PM. This lowers the activation of PM H+-ATPase pumps, resulting in reduced export of H+ ions into the apoplast, thereby leading to an increase in apoplastic pH, in comparison to uninfected plants. However, during SG200Δlip3 infection, due to absence of Lip3, PS distribution is not as low as in WT infection, which results in a decrease of apoplastic pH due to elevated H+-ATPase activity compared to wild type infection and thus increased export of H+ ions into the apoplast. (B) Graph showing apoplastic pH of uninfected, SG200 WT and SG200Δlip3 infected maize plants at 6- and 12-dpi. pH was measured using a pH dependent fluorescent dye, 8-hydroxypy¬rene-1,3,6-trisulfonic acid (HPTS). Average pH values were plotted from three independent experiments where the error bars represent standard error. Statistical significance was examined by one way ANOVA followed by Tukey Kramer's post hoc analysis. (* $p<0.05$)

Future Plan:

Investigating the involvement of *U. maydis* small heat shock proteins in the endomembrane trafficking system of the fungus.

Our studies revealed significant phenotypic differences in the endocytic vesicles formed in *U. maydis* strains lacking either Hsp12 or Hsp20 compared to the wild type strain. While hsp12 deletion mutant showed reduced efficiency of uptake, the hsp20 deletion mutant exhibited abnormality in the vesicular fusion. These data taken together indicated a strong correlation between the functioning of small Hsps and the endocytosis process of the pathogen.

Investigating the extracellular RNA repertoire of maize in relation to defending *U. maydis* infection.

We have demonstrated the presence of an RNA pool comprising of different RNA biotypes within the apoplastic space of maize either vesicle bound or freely dispersed. Extracellular RNA has been demonstrated to play important roles in cell-cell communication across different organisms. Taking lead from the available literature we have initiated studying the extracellular RNA repertoire of maize and understand its contribution towards molecular communication of the host with *U. maydis* during corn smut disease.

DR. SMARAJIT POLLEY

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Group Members:

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Deeparna Sutradhar
Afreen Haque

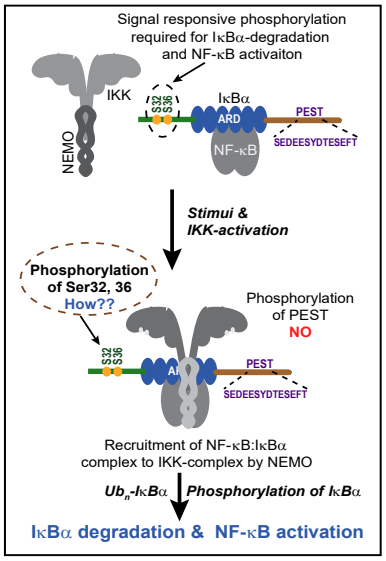
Summary of Research:

As a research group we aspire to decipher mechanism of fundamental cellular/biochemical process at highest (possible) resolution employing multidisciplinary approaches.

Multicellularity is the most complex form of life. Well-being of multicellular organisms depend upon delicate balance and fine-tuned regulation of inter- and intra-cellular signalling pathways. We primarily use biochemical, chemical and structural biology tools to understand the mechanistic details of a few key signalling pathways at highest resolution. Protein kinases and transcription factors are at the centre of attention in the laboratory.

The other themes of the lab include, but not limited to:

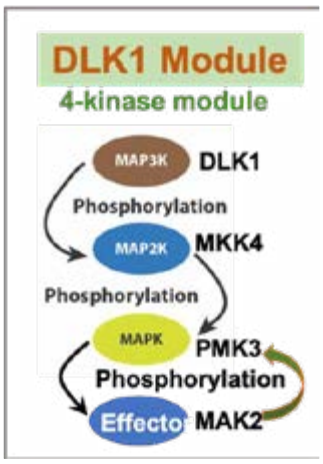
- Understanding the Structural basis of cancer promoting function of p53 GoF (Gain of Function) mutants.
- Enzymatic remediation of environmental pollutants.



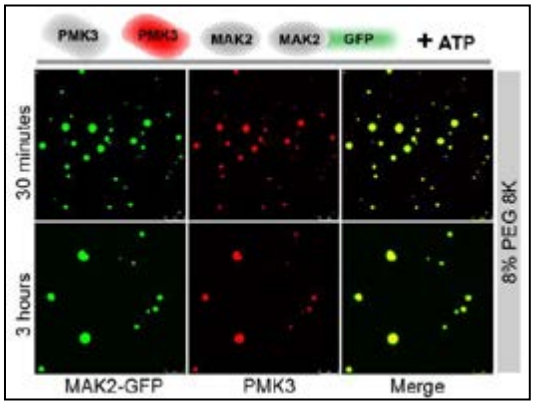
Dual-specific autophosphorylation of kinase IKK2 enables phosphorylation of substrate IκBα through a phosphoenzyme intermediate.

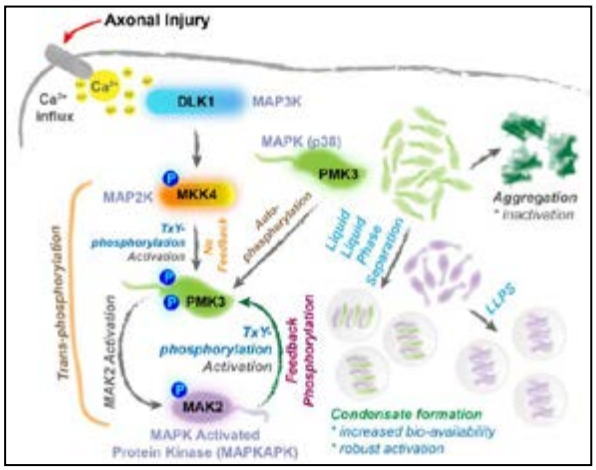
Inhibitor of κB Kinase 2/β (IKK2/β) is an essential Ser/Thr kinase in metazoans that robustly phosphorylate two specific serines on NF-κB inhibitor IκBα at positions 32 and 36. This phosphorylation event is essential for the activation of otherwise dormant NF-κB dimers through the canonical pathway. It was however not clear how IKK2 specifically recognizes IκBα in a pool of thousands of proteins. We discovered that IKK2 is a dual specificity kinase that autophosphorylates itself on Tyrosine residues along with serines on itself as well as on substrates. We also found that this tyrosine autophosphorylation was essential for confirming the specificity of phosphorylation of Ser 32/36 on IκBα. IKK2 engages this autophosphorylated state as a phopsphoenzyme intermediate (phosphate sink) to transfer the phosphate group directly from one of its phosphorylated residues to the substrate. This mode of phosphorelay, prevalent in bacterial two component systems, is rarely seen in eukaryotic protein kinase where they transfer the γ-phosphate directly from ATP to the substrate. This work is to be published in the journal eLife (https://doi.org/10.7554/eLife.98009.3).

Activation and regulation of a p38-MAPK by its downstream MAPKAP kinase through feedback phosphorylation and LLPS-driven condensate formation.



MAPK family of protein kinases are evolutionarily conserved and participate in a diverse array of signaling events. They are key players in cell survival, differentiation, metabolic processes, and neuronal response to injury. They are activated through phosphorylation by upstream MAPK kinases (MAP2Ks) or by autophosphorylation. We found that a C. elegans MAPK (PMK3) engages in a feedback phosphorylation loop with its downstream effector kinase MAK2, but not the upstream MAP2K MKK4, that ensures robust activation of PMK3 by MAK2 without requiring MKK4. Furthermore, MAK2 increases bioavailability of activation-competent and active PMK3 by preventing its aggregation through LLPS-driven condensate formation. This feedback relationship might ensure rapid activation of such MAPK pathways in response to nervous system injury or stress. MAP kinases (MAPKs) represent a class of evolutionarily conserved signaling molecules that respond to an array of extracellular stimuli and stresses. p38 group of MAPKs have been implicated in a multitude of signal transduction pathways known to be activated by dual-specific upstream MAPK kinases and also by autophosphorylation. They activate MAPK activated protein kinases (MAPKAPKs) in a context dependent manner by specific phosphorylation, and together they play crucial biological roles. One such pair in C. elegans consists of PMK3, p38α-MAPK and its cognate MAPKAPK, MAK2 downstream of DLK1 (MAPK kinase kinase) and MKK4 (MAPK kinase). They are implicated in axonal regeneration, degeneration and synaptic pruning in response to neuronal injury. We found that PMK3 participates in a feedback loop with MAK2 leading to phosphorylation-mediated activation of both kinases. Interestingly, MAK2 that is a Ser/Thr kinase phosphorylates PMK3 at its TxY-motif required for the manifestation of full activity of PMK3. This observation identifies MAK2 as a dual specificity kinase. Distribution of





phosphorylation sites on either kinase and presence of long intrinsically disordered regions in each of them indicate the possibility of conformational plasticity in the PMK3:MAK2 complex. Furthermore, MAK2 increases bioavailability of aggregation-prone PMK3 by forming LLPS-driven condensates. PMK3 and MAK2 retain the feedback phosphorylation relationship and enzymatic activities in the condensate state as well. Our observations establish an unreported feedback relationship between a MAPK and its downstream MAPKAPK through phosphorylation and LLPS-driven condensate formation.

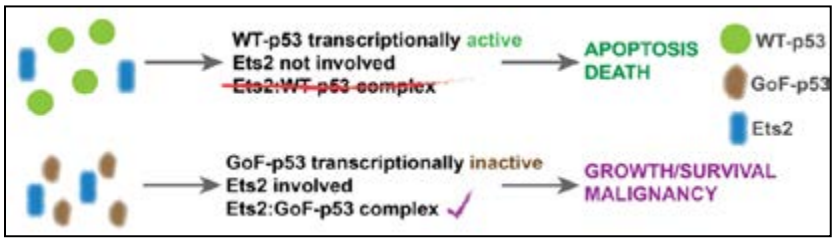
A manuscript describing this work has been communicated (https://doi.org/10.1101/2024.08.01.606155).

Understanding the Structural basis of cancer promoting function of p53 GoF (Gain of Function) mutants.

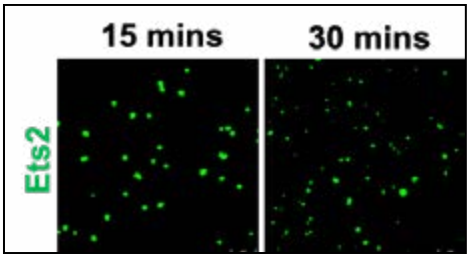
Cancer is, perhaps, the most daunting health problem in today's world, that caused about 10million deaths in 2020. And, in more than 50% of human cancers p53 is found to be mutated. There's been massive effort to tame the GoF-p53s that reverses the anti-tumorigenic function of the WT-p53. Cancer being a systemic failure of the cellular and organismal homeostasis process, and nature and prognosis of each cancer being distinct --- an 'one-size-fits-all' approach may not be as beneficial for the practical therapeutic purposes.

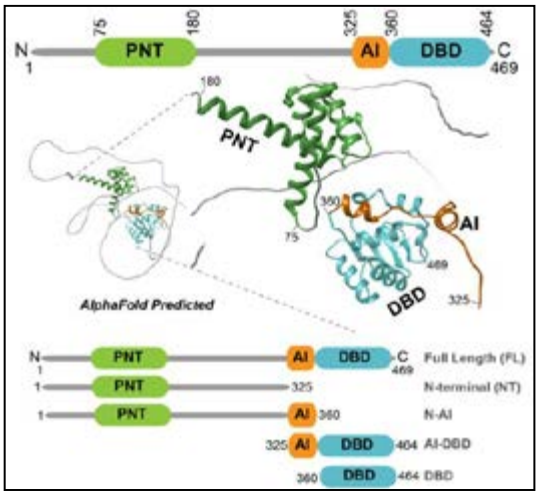
We aim to understand the structural and biochemical basis of tumor-promoting activity of a subset of GoF-p53s that rely on another transcription factor Ets2 in driving unique gene expression program in specific cancer types. The crucial nature of this association between GoF-p53 and Ets2 in driving cancer progression has been firmly established.

Major drug-discovery initiatives around mut-p53s focused on bringing back WT-like behavior in those mutants by virtue of inducing proper native-like folding into them. Mut-p53s are often thermodynamically less stable and adopt a folded state that's not reminiscent of the WT-protein, and they fail to bind cognate DNA. Response element DNA binding by the WT-p53 is a crucial event in p53-biology to bring about its anti-tumorigenic, pro-death mechanisms, loss of which plays havoc for the metazoans. Thus, means to induce native-like folding may reinstate WT-like behavior in the mut-p53s. There's been commendable success in this realm, even though a p53-specific drug is yet to see its path to the clinic.



Our study will help realizing another aspect of drug-development in addressing the unmet needs to develop drugs against a subset of GoF-p53s in specific cancer pathologies. This proof-of-the-principle study will pave ways for targeting other complexes consisting of mut-p53 and other proteins in in-tumor-only scenarios.





We have cloned and expressed both p53s (WT and GoF) and Ets2 proteins. They were cloned and expressed both as full-length versions using different tags. We have also made several truncated constructs of these two proteins. A number of those constructs have also been expressed and purified either from the soluble fraction under native condition or from inclusion bodies. We have been successful in expressing, purifying recombinant histones and reconstitute the recombinant mononucleosome using 147bp Widom sequence. We have reconstituted unlabeled, P32-labled (end labeling) and Cy5 labeled (end labeling) nucleosomes. Histone purification, mononucleosome reconstitution results are shown below. We have performed EMSA assay using Cy5-labeled mononucleosome and Ets2 that confirmed Ets2 binding to the mononucleosome. In addition, we have optimized EMSA assays to study Ets2's interaction with naked DNA using oligonucleotide probes contacting consensus Ets2 binding sequence.

Furthermore, we observed that Ets2 undergoes liquid liquid phase separation (LLPS) that responds to the presence of WT and GoF-p53 differently. In addition, binding to DNA containing multiple cognate binding sites also lead to LLPS of Ets2. We are currently analyzing this aspect in details as well as trying to obtain high resolution structural insights of these processes.

Notable Achievement/Event:

- Discovery of an unprecedented phosphor-transfer mechanism in Eukaryotic protein kinases (EPKs): EPKs transfer gamma-phosphate from ATP directly to the substrate, our study shows that IKK2, an EPK, gains its specificity by assuming a phosphoenzyme intermediate wherein the phosphate group is transferred from a phosphorylated residue in the kinase to the substrate. This mechanism of phosphorelay though prevalent in bacterial two component systems is rarely seen in EPKs.
- Activation of a MAPK by its downstream kinase: MAPKs are known to be activated by its upstream cognate MAPK Kinases (MAP2Ks). We found a neuronal p38 MAPK, PMK3 that is critically important in axonal regeneration upon injury in C. elegans participates in a novel phosphoregulatory feedback loop with its downstream MAPK Activated Protein Kinase (MAPKAPK), MAK2 through LLPS. Such engagement enables activation of PMK3 even in absence of its cognate MAP2K, MKK4.

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Group Members:

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Manash Sarkar, UGC-JRF

Summary of Research:

The current focus of our research group are:

- Understanding the mechanism of ETS-mediated chemoresistance in Triple Negative Breast Cancer.
- Transcriptional regulation of mitochondrial dynamics in cancers by ETS transcription factor.
- Studying transcriptional landscape of breast cancer in the West Bengal cohort population.
- Metabolic reprogramming induced by ERG transcriptional axis in prostate cancer
- Developed An anti-cancer peptide database (dbACP: A Comprehensive Database for Anticancer Peptides) with a collaborator from IIIT, Allahabad (https://dbacp.iiita.ac.in/)

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Rimi Kundu, JRF
Lipika Roy, JRF
Tanushree Mondal, Project Associate

Summary of Research:

It is very common practice of using chemotherapeutic agents to handle a wide variety of malignant cancers. While effective, some chemotherapeutic agents pose significant toxicity and patients gradually develop resistance against the drugs during the treatment period, as a result tumor relapse takes place. This resistance not only leads to treatment failure but also to subsequent tumor relapse and metastasis. Our laboratory aims to explore the epigenetic and metabolic alterations associated with chemotherapy resistance, which are pivotal in understanding and overcoming this hurdle. Studies have indicated that aberrant epigenetic changes after chemotherapy are common across various cancers and influence the metabolic pathways that are essential for cancer cell survival and proliferation. These alterations contribute to cancer progression and metastasis by enabling the cancer cells to adapt to and escape therapeutic interventions. The tumor microenvironment (TME) and its interactions with cancer cells, particularly through the maintenance of cancer stem cells, are critical in sustaining cancer cell growth and resistance to therapy.

Field of Research: Cancer Biology.

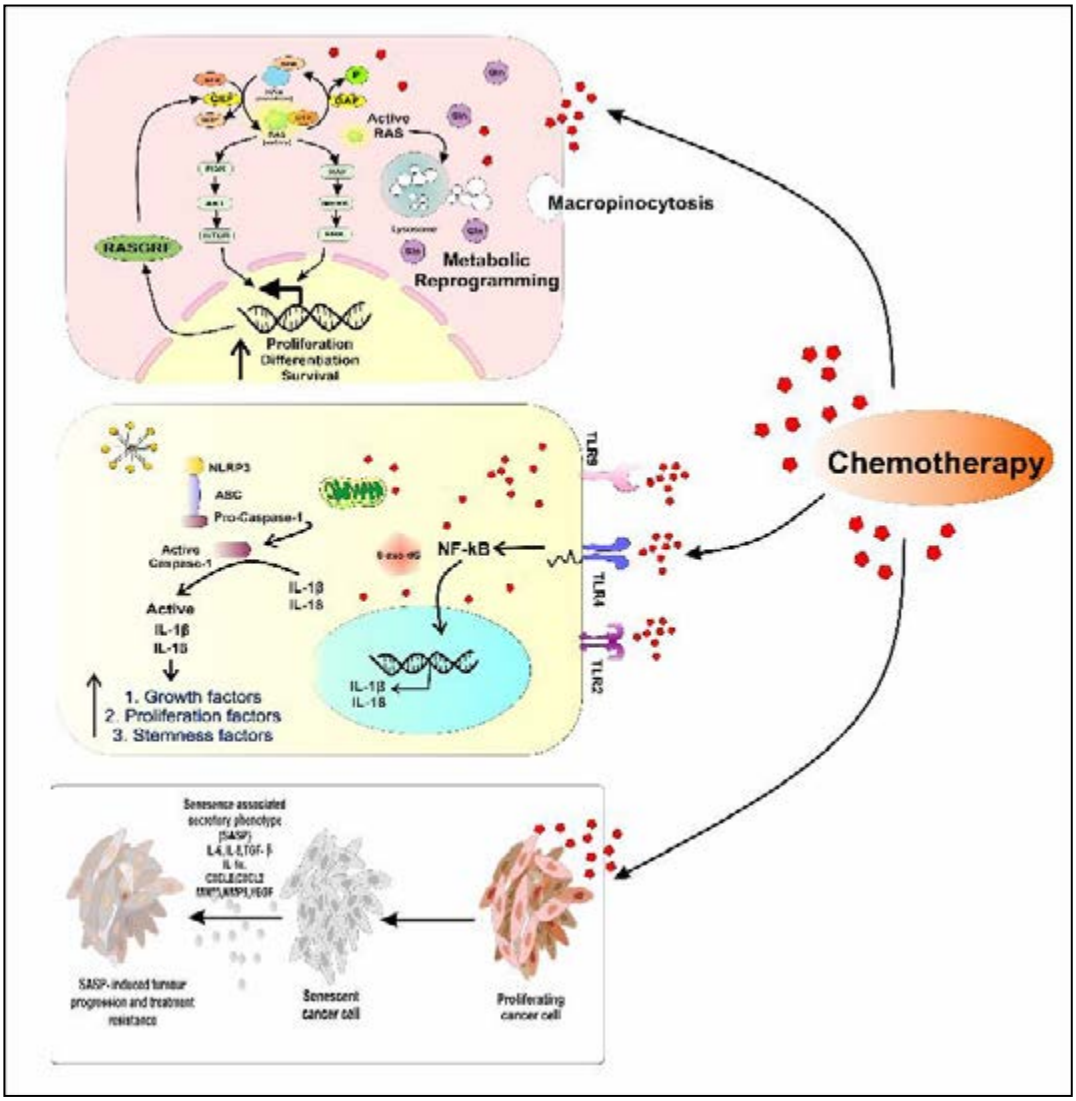
Focused Areas of Research:

1. Activation of RAS and associated metabolic reprogramming in breast cancer.
2. Inflammasome formation and determination the role of identified inflammasome molecules in chemotherapy resistant Prostate and breast cancer progression.
3. Investigating the role of therapy-induced senescence in developing chemo-resistant cancer.

Highlights of Research:

The present model is depicting our current research to find out the mechanism of chemotherapy resistant cancer development, the role of tumor microenvironment and different mediators involved in the development of therapy resistant and cancer relapse with the following mechanisms.

a) Mutation and modification of RAS and its regulators play a crucial role in controlling cell proliferation, survival, and metabolism that trigger the development of chemo resistant cancer. By examining the role of metabolic and stemness-related genes in maintaining cellular plasticity and survival in chemotherapy treated breast cancer, we aim to understand how Ras signalling contributes to the modulation of gene expression linked to drug resistance. Insights into the Ras pathway, we are also examining the roles of Ras regulators, highlighting its significance in both Ras activation and metabolic regulation. Understanding of these are crucial for developing more effective, targeted therapies for breast cancer, as modulation in RAS pathway is frequently associated with aggressive cancer phenotypes and treatment resistance.



b) Inflammasomes consist of certain multi-protein complexes which produce numerous inflammatory reactions inside the cells that is perilous for maintaining homeostasis. NOD like receptor protein 3 (NLRP3) binds and activates caspase-1 that triggers the maturation of inflammatory cytokines including IL-1β and IL-18, which are responsible for initiation of inflammatory response. Inflammasome components and pathways may provide novel targets to treat inflammation and associated cancer. As a result of chemotherapeutic treatment, cancer cells secrete many factors through the activation of the inflammasome, where IL-1β and IL-18 play important role. Because of their pro-inflammatory nature, they share certain pro-proliferating signalling responsible for cancer progression.

c) Aging is a universal biologic process accompanied by a series of prominent hallmarks, including genetic and epigenetic alterations and these alterations can contribute to the development of diseases including cancer. However, very limited studies available regarding epigenetic alteration mediated aging factors involved in different chemotherapy resistant cancers. To find out epigenetic alterations mediated aging factors involved in tumor progression, metastasis, and in chemotherapy-resistant cancer, it is pertinent to identify the epigenetically silenced/activated genes involved after and before the treatment with chemotherapeutic drugs and to check the mechanisms involved in such silencing/activation of genes expression.

DR. BASUDEB MAJI
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Department of Biological Sciences

Group Members:

Sadiya Tanga
Arpita Hota
Arkadeep Karmakar
Dr. Mala Thapa
Pallabi Das

Summary of Research:

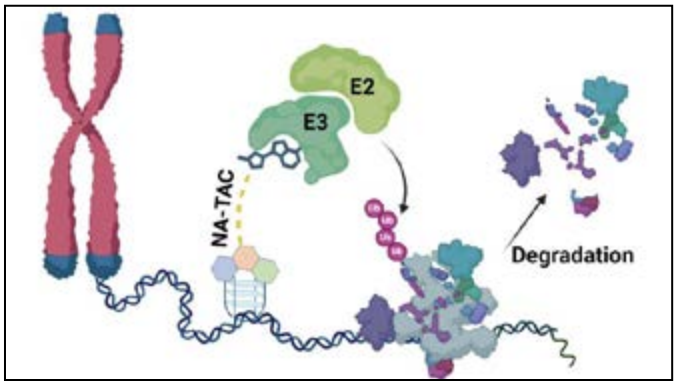
Dr. Basudeb Maji's lab works on the frontier of Chemical Biology and chemogenetics research. Their Chemogenetics Research Lab mainly focuses on developing precision gene therapy methods using CRISPR, novel drug molecules using synthetic biology, and synthetic small-molecule probes towards precision medicine.

Dr. Maji's lab is developing novel drug molecules using engineered bacteria for their applications in precision gene therapy and bacteriophage therapy.

Dr. Maji's lab developed novel PROTAC methods using small molecule chemical probes for targeted biomolecular and their interactome degradation towards precision medicine.

References:

Design and Synthesis of Nucleic Acid Nano-environment Interactome-Targeting Small Molecule PROTACs and Their Anticancer Activity. Sadiya Tanga, Arkadeep Karmakar, Arpita Hota, Paramita Banerjee and Basudeb Maji. Nanoscale, 2024,16, 12502-12509.

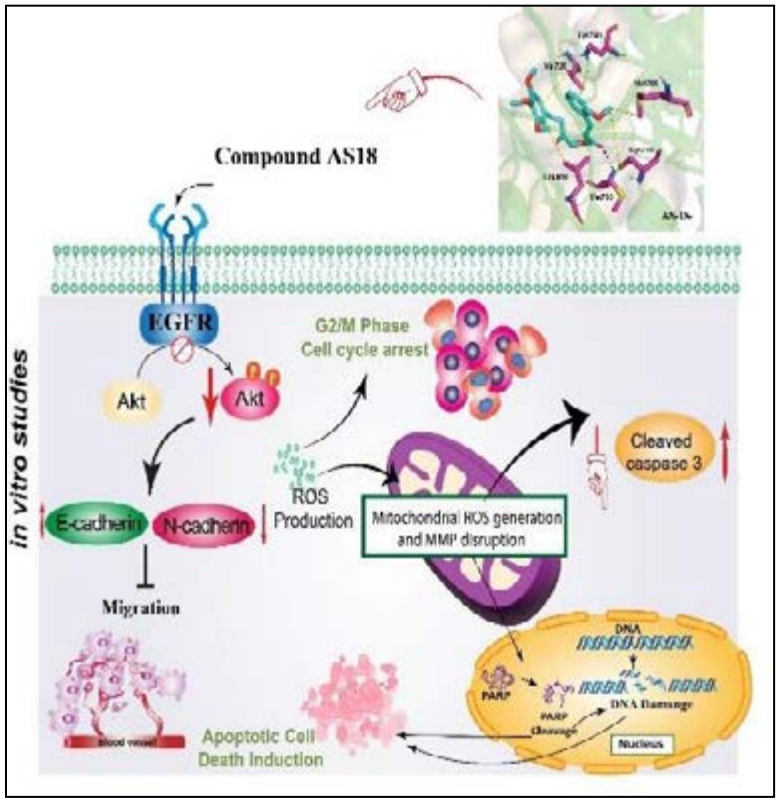


DR. KULADIP JANA
Principal Scientist
Department of Biological Sciences

Summary of Research:

1. Evaluation of Anti-Proliferative and Anti-Metastatic Potentials of Natural Product-Inspired Small Molecules

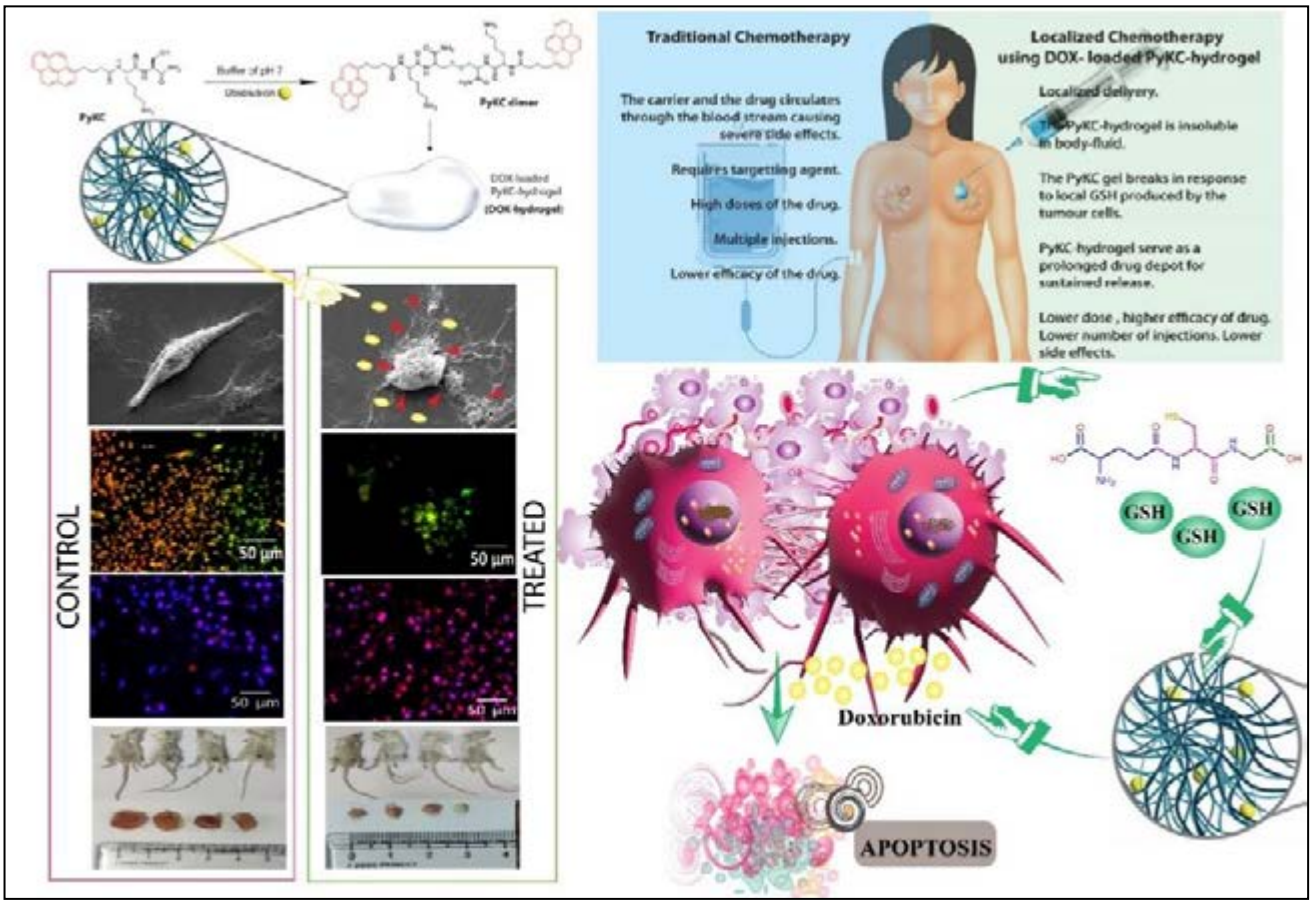
Discovery of drugs from natural sources is emerging as a highly promising strategy for identifying novel anticancer agents. Calebin A (4-[3 methoxy-4 hydroxyphenyl]−2-oxo-3-enebutanyl 3-[3-methoxy-4 hydroxyphenyl] propenoate) one of such a novel compound that was derived from Curcuma longa and Calebin A has been selected as an inspired molecule and a series of Calebin A analogs (namely AS-1 to AS-28) have been synthesized and are subjected to biological studies where in vitro chemotherapeutic potential of all the analogs were tested using MDA-MB-231, MCF-7, HeLa, PC3, MDA-MB-468, A549, HCT-116 and HepG2 as cancer cell line and NKE and WI-38 as normal cell line, where it was found that of these 28 analogs, AS-11, AS-13 and AS-18 shows cytotoxicity in all of the cancer cell lines especially showing lesser IC50 values in breast cancer specific cell line MDA-MB-231 and MCF-7.



