BOSE INSTITUTE

(AN AUTONOMOUS INSTITUTE UNDER
DEPARTMENT OF SCIENCE & TECHNOLOGY, GOVT. OF INDIA)

Azadi Ka Amrit Mahotsav

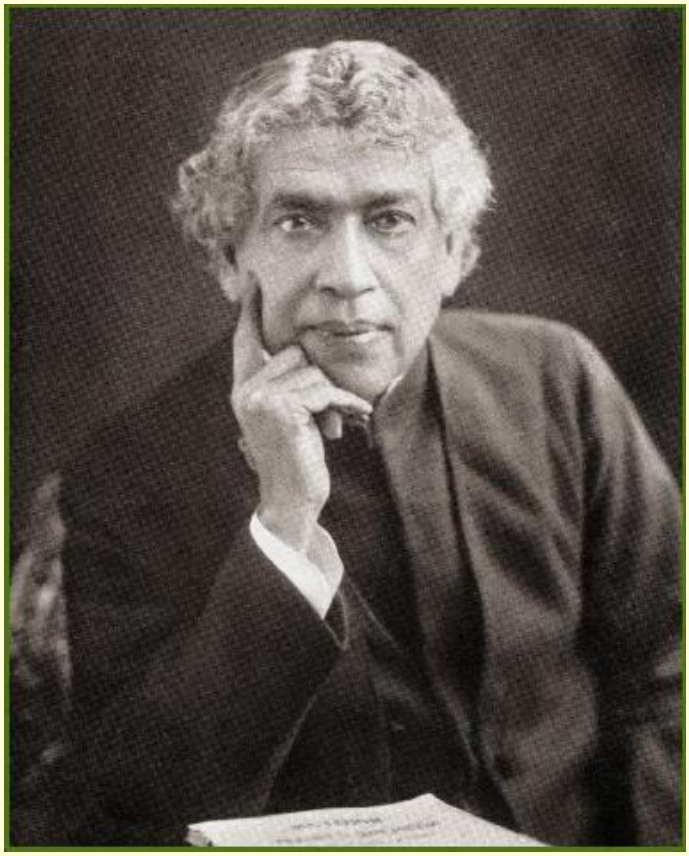
ANNUAL REPORT 2022-23

THE 106TH FOUNDATION DAY

The 106th Foundation Day of Bose Institute was celebrated on November 30, 2022. **Professor Ashutosh Sharma,** Institute Chair Professor, Department of Chemical Engineering, Indian Institute of Technology, Kanpur, delivered 83rd Acharya J.C. Bose Memorial Lecture on "The Brave New World of Science Today is but the World of J.C. Bose & C.V. Raman: Coming Full Circle". Professor Gautam R. Desiraju, Honorary Professor, Solid State and Structural Chemistry Unit, Indian Institute of Science, Bangalore, presided over the programme.

BOSE INSTITUTE

(An Autonomous Institute under Department of Science & Technology, Govt. of India)



ANNUAL REPORT
2022-2023

Edited by the members of
J. C. Bose Centre
(Museum and Publication unit)

Published by:
Registrar, Bose Institute
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FROM THE DIRECTOR'S DESK

MOU between Bose Institute and Tea Board India

The Division of Plant Biology organized the signing of MOU between Bose Institute and Tea Board India at the Unified Academic Campus, Bose Institute on August 26, 2022.

FROM THE DIRECTOR'S DESK

I am immensely delighted to present the Annual Report for the year 2022-23, explicitly focusing the dedication, accomplishments and success of the students and faculty members of Bose Institute in catalyzing frontier research, transcending national boundaries, effectively lead to the enrichment of the research base of the Institute as well as enhancement of the nation's pride to a greater height.

I would like to place and highlight few things as well as essential responsibilities of this national laboratory in front of you all. For easy understanding of the motto, mission, vision, duties and how Bose Institute is dedicated to consume and generate knowledge into technology, is always showing the light for future journey.

Bose Institute, Kolkata, an autonomous R&D Institute under the Department of Science & Technology, Govt. of India, has been designated as the Indian shareholder of the FAIR GmbH and the nodal Indian Institution for managing the FAIR programme from India. I take pleasure to mention that we have been fulfilling our commitments in overseeing the designing, manufacturing and supply of in-kind items (e.g. power converters, beam stoppers etc.) for accelerator and coordinate participation of Indian scientists in the experiments at FAIR, Germany under the project entitled "India's participation in the construction of Facility for Antiproton and Ion Research (FAIR) at Darmstadt, Germany". In this regard, it is praiseworthy to mention about the "FAIR Industry Meet" that was successfully organized by Bose Institute, Kolkata at the Unified Academic Campus of the Institute during April 12 – 13, 2023. The purpose of this Meet was to appraise Indian Industries about the opportunities and challenges in participating in the Mega Science Projects such as FAIR where India is taking a leading role to both build the facilities as well as take part in the experiments using them. Mr. Manfred Auster, the Hon'ble Consul-General, Consulate General of the Federal Republic of Germany, Kolkata was present as the Chief Guest. Among others present in the Meet were Dr. David Urner, Head, In-Kind Office & Procurement, FAIR GmbH, Dr. Sumit Som, Director, Variable Energy Cyclotron Centre (VECC) and Chief Patron for Indo-FAIR Project, Mr. Gaurav Aggarwal, Scientist from International Cooperation Division, DST, Government of India. A significant number of companies from different industry sectors relevant to the development and construction of such a large size particle accelerator facility such as cryogenics, ultra high vacuum, application specific integrated chip (ASIC) and sensor, heavy engineering, printed circuit board manufacturing, electrical and electronics, participated in the Meet where presentations by the company representatives were made on their current product range, facilities, clientele especially those where India is a partner. Detailed representations were also made by the FAIR GmbH on the requirements from the project beyond the scope of Indian in-kind contribution where FAIR asks for global tender and intimated about the procedure to participate in the tendering procedure.

Bose Institute has always been playing pioneering role in carrying out a significant number of pathbreaking research on High Energy Physics – Understanding of Sub-atomic Particles, Quantum Information and Communication, Understanding of Response of Plants under Biotic and Abiotic Stress, System and Synthetic Biology, Environmental Microbiology and Climate Change, Structure and Functions of Macromolecules, Bioinformatics, Bioorganic Chemistry for Drug Development, Identification of Drug Target and Validation of Bioactive Molecules for Therapeutic Intervention, Atmospheric dynamics and air pollution etc. With the successful coverage of rudimentary and applied contributions to the repository of scientific knowledge, Bose Institute has always been in the forefront of setting up cutting-edge scientific research in the fields of Physical, Biological and Chemical Sciences. I take pleasure to mention that a significant number of high value projects/mega projects under the auspices of the Institute are completely aligned with the mandate of Department of Science and Technology, Ministry of Science and Technology, Government of India. A considerable number of visits of students, teachers, administrative and technical trainees/executives from different schools, colleges, universities, educational institutions, Government organizations under different Ministries, have been successfully taken care of to serve their purpose. Noticeable accomplishments on the part of the Institute have been made in organizing seminars, discourses, workshops, symposia in hybrid (online/offline) mode.

It is praiseworthy to highlight the major accomplishments of the Institute in the following areas:

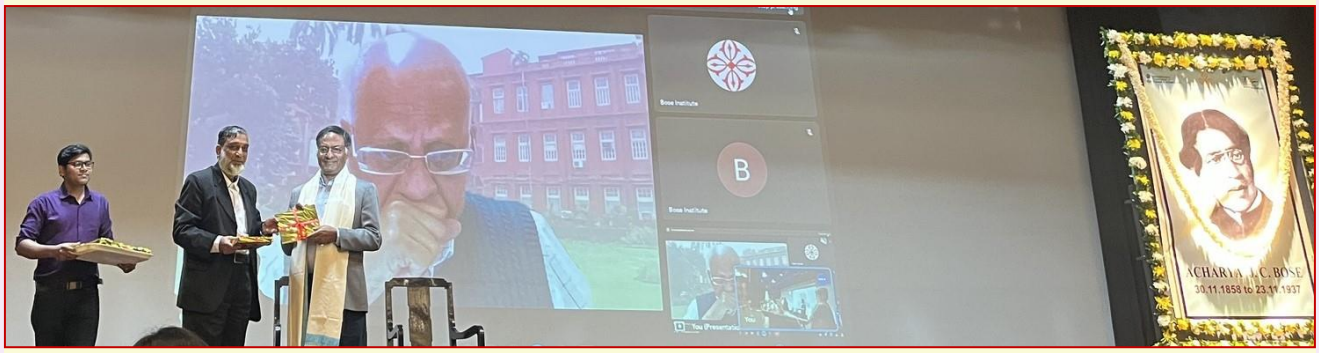
(a) Germplasm, R6 of Sesame, with high oil content and superior lignan profile has been developed and certified by the Indian Council of Agricultural Research (b) A transgenic tomato plant with inducible and reversible altered expression pattern of two stress-related genes, HSF and NAC2 has been generated (c) Studies on the Anti-CRC activity of an alkaloid-rich fraction of *E. coronaria* leaf extracts (AFE) and associated underlying mechanism provides a logical basis for consideration of AFE in future therapy (d) Water soluble Carbon dots (CD), have been synthesized which can be considered as a promising candidate for the biomedical applications (e) New studies have been initiated on the capsule-producing enzyme from *Staphylococcus aureus* (f) Recent understanding on the FKBP22, CapF, RsbW and σB would be helpful for the designing or screening of the new antibacterial agents in future. (g) Antimicrobial peptide have been shown to mimic as new adjunct antibiotics (h) In the atmospheric science studies, recent work emphasizes the immense importance of the role of biogenic emissions in cloud droplet formation over the eastern Himalaya under restricted anthropogenic emissions (i) Chemical characterization of the carbonaceous component of PM2.5 collected over a year-long campaign

Shyamnagar, West Bengal, in the Indo-Gangetic Plains (IGP), India. The findings would benefit policymakers in strategizing proper and effective management of biomass/biofuel burning in the IGP to minimize air pollution (j) New understanding on the effect of atmospheric relative humidity and temperature on bioaerosols (k) Presented a class of tachyon-free (stable) AdS as well as dS solutions in the context of type IIA orientifold compactifications (l) Broadband (visible to near-infrared) photodetection with high sensitivity in the near-infrared region is demonstrated in a MoSSe/graphene heterostructure (m) Improvement and broad-scale implementation of different biotechnology-oriented programmes for the socio-economic upliftment of Scheduled Tribe community of West Bengal (Tribal Sub Plan of DST SEED programme).

Bose Institute had published 234 numbers of full length peer reviewed research papers in referred journals, 02 Books, 33 Chapters in books and 12 Papers in conferences during the year 2022-23. The Institute had produced 29 Ph.D. students and trained 47 research manpower (other than Ph.D) who are flourishing to lead successful professional lives across the globe.

To highlight some noteworthy global and national collaborative projects / collaborations with Bose Institute, we may refer:

DST & DAE: India's participation in the construction of the Facility for Antiproton and Ion Research (FAIR) at Darmstadt, Germany: participate and oversee the designing, manufacturing and supply of in-kind items (e.g. power converters, beam stoppers etc.) for accelerator and coordinate participation of Indian scientists in the experiments at FAIR; IFCC: CBM MUCH: Compressed Baryonic Matter – Muon Chamber (CBM-MUCH): Compressed Baryonic Matter (CBM) experiment will study and characterize the matter created in the relativistic nucleus-nucleus collisions at FAIR. A large section of the Muon Chamber (MuCh) detector system will be built at Bose Institute in addition to the development of analysis tools and analysis of data from this experiment; DST & DAE: Indian Participation in the ALICE Experiment at CERN: A large ion collider experiment (ALICE): a dedicated heavy ion collision experiment at Large Hadron Collider (LHC) at CERN, Switzerland for the understanding of physics of strongly interacting matter at very high energy densities; Indo-Swiss: Next generation advanced therapies for fight β-hemoglobinopathies via rational intervention in ϒ-globin regulatory network; MoEFCC: National Carbonaceous Aerosols Programme (NCAP) WGIII: Carbonaceous Aerosols Emmissions, Source appointment and Climate effects; 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; SERB: Convergent miRNA actions in coordination of stress-response to *Alternaria solani* infection in tomato lines; SERB: Mechanism