Further it was found that AS-18 shows lesser cytotoxicity against the normal cell line NKE and WI-38 in comparison to the AS-11 and AS-13. Thus AS-18 have been selected for the further studies in MDA-MB-231 and MCF-7 cancer cell lines. AS-18 resulted in the down-regulation of the expression of proteins involved in tumor cell survival, proliferation, inflammation, and metastasis. Furthermore, AS-18 inhibited proliferation and induced apoptosis in MDA-MB-231 and MCF-7 cell lines, as examined by various assays. AS-18 treatment also suppressed NF-κB activation induced by various stimuli. Further mechanistic studies established the interaction of the compound AS-18 with the epidermal growth factor receptor (EGFR) and blocking of the Akt pathway. This led to suppression of nuclear factor erythroid 2-related factor 2 (NRF-2) protein expressions thus increasing the ROS in the tumor cells. Moreover, AS-18 potentiates ROS mediated apoptosis in cancer cells; thus, it has a potential in cancer treatment.

2. Targeted and Precise Drug Delivery Using a GSH-Responsive Ultra-Short Peptide-Based Injectable Hydrogel for Breast Cancer Cure

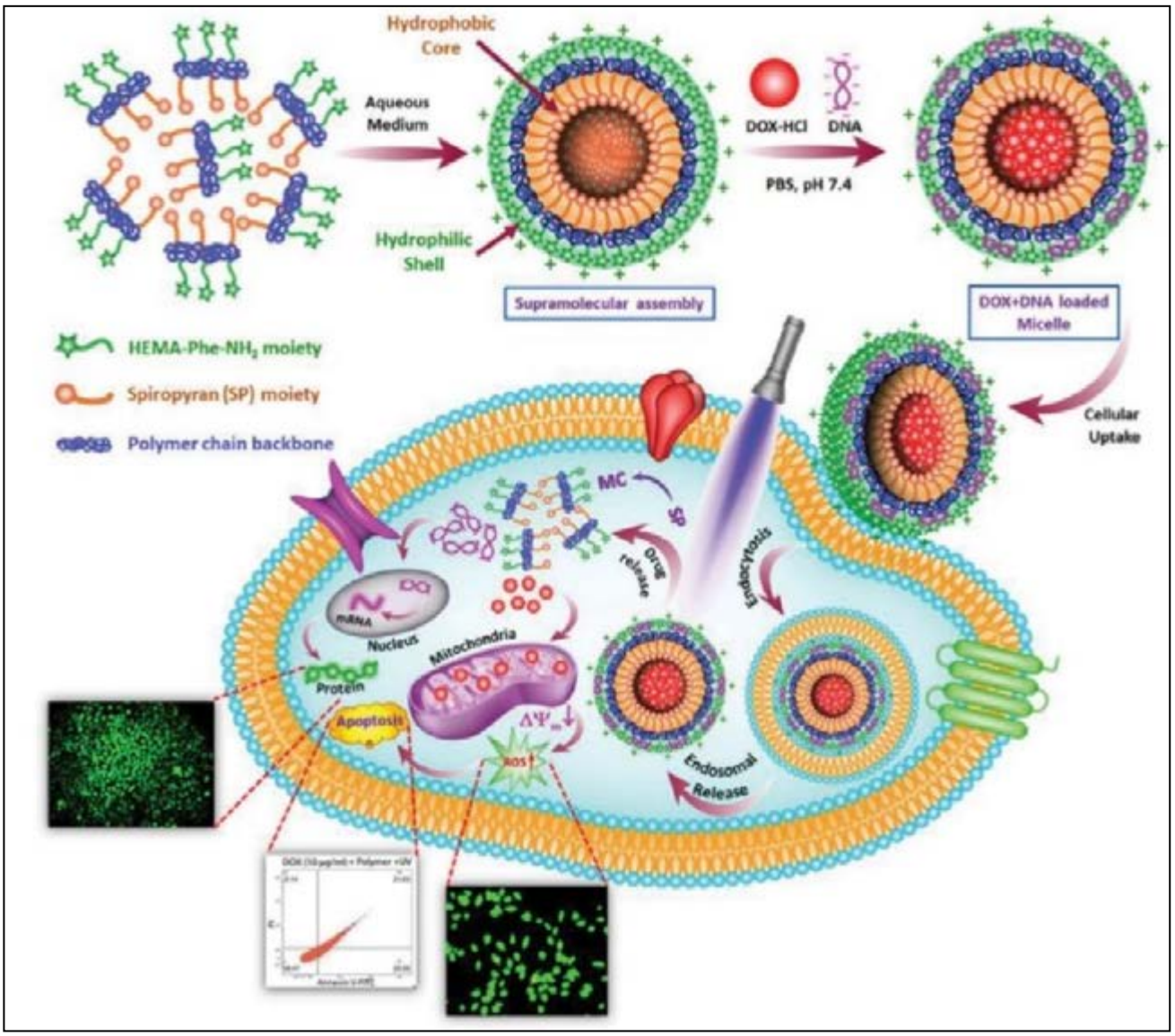
Harnessing the potential of hydrogel-based localized drug delivery systems holds immense promise in mitigating systemic side effects associated with conventional cancer therapies. However, the development of such systems demands the fulfillment of multiple stringent criteria, including injectability, biocompatibility, and controlled release. Herein, we present an ultra-small peptide-based hydrogel for the sustained and targeted delivery of doxorubicin in a murine model of breast cancer.



The hydrogel evades dissolution and remains stable in biological fluids, serving as a reliable drug reservoir. However, it reacts specifically to the high levels of glutathione (GSH) in the tumor microenvironment and releases drugs in a controlled manner over time for consistent therapeutic benefits. Remarkably, administration of a single dose of doxorubicin-loaded hydrogel elicits superior tumor regression (~75% within 18 days) compared to conventional doxorubicin treatment alone. Furthermore, the persistent presence of the drug-loaded hydrogel near the tumor site for up to 18 days after administration highlights its enduring effectiveness. Importantly, this localized delivery strategy demonstrates minimal off-target effects on healthy tissues, underscoring its clinical potential. Our findings underscore the efficacy of this smart peptide-hydrogel platform and pave the way for developing next-generation localized drug delivery systems with enhanced therapeutic outcomes in cancer treatment.

3. Highly Efficient Photo-switchable Smart Polymeric Nano-vehicle for Gene and Anticancer Drug Delivery in Triple-Negative Breast Cancer

Over the past few decades, there has been significant interest in smart drug delivery systems capable of carrying multiple drugs efficiently, particularly for treating genetic diseases such as cancer. Despite the development of various drug delivery systems, a safe and effective method for delivering both anticancer drugs and therapeutic genes for cancer therapy remains elusive. In this study, we describe the synthesis of a photoswitchable smart polymeric vehicle comprising a photoswitchable spiropyran moiety and an amino-acid-based cationic monomer-based block copolymer using reversible addition–fragmentation chain transfer (RAFT) polymerization. This system aims at diagnosing triple-negative breast cancer and subsequently delivering genes and anticancer agents. Triple-negative breast cancer patients have elevated concentrations of Cu2+ ions, making them excellent targets for diagnosis. The polymer can detect Cu2+ ions with a low limit of detection value of 9.06 nM. In vitro studies on doxorubicin drug release demonstrated sustained delivery at acidic pH level similar to the tumor environment. Furthermore, the polymer exhibited excellent blood compatibility even at the concentration as high as 500 µg/mL. Additionally, it displayed a high transfection efficiency of approximately 82 ± 5% in MDA-MB-231 triple-negative breast cancer cells at an N/P ratio of 50:1. It is observed that mitochondrial membrane depolarization and intracellular reactive oxygen species generation are responsible for apoptosis and the higher number of apoptotic cells, which occurred through the arrest of the G2/M phase of the cell cycle were observed. Therefore, the synthesized light-responsive cationic polymer may be an effective system for diagnosis, with an efficient anticancer drug and gene carrier for the treatment of triple-negative breast cancer in the future.


Hydrophobic Core
Aqueous Medium
Hydrophilic Shell
Supramolecular assembly
DOX-HCl
DNA
PBS, pH 7.4
DOX+DNA loaded Micelle
HEMA-Phe-NH2 moiety
Spiropyran (SP) moiety
Polymer chain backbone
Cellular Uptake
MC
SP
Drug release
Endocytosis
mRNA
Nucleus
Mitochondria
Protein
Apoptosis
ROS
Endosomal Release

DEPARTMENT OF CHEMICAL SCIENCES

DEPARTMENT OF CHEMICAL SCIENCES

Overview:

The Department of Chemical Sciences, erstwhile Chemistry, was established in 1917, at the time of the inception of the Institute. A major part of Shambhu Nath Dey's seminal work on discovering cholera toxin was performed in this department, for which he was nominated for the Nobel Prize. Over time, the department has adopted different aspects of chemical principles to explore carbohydrate and nucleoside chemistry, medicinal chemistry, structure and functions of anti-microbial peptides, principles of prokaryotic gene regulation, theoretical and quantum chemistry, natural product-based drug development, ultrafast spectroscopy, and environmental and atmospheric chemistry.

List of Students:

RA/SRF/JRF/Project Associate: Mr. Abhijit Rana (CSIR-SRF), Mr. Sajal Kumar Barman (CSIR-JRF), Ms. Baishakhi Saha (CSIR-JRF), Mr. Samim Sahaji (MANF-SRF), Mr. Soumen Raul (UGC-SRF), Ms. Suravi Nandi (UGC-SRF), Mr. Saikat Dogra (UGC-JRF), Ms. Puja Bag (UGC-JRF), Mr. Rahul Haldar (UGC-JRF), Sk. Bappa (UGC-JRF), Mr. Aniket Majhi (UGC-JRF), Mr. Suvajit Das (UGC-JRF), Ms. Suprity Majumder (UGC-JRF), Ms. Arpita Dey (UGC-JRF), Ms. Maitrayee Mandal (UGC-JRF), Mr. Atrin Mitra (UGC-JRF) Ms. Sanchari Kundu (Inspire-JRF), Ms. Koyel Howlader (DBT-JRF), Mr. Souvik Shaw (SERB-JRF).

DR. ANUP KUMAR MISRA
Professor
Department of Chemical Sciences

Group Members:

Abhijit Rana, CSIR-SRF
Samim Sahaji, UGC-MANF
Puja Bag, UGC-JRF
Saikat Dogra, UGC-JRF
Aniket Majhi, UGC-JRF
Debashis Mazumder, SLA

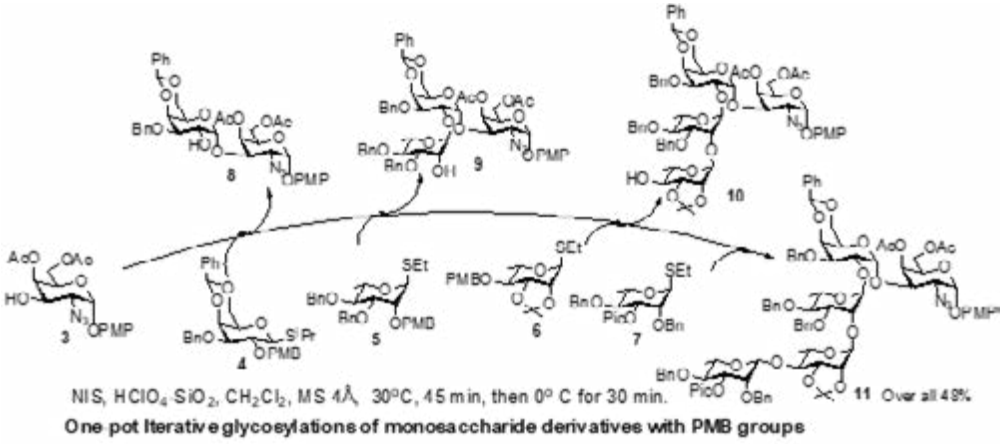
Summary of Research:

Development in glycobiology research amplified the demand for well-defined oligosaccharide motifs for various biological studies. Bacterial cell wall polysaccharides have been the basis for effective anti-bacterial vaccines, but little is known about the protective glycotopes for many serotypes. Since natural sources cannot provide a large quantity of oligosaccharides with homogeneity and adequate purity, it is essential to develop chemical synthetic approaches to access the complex oligosaccharides. The stereoselective glycosylation reaction is the key to assembling monosaccharides to synthesize complex oligosaccharides. Cell wall oligosaccharides corresponding to the repeating units and sub-units of polysaccharides, differing in chain length and monosaccharide composition, help identify antigenic determinants for creating semi-synthetic glycoconjugate vaccine candidates.

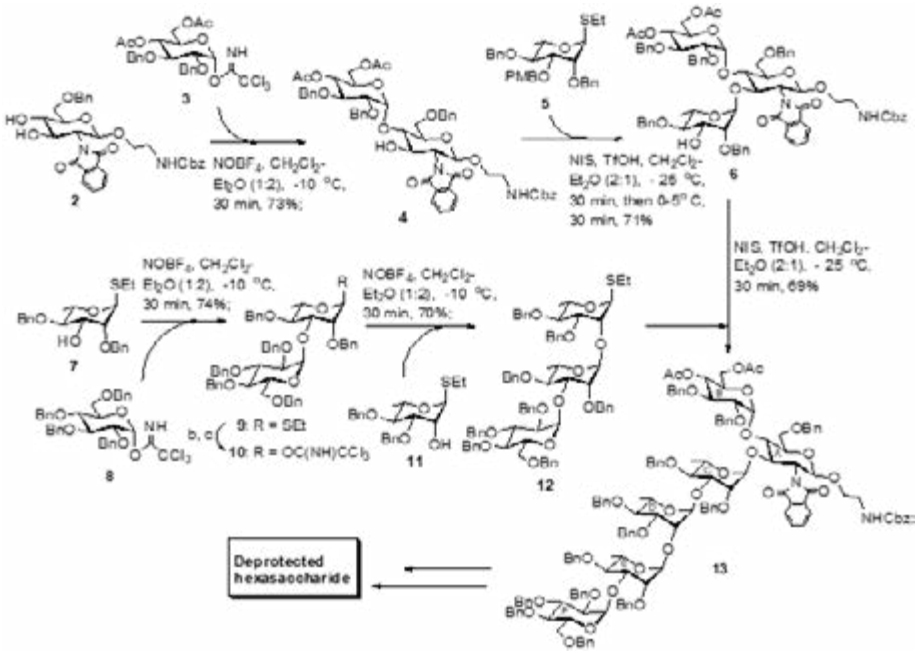
Focused Areas of Research:

- *Organic synthesis of complex oligosaccharides and development of novel reaction methodologies.*
- *Synthesis and biological evaluation of natural product inspired small molecules with promising therapeutic potential.*

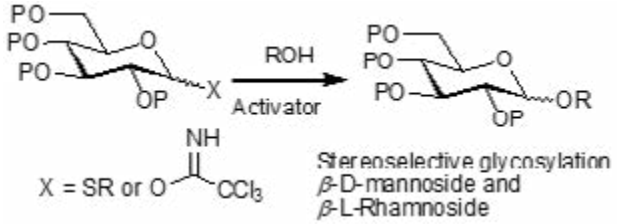
- ***Synthesis of complex oligosaccharides:***



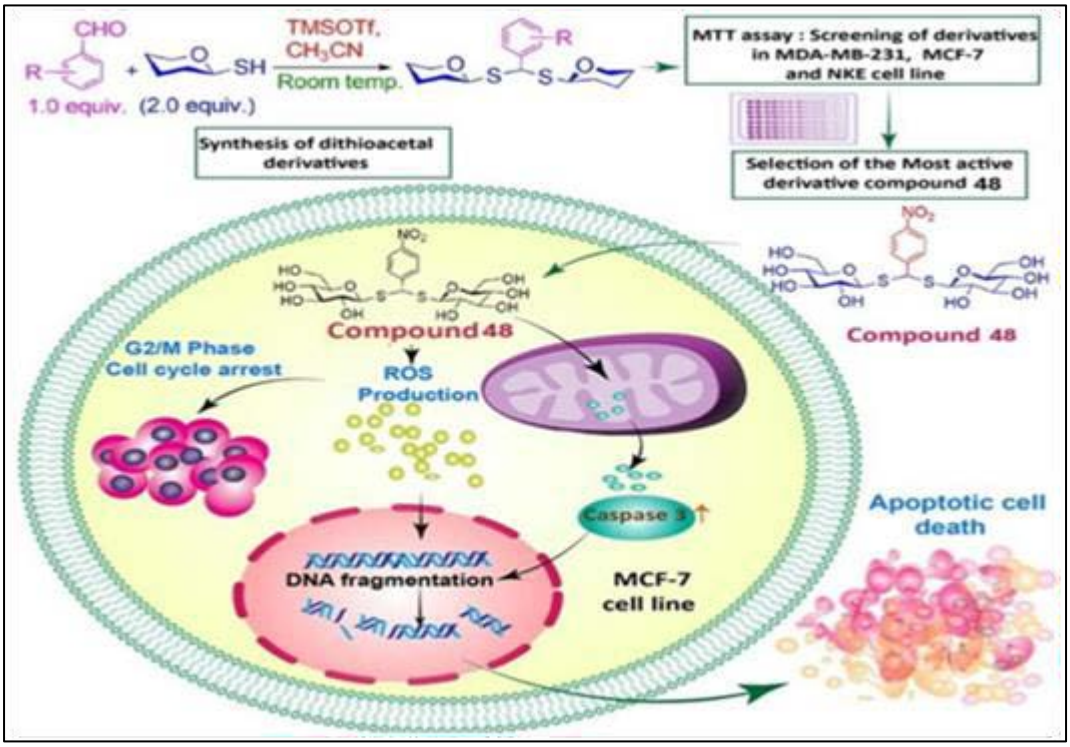
One pot Iterative glycosylations of monosaccharide derivatives with PMB groups



Development of novel reaction methodologies for the stereoselective glycosylations:



- ***Medicinal Chemistry***



Highlights of Research:

- Series of complex oligosaccharides corresponding to the cell wall of pathogenic bacteria such as *E. coli*, *Salmonella*, *Acinetobacter*, *Klebsiella* etc have been successfully synthesized using chemical synthetic strategies.
- Novel synthetic methodologies for the synthesis of glycomimetics have been developed.
- Novel aryl (dithioglycosyl)methane derivatives were synthesized and evaluated as potent anti-proliferative agents.

DR. SUMAN KUMAR BANIK
Professor
Department of Chemical Sciences

Group Member:

Atrin Mitra (JRF, UGC-Adhoc)

Summary of Research:

A living system survives in a continuously changing environment. To respond to the changes in the surroundings, each residing species has developed specialized gene regulatory networks (GRNs). One of the major functions of a GRN is to transduce the incoming signal efficiently. The inherent noisy interactions in the biochemical system make signal transmission stochastic and can be understood using the formalism of non-equilibrium processes.

Aims and Objectives:

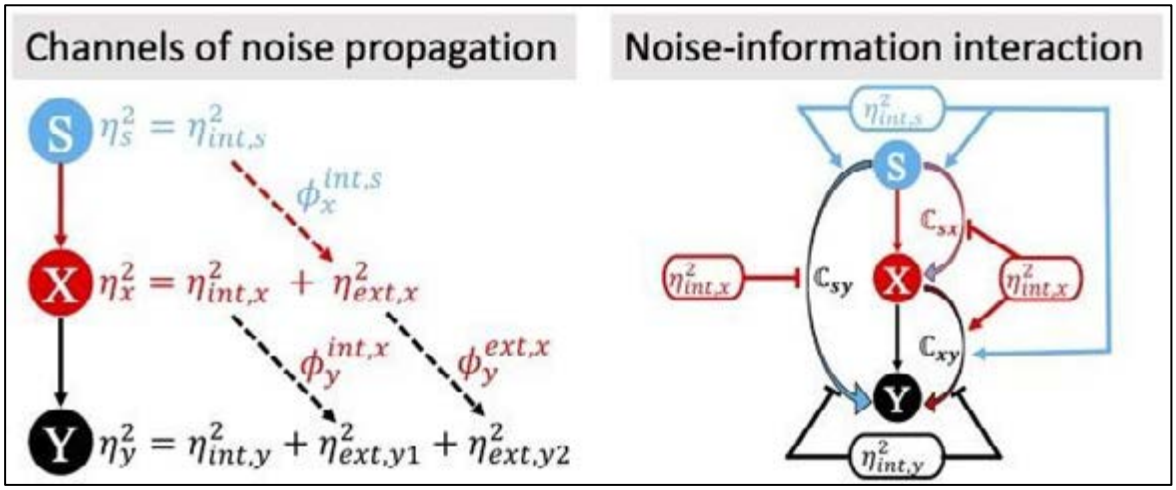
Our lab aims to develop theoretical frameworks to study signal transduction in GRNs using information theory tools. The broad focus of our research group is to understand the basis of signal transduction in biochemical networks within the purview of fluctuations in a single cell.

Work Achieved:

- Role of the bottleneck in the noise propagation in a generic two-step cascade

Future Research Plans:

- Identifying the sources of noise integration in a feed-forward loop motif
- Synthetic construction of the quorum-sensing network of *Chromobacterium violaceum*.



Left Panel: Schematic of the channels of noise propagation in a generic two-step cascade.

Right Panel: Schematic presentation of channel capacities in a two-step cascade and the role of intrinsic noise on information propagation. The pointed (→) and blunt (⊣) arrowheads stand for activation and repression, respectively.

DR. JAYANTA MUKHOPADHYAY
Professor
Department of Chemical Sciences

International and National Collaborations:

- Prof Graham Stuart, University of Surrey, UK, Project: ADP-ribosylation of DNA in *Mycobacterium tuberculosis*
- Rachna Chaba, IISER, Mohali

Summary of Research:

Our lab aims to understand the fundamental mechanism of transcription and gene regulation in bacteria by characterizing the interactions among RNAP, sigma factors, and regulators required for various gene expressions in prokaryotes. We have elucidated the mechanism of transcription by the d factor of *B. subtilis,* the mechanism of inhibition of transcription by a rifampicin derivative, RFA1, and studied the s cycle paradigm in *B. subtilis* and *M. tuberculosis*.

Research Highlights:

- Escherichia coli, σ70, which is generally, albeit not obligatorily, released from RNAP upon the transition from transcription initiation to elongation. Consistent with this observation, we show that *M. tuberculosis* σ^A and σ^E are stochastically or immediately released from RNAP during the transition from transcription initiation to elongation. We further show that, in contrast to *E. coli* σ70, the *B. subtilis* principal σ factor, σA, *M. tuberculosis* σ^F, and a mutant *E. coli* σ70 derivative lacking σ region 1.1 (σR1.1) are not released and are stably retained on RNAP core throughout transcription elongation. Our results indicate that the "σ cycle" is not a universal phenomenon in bacteria.

- Show that RFA-1 inhibits rifampicin-resistant RNA polymerase by binding to a site different than rifampin.

- Identify promoters of SigmaA of *M. tuberculosis* by SELEX.

DR. ANIRBAN BHUNIA
Professor
Department of Chemical Sciences

Group Members:

Dibakar Sarkar
Ranit Pariary
Dipanwita Roy
Karishma Biswas
Subhamoy Chakraborty
Suvajit Das
Suprity Majumder
Ananya Bhowmik

Summary of Research:

- Understanding the structure-function correlation of rationally designed antimicrobial peptides against Pseudomonas-associated corneal keratitis.
- Membrane-induced amyloid pathogenicity.
- Molecular mechanism of amyloidosis in the presence of metals and sequence context.
- Introducing peptide derivatives from the SARS-CoV E protein for materials science applications. The viral origin provides inherent bioactivity and self-assembly propensity that could enable smart biomaterials.
- The water extract of *Lasunadya Ghrita* (LG), an Indian traditional medicine, has been repurposed for the treatment of Alzheimer's disease.

Achievements/Events:

DR. DEBARAJ MUKHERJEE
Professor
Department of Chemical Sciences

Group Members:
Irshad Ahmad Zargar (AcSIR)
Norein Sakandar (AcSIR)
Bisma Rasool (AcSIR)
Rahul Haldar (Bose Institute)
Sk. Bappa (Bose Institute)
Sanchari Kundu (Bose Institute)

Summary of Research:

Our lab aims to engage in the development of novel methods for O-/C-/N-glycosylation, nucleoside synthesis, synthesis of oligosaccharide mimetics, and carbohydrate-fused bicyclic systems containing medium-ring to macrocyclic systems of promising therapeutic potential, non-infringing routes for the synthesis of carbohydrate-based active pharmaceutical ingredients (APIs). Also focusing on the generation of natural product-inspired small molecule-based leads in the area of cancer, neurodegenerative disease, antiviral, and antimicrobial chemotherapeutics.

Highlights of Research:

- Non-infringing route for API synthesis.
- Development of novel methods in carbohydrates
- Isolation and DOS of Small Molecules from Microbes as Kinase Inhibitors and their Medicinal Chemistry
- Photo redox reactions and transition metal catalysed C-H activation

Research activities:

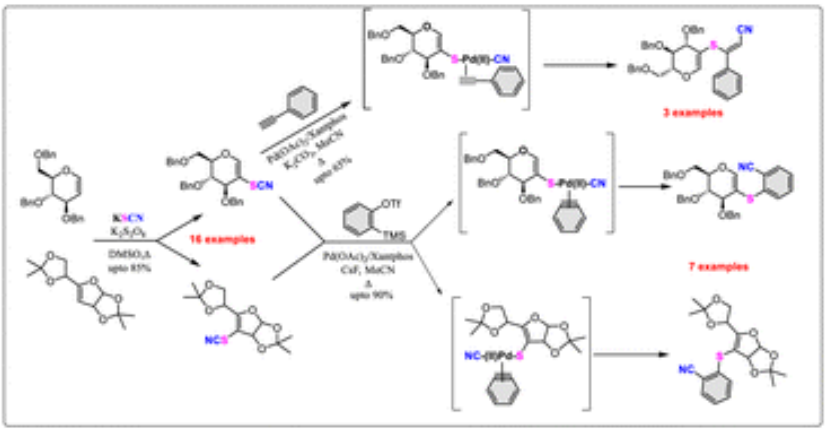
Innovative Strategies for the Efficient Strategies for C-H activation of Sugars: Overcoming Challenges in Carbohydrate Chemistry

The synthesis of C-H activation of sugars presents a significant challenge in carbohydrate chemistry, as it requires precise control over regio- and stereoselective transformations. These molecules are crucial intermediates and end products in medicinal chemistry, as they often serve as building blocks for bioactive compounds and natural products. However, achieving efficient and selective functionalization at a particular position of sugars is difficult due to the complex nature of sugar molecules, including their multiple reactive sites and inherent stereochemical constraints. Traditional methods often involve multistep procedures, reliance on protecting groups, and low yields, underscoring the need for innovative and streamlined approaches.

In a complementary effort, we developed an efficient and regioselective method to attach thiocyanato groups at the β-position of enol double bonds in sugar enol ethers using KSCN and potassium persulfate. This strategy enabled the selective formation of sugar thiocyanates, which further reacted with electron-rich species like terminal alkynes and benzynes under Pd catalysis. These reactions yielded C-2-thioacrylo/aryl nitrile glycals through simultaneous introduction of thio and cyano groups into carbon-carbon triple bonds. This dual functionalization approach significantly broadens the synthetic utility of sugar enol ethers. This work is published in *Chem. Commun.*, 2024,60, 8071.

Peroxodisulfate-assisted synthesis of 2-thiocyanato glycals and their transformation to C-2-thio acrylo/aryl nitrile-substituted glycals

B. Rasool, I. A. Zargar, S. Kundu and D. Mukherjee*



Additionally, we developed a highly efficient and regioselective method to directly convert 3-O-benzylated and silylated glycals into their corresponding enones using a DMSO–$K_2S_2O_8$ reagent system. This straightforward reaction operates under mild conditions, is scalable to gram quantities, and achieves up to 80% yields. The resulting enones are versatile intermediates, particularly valuable for synthesizing furo[3,2-c]pyrans, integral scaffolds in biologically significant compounds.This work is published in *Chem. Commun.*, 2025,61, 137.

DMSO–$K_2S_2O_8$ mediated iodine-free conversion of glycal C-3 ether to 3 enopyranones: synthesis of furo [3,2-c] pyrans

B. Rasool, S. Kundu, I. A. Zargar and D. Mukherjee*

Together, these advancements represent a significant leap forward in the synthesis of C-H activation in sugars. By simplifying reaction pathways, enhancing selectivity, and introducing novel transformations, these methodologies overcome many of the traditional barriers in carbohydrate chemistry. They not only provide efficient production of complex sugar structures but also broaden the range of tools for synthesizing biologically significant molecules, with important implications for medicinal chemistry and chemical biology.

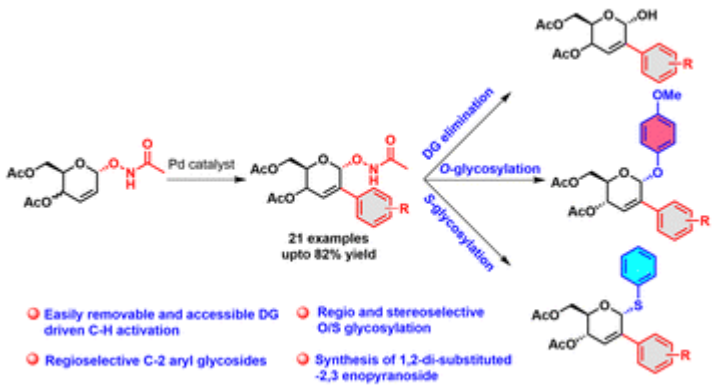
Innovative Glycosylation Methods: Addressing Key Challenges in Carbohydrate Chemistry

Glycosylation, the formation of glycosidic linkages, is a pivotal yet highly challenging process in synthetic carbohydrate chemistry. The inherent complexity of carbohydrates, characterized by multiple hydroxyl groups with similar reactivity, poses significant obstacles to achieving regio- and stereoselectivity in glycosidic bond formation. Moreover, controlling the configuration of the glycosidic linkage (α or β) often requires intricate manipulations of glycosyl donors, acceptors, and reaction conditions. Many established methods involve activators, protecting groups, or multistep processes, which can be inefficient and environmentally taxing. Addressing these challenges is critical for the synthesis of biologically significant glycoconjugates, including therapeutic glycoproteins, glycolipids, and bioactive natural products.

Building on such advances, we developed a palladium-catalyzed coupling reaction of 2,3-enopyranose with arylboronic acid, utilizing a removable oxyacetamide directing group. This methodology provides an efficient route to C-2 aryl sugars, which were subsequently employed as novel glycosyl donors in O/S glycosylation. This approach facilitated the regio- and stereoselective synthesis of 1,2-disubstituted branched sugars, expanding the toolkit for accessing complex carbohydrate architectures. This work is published in ***Chem. Commun.*, 2024,60, 13040.**

Anomeric oxyacetamide assisted site-selective C-2 arylation and its application in O/S glycosylation of 2,3 eno-pyranoside

I.A. Zargar, B. Rasool, S.K. Bappa and D. Mukherjee*

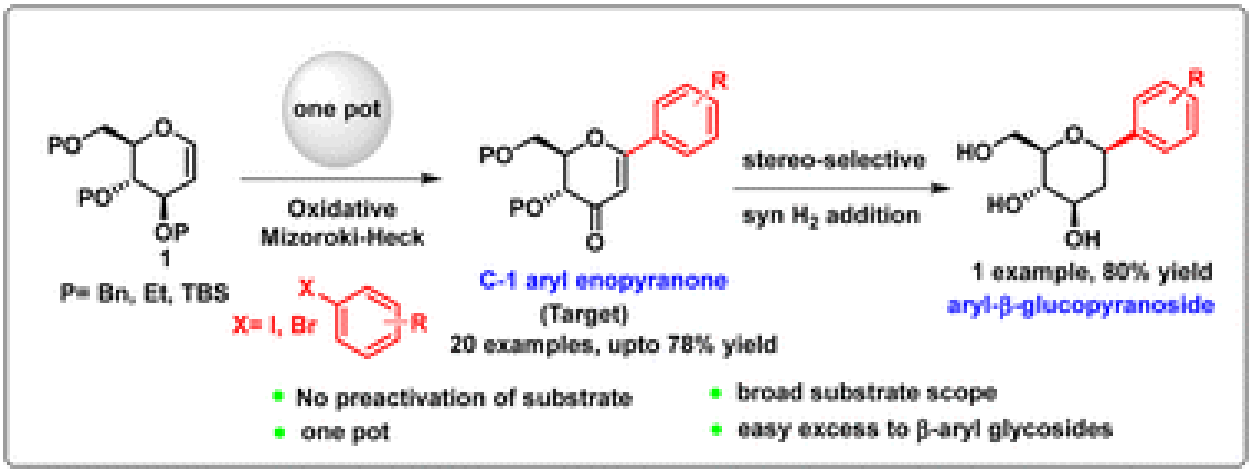


Development of Novel methods for the Synthesis of Medicinally Important Amino-aryl-C-glyacosides

A class of naturally occurring molecules having an amino-aryl-C-glycoside moiety such as C-aryl-2-deoxy-3-amino has emerged as antibiotics with promising antitumor activities and is used as drugs for mitigation of leukemia and sarcoma against multi-drug-resistant bacteria.However, availability and reproducibility limit their biological assay. Synthetic organic chemistry is a powerful tool to access such complex scaffolds and their analogues from easily available raw materials. One of the best precursors one can have for the synthesis of such scaffolds can be sugar enol ether also known as glycals. Here the major synthetic challenge is selective anomeric C-arylation and regio-selectively oxidize C-3 allylic ether to keto which can be easily converted to amines with desired stereochemistry via stereoselective reduction. Hence 3-keto-2-deoxy-C1-aryl glycals was chosen as a target. We have established a one-step procedure for the synthesis of C-1 aryl enopyranones directly from commercially available glycals with aryl halides in the absence of strong base via the oxidative Mizoroki–Heck reaction .

Synthesis of aryl enopyranones directly from glycals and aromatic halides to access 2-deoxy-β-C-aryl glycosides

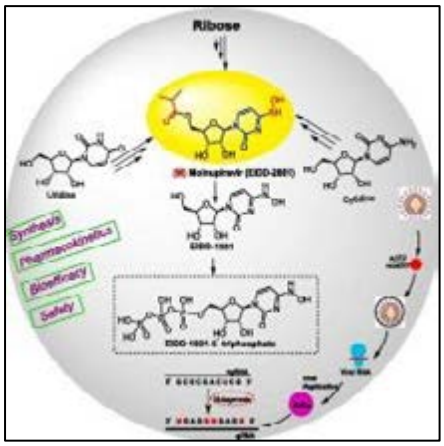
I.A Zargar, B. Rasool, S.K Bappa and D. Mukherjee*



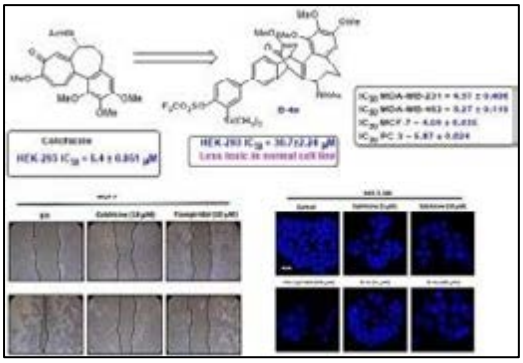
Collectively, these strategies represent significant advancements in overcoming the challenges of glycosylation. By streamlining processes, enhancing selectivity, and reducing reaction complexity, these approaches pave the way for more efficient and versatile synthesis of complex carbohydrates and glycoconjugates, with profound implications for chemical biology and medicinal chemistry.

Contribution in Medicinal Chemistry

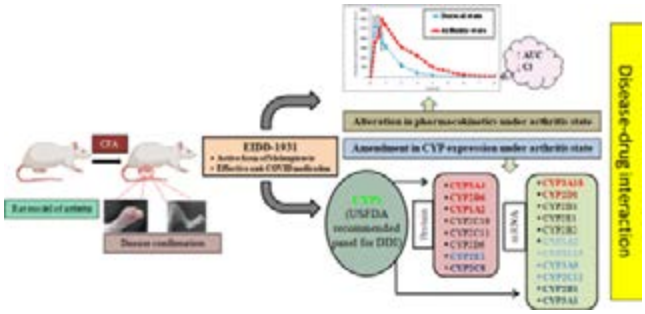
A path from synthesis to emergency use authorization of molnupiravir as a COVID-19 therapy
N. Sakandar, A. Ahmed, M. Bhardwaj, D. Kumari, U. Nandi and D. Mukherjee*



Discovery of colchicine aryne cycloadduct as a potent molecule for the abrogation of epithelial to mesenchymal transition *via* modulating cell cycle regulatory CDK-2 and CDK-4 kinases in breast cancer cells
W. I. Lone, J. Chand, P. Kumar, Y. Garg, Z. Ahmed, D. Mukherjee, and A. Goswami



EIDD-1931 Treatment Tweaks CYP3A4 and CYP2C8 in Arthritic Rats to Expedite Drug Interaction: Implication in Oral Therapy of Molnupiravir
M. Bhardwaj, D. Kour, G. Rai, S. Bhattacharya, D. Manhas, B. Vij, A. Kumar, D. Mukherjee, Z. Ahmed, S. Gandhi and U. Nandi*



Achievements/ Events:

3 Nature Indexed publications as corresponding author from DCS, Bose Institute

Delivered **plenary lecture (PL)** in the **"International conference on Chemistry for Human Development (ICCHD-2025)"** jointly organized by Professor Asima Chatterjee Foundation, Kolkata, University of Calcutta, Biswa Bangla Vishwavidyalaya and Luminescent Organic Consortium of India held on January 2025. The title of his talk was "Challenges on regio-selective glycosylation and how addition of functionality like keto can alter reactivity of monosaccharides towards synthesis of 3-aryl-thiosugars, 1-1/1-3 S/O linked disaccharides: putative substrate of metabolic glycan leveling."

Joined as an **editorial advisory board** member of Wiley journal **Chemistry & Biodiversity**. The journal covers all research fields straddling the border between the chemical and biological sciences, aiming to broaden our understanding of how nature works at a molecular level since 2004. As a part editorial advisory board member, Prof. Mukherjee will guide the editorial office on journal strategy and content development, as well as assist in the peer review process.


WILEY

Future Plan:

Journey from Conventional glycosylation to Visible light-mediated glycosylations

Visible-light-mediated glycosylation has emerged as a powerful alternative to conventional methods, offering enhanced selectivity, milder conditions, and greater functional group tolerance. Using photocatalysis, these transformations proceed via radical or photo-induced electron transfer mechanisms, enabling glycosidic bond formation without harsh reagents or high temperatures. This approach minimizes decomposition of sensitive substrates and allows late-stage glycosylation of complex molecules. Additionally, the use of visible light as a sustainable energy source aligns with green chemistry principles, making these protocols environmentally benign and operationally simple compared to traditional Lewis acid or promoter-based glycosylations, and will be taken up.

DR. ABHIJIT CHATTERJEE
Professor
Department of Chemical Sciences

Group Members:

Monami Dutta (SRF),
Sauryadeep Mukherjee (SRF),
Soumen Raul (SRF since June 2024)

Summary of Research:

Three major studies were conducted during 2024-2025 on aerosol pollution and associated factors.

1. A study was conducted to understand the level of $PM_{2.5}$pollution and its toxicity based on the oxidative potential (OP) during the winter-time pollution period over Kolkata, a megacity at the eastern most parts of Indo-Gangetic Plain (IGP) during the period of 2016–2023. We have assessed the effectiveness of the Government of India's national mission, the National Clean Air Program (NCAP) in $PM_{2.5}$reduction over this city, and the study revealed that the mission has been efficacious in lessening the $PM_{2.5}$load by 28% from pre-NCAP (2016–2019) to post-NCAP (2021−2023) periods. Several policy interventions reduced the contributions from various anthropogenic sources; however, biomass/solid waste burning remained a major concern with no significant reduction. With the rise in $PM_{2.5}$mass from 70μgm^{-3}, OP boosts up sharply and reaches its peak (at ~145μgm^{-3}) followed by an insignificant change with the further rise in $PM_{2.5}$. We observed that biomass/solid waste burning is the major concern in Kolkata in the current scenario (post-NCAP), even after NCAP policy interventions. Such high OP-based toxicity of $PM_{2.5}$during post-NCAP periods could be minimized if actions are taken against this particular source.

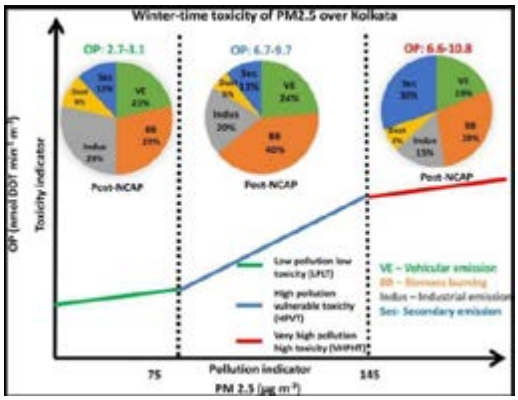


Fig 1: Variability of toxicity with PM2.5 pollution during winter in Kolkata city

2. A study examining atmospheric aerosols over the Sundarban mangrove ecosystem, a remote area, found that pollutants from Kolkata and the surrounding Indo-Gangetic Plain are significantly impacting air quality and potentially harming the ecosystem.Specifically, the study highlighted theinflux of black carbon or soot particles, contributing to increased acidity and oxidative stress in the aerosols.The study also found that these pollutants are particularly affecting the Sundarban ecosystem, which is rich in biodiversity and biogeochemistry.

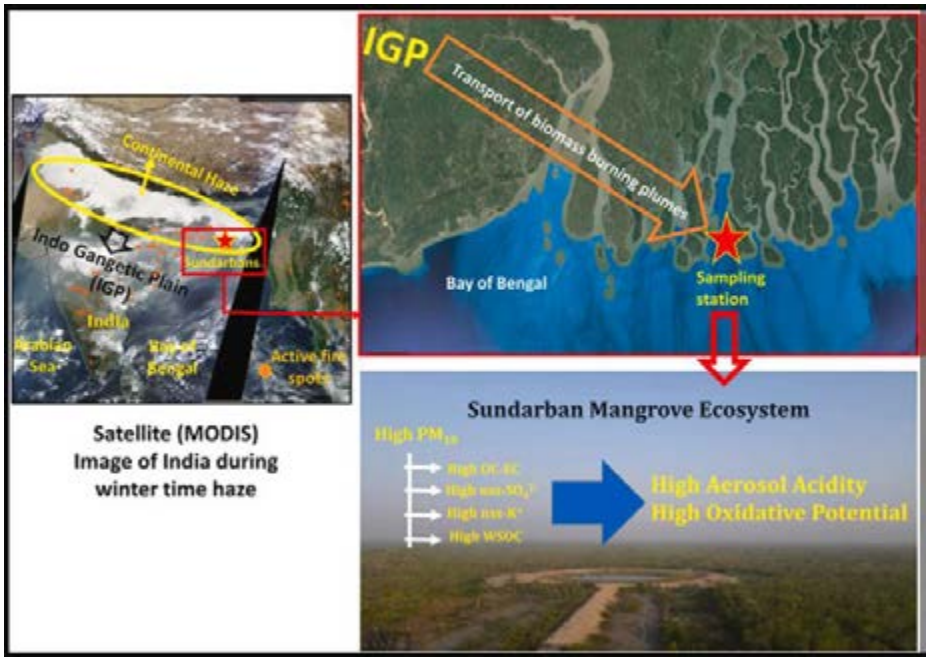


Fig 2: Transport of biomass burning plume from western IGP reaching Sundarban mangrove ecosystem enhancing oxidative stress

3. A year-long study on the chemical characterization and meteorological impact on $PM_{2.5}$was conducted over a semi-urban station, Shyamnagar, in the easternmost part of the Indo-Gangetic Plains (IGP). $PM_{2.5}$concentrations (Mean=81.69±66.27μgm^{-3}; 7.10–272.74μgm^{-3}), the total carbonaceous aerosols (TCA) (Mean=22.85±24.95μgm^{-3}; 0.77–102.97μgm^{-3}) along with differential carbonaceous components likeorganic carbon(OC) (Mean=11.28±12.48μgm^{-3}; 0.48–53.01μgm^{-3}) and elemental carbon (EC) (Mean=4.83±5.28μgm^{-3}; 0.1–22.13μgm^{-3}) exhibited prominent seasonal variability with the highest concentrations during winter, followed by post-monsoon, pre-monsoon and lowest during monsoon. We observed that under the least favorable conditions (low ventilation coefficient), high $PM_{2.5}$pollution (exceeding Indian standard) was associated with a high increase in secondary components of $PM_{2.5}$. Eastern, central and western parts of IGP, as well as Nepal, were the major long-distant source regions whereas the northern part of West Bengal and parts of Bangladesh were the major regional source region for high $PM_{2.5}$pollution over Shyamnagar. Compared with other studies, we observed that the $PM_{2.5}$pollution over this semi-urban region was comparable (and even higher in some cases) with other parts of IGP. The high exceedance of $PM_{2.5}$over the Indian standard in Shyamnagar strongly demands an immediate initiation of systematic and regular based air pollution monitoring over semi-urban/non-urban regions in India, especially IGP, in addition to the polluted cities.

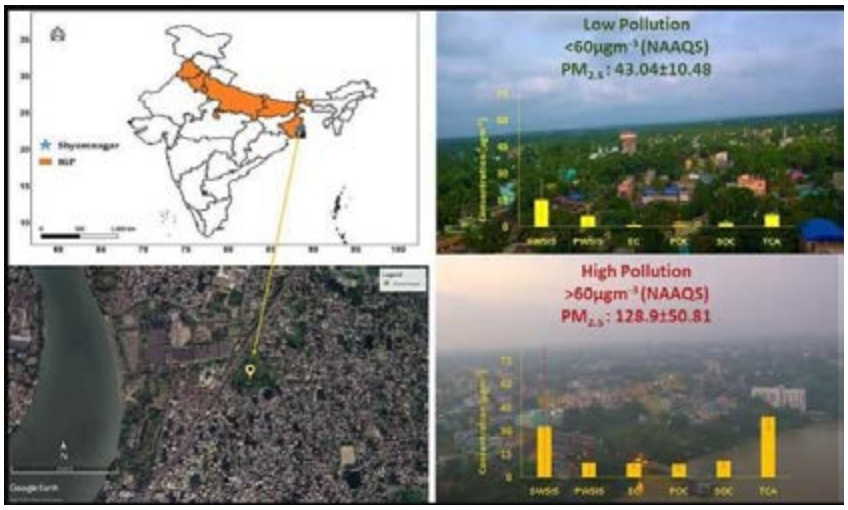


Fig 3: PM2.5 pollution under different dispersion conditions over a semi-urban atmosphere at eastern IGP

Policy related activities: Several policies and strategies were built up and formulated for the air pollution mitigation over Kolkata under National Clean Air Program, GoI. Emission inventory is being generated for the micro-environments in this city. After identification of the hotspots and major sources, several sectoral interventions are taken. The recommendations and action plans have been submitted to Govt. of West Bengal for their effective implementation.

Notable Achievement/Event:

Prof Abhijit Chatterjee and his team have introduced a "Toxicity Standard" of PM2.5 pollutant in Kolkata. They have shown that the threshold level of PM2.5 in Kolkata is 70 micrograms per volume of air (m3), below which the level of toxicity (oxidative stress) remains low and above which the toxicity increases rapidly. They have identified major sources for such a high toxicity level. Accordingly, Prof Chatterjee made a "Winter Action Plan" for Kolkata and submitted it to the Government of West Bengal. The Press Information Bureau of the GoI has shared this remarkable research (https://www.pib.gov.in/PressReleasePage.aspx?PRID=2120919#:~:text=Study%20introduces%20a%20%E2%80%9Ctoxicity%20standard,5)%20pollution%20over%20Kolkata%20megacity&text=A%20new%20study%20conducted%20in,around%2070%20%C2%B5g%20m%2D3) and highlighted by many leading print media in India. The Govt. of West Bengal and KMC have started implementing the policies recommended by Prof Chatterjee to reduce the toxicity level in Kolkata due to air pollution.

Prof. Abhijit Chatterjee with his scholars, intern students, project associates and scientists and faculties from University of Wisconsin Madison, USA

DR. UTPAL NANDI
Associate Professor
Department of Chemical Sciences

Group Members:

Baishakhi Saha, CSIR-JRF
Arpita Dey, UGC-JRF

Summary of Research:

Our lab is focused on the topic entitled 'Deciphering the role of CYP2J2/EETs axis in breast cancer pathogenesis'. Arachidonic acid metabolism via the CYP epoxygenase pathway produces epoxyeicosatrienoic acids (EETs), which promote tumorigenesis. While COX and LOX pathways have been extensively studied for drug discovery (e.g., NSAIDs and leukotriene antagonists), the role of CYP epoxygenase, particularly CYP2J2, remains largely unexplored in cancer. This study aims to elucidate the signaling pathways underlying CYP2J2 inhibition-mediated EET formation in triple-negative breast cancer (TNBC) within the framework of targeted cancer therapy to address recurrence and resistance. Additionally, we seek to identify plant-derived CYP2J2 inhibitors and evaluate their ADME/PK properties to assess their druggability for potential therapeutic development.

DR. AMIT KUMAR PAUL
Associate Professor
Department of Chemical Sciences

Group Members:

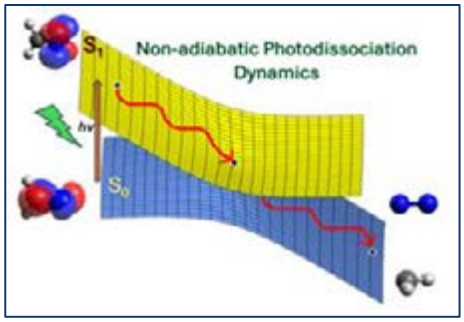
Basudha Deb, Registered to NIT Meghalaya
Manju Siyaram Yadav, Registered to NIT Meghalaya
Sajal Barman
Suvajit Das
Souvik Shaw, Project JRF
Krishnandu Dey, Registered to NIT Meghalaya under co-supervision

Summary of Research:

In our group, we pursue theoretical and computational calculations for understanding chemical processes, including reactions. In this process, we perform time-independent electronic structure calculations and time-dependent dynamics. For electronic structure calculations, we use the commercial or available free packages, whereas for dynamics, we mainly develop our own packages within the group. We are trained in quantum, semiclassical, and classical molecular dynamics simulations. Current group members are focused on intramolecular vibrational energy redistribution (IVR) dynamics, chemical processes in condensed phase, semiclassical non-adiabatic dynamics, machine learning approaches in chemical dynamics, and understanding biophysical properties of protein-ligand interactions.

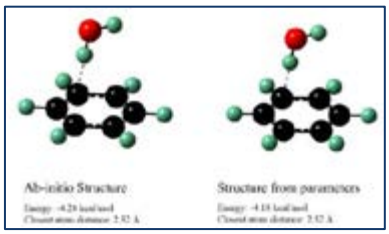
Highlights of Research:

Photodissociation Reaction of Diazirine: An Electronic Structure and Non-Adiabatic Molecular Dynamics Study



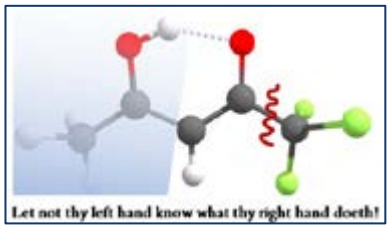
This work is done to understand the mechanistic details of the excited state non-adiabatic process of diazirine and three other derivatives that are substituted with electron-donating (methoxy-diazirine) and withdrawing (fluoro-diazirine) groups, as well as combining both (fluoro-methoxy-diazirine), to study their effect on generating carbene and molecular nitrogen via diazomethane. Electronic structure calculations are performed at higher level followed by non-adiabatic molecular dynamics simulations. Two conical intersections (CIs) are found for each of the molecules in the non-adiabatic process, which are associated with asymmetric vibrations of the C-N bonds in the three-membered ring of the diazirines, except for pure diazirine, where the second CI is associated with symmetric vibration. In the dynamics, trajectories were seen to go through both the CIs whichever is energetically and dynamically permissible. The first-order kinetics of N2 formation revealed that the reaction is fastest for pure diazirine and slowest for fluoro-methoxy-diazirine.

Analytic Potential Energy Functions for Benzene-Water Interactions Based on Accurate Ab initio Calculations and Ghost Atom Formalism



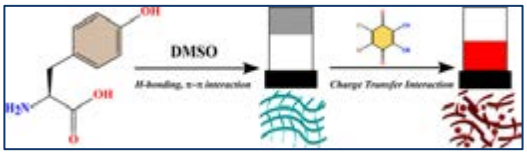
In this work, we have obtained so far, best interaction potential energy between Benzene and Water with analytical function. Accurate intermolecular potential energy of C6H6-H2O system is calculated from electronic structure theory. The calculations are done by MP2 level of theory considering aug-cc-pVTZ basis set and results are comparable with CCSD(T) at the complete basis set (CBS) limit. The ab initio calculations are performed at nine different orientations. The ab initio potential energies points are then well-fitted to a modified Buckingham-type analytic function with atom-atom and ghost atom-atom interactions. The ghost atom position is situated at the center of the benzene ring. An analytical derivation for calculating the potential energy gradient is provided for the ghost atom model and the use of molecular dynamics.

Local dynamics control the C–CX3 (X = H and F) bond photodissociation in acetylacetones.



In this work, we collaborate with Prof. Naresh Patwari from IIT Bombay. The primary photodissociation events of acetylacetone and its fluorinated analogues reveal that the translational energy distribution profiles of the CH3 and CF3 radicals follow a barrier-impulsive model for the C–C bond cleavage. Analysis based on the one-dimensional potential energy surfaces in the T1 state as well as dynamics simulations using on-the-fly semi-empirical potentials suggest that the C–C bond cleavage with OH in syn orientation, in general, is accompanied by proton migration. Interestingly, the near identical fragment translational energy distribution profiles of CH3 radical release from acetylacetone and trifluoroacetylacetone, as well as CF3 radical release from trifluoroacetylacetone and hexafluoroacetylacetone, suggest that the dynamics of formation of CH3 / CF3 radicals in acetylacetones appears to be independent of nature of the substituent on the other end of the molecule and the behaviour is akin to “let not thy left hand know what thy right hand doeth.”

Supramolecular Gelation Based on Native Amino Acid Tyrosine and Its Charge-Transfer Complex Formation



In another collaborative project, we are first-time reporting the self-assembly process of tyrosine (Tyr), an aromatic amino acid, in dimethyl sulfoxide (DMSO) solvent. Most of the studies related to Tyr self-assembly were reported in different aqueous solutions. In our work, we studied the self-assembly in several common organic solvents and found that Tyr could self-assemble into a supramolecular gel in dimethyl sulfoxide (DMSO) solvent. In our group, we have done some theoretical calculations to explore the possible interactions, namely, π-π stacking, H-bonding, etc., among the monomers of tyrosine.

Notable Achievement/Event:

An Outreach activity was conducted jointly with Prof. Debaraj Mukherjee on January 14, 2025 in which ~20 undergraduate students from 4 colleges were invited to visit the Bose Institute Museum, listen to the scientific lectures by eminent scientists and visit various laboratories of the Institute.

DR. ANUP GHOSH
Assistant Professor
Department of Chemical Sciences

Group Members:

Suranjana Chakrabarty, Registered at S N Bose National Centre for Basic Science, Kolkata
Koyel Howlader

Summary of Research:

Small Molecule Structure and Solvation Dynamics

Investigation of molecular conformations in solution; Study of solute–solvent interactions using spectroscopic and computational techniques; Analysis of how solvation affects molecular behaviour and stability.

Surface Characterization of Peptide-Coated Nanoparticles

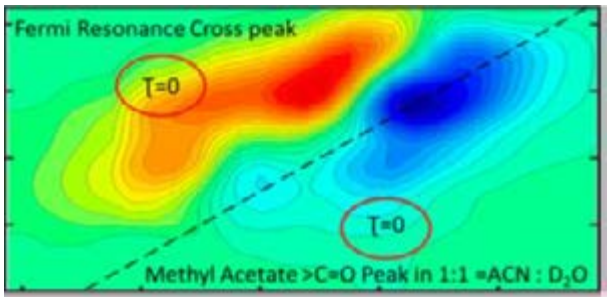
Functionalization of nanoparticles with bioactive peptides; Structural and morphological analysis using TEM, SEM, DLS, and FTIR; Evaluation of surface charge (zeta potential) and peptide–surface interactions; Study of colloidal stability and biocompatibility

Development of Nano-Vehicles for Targeted Drug Delivery

Design and synthesis of nanoparticle-based delivery systems; Surface modification with targeting ligands (e.g., peptides or aptamers); Drug loading, release kinetics, and targeting efficiency studies; In vitro and in vivo evaluation for site-specific drug delivery.

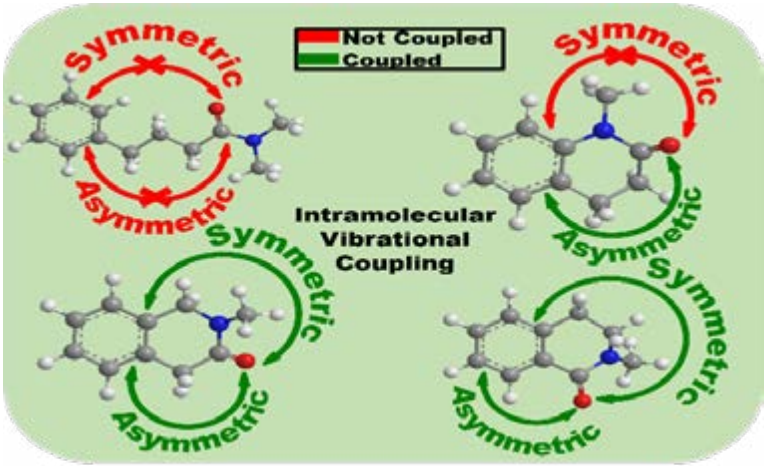
Highlights of Research:

Perturbation of Fermi Resonance on Hydrogen-Bonded > C=O: 2D IR Studies of Small Ester Probes



We utilized linear and 2D infrared spectroscopy to analyze the carbonyl stretching modes of small esters in different solvents. Particularly noteworthy were the distinct carbonyl spectral line shapes in aqueous solutions, prompting our investigation of the underlying factors responsible for these differences. Through our experimental and theoretical calculations, we identified the presence of the hydrogen-bond-induced Fermi resonance as the primary contributor to the varied line shapes of small esters in aqueous solutions. Furthermore, our findings revealed that the skeletal deformation mode plays a crucial role in the Fermi resonance for all small esters. Specifically, the first overtone band of the skeletal deformation mode intensifies when hydrogen bonds form with the carbonyl group of esters, whereas such coupling is rare in aprotic organic solvents. These spectral insights carry significant implications for the utilization of esters as infrared probes in both biological and chemical systems.