of ganglioside GM2-mediated regulation of miR-615-5p in targeting oncogenic ID1 to mediate tumorigenesis; SERB: Fabrication of Infreared Photo-detector based on 2D systems and Tuning the Detection Windows by coupling with Nanostructures; SERB: Molecular charecterization of facor(s) regulating transcription of MYB21 and MYB24 genes in Jasmonic acid signalling pathway during pollen development; SERB: Characterization of the cellular roles of the proteasome and its deubiquitinase GIRpn11 of the differently-diverged eukaryote Giardia lamblia; SERB: Revealing bioaerosol movements within the area spanning eastern Himalayas and coastal Bay of Bengal; SERB: A Novel Approach to the Construction of N-alkylated Hydroxylamino lnterglycosidic Linkages from glycal epoxides: Application in the synthesis of esperamicin-calicheamicin cores; CSIR: Physico-chemical factors influencing Aerosol Hygroscopicity during fog, its effect on Aerosol Radiative Properties and fog nowcasting: a study in the context of Regional Climate Change over Eastern India; CSIR: Diversity and Distribution of Antibiotic Resistance Genes in the Sundarban mangrove estuary : coordination of anthropogenic and evolutionary influences; CSIR: Developmental and functional aspects of newly identified CD8+ T-regulatory cells in tumor microenvironment; CSIR: Deciphering the cross-talk between rhizosphere microbiome and the plant: insights from tea rhizosphere microbiome, metabolome and culture dependent analyses; CSIR: Deciphering the involvement of programmed cell death in the pathogenic development of *Ustilago maydis*; DST: Improvement and broad-scale implementation of different biotechnology-oriented programmes for the socio-economic upliftment of Scheduled Tribe community of West Bengal; DBT: Investigation of the Transcriptional Regulation of miR-325 and Evaluating its Potential as a Therapeutic Agent for Cancer; DBT: Development of delivery system for miR-325-3p for immunotherapy of cancer; DBT: Multi-Dimensional Research to Enable Systems Medicine: Acceleration using a Cluster Approach at Kalyani, West Bengal; DBT: Developing an optimized toolkit for induicible genome editing and regulation of gene expression in tomato plant: implications in adjusting complex traits via synthetic biology approach; DBT: Tailor Made Peptidomimetics Designing Against Human Islet Amyloid Polypeptide (hIAPP) Aggregation: A Therapeutic Approach Associated With Type-2 Diabetes: DBT-WB: Characterizing the interaction between Phosphodiesterase 8 (PDE8A) and 14-3-3 with CRAF: Gaining insights into CRAF regulation; ICMR: Understand the epigenetic regulation of GM2-synthase gene in cancer; ICMR: Epidemiological Survey on Tribal Communities of Dinajpur District in North Bengal to Develop a Knowledgebase on Disease Predisposition for Estimating Disease Etiology. Bose Institute has been actively participating in National Mission on Strategic Knowledge for Climate Change (NMSKCC), DST since 2018. We are working on “Relative role of biogenic and anthropogenic air pollutants on cloud formation over eastern Himalaya”; National clean air program: NCAP (MoEFCC, Govt of India) Strategic action plans to mitigate air pollution state-wise. Bose Institute

is the Nodal Institute and Dr. Abhijit Chatterjee, ESS is the Nodal Faculty for West Bengal; MoU between Tea Board India, Kolkata and Bose Institute, Kolkata for Research and Development Collaboration was signed on 26th August, 2023; A bipartite agreement between Bose Institute and M/s. Trident Autocomponents Pvt. Ltd. and a tripartite Non-Disclosure Agreement (NDA) among Bose Institute, CSIR-CMERI Durgapur and M/s. Trident Autocomponents Pvt. Ltd. for the procurement of Beam Stoppers as an Indian in-kind item for Facility for Anti Proton and Ion Research (FAIR) were signed on 07th December, 2022.

To mention the lectures/ seminars/symposia/colloquia organized/hosted by Bose Institute during 2022-23, we may refer a few viz.:

(i) Prof. (Dr.) Satinath Mukhopadhyay, Professor, Department of Endocrinology & Metabolism, IPGMER & SSKM Hospital, Calcutta, delivered D. M. Bose Memorial Lecture 2022 on "Impact of Vitamin D Deficiency on Skeletal and Non-skeletal Health" on 26-11-2022, the 138th Birth Day of Prof. Debendra Mohan Bose; (ii) Prof. Ashutosh Sharma, Institute Chair Professor, Department of Chemical Engineering, Indian Institute of Technology Kanpur, delivered the 83rd Acharya J. C. Bose Memorial Lecture on "The Brave New World of Science Today is but the World of J. C. Bose & C. V. Raman: Coming Full Circle" on the 106th Foundation Day Celebration of Bose Institute on 30-11-2022; (iii) Prof. Michael T. McMahon, F.M. Kirby Research Center for Functional Brain Imaging, Kennedy Krieger Institute, Baltimore, MD, USA, delivered a colloquium talk on "Chemical Exchange Saturation Transfer MRI contrast agents based on intramolecular hydrogen bonded systems and their applications to kidney and cancer imaging" on 15-02-2023; (iv) Prof. Naba Kumar Mondal, INSA Senior Scientist at Saha Institute of Nuclear Physics, Kolkata, delivered a colloquium talk on "History of the development of particle detectors in India" on 15-03-2023; (v) Dr. Devasis Ghosh, Sr. Consultant Mental Health, delivered lecture entitled "Mental stress and its management" on 04-05-2022 as a part of the celebration of 75th year of Independence "AZADI KA AMRIT MAHOTSAV"; (vi) Prof. Partha Pratim Majumder, National Science Chair and Founder Director, NIBMG, Kalyani, delivered a talk on "AND AS WE MOVED, WE EMBRACED AND ABSORBED", A Narrative and Contextualization of the Work of Svante Paabo on 04-01-2023; (vii) BIC Seminar XV: Insights into the mechanism of aging, organized on 10-02-2023 and the Speaker was Dr. Asish Chaudhuri, Consultant for Pharma particularly with L E K Consulting, 10927 Iron Spring, Helotes, TX, 78023.

To refer a few notable participation of Bose Institute in the mega events, we may highlight:

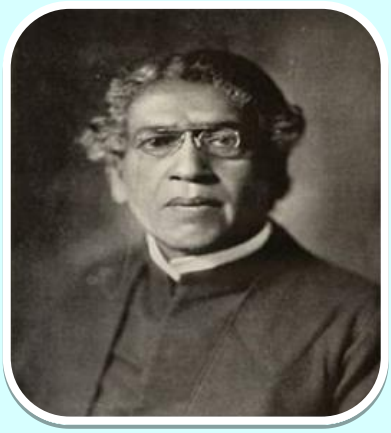
(i) 35th Meeting of the FAIR Council held at FAIR-Germany during July 05-06, 2022 (ii) Mega Science Technology & Industry Expo of 8th India International Science Festival 2022 during January 21-24, 2023 at MANIT, Bhopal (iii) Meeting I: The Inception Meeting at Puducherry as a delegate during January 30-31, 2023 as a part of the S20 Meeting and also Chairing a session in the meeting in response to the invitation received from the S20 Engagement Group (iv) 46th International Kolkata Book Fair 2023 held from 31-01-2023 to 12-02-2023 (v) 30th State Science and Technology Congress during February 28 – March 01, 2023 at Science City, Kolkata, organized by Department of Science and Technology & Biotechnology, Govt. of West Bengal.