Probing Intramolecular Vibrational Coupling between C=C Ring and Amide I modes in Quinolinone Derivatives: Insights from DFT and Molecular Dynamics Simulations



Vibrational coupling is an intrinsic component of IR spectroscopy. Coupling between vibrating modes is crucial for energy transfer and may result in frequency alterations, peak intensity variations, and perturbations in molecular dynamics. In most biomolecules, the amide-I mode (C=O) is highly studied. The data obtained regarding the observed mode may not be precise due to other perturbing modes present in a similar frequency region, such as the C=C vibrating mode. The C=C and amide-I modes can engage in intermolecular and intramolecular vibrational coupling. Intramolecular vibrational coupling is an inherent property of molecules. To investigate the influence of intramolecular vibrational coupling between symmetric/ asymmetric C=C ring and amide-I modes, we have performed theoretical calculations using DFT on three quinolinone-based fused ring derivatives. We observed that vibrational coupling is present between both symmetric/ asymmetric rings and the amide-I mode for one of the systems, but only the asymmetric vibrational ring and amide-I modes couple inthe case of the others. This observation is also validated through a Molecular Dynamics (MD) simulation performed using normal mode Hamiltonian, where the energies in the amide-I mode are monitored along with the symmetric and asymmetric C=C ring modes. This disparity in the coupling behavior is due to the difference in the positional orientation of the respective modes.

Unusual Hydrations of Amide I! An Insight of Protein Structure and Flexibility

Hydrogen bonding is a vital phenomenon in chemistry and biology, altering biomolecule behaviour and dynamical properties. At normal temperatures, water's dynamic and reversible hydrogen bond formation makes water a unique and versatile solvent for most of the biological processes, like protein folding, DNA replication, and the stability and functions of biomolecules. In this study, using linear IR spectroscopy, Molecular Dynamic Simulation (MD) and DFT calculations, the disparity between hydrogen bond dynamics of amide I in protonated and deuterated solvents is explored. Significant differences have been found between the dynamics in H_2O and isotopic heavy water D_2O. Herein, the IR spectra showed that the amide I hydrogen bond lifetime in heavy water D2O is 5.7 times slower than in neat water (H2O). Moreover, distinct hydrogen bond populations of amide I in methanol and methanol-d_4 further emphasized the role of the deuterated solvents in hydrogen bonding behaviour. These results highlight the exclusive hydrogen bonding characteristics of water and its isotopes, as well as the broader inferences of solvent effects on molecular dynamics and reactivity of biomolecules.

DEPARTMENT OF PHYSICAL SCIENCES

Prof. Kaustuv Sanyal, Director Bose Institute and Prof. Supriya Das, Professor, Department of Physical Sciences were invited to attend a two-day event to celebrate the '50 Years of Indo-German Cooperation in Science and Technology' organized during May 21-22, 2024 at FAIR/GSI, Darmstadt, Germany. Many scientists and other dignitaries from India and Germany including the Indian Ambassador in Berlin also attended the event.

The 42nd. Meeting of the FAIR Council, the highest decision-making body of FAIR GmbH, was held at Bose Institute, Kolkata during December 3-4, 2024. In this meeting, the status of the construction of the facility as well as the strategies for coming days were discussed. It was the first time when such a meeting was held anywhere outside the FAIR site at Darmstadt, Germany. Scientists and bureaucrats as representatives from the member countries and the FAIR Management including the scientific, technical and administrative directors of the FAIR GmbH were present in this meeting.

DEPARTMENT OF PHYSICAL SCIENCES

Overview:

The Department of Physical Sciences at Bose Institute has been carrying out high quality research in advanced areas of Physics for more than a century. Drawing inspiration from the founder - Acharya J. C. Bose, the research activities in the department presently cover diverse areas in Experimental and Theoretical Physics, Environmental Sciences as well as areas at the interface of Biological and Chemical Sciences.

The research areas persued are Quantum Information, Statistical Physics, Biophysics, Complex Systems, Condensed Matter Physics, Materials Science, Cosmic Rays, Nuclear Astrophysics, High Energy Physics, String Theory and Environmental Sciences. We have active international collaborations with ALICE at LHC, CERN and the ISOLDE radioactive ion beam facility at CERN. We are the nodal centre in India to facilitate Indian activities at the Facility for Antiproton and Ion Research (FAIR) at GSI, Germany.

List of Personnel:

Senior Scientists: Prof. Dipankar Home, NASI Senior Scientist

Students: RA/SRF/JRF/Project Associate: Dr. Somen Gope (R.A.-I FAIR Project); Dr. Anjali Sharma (R.A.-I FAIR Project); Dr. Sanchari Thakur (R.A. ALICE-III);

Mr. Ritankar Mitra; Ms. Rudrapriya Das; Ms. Swati Sharma; Mr. Debanjan Roy; Mr. Arijit Roy; Mr. Niloy Ghosh; Shahina Raushan Saikh; Mr. Ramnarayan Bera; Mr. Mintu Haldar; Mr. Pritam Sinha; Mr. Sayan Samanta; Mr. Subir Mandal; Md. Abu Mushtaque; Ms. Antara Pramanik; Mr. Jashvant K. Prasad; Ms. Riya Adhikary; Mr. Subhojit Mahapatra; Mr. Prithiraj Majhi; Bushra Parveen; Mr Soumyadip Ghosh; Mr Faruque Siddique; Mr Subhadip Basak.

Departmental Activities:

A. The Department of Physical Sciences has organized the following seminars during the period of April-2024 to March-2025:

1. "Hidden quantum criticality and entanglement in quench dynamics" by Dr. Sanku Paul (DST INSPIRE Faculty, S N Bose Center), March 07, 2025.
2. "Entangling light without uncertainties" by Dr. Aniruddha Bhattacharya (Georgia Tech), February 20, 2025.
3. "Thermalization via Quantum Homogenization" by Mr. Tanmay Saha (IMSc, Chennai), January 30, 2025.
4. "LongBaseline Neutrino Experiments" by Dr. Ali Ajmi (University of Winnipeg, Canada), January 08, 2025.
5. "Nuclear Astrophysics with Charge-Exchange Reactions at FRIB" by Dr. Sk Mustak Ali (Michigan State University, USA), January 07, 2025.
6. "Towards a complete classification of holographic entropy inequalities, and beyond..." by Mr. Joydeep Naskar (Northeastern University, Boston, USA), December 24, 2024.
7. "Self-organization in Active Polymers and Living Matter" by Dr. Rakesh Das, (Guest Scientist, Visitors Program, MPI-PKS, Dresden), December 20, 2024.
8. "Long distance entanglement sharing with optical hybrid states" by Dr. Soumyakanti Bose (Postdoc, Seoul National University), October 25, 2024.
9. "Insights into quantum magnetism: A concise account of my research" by Dr. Jhuma Sannigrahi (Ramanujan Fellow, IIT Goa), September 05, 2024.
10. "Recent results on heavy flavours and quarkonia from ALICE focusing on Run-3 data" by Dr. Shreyasi Acharya (Postdoc, CERN), August 19, 2024.
11. "A sharp future of medium-size telescopes in the era of automated adaptive optics" by Mr. Kinjal Roy (Astronomy & Astrophysics Group, RRI), August 08, 2024.
12. "Contact Geometry and Thermodynamics" by Mr. Aritra Ghosh (School of Basic Sciences, IIT-BBS, Bhubaneswar), August 07, 2024.
13. "Performing High-Dimensional Statistical Inference with Artificial Intelligence in Particle and Astrophysics" by Dr. Aishik Ghosh (UC Irvine and Berkeley Lab), June 07, 2024.
14. "Atomically thin 2D-Field Effect Transistors and Printed Chemi-resistors for Rapid biopsy of Cancer, Chiral Spin Device, and Aquatic Hazards Assessment" by Dr. Arnab Maity (Technion - Israel Institute of Technology), April 09, 2024.

B. **Students from Presidency University, Bidhannagar College, St Xavier's College, Jadavpur University, B K C College, AJC Bose College visited laboratories of the Department of Physical Sciences on the National Science Day (Feb 28, 2025).**

DR. RAJARSHI RAY
Professor
Department of Physical Sciences

Group Members:

Pratik Ghoshal
Pracheta Singha

Other Collaborators:
Chowdhury Aminul Islam
Munshi Golam Mustafa

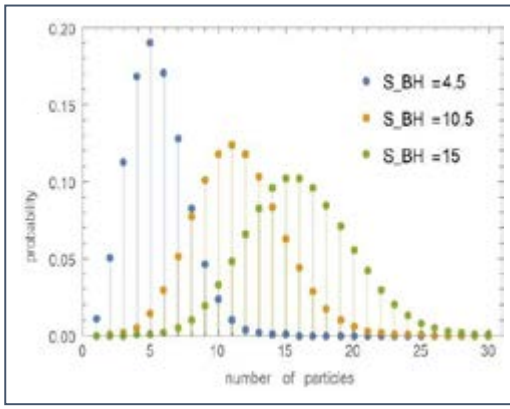


Figure illustrating the essence of our research work

The figure illustrates the probability distribution of decay of a Black Hole having entropy S_BH via the emission of various number of particles. It resembles a Planckian distribution except that instead of the Wein's displacement law where the location of the maxima of the distribution is inversely proportional to temperature, here the maxima is proportional to inverse of the square of the temperature.

Summary of Research:

Our work has been mainly to develop a consistent model framework for understanding the thermodynamic properties of strongly interacting matter. Our objective has been to study the limitations of existing models by contrasting them with certain available first principle calculations as well as by contrasting them with the experimental data. Thereby we developed an extremely well suited quasi-particle model of gluon thermodynamics for the exploration of the phases of strongly interacting matter.

We have further initiated some studies in understanding the field theoretic properties in gravitational backgrounds to study thermodynamic properties during the evolution of the early universe as well as the properties of super-massive stars.

Major Achievements:

- Developed the most consistent model for gluon thermodynamics.
- Obtained the probability distribution for the number of decay modes of a stationary Black Hole.

Future Plan:

- Develop a consistent description of phases of strong interaction for a wide range of temperature and chemical potentials.
- Explore strongly interacting matter in gravitational backgrounds.

DR. SOMSHUBHRO BANDYOPADHYAY
Professor
Department of Physical Sciences

Summary of Research:

Quantum change point and entanglement distillation

- In a quantum change point problem, a source emitting particles in a fixed quantum state (default) switches to a different state at some stage, and the objective is to identify when the change happened by measuring a sequence of particles emitted from such a source. Motivated by entanglement-sharing protocols in quantum information, we study this problem within the paradigm of local operations and classical communication (LOCC). Here, we consider a source that emits entangled pairs in a default state, but starts producing another entangled state (mutation) at a later stage. Then, a sequence of entangled pairs prepared from such a source and shared between distant observers cannot be used for quantum information processing tasks as the identity of each entangled pair remains unknown. We show that identifying the change point using LOCC leads to the distillation of free entangled pairs. In particular, if the default and the mutation are mutually orthogonal, there exists an efficient LOCC protocol that identifies the change point without fail and distills a sufficiently large number of pairs. However, if they are nonorthogonal, there is a probability of failure. In this case, we compute the number of entangled pairs that may be obtained on average. We also consider a relaxation of the two-state problem where the mutation is not known a priori, but instead belongs to a known set. Here we show that local distinguishability plays a crucial role: if the default and the possible mutations are locally distinguishable, the problem reduces to the two-state problem with orthogonal states, but if not, one may still identify the mutation, the change point, and distill entanglement.

Unambiguous discrimination of sequences of quantum states

- We consider the problem of determining the state of an unknown quantum sequence without error. The elements of the given sequence are drawn with equal probability from a known set of linearly independent pure quantum states with the property that their mutual inner products are all real and equal. This problem can be posed as an instance of unambiguous state discrimination where the states correspond to that of all possible sequences having the same length as the given one. We calculate the optimum probability by solving the optimality conditions of a semidefinite program. The optimum value is achievable by measuring individual members of the sequence, and no collective measurement is necessary.

Entanglement cost of discriminating noisy Bell states by local operations and classical communication

- Entangled states can help in quantum state discrimination by local operations and classical communication (LOCC). For example, a Bell state is necessary (and sufficient) to perfectly discriminate a set of either three or four Bell states by LOCC. In this paper, we consider the task of LOCC discrimination of the states of noisy Bell ensembles, where a given ensemble consists of the states obtained by mixing the Bell states with an arbitrary two-qubit state with nonzero probabilities. It is proved that a Bell state is required for optimal discrimination by LOCC, even though the ensembles do not contain, in general, any maximally entangled state, and in specific instances, any entangled state.

DR. DHRUBA GUPTA
Professor
Department of Physical Sciences

Group Members:

Ritankar Mitra, SRF
Sayan Samanta, JRF
Niloy Ghosh, JRF
Manas Datta, JLA

Summary of Research:

Nuclear Astrophysics

The cosmological lithium problem is an important and thought-provoking topic in nuclear astrophysics. The problem delineates a serious anomaly of about three times in abundance of ^{7}Li between observation and prediction of the big-bang nucleosynthesis (BBN) theory. There is however, very good agreement between observation and prediction for lighter nuclei ^{2}H and ^{4}He. Since ^{7}Be is the main source of primordial ^{7}Li, we are investigating the breakup and transfer reactions of ^{7}Be to look for a nuclear physics solution to the problem.

We are also studying the α-capture reaction $^{12}C(\alpha,\gamma)^{16}O$, which along with the preceding triple-α fusion reaction determines the C/O abundance ratio in stars. This ratio is crucial for stellar nucleosynthesis of elements heavier than carbon. The final fate of a star as well as the evolution of life in the universe depends on this ratio. There is however, a large uncertainty in the reaction rate despite extensive studies. Since the extremely small cross section of the reaction at the Gamow energy, precludes any direct measurement, we utilized an efficient indirect technique of Asymptotic Normalization Coefficients (ANC) by measuring α-cluster transfer reactions with ^{7}Be + ^{12}C.

Research Highlights/Accomplishments:

Measurement of the ^{7}Be(d,^{3}He)^{6}Li* reaction and the ^{6,7}Li anomalies

The study of the transfer reaction ^{7}Be(d,^{3}He)^{6}Li* is carried out at 5 MeV/u. The 2.186 MeV excited state of ^{6}Li in this reaction channel is observed for the first time. The experimental angular distributions have been compared to the finite range DWBA and coupled-channel calculations. The effect of the

^{7}Be(d,^{3}He)^{6}Li reaction on both the ^{6}Li and ^{7}Li abundances are studied at the relevant big-bang nucleosynthesis energies. The excitation function is calculated by the TALYS code and normalized to our experimental data. The S factor of the (d,^{3}He) channel from the present work is about 50% lower than extant data. At big-bang energies, the S factor is about three orders of magnitude smaller than that of the (d, p) channel. It was concluded that the (d,^{3}He) reaction rate has a less than 0.1% effect on the ^{6,7}Li abundances. The paper has been published in **Physics Letters B.**

Study of the transfer reaction ^{12}C(^{7}Be,^{3}He)^{16}O and the ANC of ^{16}O states

We carried out an experiment measuring the angular distributions for the ^{12}C(^{7}Be,^{3}He)^{16}O transfer reaction at 5 MeV/u leading to several excited states of ^{16}O. The angular distribution of the ground state of ^{16}O was measured for the first time. The corresponding Asymptotic Normalization Coefficients (ANC) of all the observed states were determined. The ANCs of 6.92 MeV (2^{+}) and 7.12 MeV (1^{-}) subthreshold states of ^{16}O from this work are useful for an indirect study of ^{12}C(α,γ)^{16}O reaction in the helium burning of stars. The paper is under review in **Physics Letters B.**

Breakup reactions from ^{7}Be + ^{12}C at 5 MeV/u

We carried out the first exclusive breakup measurement of ^{7}Be on ^{12}C at 5 MeV/u covering a wide angular range. Significant breakup events are observed in contrast to earlier works. The contributions of direct and sequential breakup are distinctly identified and direct breakup is found to be dominant over sequential breakup at this energy. Further work is in progress to obtain the angular distribution and comparison with CDCC calculations. This work is important in the context of structure and reaction dynamics of light stable/unstable nuclei.

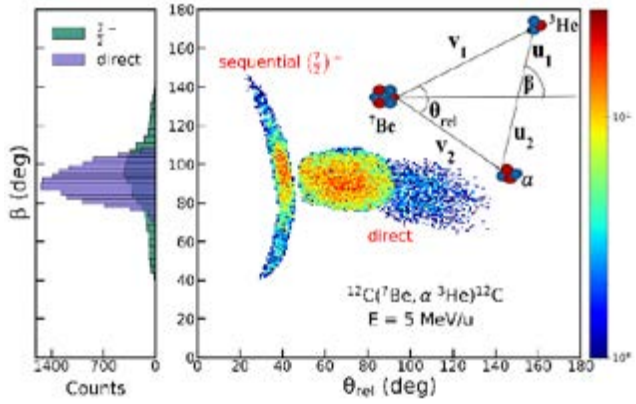


Figure 1: β-θrel correlation for the breakup of ^{7}Be along with β distribution. A distinct correlation is observed for sequential breakup in contrast to direct breakup. The inset is the schematic representation of β.

Future Plan:

1. Breakup reactions involving the radioactive nucleus ^{7}Be to study properties of light stable/unstable exotic nuclei.
2. Transfer reaction ^{6}Li(^{3}He,d)^{7}Be in the context of big-bang nucleosynthesis
3. Breakup and transfer reactions involving the one-proton halo nucleus ^{17}Ne.

DR. SUPRIYA DAS
Professor
Department of Physical Sciences

Group Members:

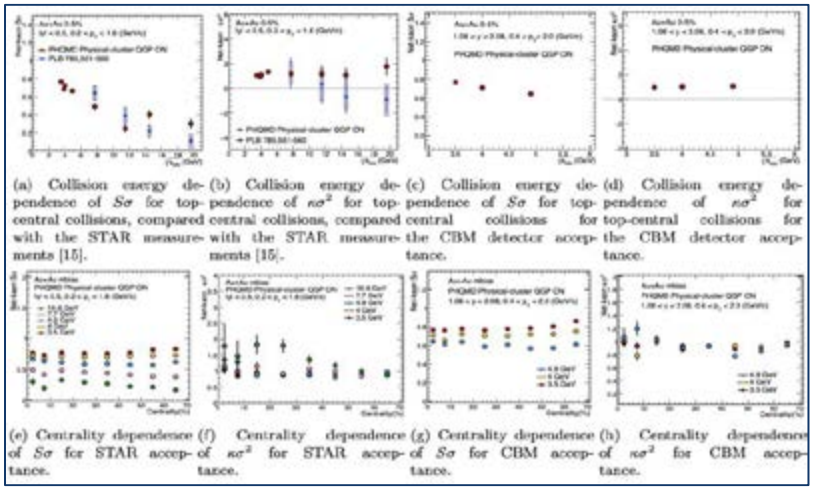
Bushra Parveen, JRF
Rudrapriya Das, SRF
Somen Gope, RA
Anjali Sharma, RA
Sanchari Thakur, RA

Summary of Research:

Net-proton and net-kaon fluctuations at FAIR energies using PHQMD model

In this study, we present the first measurements of the moments of net-proton (a proxy for net-baryon) as well as net-kaon distributions in Au+Au collisions at √sNN ranging from 3.5 to 19.6 GeV, using the PHQMD model within the Solenoidal Tracker at Relativistic Heavy Ion Collider (STAR) acceptance ($|y|<0.5$, $0.4< pT <2.0$, where y is the rapidity and pT is the transverse momentum) and CBM detector acceptances ($1.08< y <2.08$, $0.4< pT <2.0$). These results serve as baseline calculations of proton cumulants and correlation functions from the PHQMD model, contributing to the ongoing search for the QCD critical point in heavy-ion collisions. At low collision energies, the net-proton number is primarily dominated by protons, making it a sensitive observable in this regime.

The cumulant ratios of net-proton distributions from PHQMD simulations display a non-monotonic trend as a function of collision energy within the CBM energy range, albeit within the current statistical uncertainties. This analysis offers new insights into the behavior of net-proton fluctuations in the CBM energy domain and contributes to establishing a baseline for interpreting net-proton and net-baryon fluctuations. Such a baseline is essential for future high statistics measurements with the CBM experiment aimed at probing possible critical phenomena near the QCD critical end point.



(a) Collision energy dependence of $S\sigma$ for top-central collisions, compared with the STAR measurements [15]. (b) Collision energy dependence of $\kappa\sigma^2$ for top-central collisions, compared with the STAR measurements [15]. (c) Collision energy dependence of $S\sigma$ for top-central collisions for the CBM detector acceptance. (d) Collision energy dependence of $\kappa\sigma^2$ for top-central collisions for the CBM detector acceptance. (e) Centrality dependence of $S\sigma$ for STAR acceptance. (f) Centrality dependence of $\kappa\sigma^2$ for STAR acceptance. (g) Centrality dependence of $S\sigma$ for CBM acceptance. (h) Centrality dependence of $\kappa\sigma^2$ for CBM acceptance.

(Manuscripts for a proceedings and a full journal paper are under preparation.)

Collaborators: Rudrapriya Das, Anjali Sharma, Susanne Glaessel (external)

DR. ACHINTYA SINGHA
Professor
Department of Physical Sciences

Group Members:
Chumki Nayak, SRF
Suvadip Masanta, SRF
Himadri Sekhar Tripathi, SRF
Pritam Sinha, JRF
Subhajit Mahapatra, JRF
Prithwiraj Majhi, JRF
Tara Shankar Bhattacharya, Guest Researcher
Dr. Debasree Chowdhury, NPDF
Saikat Ray, Department of Chemistry
Scottish Church College, Kolkata (M.Sc. project)
Sudatta Chowdhury,
student of MSc Physics at IIT Hyderabad (summer trainee)
Sakshi Sheoran, MSc student of University of Delhi
New Delhi (Academies Summer Research Fellowship Program for 2024)
Shyam Sundar Mallik, Technical Assistant

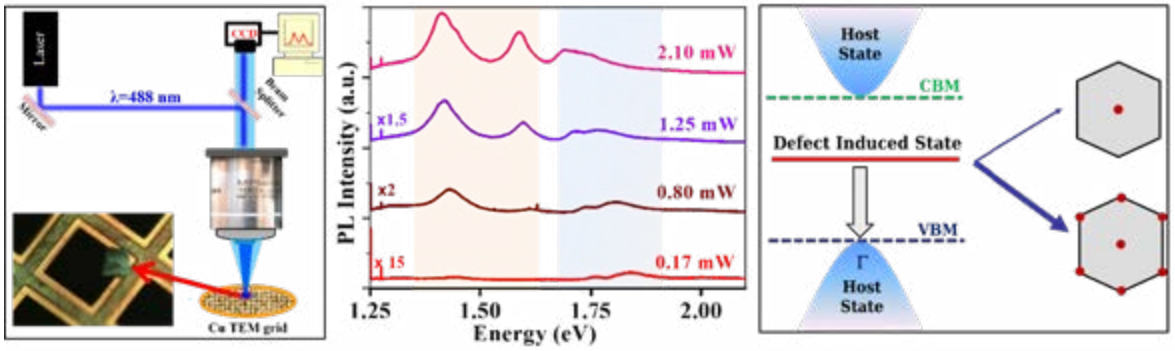
Summary of Research:

Over the past decade, quantum materials derived from transition metal dichalcogenides (TMDCs) and transition metal oxides (TMOs) have emerged as a vibrant frontier in materials science, thanks to their remarkable physical and chemical characteristics. These materials hold tremendous promise for a wide spectrum of advanced technological applications. Recent advances in crystal engineering have opened new doors to the discovery of exotic physical phenomena, driving innovation in next-generation quantum technologies. In our research, we delve into the strategic engineering of TMDCs and TMOs through alloying, doping, functionalization, and the creation of heterostructures. These techniques allow us to probe and manipulate fascinating effects such as light-matter interactions, spin-valley coupling, and exciton–plasmon hybridization. Beyond fundamental exploration, we also investigate the practical potential of these tailored materials in fields like optoelectronics and energy storage. Our work not only deepens the understanding of quantum material behavior but also paves the way for their integration into future technologies.

Highlight & Accomplishment:

- **Optical intensity-driven mid-gap transitions in few-layered MoS_2**

The utilization of semiconducting 2D materials in photonics or optoelectronics depends on having a tunable optical band gap, typically influenced by the material's layer count and modified interlayer interactions. Extensive research has been conducted on semiconducting transition metal dichalcogenides to explore their potential in light-matter applications through the manipulation of electronic states' interactions.



Notably, intrinsic defects in these 2D materials generate electronic states within the mid-gap regions, enhancing their versatility as promising candidates for potential optoelectronic applications. In our study, we realized the optical transitions from the mid-gap states in liquid-phase exfoliated MoS2 through varying light intensity. We note the emergence and reversible evolution of two additional photoluminescence emissions at lower energy, complementing the standard photoluminescence spectra of MoS2 at room temperature. Our density functional theory simulations indicate that these novel optical pathways stem from sulfur vacancy defect states in the mid-gap regions, and the intensity of the optical excitation can be used to tune the transitions. This finding presents an exciting opportunity for further investigation and control of mid-gap states, which could have potential applications in optical communication (Tara Shankar Bhattacharya et al., Physical Review B, 111, 115412 (2025)).

Future Plan:

To study the following:

- Light-matter interaction at low dimension
- Spin-valley physics and Interlayer exciton in 2D materials
- Understanding phonons and their couplings with various other quasiparticles in quantum materials
- Development of efficient broadband IR photodetectors
- Development of energy storage devices
- Development of SERS based biosensors.

DR. SOUMEN ROY
Professor
Department of Physical Sciences

Group Members:

Deep Nath, SRF
Swati Sharma, SRF
Ramnarayan Bera, SRF
Arijit Roy, JRF
Faruque Siddique, JRF
Soumyadip Ghosh, JRF

Summary of Research:

We have formulated an ab initio information-theoretic approach to study proteins and protein-ligand interactions. We introduce a de novo measure called protein residue information (PRI), which incorporates details of interactions between all pairs of atoms within and across all residues of the protein. By analyzing twenty-eight distinct pairs of protein structures from ten different classes, we observe that PRI identifies important residues displaying significant conformational changes.

Notable Achievement/Event:

- Interview on Doordarshan (DD Bangla) - Nobel prize in Physics, 2024 (Neural networks and Machine Learning), Broadcast Live on December 5, 2024.
- Interview on All India Radio (Akashvani) Kolkata -- Phage therapy, First broadcast on May 30, 2024.
- Acted as Judge, State science seminar, Birla Industrial and Technological Museum, Kolkata (Ministry of Culture, Govt. of India), September 20, 2024.
- Acted as Judge, Science and Engineering Fair, Birla Industrial and Technological Museum, Kolkata (Ministry of culture, Govt. of India), January 08, 2025.
- Chairman, Joint Entrance Screening Test (JEST) 2025: The premier all India examination, whose scores are used for admission to PhD and Integrated-PhD in Physics and Theoretical computer Science by most of the premier institutions in India.

DR. SIDHARTH KUMAR PRASAD
Associate Professor
Department of Physical Sciences

Group Members:

Mintu Haldar, SRF, UGC Fellow
Sanchari Thakur, RA, ALICE Project
Subhalaxmi Mishra, Summer Trainee
Suranjan Atta, Summer Trainee

Collaborations:

A Large Ion Collider Experiment (ALICE) at CERN, Geneva

Compressed Baryonic Matter (CBM) experiment at GSI, Germany

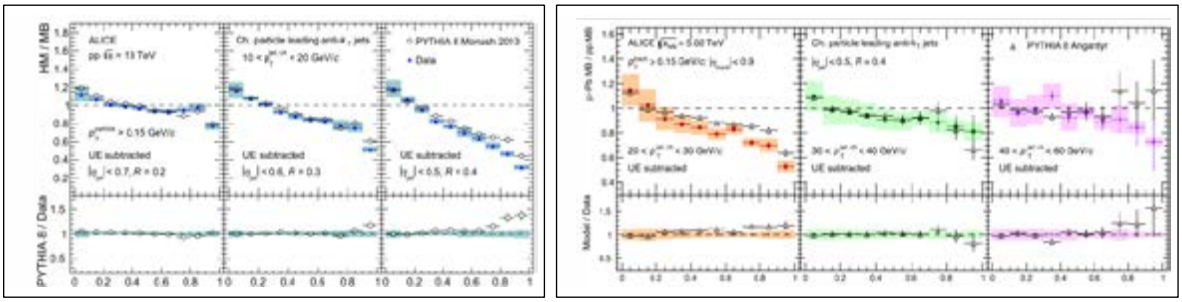
Summary of Research:

Broad Area of Research: Experimental High Energy Physics

Focus Area of Research:

Understanding the strong interaction and characterization of a novel state of matter with partonic degrees of freedom known as Quark Gluon Plasma (QGP) formed in relativistic heavy ion collisions and believed to have existed micro seconds after the big-bang.

- Study of jet production, jet properties and jet-medium interactions in hadronic and nuclear collisions using LHC data with the ALICE experiment.
- Study of global observables such as multiplicity and psuedorapidity distributions of the produced particles in proton- proton and proton-lead collisions with the ALICE experiment.
- Phenomenological study of jet production, jet-medium interactions and global observables using theoretical Monte Carlo models.
- Design and development of a water based cooling system for the Muon Chamber (MuCh) detector of the CBM experiment at FAIR, GSI.



Jet modification is observed in small systems (proton-Lead and High multiplicity proton-proton collisions), shifting the question towards how one can attribute the observed modification to different causes, e.g., multiparton interactions, jet bias from high multiplicity event selection or jet quenching in mini-QGP.

Notable Achievements/Event:

- Dr. Abhi Modak received prestigious INFN fellowship at University of Trieste, Italy and working for the ALICE experiment at CERN.
- Dr. Debjani Banerjee received a Postdoctoral Fellow position at University of Illinois Urbana-Champaign, USA and working for the ATLAS experiment at CERN.
- Dr. Prottoy Das secured a Postdoctoral Fellow position at University of Illinois, Chicago, USA and working for the CMS experiment at CERN.

DR. SAIKAT BISWAS
Associate Professor
Department of Physical Sciences

Group Members:

Subir Mandal, SRF, UGC
Somen Gope, Research Associate-I FAIR project
Anjali Sharma, Research Associate-I FAIR project
Sayan Dhani, IIT Bombay
Monika Aggarwal, Central University of Haryana
Ashwin Satheesan, Mahatma Gandhi University, Kerala
Meghamala Mallick, IISER Tirupati
Subrata Das.

Summary of Research:

Investigation of the stability in the performance of triple GEM detectors for High Energy Physics experiments.