Bose Institute organized/coordinated/provided all kinds of support/assistance to a considerable number of visits/visitors including study tour from different colleges/universities/educational institutions/Departments under Govt. of India, during 2022-23 for diffusion of knowledge and building the scientific temper of the society.

Now time has come to reciprocate what we have received, what we have provided to increase our efficiency as well as efficaciousness in order to make our Nation visible in the field of Science and Technology. The Government has provided all kinds of support and assistance to make the Institute viable, but the contribution from our end is not satisfactory at all. We should keep our powder dry, we should push our limits not only to fulfil the research needs of the Institute but also to elevate the level of Research & Development of the Nation as well as of the country by incubating creative ideas and translating noble ideas/thoughts into practices/actions. We should realize that harping on one string about the problems persistently doesn't make any heal, doesn't ensure sustainable solution holistically. Therefore, we should dedicate ourselves more systematically, our endeavours must be logical and goal-oriented. We should not be aimless ship without radar. We have amazing scientists, beautiful building, well-equipped laboratories, wonderful garden, vibrant cafeteria and all kinds of amenities in this Unified Academic Campus. We have to exert ourselves beyond the comfort zone to set an example, to enlist our name in the break-through discoveries, keeping in mind the solemn objective set by our iconic founder, the doyen of Modern Indian Science, Acharya Jagadis Chandra Bose, whose bodiless spirit has been roaming around the campus in search of future Jagadis.

Last but not the least, I, most respectfully, extend my sincere thanks and heart-felt gratitude to the Hon'ble Chairman and Members of Bose Institute Council for their support, assistance and valued guidance from time to time. I am really indebted to the funding agency, Department of Science & Technology, Government of India, for their uninterrupted flow of funds as well as administrative support as and when required so as to ensure optimum utilization of human resource management efficaciously using set of designed system, principles, structures, technologies leading to leveraging the creativity/capacity of the students and the staff members to create/add value in a sustainable manner for holistic development of the Institute.

Prof. (Dr.) Uday Bandyopadhyay
Director
Bose Institute, Kolkata



ABOUT
BOSE INSTITUTE

A bipartite agreement between Bose Institute and M/s. Trident Autocomponents Pvt. Ltd. and a tripartite Non Disclosure Agreement (NDA) among Bose Institute, CSIR-CMERI Durgapur and M/s. Trident Autocomponents Pvt. Ltd. for the procurement of Beam Stoppers as an Indian in-kind item for Facility for Antiproton and Ion Research (FAIR) were signed on December 7, 2022.

This is a major milestone for leveraging the potential for Indian industries through handshaking between academia and industries in India.

MANAGEMENT OF THE INSTITUTE

Bose Institute is a grant-in-aid autonomous institution under the Department of Science and Technology (DST), Ministry of Science & Technology, Government of India. It has a Governing Body. The management of the Institute is vested in Bose Institute Council. The Institute also has a Finance Committee responsible for the financial policies and management.

Bose 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 – Secretary

Bose Institute Council

1. **Prof. Gautam R. Desiraju, *Chairman***
   IISc, Bangalore
2. Prof. Dipankar Chatterji
   Honorary Professor, Molecular Biophysics Unit, IISc, Bangalore.
3. Prof. G. Balakrish Nair
   Distinguished Professor, RGCB Bio Innovation Center, Thiruvananthapuram, Kerala
4. Prof. Subodh R. Shenoy
   Visiting Professor TIFR, Hyderabad
5. Prof. Basanta Kumar Nandi
   Dept. of Physics, IIT Mumbai.
6. Secretary, DST or his nominee
7. Financial Adviser, DST
8. The Chief Secretary, Govt. of WB or his nominee
9. The Director, Indian Association for the Cultivation of Science, Kolkata
10. The Director, S. N. Bose National Centre for Basic Sciences, Kolkata
11. The Director, Bose Institute
12. The Registrar, Bose Institute – Non-Member Secretary

Members of the Finance Committee

The Chairman, Bose Institute Council, *Chairman*.

Secretary, DST,
Govt. of India or his nominee

Financial Advisor, DST,
Govt. of India or his nominee

The Director, Bose Institute

The Registrar, Bose Institute – Secretary

Members of the Research Advisory Council (RAC)

Prof. D. N. Rao, Chairman
Department of Biochemistry, IISc, Bangalore

Prof. Dipankar Nandi, Member
Department of Biochemistry
IISc, Bangalore

Prof. Prasanta K. Panigrahi, Member
Department of Physical Science
IISER, Kolkata

Prof. Ashwini Nangia, Member
School of Chemistry
University of Hyderabad, Hyderabad

Prof. Arindam Ghosh, Member
Centre for Nano Science and Engineering
Department of Physics, IISc, Bangalore

Dr. Ramesh Venkata Sonti, Member
Indian Institute of Science Education
and Research Tirupati, Tirupati, AP

Prof. J. N. Moorthy, Member
Director, IISER, Thiruvananthapuram
Maruthamala PO, Vithura, Thiruvananthapuram

Dr. Amit Prakash Sharma, Member
ICMR – National Institute of Malaria
Research (Delhi Campus), New Delhi

Prof. Mahan Maharaj, Member
School of Mathematics,
Tata Institute of Fundamental Research, Mumbai

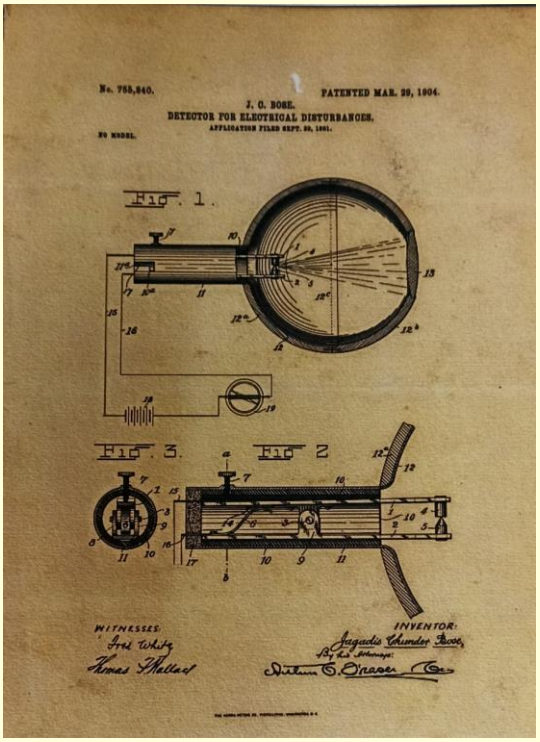
Registrar, Non-Member Secretary, Bose Institute, Kolkata

BOSE INSTITUTE

The doyen of modern science in India, Acharya Jagadis Chandra (J. C.) Bose was a pioneer in the real sense of the word. He was the first to demonstrate wireless transmission of signals. That research paved the way for radio communications, although Guglielmo Marconi received the Nobel Prize for the discovery. J. C. Bose was the first in the world to employ semiconductor technology, sixty years ahead of the times, in the words of the Nobel Laureate Sir Neville Mott. His seminal work on electrophysiology started the discipline of Biophysics.

Despite all these achievements, the scientific career of J. C. Bose was full of continuous struggles. The West promptly hailed his first discovery of wireless transmission, but they denied or often ridiculed his later works on 'living and non-living'. To prove his results, J. C. Bose fabricated his scientific instruments. The accuracy and ingenuity of those instruments amaze the scientific community until now. Since he had no institutional support until then, J. C. Bose acutely felt the need for an institute, which will cater to the need generations to come. He found generous support in his resolve from stalwarts like Rabindra Nath Tagore, Sister Nivedita, Gokhale, and Mahatma Gandhi, to name a few.

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 him at that time. J. C. Bose even


No. 755,840. PATENTED MAR. 29, 1904.

J. C. BOSE.

DETECTOR FOR ELECTRICAL DISTURBANCES.

APPLICATION FILED SEPT. 30, 1901.

NO MODEL.

FIG. 1.

FIG. 3. FIG. 2

WITNESSES: Fred White, Thomas Shellard

INVENTOR: Jagadis Chunder Bose, By his Attorneys: Dickson & Brewer

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.

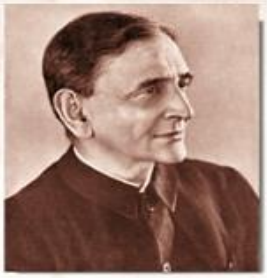
J. C. Bose encouraged his followers to pursue *the investigation of the ever-opening problems of developing science. In his own words "which includes both Life and Non-Life...The advance of science is the principal objective of this Institute and also the diffusion of knowledge.. to associate the advancement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

With this lofty ideal, Bose Institute is striving for the past hundred years to justify the expectation of its illustrious Founder. After his demise in 1937, his nephew, Dr. Debendra Mohan (D. M.) Bose, then Sir Rashbehari Ghose Professor of Physics at the University of Calcutta, was prevailed upon by Rabindra Nath Tagore to take over the reins of Bose Institute as Director. During his leadership of 30 years, Bose Institute progressed to a modern laboratory to compete in the international scientific scene. Under his tutelage, the research in high energy physics and nuclear physics started for the first time in India. D. M. Bose and his student Biva Chowdhury succeeded in detecting a new elementary particle, the mu meson, by exposing photographic emulsions at mountain altitudes. The Nobel Prize also eluded them for this profound discovery. It is a matter of ill-fate since they needed some emulsion of more acceptable resolution than the ones they were using, quantifying their results conclusively but were unable to procure such films because of the raging Second World War at the time.

Meanwhile, C. F. Powell independently succeeded in discovering with the required accuracy and bagged the Noble Prize for it. In his Nobel Lecture, however, Powell did acknowledge the original work of Bose and Chowdhury. After J. C. Bose, that was another occasion of Bose Institute, and India, being deprived of a well-deserved Nobel Prize.

D. M. Bose set Bose Institute on a course of an international contemporary and competitive programme. He established the first Microbiology Department in India at Bose Institute. D. M. Bose initiated research in understanding the observations of J. C. Bose in plant electrophysiology from the standpoint of biochemical processes. He paved the way for establishing the discipline of molecular biology in India. Bose Institute was one of the first institutions in India to embark on such studies and earned an enviable reputation in the area. Another significant discovery, worthy of a Nobel

CONTRIBUTION OF PROF. D.M. BOSE
WITH HIS YOUNG COLLABORATOR DR. BIVA CHOWDHURY



Prof. D.M. Bose

Prof. D. M. Bose pioneered cosmic ray research in India. In early forties, D. M. Bose and Biva Chowdhuri made a pathbreaking contribution by identifying a cosmic particle having mass close to 200 times the mass of electron (later known as pi-meson) by exposing photographic emulsions at high altitudes in Darjeeling and Sandakphu.

Dr. Biva Chowdhury

This work laid the basis for more precise determination of the mass of pi-meson by Prof. C. F. Powell who was awarded the Nobel Prize in 1950.

Prize, was carried out in the Chemistry laboratory of Bose Institute, the seminal discovery of the Cholera endotoxin, by Prof. Sambhu Nath De, a professor of pathology at Calcutta Medical College. Nobel Laureate Joshua Lederberg did nominate De for the Nobel Prize on more than one occasion, but unfortunately without success.

The later generations of scientists at Bose Institute have followed in these lofty paths, if not with similar achievements but with intense dedication and commitment and commendable success. They can boast of significant contributions in plant genetics and biotechnology, structural and computational biology, microbiology, systems biology, molecular medicine, astroparticle, particle and quantum physics, and the environmental sciences. The Bose Scientists have collaborated in several international endeavours both in physical and biological sciences.

Faithful to the exhortation of the Founder, Bose Institute undertakes extensive social outreach programmes in rural biotechnology, aiming at bringing the fruits of science and technology to the economically weaker section. Bose Institute conducts regular science camps for school children and science teachers, especially from the North-Eastern states of India through the hands-on programme. The Institute also runs an integrated MSc- PhD programme in Physical and Life Sciences besides training of a large number of doctoral and post-doctoral students. The activities of Bose Institute encompass over seven academic campuses, and experimental field stations spread all over the state of West Bengal.

Acharya J. C. Bose was an ardent nationalist who desired India to rediscover its glorious heritage and reclaim its leading position in the world of science and technology. Bose Institute indeed is fortunate to inherit his great legacy and tries to prove itself worthy of this inheritance. To keep the spirit of inquiry alive and fulfil the Founder's dream, the Institute plans to embark on some new directions of research in the coming years, which would build on the present expertise and take on new challenges.

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.