(With S. Mandal, S. Chatterjee, A. Sen, S. Gope, S. Das, S. Dhani, A. C. Hegde, M. Chatterjee)

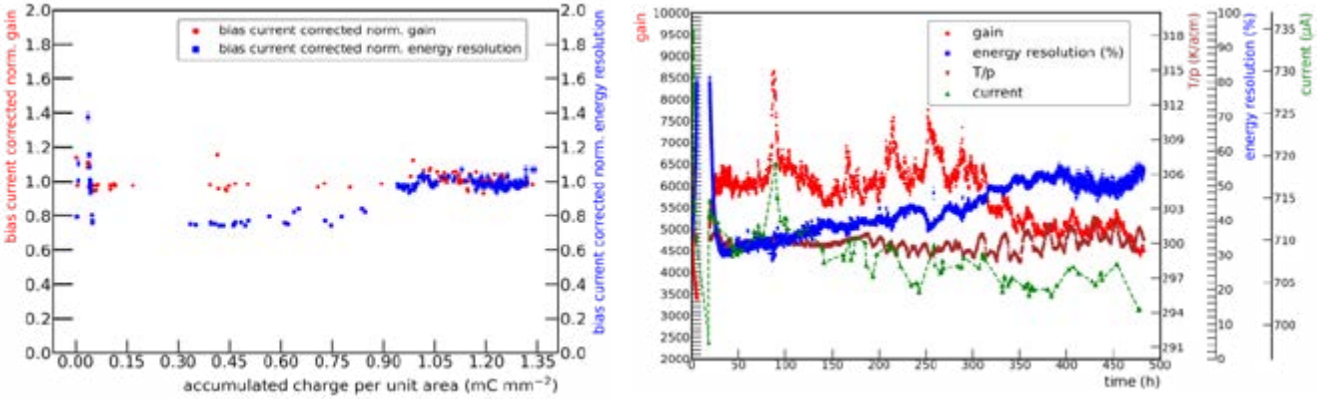
Gas Electron Multiplier (GEM) is one of the mostly used technologies in the High Energy Physics (HEP) experiments. GEMs are widely used as tracking devices due to their high-rate handling capability and good position resolution.

A comprehensive investigation is conducted on the study of stability of the gain and energy resolution of a SM triple-GEM detector under continuous high-rate 55Fe X-ray irradiation using NIM electronics and a mixture of Argon and CO2 in 70/30 volume ratio. In this continuous study it is observed that the T/p normalized gain decreases with time after initial charging up phase. The probable reason is that, although there is a sudden jump in the bias current observed at the starting, after sometimes the bias current started decreasing gradually. As a result, the ΔV across the GEM foils decrease which in turn reduce the gain of the detector.

In addition to that several behavioral changes are also observed in the chamber. After a continuous operation of the chamber if there is a gap in operation and when the HV is ramped up then shape of some initial spectra are not normal. It has been observed that the time taken for the spectra to come to its normal shape can take up to 10–12 h. This particular chamber is under several long-term test since 2015. Several interesting results have been achieved from this particular chamber. During the

charging-up studies good spectrum having main and escape peaks are obtained immediately after application of high voltage. However, since last year the bias current is decreasing with time which might be due to the ageing in the resistors of divider chain. The bias current is established by the applied constant voltage on the resistor chain. The current is not stable as the resistor chain values change over time and the bias current is continuously decreasing and not only fluctuating. That means the value of the parallel divider resistance is increasing over time. It is to be mentioned here that, for a typical bias current of 707.5 µA the generated heat for 1 MΩ and 560 kΩ resistors are calculated to be about 30 Joule and 17 Joule respectively in 1 min. There is a possibility that, this generated heat can cause increase in the resistor temperature (while in operation) which can in turn increase the value of the resistance. It is also to be mentioned here that, the GEM foils were inspected without resistor chain before building the chamber and no short circuit or unusually high leakage current was observed in the foil.

The take home message from this article is that, even though the chamber did not show any signs of classical ageing due to polymerization after long-term irradiation, it now seems to experience HV instabilities such that, immediately after applying HV the detector is not working properly, it is taking some time for conditioning, even the desired HV cannot be applied directly without spark etc. after a few years of operation. It is also observed that the decrease in the normalized gain is directly proportional to the decrease in the bias current. The detailed investigation is ongoing.



Left: Variation of the measured gain, energy resolution, divider current and T/p as a function of the time. Right: Bias current corrected normalized gain and normalized energy resolution as a function of accumulated charge per unit area

Performance study of a bakelite RPC prototype built by new technique of linseed oil coating.

(With A. Sen, S. Mandal, S. Chatterjee, S. Gope, S. Das)

Resistive Plate Chamber (RPC) is one of the most commonly used detectors in high energy physics experiments for triggering and tracking because of its good efficiency (> 90%) and time resolution (~ 1–2 ns). Generally, bakelite which is one of the most commonly used materials as electrode plates in RPC, sometimes suffers from surface roughness issues. If the surface is not smooth, the probability of micro discharges and spurious pulses increase, which leads to the deterioration in the performance of the detector. We have developed a new method of linseed oil coating for the bakelite based detectors to avoid the surface roughness issue.

A RPC prototype made of linseed oil coated indigenous bakelite material of thickness 2 mm and having bulk resistivity ~ 3 × 1010 Ω cm is tested. The electrode material used here is bakelite high pressure paper laminates commercially available in the market.

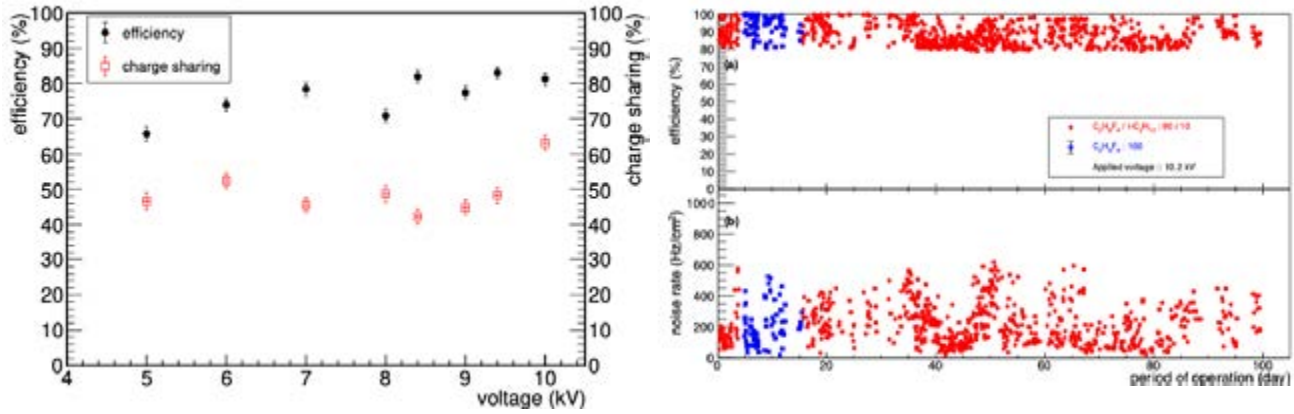
The detector is tested initially with 100% C2H2F4 gas. With the applied voltage of 10.6 kV, the time resolution obtained is ~ 1.03 ± 0.03 ns. The time resolution of the module is also comparable with that of the conventional linseed oil-coated bakelite RPC.

Variation of charge sharing between the consecutive strips is measured with the applied voltage. From 5 to 9 kV the shared charge fluctuates between 40-50% after that it increases to ~ 60%. With the increasing voltage shared charge has not increased further and remained constant with a slight fluctuation.

The preliminary stability test of the chamber is performed using C2H2F4 and i-C4H10 mixture and 100% C2H2F4 for about 100 days. The overall efficiency for the entire period is found to be ~ 90%. This radiation tolerance test is very important for an experiment, especially for high-energy

physics experiments where detectors are subjected to continuous operation at high rate environment for a long time. For the present prototype a very good efficiency is obtained where it is operated in the presence of a high-intensity photon source. It is also observed that the efficiency decreased by only 1% from the efficiency value without the source with a gamma ray flux of 46 kHz/cm2.

However, the operation mode of RPCs with pure Tetrafluoroethane (R134a) or with a binary mixture of 90% Tetrafluoroethane and 10% iso-butane is not the pure avalanche mode, as it was found in several crucial tests which were carried out between 1994 and 1998, both at the INFN laboratory in Rome and at CERN. At high voltage, the RPC signals in most events show an avalanche precursor followed by a much bigger streamer after pulse. This urged researchers to find a way to suppress the streamer afterpulse, and the solution was found by adding a very small fraction of Sulphur Hexafluoride (SF6 ~ 0.3%), allowing 2-mm RPCs to operate in saturated avalanche mode with no streamer after pulses. The chamber will be tested adding small fraction of SF6 in future.



Left: Variation of efficiency and shared charge between two consecutive strips with the voltage. Right: Efficiency and noise rate of the detector as a function of period of operation for two different gas compositions at applied voltage of 10.2 kV.

Existence of dynamical fluctuation in AMPT generated data for Au+Au collisions at 10 AGeV.

(Work done by Somen Gope)

In this study, the intermittency behavior of emitted particles produced in heavy ion collisions has been studied using both modes (default & string melting) of A Multi Phase Transport (AMPT) model-generated data. We adopted one of the most conventional and successful techniques, the Scaled Factorial Moment (SFM) method, using Monte Carlo (MC) data for 10 AGeV

Au+Au collisions in search of intermittency in the model-generated data. Our interest is to search for intermittency behavior of particles that leads to multiplicity fluctuations and that would reveal a phase transition from hadronic matter to QGP. In this article, the intermittency values for both modes of AMPT data are presented. The results obtain some insight into the dynamics of heavy ion collisions and the formation of QGP.

The AMPT (default) focuses mainly on hadronic interactions with a limited partonic phase, while the AMPT (SM) assumes a full partonic phase and is better suited for heavy ion collisions where a quark-gluon plasma is expected to form. Also, string melting mode of AMPT might be suitable for strongly interacting matter under extreme dense conditions in HIC.

In this article, the SFM is analyzed for AMPT-generated data at 10 AGeV Au+Au collisions. The study has been done in two-dimensional (Px – Py) space. It is found that the AMPT-generated data with both modes shows some noticeable signature of intermittency. Thus, the multiparticle correlations that could be observed in AMPT data for charged particles produced in HIC.

From the present investigation, it has been observed that the intermittency indices for q =5 and 6 are significantly higher in the AMPT (String Melting) generated data compared to the AMPT (Default) data. This pronounced increase in intermittency indices suggests that the string melting mode, with its more extensive partonic interactions and richer dynamics, leads to stronger and more complex dynamical fluctuations. These findings highlight the string melting mode's heightened sensitivity to the underlying physics, potentially offering deeper insights into the behavior of the quark gluon plasma and related critical phenomena.

DR. SANAT KUMAR DAS
Associate Professor
Department of Physical Sciences

Group Members:

Shahina Raushan Saikh, SRF
Md Abu Mushtaque, SRF
Antara Pramanick, SRF
Riya Adhikary, JRF
Bipasha Barua, Summer Trainees
Sukanya Shit, Summer Trainees
Subrata Das.

Summary of Research:

The curiosity and requirement for accurate weather prediction are steadily increasing. The key challenges are in precise measurements of atmospheric compositions, which introduces significant error into the prediction due to uncontrolled and continuously changing in nature of air pollutants both in amount and type. The primary objective of our research is to understand the role of airborne living and non-living particles (aerosols) in climate change processes, their interference with cloud formation, and their contribution to deteriorating air quality that have direct effects on human health from ground-based and space-borne observations. In recent years, we have expanded our efforts to explore various places on the globe including polluted urban to hilltop Himalayas to pristine polar regions to understand how different atmospheric conditions influence the diversity and behaviour of airborne microorganisms (bioaerosols). Our research focuses to deepen our understanding of the role of bioaerosols in environmental and public health dynamics from our basic knowledge on fundamental laws of nature.

Aim and Objectives:

Presently we are working on the following topics:

1. Himalayan Climate Change and its impact on human health
2. Interaction between Atmospheric non-living and living particles
3. Role of airborne microbes on cloud microphysical process
4. Transport of airborne pathogenic bacteria on polar bacterial diversity

Focused Area of Research: Atmospheric Sciences

Highlights of Research:

I. Urban atmosphere enriched with diverse bacteria communities loaded with pathogens in India

Composition, diversity, and variability in urban airborne bacterial communities over high-population region (HPR) and low-population region (LPR) within highly polluted metropolitan city, New Delhi, India, are presented in this study. Samples collected in haze (HZ), rain (RN), and seasonal transition (ST) conditions in winter are compared with typical winter (TW) condition. Abundance of airborne bacterial loading has strong positive correlation with temperature, visibility, PM2.5, and AQI; and negative correlation with relative humidity and wind speed. Maximum bacterial diversity is observed in HZ, followed by ST, TW, and RN. Beta diversities exhibit distinct diversities in HZ, RN, and ST compared to TW. Pathogenic bacteria are significantly enhanced in RN and ST conditions at both urban sites due to availability of moisture and favourable temperature for bacterial proliferation. Pathogens like Acinetobacter lwoffii and Clostridium sordellii, responsible for respiratory diseases and skin infections, are abundant in RN and ST, indicating an alarming situation for human health over New Delhi.

II. Source-Specific Multi-Pathway Human Health Risk Assessment of Metals Present in Clouds over Indian Subcontinent

Metal in cloud is a matter of growing concern due to adverse impact on human health in on a wider scale though continental long-range transport. Present study identifies the toxic metals present in non-precipitating clouds during on-set of monsoon over Western Ghat and Eastern Himalayas over Indian subcontinent, and quantifies their health risk factors of carcinogenic and non-carcinogenic diseases through inhalation, ingestion, and dermal absorption. Clouds over Eastern Himalayas are found to be have 1.5 times higher pollution levels due to an increase in 40-60% higher loading of toxic metals like Cd, Cu, and Zn emitted from heavy traffic and industrial emissions that causes high health risk factors for carcinogenic diseases. Children are at higher risk of 30% of such toxic metals than that of adults in India. However, clouds over Western Ghats carrying heavy metals like Ca, and Al coming from floating atmospheric dust particles over Arabian Sea, have relatively lower health risk factors. Inhalation of polluted clouds over Eastern Himalayas containing high concentrations of toxic metals is the most potential route for non-carcinogenic diseases. Health risk for the occurrence of carcinogenic diseases has increased due to inhalation of dissolved Cr present into clouds. Present study highlights that Eastern Himalayas experiences higher polluted clouds which contains toxic metals like Cd, Cr, Cu, and Zn coming from vehicular and industrial emissions over foothill regions, and inhalation of such polluted clouds is the potential cause of carcinogenic and non-carcinogenic diseases in India.

III. Inter-annual variability in sources and characteristics of carbonaceous aerosols using dual-carbon isotopes over a megacity in eastern India

Present study investigates the inter-annual variability of carbonaceous aerosols (CA) over Kolkata, a megacity in eastern India, using dual carbon isotopes (^{14}C and ^{13}C) and the optical properties of brown carbon (BrC). Sampling was conducted during the post-monsoon, winter, and spring seasons over two consecutive years (2020–21 and 2021–22) over Kolkata. The analysis reveals that PM2.5 levels and carbonaceous components were higher in 2020–21 compared to 2021–22, attributable to higher precipitation in the latter year. The contribution of biomass burning and biogenic sources to CA (fbio_TC) showed a clear decreasing trend from post-monsoon to spring during both the years. A lower WSOC/OC ratio and AMS-derived f44 values indicate that surface CA over Kolkata are primarily from local sources rather than being transported. Optical analyses show that BrC from

methanol-soluble fraction exhibited three times higher radiative forcing compared to water-soluble fraction, highlighting the importance of total BrC in influencing regional radiative forcing. The findings emphasize the dominance of local sources over transported contributions to Kolkata's air pollution and underscore the need for targeted emission control strategies.

Innovation content of the work done:

Several innovations have taken place in the last year, 2024, as given below.

1. Improvement of atmospheric research work at Bose Institute
2. New research concept on identification of local and long-range transported aerosols and living airborne microorganisms
3. One on-going Extramural Project sponsored by SERB and one recently accepted extramural project sponsored by DST. Two extramural projects during polar winter and summer expeditions sponsored by MoES.
4. Interdisciplinary approach in atmospheric sciences and environmental microbiology.

Significant Research activities in the last year:

1. The outcome of Artic sampling and strategic S&T planning on collection of samples in ambient harsh polar dark nights is successfully conducted and brought to our lab at Bose Institute
2. A proposal for Arctic summer expedition has been accepted and following winter-time sampling, strategic S&T planning on collection of samples on ambient harsh polar day-time with proper precaution from polar bear attacks and brought preserved samples to our lab at Bose Institute
3. Proper strategic S&T planning for on-board sampling at Sundarban within the wild research forest and brought samples to our lab at Bose Institute

DR. PRAMOD KUMAR SHUKLA
Assistant Professor
Department of Physical Sciences

Group Members:

Collaborators:
Prof. George K. Leontaris (Ioannina University, Greece)
Dr. Shehu AbdusSalam (Shahid Beheshti University, Iran)
Dr. Xin Gao (Sichuan University, China)
Dr David Prieto (Postdoc, ITP, Utrecht University, Netherlands)
Dr Jaon Quirant (Postdoc, Ben-Gurion University of the Negev, Israel)
Dr. Dibya Chakraborty (Postdoc, IIT, Madras, India)

Long-term-visitors/Master-students at Bose Institute
Manas Kumar Sinha
Swagata Bera
Sayan Biswas.

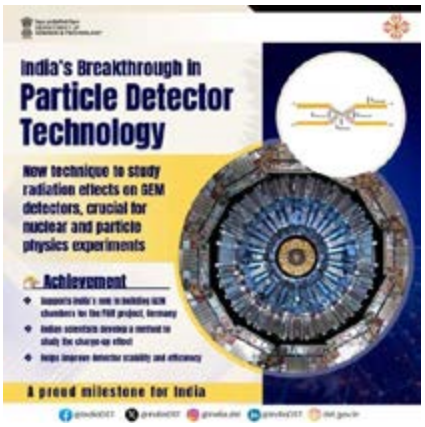
Summary of Research:

We worked on model building in area of string cosmology. The main improvements towards the existing challenges in the state-of-the-art, which we presented in 5 research publications (and an invited review), can be counted along the following lines:

(i). We proposed a resolution to the inflaton field range problem in Fibre inflation (which remains among the most attractive string inflationary models) by providing a perturbative large volume embedding of the models in a new Calabi Yau threefold which has a toroidal-like volume form for which Kaehler cone conditions are milder. In addition, we have presented the global embedding of the volume-modulus-inflation, also known as inflation point inflation in perturbative large volume scenarios.

(ii). For non-geometric effective type II supergravity models, the size of scalar potential is usually huge with thousands of terms which make is impossible to perform any minimization using analytic approach. For this, we have proposed a new formulation in which the scalar potential can rather be expressed in a very compact form. Using this formulation we have analytically classified a huge the No-Go results regarding the de-Sitter realization in type II non-geometric models with a subset of T/S-dual fluxes turned-on.

While working on all these projects we have worked on, have involved some significant numerical/analytical study related to model building, at least two projects have involved the need of analysing a huge dataset. One is related to finding/classifying the Calabi Yau geometries and other one is related to finding the class of flux vacua.



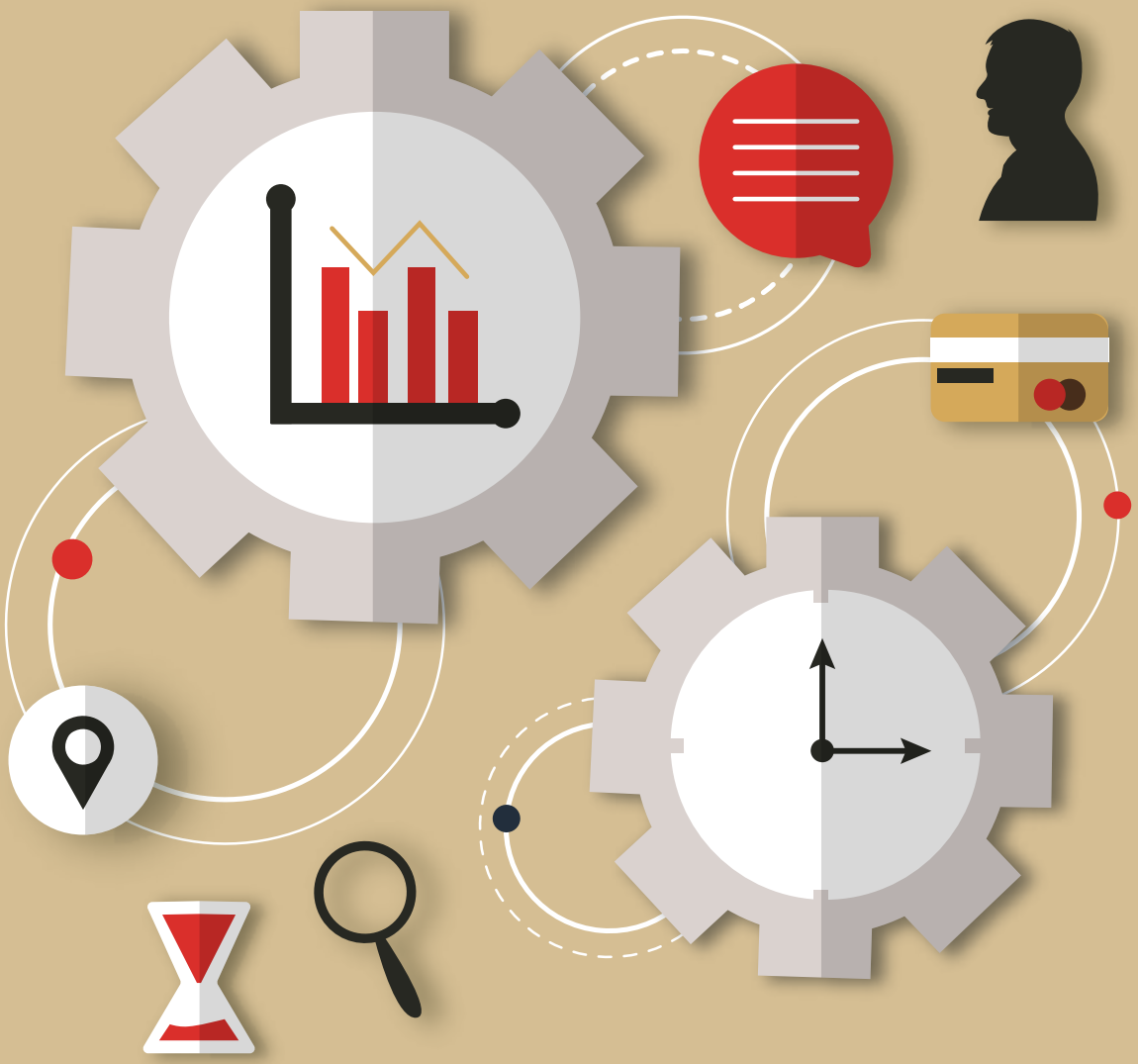
Happy to share the work of Dr. Saikat Biswas, Department of Physical Sciences, Bose Institute.

ALICE Run Manager (27 May - 9 June 2024): Sanchari Thakur

Sanchari is a post-doc at the Bose Institute, Kolkata, India. She is mostly active in physics data analysis. In particular, during her PhD at the Variable Energy Cyclotron Centre (VECC, Homi Bhabha National Institute), she investigated two-particle correlations in PbPb collisions. She has studied the nearside jet-like yield with pion and proton-triggered correlation in the intermediate pT range to see the effect of the quark coalescence and radial flow in the particle ratio in heavy ion physics. In Run 2 she was already involved in operations at Point 2 by taking PMD on-call and DQM shifts. This year she has taken central shifts for all the roles (QC, DCS, ECS, and Shift Leader) over the past three months, and she is now fully trained and qualified to start her first Run Manager mandate.

During her mandate, Sanchari will supervise the production of proton-proton physics at 500 kHz, focusing on efficient data taking and the best possible data quality. The second week will be partly devoted to the second LHC machine development period when we will have the opportunity to focus on software deployment and dedicated system tests.

Bose Institute observed **140th Birthday of Prof. Debendra Mohan Bose** on 26 November 2024. **Prof. Sanghamitra Bandyopadhyay**, Director, Indian Statistical Institute, Kolkata graced the occasion as Guest of Honour and delivered the **D. M. Bose Memorial Lecture 2024** on the topic **"Artificial Intelligence and Life Sciences: A Synergistic Relationship". Prof. Indrani Bose,** Former Professor & Chairman, Department of Physics, Bose Institute, Kolkata, presided over the programme.



SERVICE DEPARTMENTS/ SECTIONS

CENTRE FOR ASTROPARTICLE PHYSICS & SPACE SCIENCE, MAYAPURI, DARJEELING

A national facility for the observational studies on Cosmic Ray and atmospheric phenomena has been developed at Darjeeling campus of Bose Institute under the IRHPA scheme of Department of Science & Technology, Govt. of India. The main objectives of this center are to understand the interaction characteristics of Cosmic Ray at low and high energy, search for exotic phenomena in Cosmic Rays, studies of the changing Airspace Environment in Eastern Himalayas in the context of regional climate change along with the studies to understand the connection between the cosmic Ray and Cloud. In order to fulfil these objectives observational facilities for monitoring the various aspects of Cosmic Ray and atmospheric phenomena have been created at Darjeeling.

CENTRAL INSTRUMENT FACILITY (CIF)

In the pursuit of excellence in scientific research and technological innovation, access to advanced analytical tools and sophisticated instrumentation has become a cornerstone of modern investigation. The Central Instrument Facility (CIF) stands as a testament to this need — a hub where precision meets possibility, and where researchers from diverse disciplines converge to explore, measure, and discover. Established with the vision of supporting interdisciplinary research and fostering collaboration, the CIF provides state-of-the-art instrumentation and technical expertise to students, scholars, and industry professionals alike. More than just a collection of machines, the CIF represents a commitment to quality, accessibility, and scientific rigor. External users are most welcome to reserve any available equipment through iSTEM with a nominal user charge.

FACILITIES:

HPLC

FUNCTION: -HPLC separates, identifies, and quantifies components of complex mixtures using a liquid mobile phase and stationary phase. It is widely applied in pharmaceuticals, food, environmental, and biochemical analysis for high accuracy.

MODEL NO: SPO-M20A

YEAR OF INSTALLATION- 2021

FPLC

FUNCTION: FPLC purifies proteins, nucleic acids, and biomolecules using liquid chromatography under controlled flow and pressure. It enables high-resolution separation based on size, charge, or affinity, supporting structural, biochemical, and pharmaceutical research.

MODEL NO : AKTA PURE M

YEAR OF INSTALLATION: 2017

MALDI-TOF/TOF

FUNCTION: MALDI-TOF/TOF enables soft ionization of biomolecules, rapid mass analysis, and tandem fragmentation . It is widely applied in proteomics, metabolomics, microbial identification, and post-translational modification studies..
MODEL NO :-Autoflex Speed

YEAR OF INSTALLATION- 2017

LC-ESI MS/MS

FUNCTION: Complex proteomics & metabolomics, qualitative & quantitative analysis of small metabolites, peptide mass fingerprinting, post translational modification

MODEL NO Xevo-G2-XS-QTof

YEAR OF INSTALLATION- 2019

CD-Spectrophotometer

FUNCTION: A CD-Spectrophotometer measures differential absorption of left- and right-circularly polarized light, providing insights into biomolecular secondary structures, conformational changes, folding/unfolding processes, and ligand interactions, widely used in protein, nucleic acid, and drug research.

MODEL NO: J-1500

YEAR OF INSTALLATION: 2025

X- Ray Diffractometer

FUNCTION: X-Ray Diffraction (XRD) determines crystal structure, phase identification, lattice parameters, and crystallinity. It reveals atomic arrangements, defects, and material composition, supporting research in chemistry, physics, geology, materials science, and pharmaceuticals.

INSTRUMENT: X- Ray Diffractometer

MODEL NO: FRX

NMR 700 MHz

FUNCTION: NMR 700 MHz provides high-resolution structural determination of biomolecules, studying molecular dynamics, ligand binding, and interactions. Operating at 700 MHz, it delivers detailed atomic-level insights essential for chemistry, biology, drug discovery, and material sciences.
MODEL NO: Avance III HD 700

YEAR OF INSTALLATION: 2015

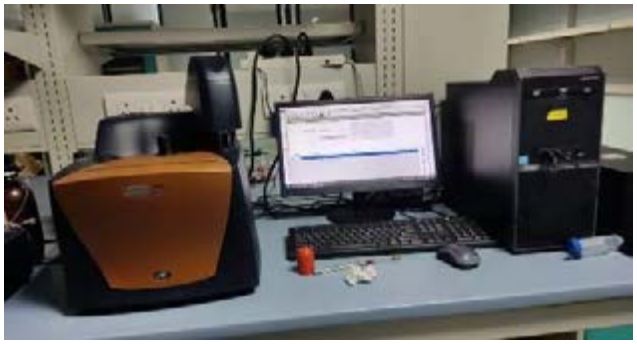
NMR500 MHz

FUNCTION: NMR 500 enables high-resolution structural analysis of biomolecules, molecular interactions, and dynamics. Operating at 500 MHz, it supports studies in chemistry, biology, and drug design by providing detailed atomic-level information and binding insights.