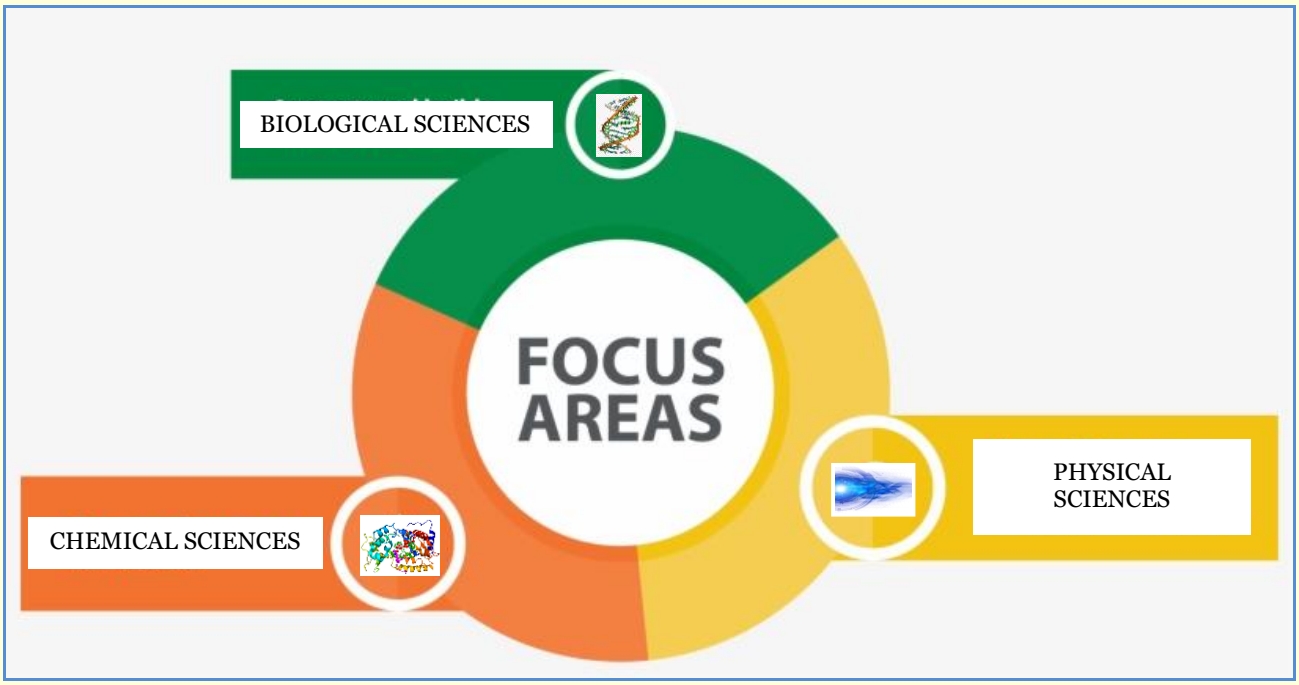
OBJECTIVES

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

A. Advancement of knowledge by means of research.

B. The diffusion of knowledge by organizing discourses, demonstration and lectures to be given by original workers in it and thinkers.

C. To do all such things as are incidental or conducive to the attainment of the above objects or any of them.



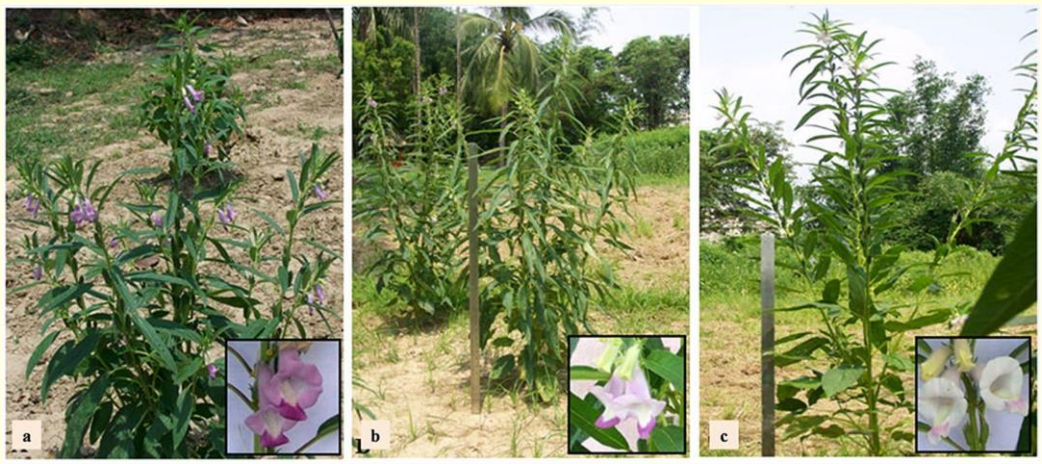
Bose Institute pursues research for augmentation of fundamental knowledge-base and developing solutions to national problems in the areas of healthcare, food security, environmental pollution and climate change. Taking advantage of the diverse and complementary research expertise of the faculty, coherent and synergistic multi-disciplinary research approaches focus on achieving scientific goals that are completely aligned with the mandate of the Department of Science and Technology, Government of India.

Research is pursued in following areas:

- High Energy and Nuclear Physics – Understanding of Sub-atomic Particles
- Quantum Information and Communication
- Quantum Materials and Devices
- Understanding of Response of Plants Under Biotic and Abiotic Stress
- System and Synthetic Biology
- Cancer Biology
- Environmental Microbiology and Climate Change
- Structure and Functions of Macromolecules
- Bioinformatics
- Bioorganic Chemistry for Drug Development
- Identification of Drug Target and Validation of Bioactive Molecules for Therapeutic Intervention.

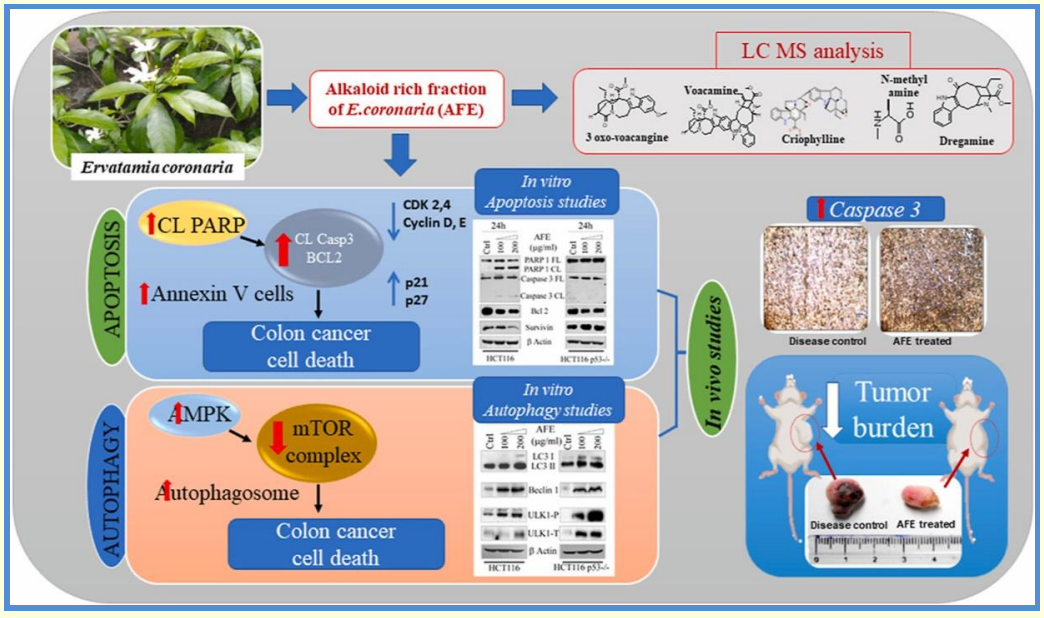
IMPORTANT HIGHLIGHTS OF MAJOR PROGRAMMES

- Germplasm, R6 of Sesame, with high oil content and superior lignan profile has been developed. Plant Germplasm Registration Committee of the Indian Council of Agricultural Research has certified the germplasm (R6 of sesame) with the registration number INGR22090.



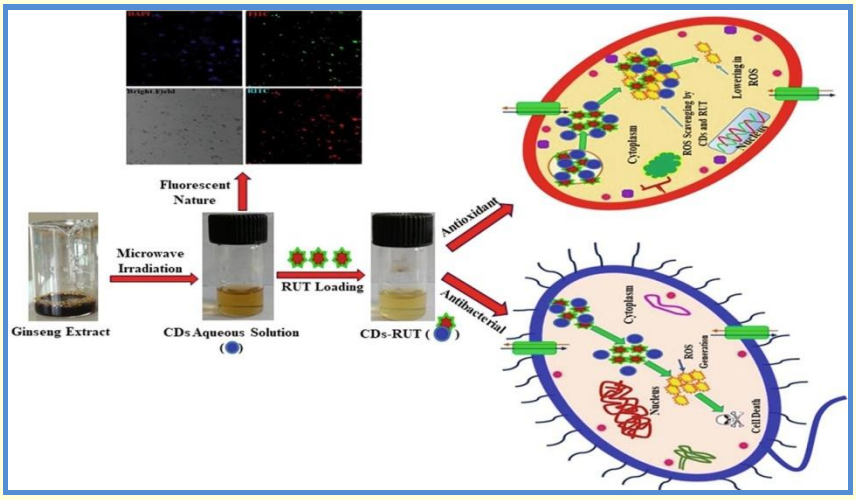
Plant architecture of S. mulayanum (a), the selected line R6 (b) and S. indicum (c)
(*https://doi.org/10.1007/s13237-021-00354-3*)

- Anti-CRC activity of an alkaloid-rich fraction of *E. coronaria* leaf extracts (AFE) and associated underlying mechanism has been reported. This study provides a logical basis for consideration of AFE in future therapy regimen to overcome the limitations associated with existing anti-CRC chemotherapy.



Graphical abstract of the study on *E.Coronaria* leaf abstract
https://doi.org/10.1016/j.jep.2021.114666)

- Water soluble Carbon dots (CD), have been synthesized which can be considered as a promising candidate for the biomedical applications due to its facile synthesis, low cytotoxicity, excellent fluorescent properties and potential as drug delivery systems.



Carbon dots from red koren ginseng (https://doi.org/10.1016/j.inoche.2022.109317)

- A unique mannose binding plant lectin from Narcissus tazetta bulb, NTL125 is found to be a highly potential antiviral compound of natural origin against SARS-CoV-2 and may serve as an important therapeutic for management of COVID-19.

- A web based tool has been developed that uses regression models to score CT scan reports from only 7 input features and predict risk of pneumonia. The automated determination of CT severity score can reduce the workload of radiologists significantly during the pandemic. It can be used by doctors for early detection of patients with high risk in order to offer better therapeutics.

- An new study provides a national scenario of aerosol pollution with the long-term (2005-2019) trend, source apportionment, and future scenario (2023) for each of the Indian states. This study would complement and strengthen the ongoing national missions to combat air pollution in India.

- The anomaly in lithium abundance is a well-known unresolved problem in nuclear astrophysics. A recent revisit to the problem tried the avenue of resonance enhancement to account for the primordial 7Li abundance in standard big-bang nucleosynthesis.

- A new study unravels the potential of the Cygnus Cocoon to be a Galactic cosmic-ray source capable of accelerating at least up to PeV energies.

- A new method has been developed, to transfer information of an unknown quantum state of any known dimensions, encompassing continuous variable states, from one party to another spatially separated party using a non-product bipartite quantum state of any dimensionality as a resource.

- New study showing the immense importance of the role of biogenic emissions in cloud droplet formation over the eastern Himalaya under restricted anthropogenic emissions.
- Chemical characterization of the carbonaceous component of PM2.5 collected over a year-long campaign from a regional site in Shyamnagar, West Bengal, in the Indo-Gangetic Plains (IGP), India. The findings would benefit policymakers in strategizing proper and effective management of biomass/biofuel burning in the IGP to minimize air pollution.
- New understanding on the effect of atmospheric relative humidity and temperature on bioaerosols.
- Presented a class of tachyon-free (stable) AdS as well as dS solutions in the context of type IIA orientifold compactifications.
- Broadband (visible to near-infrared) photodetection with high sensitivity in the near-infrared region is demonstrated in a MoSSe/graphene heterostructure.
- New understanding on the some significance of miR398 in *Alternaria*-stress response
- A transgenic tomato plant with inducible and reversible altered expression pattern of two stress-related genes, HSF and NAC2 has been generated. These transgenic lines are being characterized.
- Improvement and broad-scale implementation of different biotechnology-oriented programmes for the socio-economic upliftment of Scheduled Tribe community of West Bengal, (Tribal Sub Plan of DST SEED programme)
- New studies on a capsule-producing enzyme from *Staphylococcus aureus*
- Recent studies on the FKBP22, CapF, RsbW and σB will help to designing or screening of the new antibacterial agents in future.
- Polyclonal antibody successfully raised against GlNSF112681, one of the two NSFs encoded by the *Giardia* genome.
- Recent study shows that antimicrobial peptide mimics as new adjunct antibiotics.