MODEL NO: Avance III 500

YEAR OF INSTALLATION: 1997

ISO-THERMAL TITRATION CALORIMETER



FUNCTION: Isothermal Titration Calorimetry (ITC) measures heat changes during molecular interactions, providing thermodynamic parameters like binding affinity, enthalpy, entropy, and stoichiometry. It is essential for studying biomolecular binding, enzyme kinetics, and drug discovery.
MODEL NO: AITC

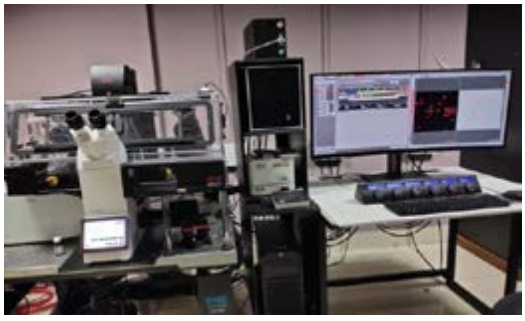
YEAR OF INSTALLATION: 2018

PEPTIDE SYNTHESIZER

FUNCTION: A Peptide Synthesizer automates solid-phase peptide synthesis, enabling stepwise assembly of amino acids into precise sequences. It ensures efficiency in biochemistry, drug discovery, diagnostics, and therapeutic peptide development.
MODEL NO: Initiator +Alstra

YEAR OF INSTALLATION: 2025

CONFOCAL MICROSCOPE



FUNCTION: A Confocal Microscope provides high-resolution, three-dimensional imaging of live or fixed cells and tissues using lasers and fluorophores. It enables optical sectioning, reduces background noise, and supports cell biology, pathology, and biomedical research.
MODEL NO: STELLARIS 5

YEAR OF INSTALLATION: 2021

Flow Cytometer

FUNCTION: A Flow Cytometer analyzes physical and chemical characteristics of cells or particles in suspension, enabling cell counting, size measurement, phenotype identification, and protein expression analysis, widely applied in immunology, oncology, and biomedical research.

MODEL NO: BD FACS Verse

YEAR OF INSTALLATION: 2012

PHOSPHORIMAGER

FUNCTION: A Phosphorimager detects and quantifies radioisotopes, fluorescence, and chemiluminescence signals in gels, blots, or membranes. It enables sensitive, high-resolution analysis of proteins, nucleic acids, and molecular interactions in biological and biomedical research.

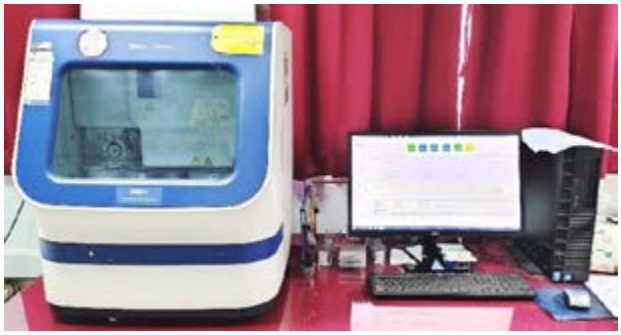
MODEL NO: TYPHOON RGB
YEAR OF INSTALLATION: 2018

DNA Sequencer

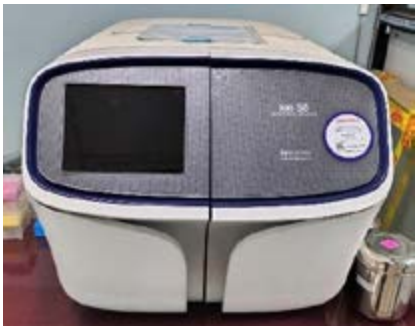
FUNCTION: A DNA Sequencer determines nucleotide sequences of DNA using methods like Sanger or next-generation sequencing. It supports genetic research, mutation detection, diagnostics, evolutionary studies, and personalized medicine by providing accurate genomic information.

MODEL NO:3530 XL & 3130 XL

YEAR OF INSTALLATION: 2013



NEXT GEN SEQUENCER



FUNCTION: Next Generation Sequencing (NGS) rapidly sequences millions of DNA or RNA fragments simultaneously, providing comprehensive genomic, transcriptomic, and epigenetic insights. It revolutionizes genetics, diagnostics, evolutionary biology, cancer research, and personalized medicine.

MODEL NO: IONS5

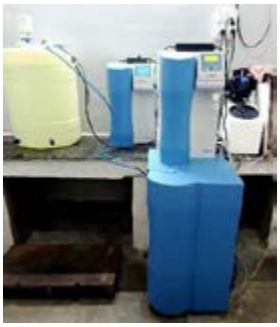
YEAR OF INSTALLATION: 2017

LAB WATER PURIFICATION SYSTEM

FUNCTION: A Lab Water Purification System converts tap or pretreated water into ultrapure water by removing ions, organics, particulates, and microorganisms. It ensures reliable, contamination-free water for molecular biology, analytical chemistry, and laboratory applications.

MODEL NO: GENPURE/LABTOWER

YEAR OF INSTALLATION: 2021



LIST OF INSTRUMENTS

SL	INSTRUMENT(COMPANY)	Model No
1	LC-ESI-MS/MS (WATERS)	Xevo-G2-Xs-Qtof
2	MALDI MS/MS (BRUKER)	Autoflex Speed Tof/Tof
3	DNA SEQUENCER MODEL (THERMO FISHER)	3530XL
4	DNA SEQUENCER MODEL (THERMO FISHER)	3130XL
5	RT-PCR (INVITROGEN)	7500 FAST
6	NGS (INVITROGEN)	ION S5
7	GEL DOC / CHEM DOC (BIO RAD)	XR+
8	FACS (BECTON DICKINSON)	VERSE
9	CONFOCAL MICROSCOPE (LEICA)	STELLARIS 5
10	CONFOCAL MICROSCOPE (LEICA)	TCS SP8
11	PHOSPHORIMAGER (CYTIVA)	TYPHOON RGB
12	FPLC (CYTIVA)	AKTA PURE M
13	FPLC (CYTIVA)	AKTA PURE
14	HPLC (SHIMADZU)	SPA-M20A-PDA
15	HPLC (SHIMADZU)	SPA-M20A-UV
16	PREPARATIVE HPLC (WATERS)	1525EF
17	CD SPECTRA (JASCO)	J-1500
18	UV-VIS SPECTROPHOTOMETER (AGILENT)	CARY 6860A
19	FLUORESCENCE SPECTROPHOTOMETER (HORIBA)	NANO LOG UV-VIS
20	FLUORESCENCE SPECTROPHOTOMETER (HITACHI)	F-7000
21	NMR 500 (BRUKER)	Avance III 500
22	NMR 700 (BRUKER)	Avance III HD 700
23	PEPTIDE SYNTHESIZER (BIOTAGE)	INITIATOR + ALSTRA
24	XRD SPECTRA (RIGAKU)	FRX
25	ITC (TA by waters)	AITC
26	PREAPARATIVE HPLC(WATERS)	
27	FLUX ANALYZER (SEA HORSE)	XFP
28	PLATE CENTRIFUGE(THERMO SCIENTIFIC)	SORVAL ST8
29	CENTRIFUGE (HERMLE)	
30	HEAT BLOCK (BENCHMARK SCIENTIFIC)	BSH50001-E
31	WEIGHING MACHINE (BR BIOCHEM)	
32	PCR(VERITI)	96 WELL THERMOCYCLER
33	VORTEX	REMI
34	SPIN CENTRIFUGE (ALLIED SCIENTIFIC)	SPROUT
35	TABLE TOP CENTRIFUGE (HERMLE)	HERMLE
36	WATER BATH SONICATOR	UC-05
37	PROBE SONICATOR	SARTORIUS

RATE LIST FOR EXTERNAL USERS

EQIPMENT		RATE FOR ACADEMIC INSTITUTE (Rs)	RATE FOR INDUSTRIES (Rs)
MALDI TOF /TOF (BRUKER)		MS 1000/ SAMPLE	MS 2000/ SAMPLE
		MS MS 2000/ SAMPLE	MS MS 2000/ SAMPLE
LC –ESI-MS/MS (WATERS)		ESI MS DIRECT INFUSION 1500/SAMPLE	ESI MS DIRECT INFUSION 3000/SAMPLE
		LC ESI MS/MS THROUGH COLUMN 4000/ SAMPLE	LC ESI MS/MS THROUGH COLUMN 8000/ SAMPLE
DNA SEQUENCER MODEL 3500 XL & 3130 XL (INVITROGEN)		600/ SAMPLE 200/SAMPLE (RR MIX NOT PROVIDED)	600/sample 200/SAMPLE (RR MIX NOT PROVIDED
NGS ION S5 (THERMO FISCHER)		NO REAGENTS ONLY RUN ION 520 CHIP: RS 4000	NO REAGENTS ONLY RUN ION 520 CHIP: RS 6000
		ION 530 CHIP: RS 6000	ION 530 CHIP: RS 8000
		ION 540CHIP: RS 8000	ION 540CHIP: RS 10000
FACS VERSE (BD)		3000/HR	5000/HR
Fluorescence spectrophotometer (HITACHI)		250/HR	500/HR
Gel doc XR + Versa (BIO RAD)		100/GEL	200/GEL
HPLC (SHIMADZU)		500/SAMPLE	1000/SAMPLE
FPLC(GE)		1000/DAY	2000/DAY
NMR (500 MHZ) (Bruker)	1H WITHOUT WATER SUPRESSION	500/ SAMPLE	1000/ SAMPLE
	1H WITH WATER SUPRESSION	1000/SAMPLE	2000/SAMPLE
	13C/DEPT/OTHER NUCLEI PER HOUR	600/Hr	1200/Hr
	ALL 2D EXPERIMENTS /HR	600/Hr	1200/Hr
NMR (700 MHZ) (Bruker)	1H	1000/-	2000/-
	13C/DEPT/OTHER NUCLEI PER HR	1200/-	2400/-
	ALL 2D EXPERIMENTS/HR	1200/-	2400/-
	ALL 3D EXPERIMENTS /HR	1500/-	3000/-
CD Spectra (Jasco)		1000/- HR	2000/- HR
Confocal Microscope (Leica)		2500/ sample	4000/sample
AAS		Standard (each metal) 300/- Sample (each)100/-	Standard (each metal) 600/- Sample (each)200/-
Peptide Synthesizer		0.05 mmol scale :Rs 2500 (minimum residues). Rs 500 per residue upto 15 residues). Rs 700/ per residue (beyond first 15 residues). Plus Rs 750 (for resin). HPLC purification will cost more	
XRD (RIGAKU)		RS 5000/DAY & Rs. 10000/DAY with Liquid Nitrogen	10000/DAY & Rs.20000/DAY with Liquid Nitrogen
ITC (TA)		2000/ per hour	2000/ per hour
Raman Spectra		500/ per sample for half hour	1000/ per sample for half hour
Phosphorimager (Cytiva)		300/RUN	300/RUN
Spectrophotometer (Agilent Technologies)		100/Hour	200/hour
DLS		Rs 200/hr	Rs 400/Hr
Seahorse Real time Cell Metabolic Analysis 8 Channel(Agilent Technologies		RS 1000/RUN No consumables	RS 2000/RUN No consumables
RT-PCR		600/plate	1200/plate
SPR (Surface Plasmon Resonance)		Rs. 2000.00 per sample (User should bring Compatible chip)	Rs. 4000.00 per sample (User should bring Compatible chip)

TRAINING AND OUTREACH PROGRAMMES

TRAINING AND OUTREACH PROGRAMMES

CENTRE FOR TRANSLATIONAL ANIMAL RESEARCH, MADHYAMGRAM

(CENTRAL ANIMAL HOUSE & RESEARCH FACILITY)

CPCSEA, Ministry of Environment, Forests & Climate Change, Govt. of India Registration Number: 1796/GO/EReBiBt/S/14/CPCSEA (Education, Research for Educational purpose, breeding in-house and breeding for trading of small animals)

CTAR was inaugurated by Honorable Union Minister, Ministry of Science & Technology & Earth Sciences, Govt. of India, Dr. Harsh Vhardhan on 2nd May, 2015 with sole objective of translating laboratory science in experimental small laboratory animals, for eg. from demonstrating simple biological phenomena in animal system, through studying and identifying functions of unknown genes or gene products targeting a particular disease in a feasible disease model, to identify and characterize bio-active products from natural sources, including but not limited to plant products, or chemicals obtained from synthetic chemical reactions in targeted models u sing experimental animals.



This is a state of the art translational animal research centre (CTAR) with environmentally controlled "Centralized Animal House" along with all facilities for breeding, maintenance, experimentation on small laboratory animals. This Animal facility is utilized for experimental research in accordance with the principles of good laboratory practices and CPCSEA (Committee for the Purpose of Control and Supervision of Experiments in Animals), Ministry of Environment, Forest & Climate Change, Government of India guidelines. Further, it envisions facilitation of research and development activities in partnership with academic Institutions, Industries and funding agencies for drug discovery-cum-validation for translational medical research with the sole objective of advancement of biological knowledge which is useful for improving the quality of life and /or alleviating the suffering of human being, animals and plants. The Centre is also involved in skilled manpower development through education and training in laboratory animal care and experimental techniques. The CTAR also provides services and resources for investigators to accomplish animal related Bio-medical research activities.

The main objective of the Centre is to supply defined strains of laboratory animals like mice, rats, guinea pigs, hamsters and rabbits for Bio-medical Research to the Scientific Community of Bose Institute and other Institutes of the Eastern and North eastern part of India.

Future Plan of the Centre:

In view of global competitiveness, there is an urgent as well as strong need to synthesise novel molecules which may be considered for IPR protections, provided data on these entities can be generated in specific genetically engineered strains, species and animal models for diseases like Diabetes, Hyperlipidaemia, Immunodeficiency and Cancer, as well as infectious diseases like Malaria and Tuberculosis etc. It becomes crucial for the laboratories to develop facilities where these activities are thoroughly evaluated and labs are able to provide data, which is acceptable to regulatory authorities. Unless we are able to get these opportunities more within the Country, it would be extremely difficult for the Scientists as well as institutions to obtain global marketing rights for drugs. Hence, it is an utmost need to set up here a state-of-the-art well-equipped transgenic/ knockout/ Xenograft mouse laboratory for the Scientists of Eastern & North Eastern part of India.

FALTA EXPERIMENTAL FARM (FEF)

Bose Institute Falta Experimental Farm (FEF) is located in Falta Village, South 24 Parganas, about 80 km away from the Bose Institute Unified Academic Campus. This farm serves as a focal point for Bose Institute outreach activities, where we conduct rural biotechnology research and training programs. Additionally, we cultivate various crops throughout the year using proper planning, dedicated efforts, and scientific methods, resulting in the production of high-quality and hygienic crops annually. Student groups from different schools and colleges visit the farm to learn about its activities. Furthermore, the farm is used for internal meetings, brainstorming sessions, and scientific retreats.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(AN AUTONOMOUS INSTITUTE UNDER DEPARTMENT OF SCIENCE & TECHNOLOGY, GOVT. OF INDIA)

J.C. BOSE MUSEUM & PUBLICATION UNIT

Acharya Jagadis Chandra Bose Museum and the Lecture Hall is a unique treasure of Main Campus of Bose Institute. The Lecture Hall was inspired by the Royal Institution of London and personally designed by J.C. Bose with inputs from stalwarts like Nandalal Bose and Rabindra Nath Tagore. The Museum has been an integral part of the Institute since its foundation, serving as a platform to disseminate Bose's remarkable discoveries, often accompanied by a live demonstration by Jagadis Bose himself. Aldous Huxley, who visited Bose Institute in 1926, wrote, "all the experiments in full blast – the heart beats of plants, plants being drugged and recording their symptoms automatically in a graph. The great experimenter himself was our guide." Many of the original instruments have become part of the present display that was re-curated around 1986. The museum houses some originals and replicas of the instruments designed and used by Bose, along with his handwritten diaries, (which have all been digitized), mementos and certificates, patent, original photographs and letters, manuscripts, paintings and other objects of interest. Guided tours are conducted on special occasions for group visits of school/college/ University students/ scholars and special delegates. New acquisitions from various Libraries, Institutes and other Museums from both India and abroad are undertaken every year. Detailed information on J.C. Bose is available in the archives which are helpful for researchers/professionals for any sort of academic work in this field. A large number of original Laboratory/ College notebooks have been digitized and kept on display during important occasions. Further development of our museum is under progress.

The Publication Section is involved in bringing out publications of Bose Institute on a regular basis and has been functioning since 1980. The Annual Report of Bose Institute (both English & Hindi versions) and Bose Institute Newsletter (BI News) are published each year. Posters, pamphlets are regularly published as per the requisition during different Symposia, Seminars and Training programmes. The following books have been published so far and presently available for sale:

Sl. Nos.	Title of Book	Price
1	J.C. Bose and Microwaves- A Collection	Rs.200/-
2	Science & Society-Reflections	Rs. 1050/-
3	Acharya J.C. Bose- A Scientist & A Dreamer Volume-1 Volume-2 Volume-3 Volume-4 Volume-5	 Rs.1250/- Rs.1250/- Rs.600/- Rs.1500/- Rs.550/-
4	Patrabali (Bengali)	Rs.350/-
5	Acharya Jagadis Chandra Bose (Bengali)	Rs.325/-
6	Abyakta (Bengali)	Rs.80/-
7	Bose Institute, Myself & Ribosome	Rs.200/-
8	In the Realm of Bose (*the diary of a teenager's brief sojourn at Bose Institute*)	Rs.180/-
9	An Appraisal of J.C. Bose- in the context of Sociology of Science	Rs.350/-
10	Nivedita Commemoration Volume	Rs.500/-
11	D.M. Bose- A scientist Incognito	Rs.350/-
12	*Basu Vigyan Mandir-o-amar Karmojibon*	Rs. 200/-

The above mentioned books are housed in the Institute Library at Unified Academic Campus for reading purpose. The books are also available for sale. On special occasions, some of the publications like Abyakto, Patrabali, In the Realm of Bose, D.M. Bose- A Scientist Incognito, are presented to distinguished delegates and Speakers. Bose Institute also takes part in National Level Science Exhibitions, Science Fairs, whereby the publications are carried for sale.

MUSEUM VISIT

Students from La Martiniere for Girls (Class-XII Science stream), Kolkata alongwith their teachers visited Acharya J.C. Bose Museum on 31.07.2024.

The newly admitted PhD. students visited J.C. Bose Museum and Main Campus of the Bose Institute on 12.09.2024, as an integral part of their PhD Orientation Programme.

Prof. Kaustuv Sanyal, Director, Bose Institute garlanding the bust of Acharya Jagadis Chandra Bose, sculpted by renowned sculptor Shri Debiprosad Mukherjee, within J.C. Bose Museum, Main Campus on 30.11.2024 to mark the Foundation Day of Bose Institute.

The delegates who attended the 42nd FAIR Council Meeting, held at Bose Institute during December 3-4, 2024 visited the Bose Institute Main Campus and J.C. Bose Museum on 04.12.2024.

Students from St. Xavier's College, Kolkata, Victoria Institution (College), Rammohan College and Vidyasagar College for Women visited the Main Campus and the J. C. Bose Museum on 14.01.2025, following their participation in the day-long programme, organised for undergraduate Chemistry students at Bose institute.

LIBRARY

The Institute Library system is one of the best 'Science Reference Libraries in Eastern India, set up on the main campus in 1917 by Acharya Jagadish Chandra Bose, and a wing at the 'Centenary Building' was opened in 1983. In the year 2007, a small library was set up in the Salt Lake Campus of the Institute. In 2021, the library started functioning in its new building, Unified Academic Campus, Saltlake, Kolkata.

The library provides the latest information to the BI faculty, researchers, and staff members. The library also regularly provides document delivery services and other services to Faculty/researchers/students of the institute as well as faculty/scholars/researchers of other DST and CSIR Institutes in India as a mandate of National Knowledge Resource Consortia (NKRC), Govt of India. The library aims to reach the informational and educational needs of its user community by providing pinpointed relevant personalized information services. Library has joined with the National Knowledge Resource Consortia (NKRC) since 2008.

Resources - The Library has a good and useful collection of documents. In addition, being a member of National Knowledge Resource Consortium (NKRC), library gets access to a wide range of online journals. Online journals and databases are accessible within all the seven campuses. Library has a Section with books on Hindi and Bengali Fictions. It includes novels, short stories, biographies, dramas, and books on general interests aiming to satisfy all type of readers. In the newspaper reading section, 5 daily newspapers in different languages have been subscribed in Library regularly. The library is enriched with a valuable archive of Sir J C Bose.

Now, Bose Institute library is a part of The ONOS (One Nation One Subscription) initiative, approved by the Indian government, is a scheme that provides national access to international scholarly research articles and journal publications to students, faculty, and researchers in higher education institutions and research & development institutions. The program aims to foster research and innovation by ensuring that researchers have access to high-quality research materials regardless of their geographic location or financial resources, Library is getting access of the following through ONOS:

List of 30 Publishers included in One Nation One Subscription (ONOS) of Government of India:

1. Elsevier Science Direct
2. Springer Nature
3. IEEE -IEL Online-Complete
4. Wiley Blackwell Publishing
5. Taylor and Francis
6. Lippincott Williams & Wilkins (Wolters Kluwer)
7. Institute of Physics
8. American Chemical Socicty
9. Cambridge University Press
10. American Physical Society
11. Oxford University Press
12. BMJ Journals
13. American Institute of Physics
14. ASCE
15. Project Muse
16. Indianjournals.com
17. ASME
18. Bentham Science
19. Cold Spring Harbor Laboratory Press
20. ACM Digital Library
21. Annual Reviews
22. ICE Publishing
23. American Society for Microbiology
24. American Association for the Advancement of Science
25. American Institute of Aeronautics and Astronautics (AIAA)
26. American Mathematical Society
27. Emerald Publishing
28. Sage Publishing
29. SPIE Digital library
30. Thieme Medical Publisher

Services

1. ***Reading Facility:*** Library provides reading facility to its members as well as outside visitors. All the books including reference collections are classified and open-accessed.
2. ***Document Lending Service:*** Each Faculty member and Research scholar is entitled to issue 6 books at a time. Students are entitled to issue 4 books at a time. Staff are entitled with 2 books at a time.
3. ***Reference Service:*** Reference service is provided via e-mail, telephone or personal interaction.
4. ***E-resources and Internet Facility:*** Library is well equipped with sufficient number of computers with internet connectivity through LAN and wireless networking facility for laptop users. Library is having access to plenty of electronic journals, databases, archives and consortium resources. Users are having full access to the subscribed e-resources.
5. ***Software and database service:*** Software and database services provided for the following :
    - ENDNOTE X8 Multi-User Download-Research Software
    - iThenticate-anti-plagiarism software
    - Grammarly: Free Writing AI Assistance
    - SCOPUS the largest abstract and citation database
    - Web of Science Core Collection
    - SciFinder
6. ***Reprographic Services:*** Library has black & white printer cum copier, good colour printer, photocopy machine for providing extensive reprographic service.
7. ***Bibliometric Services:*** Library helps to prepare various bibliometric reports specially usage statistics, citation analysis, Impact factor of Journals etc. as per users' requirements.
8. ***Library Resource Sharing Activities:*** The library shares its resources with all important academic/research institutions in India. As a member of National Knowledge Resource Consortium (NKRC), the library keeps close contacts with libraries under DST and CSIR Labs.
9. ***Library is for Leisure:*** Library has a separate section for Bengali, Hindi literature, fiction, novel, history, and books on general interest.
10. Library Hours - The Library is open from morning 9.45 AM to 6.15 PM . Circulation is open from 9.45 AM to 6.15 PM. Library is closed on Saturdays, Sundays and institutional holidays.

MADHYAMGRAM EXPERIMENTAL FARM (MEF)

Madhyamgram Experimental Farm (MEF) is the translational research hub of Bose Institute. Its main componentis the agricultural fields where the plant scientists grow their experimental crops in different seasons for seed multiplication, collection of specific plant parts other than seeds, selfing and to raise selfed seeds, hybridization between desired parents, the study of agro-morphology, etc. The J C Bose Innovation Centre in MEF comprises of Transgenic Plant Research Laboratory and Greenhouses. The Greenhouses are presently fourteen in number, some of which are dedicated to transgenic plant research, while the rest are for routine hardening and transplantation of tissue culture plantlets. The laboratory is a fully equipped one with standard biotechnology and molecular biology research.


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SHYAMNAGAR EXPERIMENTAL FARM (SEF)

Shyamnagar experimental farm is one among the seven campuses of Bose Institute, Kolkata. This campus is located 30 km north from Kolkata and well within the suburban region of the metropolitan city. Prof. D. M. Bose established this campus and dedicated for nurturing the modern science in India. A variety of scientific experiments including microwave scattering, development of gas detectors and monitoring of raindrop size distribution are conducted within this campus. Experiments mainly related to atmospheric sciences are initiated at this campus after successfully achieving the goal of the project "Studies on Microwave Scattering (SMS)" , namely, the detection and imaging of the microwave scattering patterns and radar cross section measurements, sponsored by DRDO, Ministry of Defence, Govt. of India. World-class research & development (R & D) laboratories are presently under constructed within this campus for the development of gas detectors for High Energy physics experiments as well as the development of instruments for atmospheric observations. At present two extramural projects sponsored by CSIR and MoEF respectively, are also running at this campus. The CSIR project is related to the measurement of hygroscopic growth factor of aerosols during fog. The MoEF project corresponds to the measurement of emission factor of Black carbon coming into the atmosphere from biomass burnings. Shyamnagar campus provides a suitable environment of fog occurrence in winter and thereby, becomes the ideal location for these two projects.

INTEGRATED M.SC.-PH.D. PROGRAMME

The Integrated M.Sc.-Ph.D. Programme in Life Sciences and Physical Sciences at Bose Institute has evolved through a series of strategic academic collaborations and curricular advancements. Beginning in 2006 with M.Sc. programmes in Physical Sciences in partnership with St. Xavier's College, Kolkata, and followed by the 2008 launch of an Integrated M.Sc.-Ph.D. in Plant Molecular Biology and Biotechnology with the University of Calcutta, these early initiatives laid a strong foundation for research-oriented education. Building on their success, Bose Institute transitioned to fully integrate postgraduate programmes, streamlining M.Sc. training with doctoral research. The Life Sciences programme was formally launched in 2011, offering interdisciplinary subjects such as Plant Molecular Biology, Molecular & Cellular Biology, Biophysical Chemistry, and Computational Biology, with an annual intake of up to 20 students. In 2012, the Physical Sciences programme commenced, focusing on areas like Astroparticle Physics, Quantum Computation, Complex Systems, and Condensed Matter Physics, admitting up to 5 students each year. Both programmes continued steadily through 2019, and in 2025, Bose Institute proudly re-initiated the Integrated M.Sc.-Ph.D. programmes, admitting 16 students in Life Sciences and 8 in Physical Sciences, reaffirming its commitment to excellence in advanced scientific training.

WORKSHOP

The Workshop is the nucleus of the maintenance activities including the seven campuses of the Bose Institute. Workshop is situated at Main Campus, Unified Campus and its branches are i) Machine Shop ii) Carpentry section iii) Store iv) Transport & v) Electrical unit at Main Campus and at Centenary Campus. The activities of the said units are as follows.

I. Machine Shop- The shop consists of a few nos. of lathe, shaping, drill, grinding machine etc. This shop is actually named as mechanical section because under the umbrella of this section there are some other units like fabrication wing, the wing where the prototype models of the instruments (using which Sir J.C. Bose conducted his various famous experiments) as well as various types of instruments like gradient mixtures, gel tray etc. are being manufactured against the requisitions of internal Scientist and Officers.

II. Carpentry Section- This section deals with all furniture manufacturing, repairing jobs etc. as per the requirements of Scientists, officers etc.

III. Store- Workshop store maintains the materials (civil, electrical, mechanical, plumbing, building and furniture related materials etc) required for all seven campuses.

IV. Transport- Workshop Superintendent personally deals with the allocation of internal transports as per requirement of Scientists, different internal offices, outside guests etc. Except this outside transports are being utilized as per requirement when internal transports are not affordable.

V. Electrical Unit- This section attains all the electrical related problems specifically of Main Campus, Centenary Campus & Unified Academic Campus. Except the above this unit also deals with the breakdown problems and execution of new project in other campuses.

The remarkable jobs as well as other maintenance job of Workshop in the year 2024-25:-

I. Study & monitoring of all the electrical drawings of Unified Campus including planning for execution of substation etc. are being done to give a proper shape of the electrical system.

II. Study & day to day monitoring of HVAC & other related issues including various civil part of Unified Academic Campus to ensure that the building should be run smoothly.

III. Monitoring of the Electrical Installations of the seven campuses.

STATEMENT OF ACCOUNTS FOR THE YEAR 2024-25

INDEPENDENT AUDITOR'S REPORT

To the Members of the Council

Qualified Opinion

We have audited the accompanying financial statements of BOSE INSTITUTE (the Institute), which comprise the Balance Sheet at 31s March, 2025, and the Income & Expenditure account, Receipts & Payment Account for the year ended on that date, and notes to the financial statements, including a summary of significant accounting policies and other explanatory information. In our opinion and to the best of our information and according to the explanations given to us, except for the effect of the matter described in the Basis for Qualified Opinion section of our report, the accompanying financial statements give a true and fair view of the financial position of the Institute as at 31stMarch, 2025, and of its financial performance for the year then ended.

Basis for Qualified Opinion

1. Fixed Assets have not been periodically physically verified. In respect of equipment under schemes, no register is available. The same is recorded under respective scheme sub ledger. In view of this it is not possible to opine on correctness or otherwise of fixed assets. No Impairment testing has been performed during the year under audit. Refer point no. 2.7(c) in Notes to Accounts.

   Refer Schedule 22 clause 2.1 of Notes on Accounts on Fixed Assets. Institute has taken up initiatives to prepare a comprehensive Fixed Asset Register. Register up to 2019-20 is prepared and work for preparation of Fixed Asset Register for 2020-21onwards not yet taken up till the date of our audit, When the Fixed Asset Register will become ready, then the nomenclatures and order mentioned in Schedule 8 (old form schedule 4) will be taken into account.

   Refer Schedule 22 clause 2.3 (c) of the "Significant Accounting Policies and Notes to Accounts" identification of assets, impaired if any, as required in AS – 28 (Ind AS 36) issued by ICAI, has not been done.

2. Refer Schedule 3 of Balance Sheet Liability under "Earmarked /Endowment Fund-Development Fund (Planning commission), closing balance as on 31.03.2025is Rs. 8,56,05,296.00 and corresponding Assets Schedule 10 "Investment from Earmarked/ Endowment Fund Asset acquired under for Development and Modernisation fund amounting to Rs. 6,66,57,578.15 have been held under "investment and under earmarked fund" and have not been capitalised thereby understating the fixed assets to that extent. Consequent impact on Income & Expenditure Account and on Depreciation is not ascertainable.

3. Capital WIP to the tune of Rs. 3,64,162.00 represents import of equipment which has no movement since long. Current status of work and consequential impact on the books of accounts is not ascertainable. (Refer Schedule 8C of the Financial Statements – Capital W.I.P).

4. Refer Schedule 22 clause 2.5 of the "Significant Accounting Policies and Notes to Accounts". For the first time Consumable stores of Rs. 1,31,18,570.00 have been accounted for on the basis of purchase cost. The stock register as stated to us is under process and not provided to us for verification. The details of closing stock and certificate of stock balance as on 31.03.2025 are not made available to us.

5. Liability towards Gratuity and Leave Encashment is not ascertainable as no actuarial valuation was undertaken, and the same are accounted on cash basis contrary to requirements of AS-15 notified by the Institute of Chartered Accountants of India. The impact on current year Financial Statement is not ascertained.

6. Funds with M/s. RITES of Rs. 11,31,55,655.00 are pending for adjustment. The account has not yet been finalized with M/s. RITES. Total Expenses shown by M/s. RITES is Rs. 1,78,77,81,861.07 and the amount capitalized by Bose Institute is Rs. 1,66,65,08,132.49. The difference of Rs. 12,12,73,728.58 has yet to be capitalized. Refer clause 13 of Schedule – 22 – Notes on Accounts.

   The details are as follows:.

Particulars	Capitalised By Bose Institute	Expenses Incurred by RITES	Difference
ITD Cementation India Ltd.	1,32,03,86,614.49	1,33,67,28,774.00	1,63,42,159.51
Unique Engineers Pvt. Ltd.	23,15,80,966.00	22,96,79,699.00	-19,01,267.00
Hitech Erectors Pvt. Ltd.	9,39,18,218.00	9,87,62,436.00	48,44,218.00
Satelite Electronics	2,06,22,334.00	2,04,23,773.00	-1,98,561.00
RITES Fees	0.00	9,81,20,452.86	98,120,452.86
Other Expenses	0.00	40,66,726.21	40,66,726.21
Total	**1,66,65,08,132.49**	**1,78,77,81,861.07**	**12,12,73,728.58**

7. GST Annual Return GSTR 9 and GSTR 9C (reconciliation statement)have not been submitted since 2017-18 onwards. This is to be noted that as per section 44 of the CGST Act read with rule 80(1) of CGST Rules Every Registered person other than any department of the Central Government or a State Government or a Local Authority, whose books of account are subject to audit by the C & AG of India or an auditor appointed for auditing of the accounts of local authorities under any law for the time being in force are required to file Annual Return GSTR9 and GSTR 9C. Bose Institute does not fall under above category as the same is an autonomous body and required to file GSTR 9 and GSTR 9C.

8. Refer Schedule 22 clause 2.3 of the "Significant Accounting Policies and Notes to Accounts" in case of deposit works executed by CPWD, assets are booked in accounts on the basis of Form 65 issued by CPWD but in the following cases FORM 65 is not made available to us.

Description of Works	Amount (Rs.)	Remarks
CPWD work for fire alarm for above 9th floor	55,84,652.00	Incomplete Form 65 provided to us
CPWD fall ceilings for different floors	16,94,871.00	Form 65 not available
For Statue of Sir J.C. Bose	18,179.00	Form 65 not available

We conducted our audit in accordance with the Standards on Auditing (SAs) issued by ICAI. Our responsibilities under those standards are further described in the Auditor's Responsibilities for the Audit of the Financial Statements section of our report. We are independent of the Institute in accordance with the ethical requirements that are relevant to our audit of the financial statements in India, and we have fulfilled our other ethical responsibilities in accordance with these requirements. We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our qualified opinion.

Emphasis of Matter

We draw attention to the following matters:

1. Refund claim against Service Tax for construction of Unified Campus amounting to Rs. 2,02,83,385.00 has been claimed on 27.03.2017 but has not been settled yet. Further on the basis of rejection order issued by the Department dated 17.06.2025 Institute has filed an Appeal before the Commissioner of CGST and Central Excise on 13.08.2025 for the above-mentioned claim.

As per Schedule 22 Clause 14of Notes on Accounts on Implementation of 7th Central Pay Commission recommendations at Bose, a due drawn statement has been prepared up to April 2020 as follows:

The detailed calculation is submitted to DST for its necessary action for placing the same to Ministry of Finance for waiver of recovery of the excess payments as mentioned above and the matter is pending till date.

2. Refer Schedule 22 clause 11 of Notes on Accounts on Long Un-Reconciled Balance. There are un-reconciled balances appearing in books of account. The total impact is not ascertainable. Details are as follows:

Head of Account	Amount (Rs)	Remarks
Stale cheque in Scheme Book	3,01,629.00 (Cr.)	Unadjusted for long period
Adjustable Security Deposit	10,000.00	Lying unadjusted since 2010
AECD Fund with SBI	6,213.00	Lying unadjusted for a long time. No details available
Co-operative	20,414.00	Unadjusted since 2021-22.
Platinum Jubilee Committee	28,411.00	Unadjusted since 2009-10
RSIC Unit	5,62,593.96	
TDS on Interest	1,55,693.77	

Head of Account	Amount (Rs)	Remarks
Adhoc Advances	5,000.00	No details available
Festival Advance	64,010.00	Lying unadjusted since 07.09.2015. Employee wise details not available.
Imprest Advance	15,000.00	Outstanding since 30.05.2012 against Mr. Sujoy Dasgupta
Medical Advance	21,000.00	Outstanding since 2010. No details available.
Party Advance (EPF)	1,56,500.00 (Cr)	Deducted from M/S A.G. Enterprise during 2016-17 due to the fact that they did not deposit P.F. of their casual employees but the same has not been adjusted till date.
Staff Welfare Advance	7,500.00 (Cr)	Excess deducted from Festival Advance during 2015-16 but not yet adjusted. Employee wise details not available.
Bank Suspense	46,029.90	Lying unadjusted prior to 2012-13
Receivable from Co-Operative	18,000.00	Outstanding from 30.06.2018
Expert Committee Meeting	10,428.00	Debit balance in liability account coming since long. No details available.
Payable to Lawyer	514.00	Unadjusted for a long period of time
Stale Cheque	10,000.00	
Goods & Service Tax	1,06,589.00	G.S.T collected but not deposited
Receivable from Employees	3,17,126.00	Old outstanding unadjusted for a long period of time. The impact on current year Financial Statement is not ascertained.
Receivable from Party	78,877.00	Party wise and age wise list as on 31.03.2024 not provided to us. The impact on current year Financial Statement is not ascertained.
IRPHA (Prof. A. Lohia)	99,10,048.67	Excess expenditure on project coming from 01.04.2013 not yet adjusted.
IRPHA (Prof. S.Raha)	1,61,089.00 1,80,922.00	Advance & Receivable from Staff Lying unadjusted from 01.04.2014
T.D.S pension	16,000.00	Unadjusted from 2010
Arrear P.Tax	1,570.00	Unadjusted for a long period of time
Labour Welfare Cess	1,77,968.00	
Party Income Tax (20%)	4,290.00	
Party Income Tax	18,882.00 (Dr)	
Party Income Tax (194J)	1,74,101.00 (Dr)	

3. Refer Schedule 22 clause 10 of Notes on Accounts on Contingent Liability, no contingent liability has been ascertained. Though, there are several pending cases against the Institute.
4. Refer Schedule 22 clause 3.1 of Notes on Accounts, the Institute has charged full depreciation for whole year on Written down Value Method as per given rates.
5. Unspent amount is not matching with the Deposits created for such funds as follows:

Name of the Fund	Fund Balance (Rs.)	Deposit (Rs.)
Fund for other Development	9,23,79,094.57	2,91,40,695.00
Employees Welfare Fund	3,46,6017.31	4,06,797.00
Development Fund – Planning Commission	8,56,05,296.00	6,66,57,578.17

6. No separate trust has been created in respect of General Provident Fund and Employees' Pension Fund. Refer clause 5.3 of Schedule 22 – notes on Accounts.
7. In Assignment of Fund an amount of Rs. 11,00,00,000.00 was allotted for the Financial Year 2024-25 as capital fund. Out of that Rs. 9,16,46,946.00 was utilized. Balance amount of Rs. 1,83,53,054.00(including an amount of Rs. 1,79,40,000.00 received on 28.03.2025) was not utilized and the same was refunded.
8. In respect of internal control commensurate in accounts department regarding data entry and privacy of date we are in the opinion that the same needs to be strengthened with respect to the nature and size of the organization.
9. Attention is drawn to point 4.3 of Schedule 22. Amount of Rs. 33,21,432.00 has been provided for electricity bill.
10. Attention is drawn to point 4.4 of Schedule 22. A provision (Expenses) has been created from interest accrued in the books of Scheme totaling to Rs. 1,12,82,798.15.

Our opinion is not modified in respect of these matters.

Key Audit Matters

Key audit matters are those matters that, in our professional judgment, were of most significance in our audit of the Financial Statements of the current period. In this audit we have not determined any specific Key Audit Matter to be addressed separately.

Responsibilities of Management and Those Charged with Governance for the Financial Statements

Management is responsible for the preparation and fair presentation of the financial statements in accordance with the aforesaid Accounting Standards, and for such internal control as management determines is necessary to enable the preparation of financial statements that are free from material misstatement, whether due to fraud or error. In preparing the financial statements, management is responsible for assessing the Institute ability to continue as a going concern, disclosing, as applicable, matters related to going concern and using

the going concern basis of accounting unless management either intends to liquidate the Institute or to cease operations, or has no realistic alternative but to do so. Those charged with governance are responsible for overseeing the Institute financial reporting process.

Auditor's Responsibilities for the Audit of the Financial Statements

Our objectives are to obtain reasonable assurance about whether the financial statements as a whole are free from material misstatement, whether due to fraud or error, and to issue an auditor's report that includes our opinion.

Reasonable assurance is a high level of assurance but is not a guarantee that an audit conducted in accordance with SAs will always detect a material misstatement when it exists. Misstatements can arise from fraud or error and are considered material if, individually or in the aggregate, they could reasonably be expected to influence the economic decisions of users taken on the basis of these financial statements.

Place: Kolkata
Dated: 29.08.202
UDIN: 25061616BMLJZI3731

For A.N.Chatterjee & Co.
Chartered Accountants
F.R.N. 302143E
Avijit Auddy
(Partner)
M.No. 061616

BOSE INSTITUTE
BALANCE SHEET AS ON 31ST MARCH 2025

Corpus /Capital fund and liabilities	Schedule	2024-25 (₹)	2023-24 (₹)
Corpus /Capital fund	1	1,59,85,55,201.32	1,73,06,52,385.62
Reserves and surplus	2	-	-
Earmarked/Endowment funds	3	1,85,78,31,313.21	1,32,24,79,746.96
Secured loans and borrowings	4	-	-
Unsecured loans and borrowings	5	-	-
Deferred credit liabilities	6	-	-
Current liabilities and provisions	7	63,81,40,712.36	99,99,76,349.25
Total		**4,09,45,27,226.89**	**4,05,31,08,481.83**
Assets			
Fixed Assets	8	41,54,66,772.66	42,26,89,951.76
Fixed Assets for FAIR	8A	1,22,08,73,842.25	68,90,64,789.00
Fixed Assets of Unified Academic Campus	8B	1,05,68,58,107.51	1,18,17,46,951.71
Work in Progress	8C	11,33,73,227.20	11,33,73,227.20
Investments-others	9	42,54,63,035.72	42, 36,54,828.72
Investments -from earmarked/endowment Funds	10	10,50,31,638.15	14,98,11,186.15
Current assets, loans, advances etc.	11	75,74,60,603.40	1,07, 27,67,547.29
Miscellaneous expenditure (to the extent not written off or adjusted)			
Total		**4,09,45,27,226.89**	**4,05,31,08,481.83**
Significant accounting policies	24		
Significant accounting policies and notes on accounts	25		

Place : Kolkata
Date : 29.08.2025
UDIN : 25061616BMLJZI3731

Signed in terms of our separate Report of even date.
For A.N. Chatterjee & Co.
Chartered Accountants
Firm Registration No. 302143E
Avijit Auddy
Partner
Membership No. 061616

Sd/-
Shaubhik Ghosh
UDC

Sd/-
Kamal Sing
Accountant (Cash)

Sd/-
Vikash Kumar
Audit & Finance Officer

Sd/-
Achintya Mukherjee
Accounts Officer

Sd/-
Prof. Srimonti Sarkar
Registrar(O)

Sd/-
Prof. Kaustuv Sanyal
Director

BOSE INSTITUTE
INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31.03.2025

	Schedule	2024-25	2023-24
		₹	₹
INCOME			
Income from Sales and Services	12	20,78,963.82	37,27,270.29
Grants/Subsidies	13	1,02,73,01,127.00	85,44,03,235.50
Income from Investments (Income on Investment, from earmarked /endowment funds transferred to Funds)	14	1,58,46,986.15	-
Other Income	15	28,56,516.99	13,38,630.87
Increase/ (decrease) in stock of Finished goods and work-in-progress	16	-	-
Total (A)		**1,04,80,83,593.96**	**85,94,69,136.66**
EXPENDITURE			
Establishment Expenses	17	55,15,95,018.00	50,55,74,225.00
Other Administrative Expenses	18	34,99,58,994.11	29,89,05,540.00
Expenditure on Grant, Subsidies etc.	19	-	-
Provision for interest and other Income in the Scheme Books	20	1,12,82,798.15	-
Fund for capital Expenditure	21	5,88,33,460.96	4,86,58,928.75
Depreciation (Net Total at the year end corresponding to Schedule 8)		-	-
Total (B)		**97,16,70,272.02**	**85,31,38,693.75**
Balance being excess of Income over Expenditure (A-B)		7,64,13,321.94	63,30,442.91
Transfer to Special Reserve (Specify each)			
Prior Period Items		-12,840.00	-14,65,663.00
		7,64,00,481.94	48,64,779.91
Last Year Unspent Balance /overspent balance		**35,38,08,543.39**	**-43,72,04,553.30**
Balance of Unspent Balance After Adjustment		43,02,09,025.33	-43,23,39,773.39
Depreciation Adjustment		-	1,32,42,22,316.78
Amount Surrendered to DST		-4,32,67,000.00	53,80,74000.00
Balance being Surplus/(deficit) carried to corpus/capital fund		**38,69,42,025.33**	**35,38,08,543.39**
Significant accounting policies	22		
Contingent liabilities and notes on accounts	22		

Place : Kolkata
Date : 29.08.2025
UDIN : 25061616BMLJZI3731

Signed in terms of our separate Report of even date.
For A.N. Chatterjee & Co.
Chartered Accountants
Firm Registration No. 302143E

Sd/-
Shaubhik Ghosh
UDC

Sd/-
Kamal Sing
Accountant (Cash)

Sd/-
Vikash Kumar
Audit & Finance Officer

Sd/-
Achintya Mukherjee
Accounts Officer

Sd/-
Prof. Srimonti Sarkar
Registrar(O)

Sd/-
Prof. Kaustuv Sanyal
Director

BOSE INSTITUTE
RECEIPTS & PAYMENT ACCOUNTS FOR YEAR ENDED 31ST MARCH 2025 (COUNCIL A/C)

Receipts	Sch. No.	Amount (Rs.)	Payments	Sch. No.	Amount (Rs.)
Opening Balance	1	30,69,04,114,.61			
Receipt against Establishment Expenses	2	19,95,782.00			
Receipt against Laboratory Expenses	3	12,05,197.00	Establishment Expenses	2	55,45,91,021.00
Receipt Against Other Administrative Expenses	4	7,40,200.00	Laboratory Expenses	3	20,46,27,506.21
Receipt from Indirect Income	9	1,35,89,608.53	Other Administrative Expenses	4	20,24,79,561.45
Receipt from Grant in Aids form Scheme	9	1,05,89,40,000.00			
Receipt from other Assets	10	1,53,255.00	Payment for Indirect (Other) income	9	3,06,839.72
			Grant in Aid	9	3,16,38,873.00
Receipts from Current Assets	8	2,86,04,626.00	Payments for Fixed (other) assets	10	5,89,57,434.06
Receipts from Statutory Liabilities	7	11,57,11,824.28	Payment for current assets Payment for statutory liabilities	8 7	2,97,91,834.00 11,53,64,360.00
Receipts from Current Liabilities & Other Liabilities (except Statutory Liabilities)	5&6	1,10,98,927.00	Payments for the current assets & other liabilities (except statutory liabilities)	5&6	35,64,563.00
Grant in Aid for Unified Campus (Interest)		8,03,986.00	Intellectual Property Development Fund		-
Employees General Provident Fund		-	**Inter Unit Account**		
			FAIR		
			Scheme/Project Grant-in-aid		-
Inter Unit Account			Scheme/Project		2,48,03,412.00
FAIR		-	ST-Rural		-
Scheme/Project Grant-in-aid		-	Governing Body		5,900.00
Scheme/Project		-			
ST-Rural		-	Closing Balance	1	31,36,16,215.08
		1,53,97,47,520.42			**1,53,97,47,520.42**

Place : Kolkata
Date : 29.08.2025
UDIN : 25061616BMLJZI3731

Signed in terms of our separate Report of even date.
For A.N. Chatterjee & Co.
Chartered Accountants
Firm Registration No. 302143E

Sd/-	Sd/-	Sd/-	Sd/-
Shaubhik Ghosh	Kamal Sing	Vikash Kumar	Achintya Mukherjee
UDC	Accountant (Cash)	Audit & Finance Officer	Accounts Officer

BOSE INSTITUTE
RECEIPTS & PAYMENT ACCOUNTS FOR YEAR ENDED 31ST MARCH 2025 (Project)

RECEIPTS	Sch. No.	Amount Rs	PAYMENTS	Sch. No.	Amount Rs
OPENING BALANCE	1	**49,17,91,131.11**			
Receipt from projects	2	8,45,41,449.00	Payment from Projects	2	40,06,74,171.00
Receipt from projects from Adhoc / RA / PDF	3	1,88,77,843.00	Payment from Adhoc/RA/PDF	3	1,49,10,825.00
Receipts from Other Than Scheme / Projects	4	8,52,696.00	Payment for other than Scheme/ Project	4	27,49,935.00
Receipts from IFCC (Indo-FAIR Project)	1A	57,57,60,983.75			
			Payment OF IFCC (Indo-FAIR Project)	1A	60,94,55,296.00
Receipts from St Rural	1B	58,60,609.00	Payment of ST-Rural	1B	13.26
Receivable From Scholars'		-	Receivable From Scholars'		-
Branch/Inter Unit					
Bose Institute		3,83,16,544.83	**Branch/Inter Unit**		
			Bose Institute		8,90,51937.68
Margin cum FD		30,65,48,003.00			
			Margin cum FD		26,67,84,000.00
			CLOSING BALANCE	1	13,89,23,081.75
		1,52,25,49,259.69			**1,52,25,49,259.69**

Place : Kolkata
Date : 29.08.2029
UDIN : 25061616BMLJZI3731

Signed in terms of our separate Report of even date.
For A.N. Chatterjee & Co.
Chartered Accountants
Firm Registration No. 302143E
Avijit Auddy
Partner
Membership No. 061616

Sd/-	Sd/-	Sd/-	Sd/-
Shaubhik Ghosh	Kamal Sing	Vikash Kumar	Achintya Mukherjee
UDC	Accountant (Cash)	Audit & Finance Officer	Accounts Officer

BOSE INSTITUTE

Bose Institute Employees' Pension Fund

Balance Sheet as at 31 March 2025

In ₹ (Rupees)

	Particulars	Schedule No	as at 31-March-2025	as at 31-March-2024
I.	Capital Fund	1	18,14,26,658.05	17,15,39,096.05
	Current Liabilities and Provision	2	5,82,27,291.00	5,27,46,377.00
	Total		**23,96,53,949.05**	**22,42,85,473.05**
II.	ASSETS			
	Other Current Assets	3	16,000.00	16,000.00
	Bank Balance and Fixed Deposits	4	23,96,37,949.05	22,4269,473.05
	Total		**23,96,53,949.05**	**22,42,85,473.05**

Place : Kolkata
Date : 29.08.2025
UDIN : 25061616BMLJZI3731

Signed in terms of our separate Report of even date.
For A.N. Chatterjee & Co.
Chartered Accountants
Firm Registration No. 302143E
Avijit Auddy
Partner
Membership No. 061616

Sd/-
Shaubhik Ghosh
UDC

Sd/-
Vikash Kumar
Audit & Finance Officer

Sd/-
Achintya Mukherjee
Accounts Officer

Sd/-
Prof. Srimonti Sarkar
Registrar(O)

Sd/-
Prof. Kaustuv Sanyal
Director

BOSE INSTITUTE
Bose Institute Employees' Pension Fund
Statement of Income & Expenditure
for the year ended 31-March-2025

In ₹ (Rupees)

	Particulars	Schedule No	1-April-2024 to 31-March-2025	1-April-2023 to 31-March-2024
I	**Revenue from Operations**		-	-
II	**Other Income**	5	1,26,92,711.00	1,06,87,997.00
III	**TOTAL REVENUE (I + II)**		1,26,92,711.00	1,06,87,997.00
IV	**EXPENSES**			
	Other Expenses		28,05,149.00	-
	TOTAL EXPENSES		98,87,562.00	-
V	Profit before Exceptional and Extraordinary Items and Tax (III-IV)	6	98,87,562.00	1,06,87,997.00
VI	Exceptional Items		-	-
VII	**Profit before Extraordinary Items and Tax**		98,87,562.00	1,06,87,997.00
VIII	Extraordinary Items		-	-
IX	**Profit Before Tax**		98,87,562.00	1,06,87,997.00
X	**Tax Expense**		-	-
	Current Tax		-	-
	Deferred Tax		-	-
XI	**Profit/(Loss) for the period from Continuing Operations(IX-X)**		98,87,562.00	1,06,87,997.00
XII	Profit/(Loss) from Discontinuing Operations		-	-
XIII	Tax Expense of Discontinuing Operations		-	-
XIV	**Profit/(Loss) from Discontinuing Operations (after tax)(XII-XIII)**		-	-
XV	**Profit(Loss) for the Period (XI+XIV)**		98,87,562.00	1,06,87,997.00

Place : Kolkata
Date : 29.08.2025
UDIN : 25061616BMLJZI3731

Signed in terms of our separate Report of even date.
For A.N. Chatterjee & Co.
Chartered Accountants
Firm Registration No. 302143E
Avijit Auddy
Partner
Membership No. 061616

Sd/-
Shaubhik Ghosh
UDC

Sd/-
Vikash Kumar
Audit & Finance Officer

Sd/-
Achintya Mukherjee
Accounts Officer

Sd/-
Prof. Srimonti Sarkar
Registrar(O)

Sd/-
Prof. Kaustuv Sanyal
Director

BOSE INSTITUTE

Bose Institute Employees' General Provident Fund

Balance Sheet as at 31 March 2025

In ₹ (Rupees)

	Particulars	Schedule No	as at 31-Mar-2025	as at 31-Mar-2024
I.	Capital Fund	1	**14,84,14,393.06**	**16,21,74,702.06**
	Current Liabilities and Provision	2	**3,73,88,651.94**	**3,71,88,611.94**
	Total		**18,58,03,045.00**	**19,93,63,314.00**
II.	**ASSETS**			
	Other Current Assets	3	**1,47,95,599.00**	**1,48,35,847.00**
	Bank Balance and Fixed Deposits	4	**17,10,07,446.00**	**18,45,27,467.00**
	Total		**18,58,03,045.00**	**19,93,63,314.00**

Place : Kolkata
Date : 29.08.2025
UDIN : 25061616BMLJZI3731

Signed in terms of our separate Report of even date.
For A.N. Chatterjee & Co.
Chartered Accountants
Firm Registration No. 302143E
Avijit Auddy
Partner
Membership No. 061616

Sd/-
Shaubhik Ghosh
UDC

Sd/-
Vikash Kumar
Audit & Finance Officer

Sd/-
Achintya Mukherjee
Accounts Officer

Sd/-
Prof. Srimonti Sarkar
Registrar(O)

Sd/-
Prof. Kaustuv Sanyal
Director

BOSE INSTITUTE

Bose Institute Employees' General Provident Fund

Statement of Income & Expenditure

for the year ended 31-March-2025

In ₹ (Rupees)

	Particulars	Note No.	1-Apr-2024 to 31-Mar-2025	1-Apr-2023 to 31-Mar-2024
I	Revenue from Operations		-	-
II	Other Income		1,07,47,263.00	1,19,14,988.00
III	TOTAL REVENUE (I + II)		1,07,47,263.00	1,19,14,988.00
IV	EXPENSES			
	Other Expenses		94,14,652.00	1,18,56,385.00
	TOTAL EXPENSES		-	-
V	Profit before Exceptional and Extraordinary Items and Tax (III-IV)		13,32,611.00	58,603.00
VI	Exceptional Items		-	-
VII	Profit before Extraordinary Items and Tax		13,32,611.00	58,603.00
VIII	Extraordinary Items		-	-
IX	Profit Before Tax		13,32,611.00	58,603.00
X	Tax Expense		-	-
	Current Tax		-	-
	Deferred Tax		-	-
XI	Profit/(Loss) for the period from Continuing Operations (IX-X)		13,32,611.00	58,603.00
XII	Previous Year Excess of Income over Expenditure		2,19,61,125.94 (9,66,924.00)	2,19,02,522.94
XIII	Tax Expense of Discontinuing Operations		-	-
XIV	Profit/(Loss) from Discontinuing Operations (after tax) (XII-XIII)		-	-
XV	Profit (Loss) for the Period (XI+XIV)		**2,23,26,812.94**	**2,19,61,125.94**

Place : Kolkata
Date : 29.08.2025

UDIN : 25061616BMLJZI3731

Signed in terms of our separate Report of even date.
For A.N. Chatterjee & Co.

Chartered Accountants
Firm Registration No. 302143E
Avijit Auddy
Partner
Membership No. 061616

Sd/-
Shaubhik Ghosh
UDC

Sd/-
Vikash Kumar
Audit & Finance Officer

Sd/-
Achintya Mukherjee
Accounts Officer

Sd/-
Prof. Srimonti Sarkar
Registrar(O)

Sd/-
Prof. Kaustuv Sanyal
Director

SIGNIFICANT ACCOUNTING POLICIES & NOTES TO ACCOUNTS

Schedule 24

1.0 Change in Accounting Policy:

The Statement of Accounts has been drawn in the specified form applicable to Central Autonomous Bodies (NPOs) and Similar Institutions from the Financial Year 2013-14. The Balance Sheet has been drawn by consolidating statement of accounts of Council and the Governing Body with schedules thereon. The accompanying financial statements have been prepared on historical cost convention and conform to the fundamental accounting assumptions.

2.0 Fixed Assets:

2. 1 Fixed Asset Register

The Institute has taken up initiatives to prepare a comprehensive Fixed Asset Register and is complete up to 2019-20, preparation for the rest of the period is underway. This initiative will also cover the assets acquired in the year 1991-92 from "Institute Development and Modernisation Fund" (provided by Planning Commission).

2.2 Work-in-Progress

The particulars of fixed assets which are under construction/installed are shown as WIP in Schedule 8 (C).

2. 3 Valuation of assets

a. The valuation of Fixed Assets has been made at cost less depreciation.

b. The assets related to terminated projects have been identified up to 2005-06. Further identification of the assets relating to the years 2006-07 to 2022-24 is in progress and will be included in the Fixed Asset Register.

c. The identification of assets, impaired if any, as required in AS-28 (Ind AS 36) issued by ICAI, has not been done.

d. In case of the deposit works executed by CPWD, assets are booked in accounts on the basis of Form 65 provided by CPWD.

2.5 Bose Institute has established a Central Store from the financial year 2024-25, the office stationery, laboratory consumable and chemicals purchased for store are shown in the Balance Sheet at their purchase cost at Rs. 1,31,18,570.00 (Rupees one crore thirty one lakh eighteen thousand five hundred and seventy) only. Maintenance of proper stock register is under process.

3.0 Depreciation:

3.1 The depreciation is calculated on Written Down Value Method as per the following rates irrespective of dates of putting the same in use:

i. Building – 10%

ii. Equipment – 15%

iii. Books & Journals – 10%

iv. Furniture – 10%

v. Vehicles – 15%

vi. Air Conditioner – 10%

vii. Electric Installation – 10%

viii. Computer & Internet Peripherals – 60%

3.2 Depreciation is not provided for on the assets of Governing Body and ST Specific Rural Biotechnology Programme, as these are not part of BI Council.

4.0 Revenue Recognition & Grant in Aid:

4.1 During financial year 2024-25, Grant-in-Aid for Council has been received under the head General, Salaries and Capital in the form of Assignment. Grant-in-Aid under General and Salaries have been treated as revenue grant. All incomes and expenses are accounted for when they arise as per general accounting practice and convention applicable to Autonomous Bodies.

4.2 All the terminal benefits of the permanent staffs during the financial year are paid from the Grant-in-Aid received from DST.

4.3 Liability has been created for the electricity bill for Rs. 33,21,432.00 (Rupees thirty three lakh twenty one thousand four hundred thirty two) only received during the fag end of the financial year 2024-25.

4.4 Overhead of Extra Mural Research grant and interest accrued in the books of scheme totalling to Rs. 1,12,82,798.15 (Rupees one crore twelve lakh eighty two thousand seven hundred ninety eight and paise fifteen) only has been transferred to create a provision for future use.

5.0 Retirement/Post Retirement and Staff Benefits:

5.1 The Institute has General Provident Fund, and Pension Fund.

5.2 All the terminal benefits of the permanent staffs during the financial year are paid from the Grant-in-Aid received from DST.

5.3 The suggestion of Jt. Secretary and F.A. Dept. of Science and Technology, Govt. of India in the Finance Committee meeting held on 24.09.1996 for managing the Provident Fund through Trust Committee is yet to be implemented.

5.4 Although by virtue of the provision 9 of the Bose Institute Employees Pension Scheme Regulations approved by the Dept. of Science and Technology, Govt. of India and Rule 3.3 of the Bose Institute Contributory Provident Fund Rules, the Pension Fund, General Provident Fund and

Contributory Provident Fund vest with the Bose Institute, separate Statement of Account with Income and Expenditure Account & Balance Sheet in respect of GPF with CPF is maintained in New prescribed format

6.0 Earmarked Funds:

Income on investments out of Earmarked Fund is recognised and credited to Earmarked Fund.

7.0 Foreign Currency Transactions:

Transactions in foreign currency are recorded at the exchange rate applicable on the date of transaction.

8.0 Research and Development Costs:

Research and Development costs are charged to the Income & Expenditure Account for the year in which these are incurred.

9.0 Advances:

A sum is included under "Advance Council" is shown in the Balance Sheet under the head Advances (Schedule-11) which include a sum of pending recovery/adjustment prior to 2019-20 amounting to Rs. 3,40,914.00.

10.0 Contingent Liability:

Legal expenses include the cost to defend the court cases lodged against the Institute; contingent liability for such cases is not ascertained.

11.0 Long Un-Reconciled Balance:

There are some old un-reconciled balances before introduction of computerized accounting in the year 2010-11. The same is under re-conciliation.

12.0 MSME Development (MSMED) Act, 2006

Provisions of MSME Development (MSMED) Act, 2006 have been complied by Bose Institute.

13.0 Capitalisation of Assets of Unified Academic Campus of Bose Institute:

Sl. No.	Contractor	Package Description	Actual Completion Cost (Rs.)
1.	M/s. ITD Cementation	Construction of Superstructure (G+15) for UAC.	132,03,86,614.49 (excluding GST)
2.	M/s. Hitech Erectors	Supply, Installation, Testing and Commissioning of External Power Distribution system for UAC.	9,39,18,218.00
3.	M/s. Unique Engineers	Supply, Installation, Testing and Commissioning of centralised HVAC, Mechanical Ventilation & VRV System at UAC.	23,15,80,966.00
4.	M/s. Satellite Electronics	Modelling of Auditorium Interior Design for Construction of UAC.	2,06,22,334.00

Bose Institute has constructed its Unified Academic campus (UAC) at Plot No. 80, Block EN, Sector V, Salt Lake City, and Kolkata 700091. M/s. DCPL was appointed as the architect of the project. Underground piling work has been completed by M/s. Macintosh & Burn Limited. M/s RITES Limited was engaged as Project Management Consultant (PMC). They have supervised the entire construction work and had appointed various contractors for entire construction package wise. The construction costs are as follows as per the certification of M/s. RITES Limited:

Sl No.	Particulars	Updated up to	Quantum of excess amount paid (Rs.)
1	Existing employees (137 Nos.)	Apr, 2020	13,46,61,260.00
2	Pensioners / Family pensioners (153 Nos.)	Aug, 2020	21,31,39,077.00
	Total		34,78,00,447.00

Above packages are completed at different dates, but Bose Institute has received the Completion Certificate and hand over during 2019-2020 financial year and due to non availability of various information capitalisation work can't be done. Since handover is taken by Bose Institute and occupancy has been started, it is required to be taken in the books of accounts at as per prudent accounting policy and applicable accounting standards.

The capitalisation is done only for accounting propose at the given completion cost by PMC, M/s. RITES Limited and the same will be subject to various audit and will be revised accordingly and will have no connection with the giving recognition of the costs given by PMC. Some final payments are yet to be made after settlement of Final Bill and completion of Defect Liability Period (DLP) and the construction costs will also be revised accordingly. Further As per AS 10 & Ind AS16 the other associated costs in connections with the construction (like preparation of project reports, site plan, fees paid to various bodies in connection with the land and construction, fees of architect etc.) will be suitably attributable with the construction cost of different packages.

Finally the completion costs given by M/s. RITES limited are taken into account to reflect the True and Fair view of the Accounting Statements prepared by Bose Institute which may revise in future due to Audit and inclusion of direct and indirect attributable costs in connection with the construction of UAC.

14.0 Implementation of 7th Central Pay Commission recommendations at Bose Institute

The Department of Science & Technology (DST), conveyed the report of Group of Officers (GoO) vide its letter no. No. AI/1/40/BI/2019, dated: 16th Oct 2019 with a observation that Bose Institute was following time scale promotion for its Non-Academic employees (both technical and administrative) on the basis of BI OM No. R/82/08/1699, dated: 08.04.2008 & R/82/08/1799, dated: 15.04.2008, which is more beneficial as compared to the corresponding categories of the Central Government employees. They recommended that the above BI OMs No. R/82/08/1699, dated: 08.04.2008 & R/82/08/1799, dated: 15.04.2008, "were illegal, arbitrary and without approval of the competent authority and hence shall be made null and void."

The committee also recommended that "grant of higher pay scales, above the norms of the Government of India, in respect of those categories of employees will be put on hold till such time the issue is examined and decision is taken by the competent authority" (Para 3 (ii). Further it was recommended to prepare a "due drawn statement in respect of all the employees, for the period 22.12.2005 onwards till the date of withdrawal of the effect of BI OMs dated 08.04.2008 & 15.04.2008 shall be prepared within two months time, and the quantum of recovery shall be calculated in respect of each employees/retirees/personnel died in harness. While preparing the due drawn statement, the excess payment made on account of disbursement of pension and pensionary benefits in respect of retired employees/died in harness employees shall also be taken into account. Settled TA cases and LTC cases shall not be reopened. However, excess leave encashment payments shall be brought out separately for appropriate direction of M/o Finance."

After a detailed calculation as per the guidelines given by GoO in its report the final due drawn statement has been prepared up to April 2020 and depicted in the following table:

Sl No.	Particulars	Updated up to	Quantum of excess amount paid (Rs.)
1	Existing employees (137 Nos.)	Apr, 2020	13,46,61,260.00
2	Pensioners/Family pensioners (153 nos.)	Aug, 2020	21,31,39,077.00
	Total		34,78,00,447.00

The detailed calculation is submitted to DST for its necessary action for placing the same to Ministry of Finance for waiver of recovery of the excess payments as mentioned above and the matter is pending till date. From the month of May 2020 the salary of 137 numbers of existing employees has been re-fixed and implemented. The above mentioned amount is subject to verification and audit.

A number of legal court cases were filed against Bose Institute in objection of the above settlement and theses cases are also pending at the courts of law.

15.0 Capitalisation of Assets created under FAIR project at Bose Institute

The facility for Anti-Proton and Ion Research (FAIR) is a global facility being created in Darmstadt, Germany under a multi-country partnership. FAIR project is managed by FAIR company (FAIR GmbH). FAIR will be one of the largest accelerator facilities in the world and also one of the mega science projects recommended by the Steering Committee on Science & Technology set up by the Planning Commission for the 11th Five Year Plan. FAIR project is taken up as part of DAE & DST joint collaboration under a MoU signed between DAE & DST.

A joint declaration was signed on 07.02.2007 by the Minister for Science & Technology and Earth Sciences, Govt. of India and the Federal Minister for Education & Research, Federal Republic of Germany concerning the participation in construction and operation of the international facility for Anti-proton and Ion research. A joint statement was issued by the Chancellor of Republic of Germany and Prime Minister of India on 30.10.2007 in this regard. On 04.10.2010, the international agreement on the construction of FAIR was signed by nine countries, namely Germany, Finland, France,

'Schedule – 4' & 'Schedule – 08 B' of Bose Institute Council Books of Accounts and the balance quantity which is yet to be delivered to FAIR and is under progress is shown as CWIP (Capital Work In Progress).

India, Poland, Romania, Russia, Slovenia and Sweden. Latter on United Kingdom also joined as a partner. India's contribution to the FAIR consortium has been estimated at 42.79 million Euro at July 2010 prices which is equivalent to Rs. 260.00 Crore (Approximately). According to the MoU between DAE & DST, the overall cost of Rs. 260.00 Crore is to be borne equally by DAE & DST. The sanction was subsequently revised vide OM no SR/MF/PF-02/2010(E-6133) dated 08.10.2021 to Rs 615.00 Crore.

Department of Science & Technology (DST), under the Ministry of Science & Technology, Govt. of India vide its Memo No. SR/MF/PS-01/2011 dated 04/03/2011 mentioned under clause 11 that "financial aspect will be issued in due course" but the same has not been received till date. However the present executive council takes both operational and financial decision.

Further, Accounting of FAIR project is unique and it is maintained in the old format as before, without changing in format for Central Autonomous Institutes.

Bose Institute, Kolkata has been designated as the Indian shareholder in the FAIR Company and the Nodal Indian institution for management of the FAIR programme in India. So far, the assets created from Indian participation was not taken under the purview of Bose Institute and was not shown in its Balance Sheet up to F.Y. 2020-21, but now Finance Committee of Bose Institute in its meeting dated 23.11.2021 has directed to show funds received under FAIR project from DST and DAE has to properly accounted for in the financial statements. The asset created under FAIR project should be capitalised first and reflected in Institutes financial Statement and also transfer entry should be made if the assets are transferred to FAIR project. Accordingly now from this year (F.Y. 2021-22) onwards the IN-KIND ITEMS already sent to FAIR Germany till date, have been capitalised and shown in the attached statement under 'Schedule – 4' & 'Schedule – 08 B' of Bose Institute Council Books of Accounts and the balance quantity which is yet to be delivered to FAIR and is under progress is shown as CWIP (Capital Work In Progress).

INDEPENDENT AUDITORS REPORT

To the Member of Council

Opinion

We have audited the accompanying financial statement of BOSE INSTITUTE, FAIR PROJECT (entity), which comprises the Balance sheet as at MARCH 31st 2025 & Statement of expenditure for the year ended on that date and notes to the financial statement, including a summary of significant accounting policies and other explanatory information. In our opinion and to the best of our information and according to the explanations given to us, the accompanying financial statement give true and fair view of the financial position of the entity as at march 31st, 2025 and of its financial performance for the year then ended.

Basis for Opinion

We have conducted our audit in accordance with the Standards on Auditing (SAs) issued by the Institute of Chartered Accountants of India (ICAI). Our responsibilities under those standards are further described in the auditor's responsibilities for the audit of the financial statements section of our reports. We are independent of the entity in accordance with the ethical requirement that is relevant to our audit of the financial statement in India. And we have fulfilled our other ethical responsibilities in accordance with these requirements. We believe that audit evidence we obtained is sufficient and appropriate to provide the basis for our opinion.

Emphasis of Matter

1. No Physical verification of the Assets was done. The Institute has not carried out test of impairment, if any, in accordance with the requirement of AS 28 notified by the Institute of Chartered Accountants of India (ICAI). In view of this it is not possible to opine on correctness or otherwise of fixed assets.
2. Depreciation is not charged on Office Equipment's valued Rs. 98530/- & Rs. 1772547/- which are used in Bose Institute – FAIR PROJECT, results overstatement of Fixed Assets as well as overstatement of Excess of Income over expenditure as at the end of the year.

Our opinion is not modified in respect of these matters.

Key Audit Matters

Key audit matters are those matters that, in our professional judgment, were of most significance in our audit of the Financial Statements of the current period. In this audit we have not determined any specific Key Audit Matter to be addressed separately.

Responsibilities of management and those charged with governance for the financial statement

Management is responsible for the preparation and fair presentation of the financial statement in accordance with the aforesaid accounting standards, and for such internal control as management determines is necessary to enables the preparation of the financial statements that are free from material misstatement, whether due to fraud and error.

In preparing the financial statement management is responsible for assessing the entity's ability to continue as going concern, disclosing as applicable, matters related to going concern and using the going concern basis of accounting unless management either intend to liquidate the entity or to cease the operation, or has no

realistic alternative but to do so. Those charged with governance are responsible for overseeing the entity's financial reporting process.

Auditor's responsibilities for the audit of the financial statements

Our objective is to obtained reasonable assurance about whether the financial statement as a whole free from material misstatement, whether due to fraud error, and to issue and auditor's report that includes our opinion. Reasonable assurance is the high level of assurance but is not guarantee that an audit conducted in accordance with SAs will always detects material misstatement when it exists. Misstatement can arise from fraud or error and are consider material if, individually or in aggregate, they could reasonably be expected to influence the economic decisions of the user taken on the basis of these financial statement.

Place: Kolkata
Dated: 29.08.2025

For A.N.Chatterjee & Co.
Chartered Accountants
F.R.N. 302143E
Avijit Auddy
(Partner)
M.No. 061616
UDIN: 25061616BMLJZI3731

NOTES ON ACCOUNTS

FAIR PROJECTS

The facility for Anti-Proton and Ion Research (FAIR) is a global facility being created in Darmstadt, Germany under a multi-country partnership. FAIR project is managed by FAIR company (FAIR GmbH). FAIR will be one of the largest accelerator facilities in the world and also one of the mega science projects recommended by the Steering Committee on Science & Technology set up by the Planning Commission for the 11th Five Year Plan. FAIR project is taken up as part of DAE & DST joint collaboration under a MoU signed between DAE & DST.

A joint declaration was signed on 07.02.2007 by the Minister for Science & Technology and Earth Sciences, Govt. of India and the Federal Minister for Education & Research, Federal Republic of Germany concerning the participation in construction and operation of the international facility for Anti-proton and Ion research. A joint statement was issued by the Chancellor of Republic of Germany and Prime Minister of India on 30.10.2007 in this regard. On 04.10.2010, the international agreement on the construction of FAIR was signed by nine countries, namely Germany, Finland, France, India, Poland, Romania, Russia, Slovenia and Sweden. Latter on United Kingdom also joined as a partner. India's contribution to the FAIR consortium has been estimated at 42.79 million Euro at July 2010 prices which is equivalent to Rs. 260.00 Crore (Approximately). According to the MoU between DAE & DST, the overall cost of Rs. 260.00 Crore is to be borne equally by DAE & DST. The sanction was subsequently revised vide OM no SR/MF/PF-02/2010(E-6133) dated 08.10.2021 to Rs 615.00 Crore.

Bose Institute, Kolkata has been designated as the Indian shareholder in the FAIR Company and the Nodal Indian institution for management of the FAIR programme in India. So far, the assets created from Indian participation was not taken under the purview of Bose Institute and was not shown in its Balance Sheet up to F.Y. 2020-21, but now Finance Committee of Bose Institute in its meeting dated 23.11.2021 has directed to show funds received under FAIR project from DST and DAE has to properly accounted for in the financial statements. The asset created under FAIR project should be capitalised first and reflected in Institutes financial Statement and also transfer entry should be made if the assets are transferred to FAIR project. Accordingly from F.Y. 2021-22 onwards the IN-KIND ITEMS already sent to FAIR Germany till date, have been capitalised and shown in the attached statement under 'Schedule – 4' & 'Schedule – 08 B' of Bose Institute Council Books of Accounts and the balance quantity which is yet to be delivered to FAIR and is under progress is shown as CWIP (Capital Work In Progress).

Department of Science & Technology (DST), under the Ministry of Science & Technology, Govt. of India vide its Memo No. SR/MF/PS-01/2011 dated 04/03/2011 mentioned under clause 11 that "financial aspect will be issued in due course" but the same has not been received till date. However the present executive council takes both operational and financial decision.

Further, Accounting of FAIR project is unique and it is maintained in the old format as before, without changing in format for Central Autonomous Institutes.

Place: Kolkata
Date: 29-08-2025

For, A. N. ChatterJee & Co.
Chartered Accountants
F.R.N. 302143E

Avijit Auddy
(Partner)
M. No. 061616

BOSE INSTITUTE (Indo-FAIR Project)
BALANCE SHEET
For the year ended 31ST March 2025

	Schedule No	2024-25 (as at 31-Mar-2025) (₹)	2023-24 (as at 31-Mar-2024) (₹)
Funds & Liabilities:			
Capital Account			
Fund for Creation of Assets	**6**	1,22,27,44,919.25	69,09,35,866.00
Current Liabilities			
Liabilities & Other Provisions	**7**	83,11,606.00	43,714.00
Branch / Divisions		-	
BOSE INSTITUTE COUNCIL			
BOSE INSTITUTE SCHEME A/C		6,52,830.00	
UNUTILISED GRANT			
Interest on Unutilised Fund	**4**	-	-
GRANT from D.A.E	**3**	42,59,012.92	4,47,69,351.17
GRANT from D.S.T.	**2**	-0.23	-0.23
Total		**1,23,59,68,367.94**	**73,57,48,930.94**
Assets:			
Investments			
Shares in FAIR GmbH		54,732.00	54,732.00
Fixed Assets			
Office Equipment (Furniture)		98,530.00	98,530.00
Office Equipment (Equipment)		17,72,547.00	17,72,547.00
Fixed Assets Transfer to FAIR	**5**	25,35,96,171.59	25,35,96,171.59
Assets under CWIP	**5**	96,72,22,938.66	43,54,13,885.41
Current Assets			
Loans & Advances (Asset)			-
Cash-in-hand			-
Bank Balances:			
Union Bank of India-SB A/c		1,17,68,432.69	4,48,13,064.94
Accrued Interest		14,55,016.00	
Fixed Deposits			-
Total		**1,23,59,68,367.94**	**73,57,48,930.94**

Place : Kolkata
Date : 29.08.2025

UDIN : 25061616BMLJZG9559

Signed in terms of our separate Report of even date.
For A.N. Chatterjee & Co.

Chartered Accountants
Firm Registration No. 302143E
Avijit Auddy
Partner
Membership No. 061616

Sd/-
Shaubhik Ghosh
UDC

Sd/-
Vikash Kumar
Audit & Finance Officer

Sd/-
Achintya Mukherjee
Accounts Officer

Sd/-
Prof. Srimonti Sarkar
Registrar(O)

Sd/-
Prof. Kaustuv Sanyal
Director

BOSE INSTITUTE (Indo-FAIR Project)
STATEMENT OF EXPENDITURE
For the year ended 31ST March 2025

	Schedule No	2024-25 (as at 31-Mar-2025) (₹)	2023-24 (as at 31-Mar-2024) (₹)
Income			
Expenditure			
IFCC EXPENSES:			
AUDIT FEES		17,700.00	17,700.00
BANK CHARGES		-	0.30
CONTINGENCY EXPENSES		1,29,623.00	13,450.00
MEETING EXPENSES		2,69,241.00	1,11,253.00
PARTICIPATION IN INITIAL EXPERIMENT		-	-
SALARY (Human Resources)		12,00,000.00	13,44,904.00
STUDENTS SUPPORT		19,20,216.00	7,06,048.00
TRAVELLING EXPENSES		6,80,124.00	11,50,066.00
WORKSHOP		-	2,07,189.00
Total		**42,16,904.00**	**35,50,610.30**
Expenditure in Profit & Loss A/c adjusted by debiting to the Grantee Organisation, i.e., DST & DAE		**(-) 42,16,904.00**	**(-) 35,50,610.30**

Place : Kolkata
Date : 29.08.2025
UDIN : 25061616BMLJZG9559

Signed in terms of our separate Report of even date.
For A.N. Chatterjee & Co.
Chartered Accountants
Firm Registration No. 302143E
Avijit Auddy
Partner
Membership No. 061616

Sd/-
Shaubhik Ghosh
UDC

Sd/-
Vikash Kumar
Audit & Finance Officer

Sd/-
Achintya Mukherjee
Accounts Officer

Sd/-
Prof. Srimonti Sarkar
Registrar(O)

Sd/-
Prof. Kaustuv Sanyal
Director

BOSE INSTITUTE (Indo-FAIR Project)
RECEIPT & PAYMENT
For the year ended 31ST March 2025

Receipts	Amount (₹)	Payments	Amount (₹)
Opening Balance			
Cash in Hand	-		
S.B A/c : Union Bank of India	4,48,13,064.94		
Fixed Deposits	-		
ZBSA A/c : Bank of Maharashtra	-		
GRANT FROM D.S.T	-		
GRANT FROM D.S.T (Unspent Balance of 2023-24 Reassigned)	15,35,05,299.00		
GRANT FROM D.A.E	34,59,00,000.00		
Interest on SB A/c	14,24,113.00		
Interest on FD (Term Deposits)	-		
Prior Period Income (Interest from Other Sources)	38,88,133.00		
Advance	2,00,455.00	Advance	2,00,455.00
Income Tax (TDS - 194C)	43,58,972.00	Income Tax (TDS - 194C)	43,60,470.00
Income Tax (TDS - 194J)	2,100.00	Income Tax (TDS - 194J)	2,100.00
Income Tax (TDS - 194Q)	2,54,238.00	Income Tax (TDS - 194Q)	2,54,238.00
TDS on GST (CGST)	1,64,220.00	TDS on GST (CGST)	1,76,478.00
TDS on GST (SGST)	1,64,220.00	TDS on GST (SGST)	1,76,478.00
TDS on GST (IGST)	1,23,37,423.00	TDS on GST (IGST)	1,23,37,423.00
		Workshop	-
		Travelling Expenses	6,80,124.00
		Meeting Expenses	2,69,241.00
		Audit Fees	17,700.00
		Contingency Expenses	1,29,623.00
		Overhead Charges	-
		Salary (Human Resources)	12,00,000.00
		Student Support	19,20,216.00
		Office Equipment	-
		Power Converter (In-Kind)	25,49,12,947.00
Detector - FAIR Experiment	4,32,28,871.75	Beam Stopper (In-Kind)	1,22,53,269.00
		IT Cable (In-Kind)	30,15,21,869.00
		Bank Interest (2023-24) deposited in to Bharatkosh (On 'Grant from DST')	-
		GRANT FROM D.S.T (Unspent Balance of DST Grant returned to DST on 15-01-2025)	87,12,876.00
Inter Unit Account		**Inter Unit Account**	
Bose Institute (Council)	24,58,080.00	Bose Institute (Council)	24,58,080.00
Scheme/Project	6,52,830.00	Schemge/Project	-
		Closin Balance	
		Cash in Hand	-
		S.B A/c : Union Bank of India	1,17,68,432.69
		Fixed Deposits	-
		ZBSA A/c : Bank of Maharashtra	-
	61,33,52,019.69		**61,33,52,019.69**

Sd/-	Sd/-	Sd/-
Shaubhik Ghosh	Vikash Kumar	Achintya Mukherjee
UDC	Audit & Finance Officer	Accounts Officer

INDEPENDENT AUDITORS REPORT

To the Member of Council

Qualified Opinion

We have audited the accompanying financial statements of BOSE INSTITUTE Governing Body (the entity), which comprise the Balance Sheet at March 31st, 2025, and the Income & Expenditure account for the year ended on that date and notes to the financial statements, including a summary of significant accounting policies and other explanatory information. In our opinion and to the best of our information and according to the explanations given to us, except for the effect of the matter described in the Basis for Qualified Opinion section of our report, the accompanying financial statements give a true and fair view of the financial position of the entity as at March 31st, 2025, and of its financial performance for the year then ended.

Basis for Qualified Opinion

1. No Fixed Asset register was provided for our verification. No Physical verification of the Assets was done. The Institute has not carried out test of impairment, if any, in accordance with the requirement of AS 28 notified by the Institute of Chartered Accountants of India (ICAI). In view of this it is not possible to opine on correctness or otherwise of fixed assets.
2. Depreciation is not charged on Fixed Assets which results overstatement of Fixed Assets as well as overstatement of Excess of Income over expenditure as at the end of the year.
3. Cash balance shown Rs. 8150.05 as on 31.03.2025 against which balance confirmation certificate not provided for our verification.
4. Share certificate for the investment of Rs. 6041.67 in 7.5% Preference share of C.E.S.C Ltd. was not available for our verification. Income, If any, accrued or arisen, out of such investment has not been accounted for.

We conducted our audit in accordance with the Standards on Auditing (SAs) issued by ICAI. Our responsibilities under those standards are further described in the Auditor's Responsibilities for the Audit of the Financial Statements section of our report. We are independent of the entity in accordance with the ethical requirements that are relevant to our audit of the financial statements in India, and we have fulfilled our other ethical responsibilities in accordance with these requirements. We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our qualified opinion.

Emphasis of Matter

We draw attention to the following matters

1. Following Advances are outstanding for a long period of time against which details and reason for non-adjustment are not available.

i) Festival Advance	Rs. 9300/-
ii) Advance to Staff	Rs. 16820/-
iii) Telephone Deposits	Rs. 6600/-
iv) Security Deposit-for electricity	Rs. 75/-

2. In respect of Special Fund which includes "Sri N.R.Sarkar Prize Fund"shows negative balance of Rs.

53055.08/- for a long period of time (Since 31.10.2019). Reason for such negative balance and non-adjustment of such negative balance not made available to us.

3. Following Liabilities are outstanding for a long period of time against which details and reason for non-adjustment are not available.

i) Outstanding Accounting Charges	Rs. 10000/-
ii) Payable to Sri. D. Ray	Rs. 14000/-
iii) Caution Money	Rs. 5000/-

Our opinion is not modified in respect of these matters.

Key Audit Matters (Difference in F.D. balance of Rs. 486514.00 to be incorporate in Notes to Accounts)

Key audit matters are those matters that, in our professional judgment, were of most significance in our audit of the Financial Statements of the current period. In this audit we have not determined any specific Key Audit Matter to be addressed separately.

Responsibilities of Management and Those Charged with Governance for the Financial Statements

Management is responsible for the preparation and fair presentation of the financial statements in accordance with the aforesaid Accounting Standards, and for such internal control as management determines is necessary to enable the preparation of financial statements that are free from material misstatement, whether due to fraud or error. In preparing the financial statements, management is responsible for assessing the entity's ability to continue as a going concern, disclosing, as applicable, matters related to going concern and using the going concern basis of accounting unless management either intends to liquidate the entity or to cease operations, or has no realistic alternative but to do so. Those charged with governance are responsible for overseeing the entity's financial reporting process.

Auditor's Responsibilities for the Audit of the Financial Statements

Our objectives are to obtain reasonable assurance about whether the financial statements as a whole are free from material misstatement, whether due to fraud or error, and to issue an auditor's report that includes our opinion.

Reasonable assurance is a high level of assurance, but is not a guarantee that an audit conducted in accordance with SAs will always detect a material misstatement when it exists. Misstatements can arise from fraud or error and are considered material if, individually or in the aggregate, they could reasonably be expected to influence the economic decisions of users taken on the basis of these financial statements.

Place: Kolkata
Dated: 29.08.2025
UDIN: 25061616BMLJZH2666

For A.N.Chatterjee & Co.
Chartered Accountants
F.R.N. 302143E
Avijit Auddy
(Partner)
M.No. 061616

BOSE INSTITUTE (GOVERNING BODY)
BALANCE SHEET AS AT 31ST MARCH 2025

	Schedule No.	As on 31/03/2025 Rs.	As on 31/03/2024 Rs.
FUNDS & LIABLITIES			
CAPITAL FUND	1	23,78,583.36	23,17,833.36
ACHARYA JC BOSE CENTENARY FUND			
AS PER LAST ACCOUNT		15,99,768.40	15,99,768.40
SPECIAL FUND			
AS PER LAST ACCOUNT	2	29,62,629.96	29,62,629.96
DEPOSITS & OTHER LIABILITIES	3	10,50,915.66	11,04,100.66
TOTAL		**79,91,897.38**	**80,45,082.38**
PROPERTIES & ASSETS			
FIXED ASSETS			
AS PER LAST ACCOUNT	4	23,74,712.85	23,74,712.85
INVESTMENTS			
AS PER LAST ACCOUNT	5	87,42,662.67	92,29,176.67
RECEIVABLE & DEPOSITS			
AS PER LAST ACCOUNT	6	5,64,549.00	32,795.00
CASH & BANK BALANCES	6	12,75,800.34	12,64,498.34
INCOME & EXPENDITURE A/C			
EXCESS OF INCOME OVER EXPENDITURE		(49,65,827.38)	(48,56,100.48)
TOTAL		**79,91,897.38**	**80,45,082.38**

INCOME & EXPENDITURE STATEMENT FOR THE YEAR ENDED 31ST MARCH 2025

Particulars	2024-25 Rs.	2023-24 Rs.
INCOME		
INTEREST ON TERM DEPOSIT	6,02,141.00	8,93,578.00
INTEREST ON SAVINGS BANK	-	-
TOTAL	**6,02,141.00**	**8,93,578.00**
EXPENDITURE		
SALARY & WAGES	-	-
ACCOUNTING CHARGES	-	-
AUDIT FEES	5,900.00	5,900.00
BANK CHARGES	-	-
EXCESS OF INCOME OVER EXPENDITURE FOR THE YEAR	5,96,241.00	8,87,678.00
TOTAL	**6,02,141.00**	**8,93,578.00**
INCOME BROUGHT DOWN AND ADJUSTED WITH LAST YEAR	5,96,241.00	8,87,678.00
Prior Period Adjustment	(4,86,514.00)	
BALANCE BROUGHT DOWN FROM LAST A/C	48,56,100.48	39,68,422.48
BALANCE TAKEN TO BALANCE SHEET	**49,65,827.48**	**48,56,100.48**

Place : Kolkata
Date : 29.08.2025
UDIN: 25061616BMLJZH2666

Signed in terms of our separate Report of even date.
For A.N. Chatterjee & Co.
Chartered Accountants
Firm Registration No. 302143E
Avijit Auddy
Partner
M.No. 061616

Sd/-
Kamal Sing
Accountant (Cash)

Sd/-
Vikash Kumar
Audit & Finance Officer

Sd/-
Achintya Mukherjee
Accounts Officer

Sd/-
Prof. Ajit Bikram Datta
Registrar(O)

Sd/-
Prof. Kaustuv Sanyal
Director


बसु विज्ञान मन्दिर
बसु विज्ञान मंदिर
BOSE INSTITUTE
(विज्ञान एंव प्रौद्योगिकी विभाग, भारत सरकार के अधीन एक स्वायत्त संस्था)
(AN AUTONOMOUS INSTITUTE UNDER DEPARTMENT OF SCIENCE & TECHNOLOGY, GOVT. OF INDIA)

NOTES

THE 108TH FOUNDATION DAY

The **108th Foundation Day** of Bose Institute was celebrated on November 30, 2024. **PROF. SANKAR K. PAL,** National Science Chair, Govt. of India, President, Indian Statistical Institute, Distinguished Scientist and Former Director, Indian Statistical Institute, Kolkata, delivered **85th Acharya J.C. Bose Memorial** Lecture on ***"Pattern Recognition, Machine Intelligence to Deep Learning and Data Science: Evolution, Challenges and Concerns"***. **Prof. Tanusri Saha-Dasgupta,** Director, S. N. Bose National Centre for Basic Sciences, Kolkata, presided over the programme.

BOSE INSTITUTE

(AN AUTONOMOUS INSTITUTE UNDER DEPARTMENT OF SCIENCE & TECHNOLOGY, GOVT. OF INDIA)

Main Campus - 93/1 A.P.C. Road, Kolkata - 700 009, West Bengal

Unified Academic Campus - EN-80, Sector - V, Salt Lake, Kolkata - 700 091, West Bengal

Centenary Campus - P-1/12, CIT Scheme VII (M), Kolkata - 700054, West Bengal