TOP TEN GOALS

- Understanding plant intelligence and information processing in response to environmental stimuli.
- Unravelling the inherent complexities in key cellular processes and their implications in disease biology.
- Exploring microbiomes to reveal biosphere functions, manage pollution, and improve lives.
- Employing multimodal approaches to understand pathogen biology and hostpathogen interactions for designing novel intervention strategies against infectious diseases.
- Developing and deploying computational tools, data mining, database management, statistical analysis, etc. for a holistic understanding of stem cell bioinformatics and regulatory RNAs, oncogenomics, proteomics, drug design, structural bioinformatics and macromolecular dynamics and for applications in healthcare.
- Application of sub-micron physics to understand macro physics: Universe to biological systems.
- Microscopic origin of elementary matter in the universe .
- Microscopic processes in natural environment.
- Mesoscopic systems: Light matter interactions.
- Microscopic systems-Quantum information in many-body systems: Entanglement properties and Quantum networks.

Microbes and Microbiome:

- Identification of promoters for sigma and transcription factors and determination of the mechanism of function of RFA1, a rif-resistant RNA polymerase inhibitor in *M. tuberculosis*.
- Understanding of the interaction between the lung microbiome, its metabolites, and host innate immune cells in obstructive pulmonary diseases.
- Development of an array of bioreporter strain s to detect specific endocrine disrupting chemicals and understanding evolution of stress adaptation machinery using archaeal model organism.
- Investigation of dissemination mechanisms of antibiotic resistance in natural environment.

Disease and Therapeutics:

- Study how transcription factors regulate oncogene expression in prostate and breast cancers and the role of ganglioside over-expression in carcinogenesis.
- Development of a PROTAC based approach in degradation of Oncogenic YAP/TAZ towards targeting EMT and Cancer Metastasis.
- Identification as well as synthesis of Natural Product based analogs against Cancer and Neurodegenerative disorders.
- Strategy development for glycoconjugates as potential anti-bacterial vaccine leads, synthesis of Nucleoside Derivatives as inhibitors of CDN signalling in MTB, ProTide approach for efficient drug delivery in Covid-19.
- Development of precision gene editing systems in vitro and vivo, and Development of synthetic biology platform for in cellulo drug discovery.
- Understanding protein homeostasis with special emphasis on the role of HSP90 and Ubiquitin ligases in Rasopathies and Neurodegenerative diseases.
- Identification of novel target against *Plasmodium falciparum*, *Mycobacterium tuberculosis*, *Giardia lamblia* and *Staphylococcus aureus*.
- Uncovering the role of Long Non-Coding RNAs in Embryonic development and Cancer.
- Deciphering the 'Trap and Kill' Mechanism of two Amyloidogenic Antimicrobial Peptides.

Structure Function and Dynamic of Protein:

- Understanding the basis of difference in the catalytic activities of Ube2Es and Ube2Ds.
- Deciphering the structural basis of differential E2 recognition by the canonical and non-canonical E1 enzymes in vertebrates.
- Setting up the SERB-National CryoEM Facility.
- Determine the structure of AzoR3A protein.

Plant Development, Stress and Yield:

- Validation of the candidate genes and molecular markers in sesame genotypes concerning charcoal rot and phyllody diseases.
- Development of Tobacco transgenic plant : A Multidisciplinary Approach
- Deciphering the biological function of small heat shock proteins in *Ustilago maydis*
- Unravelling the extrinsic and intrinsic factors regulating tomato miRNA levels under diverse stress situations and developmental stages
- Role of regulatory transcription factors in Jasmonic acid signaling pathway during pollen development.

Biological Systems, Information and Networks:

- Study of signal propagation in biochemical networks - a single-cell approach.
- Integrative understanding of microbial interactions using mathematical (both analytical as well as computational) and experimental techniques.
- Formulation of an information-theoretic approach to study proteins as well as its validation.

Climate Change, Aerosol and Cloud Formation:

- Impact of aerosol pollution on microphysical properties of cloud over vulnerable zones in India and the role of absorbing aerosols on the snow cover and snow albedo over eastern Himalaya.
- Investigation of the interaction between elevated aerosol layer and cloud-precipitation system over the Himalayas using ground-based remote sensing techniques.
- Identification of microbiomes in air and rain harmful for human society, and their possible sources.

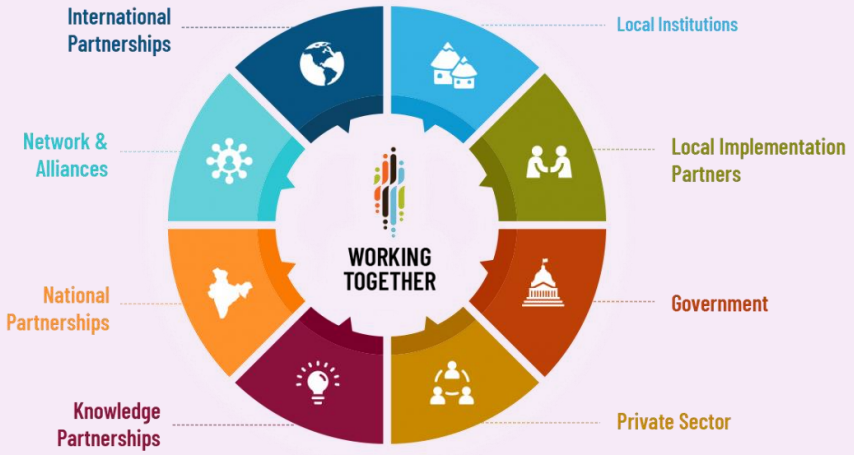
Physics of Materials and Quantum systems:

- To investigate properties of quantum gravity-induced entanglement of masses in many-body systems
- To find the entanglement cost of nonlocal quantum operations within the paradigm of LOCC (local operations and classical communication).
- Study of Carrier, spin, and valley dynamics in two-dimensional layered materials and van der Waals heterostructure**.**
- High responsive, broadband, ultrafast and spin valley selective 2D layered materials based photodetector.

High energy and Nuclear Physics:

- Breakup of ^{7}Be on ^{12}C and ^{208}Pb targets in the context of nuclear astrophysics.
- Detail study of Charging up effect of GEM detectors.
- Development of computing algorithms and simulation tools for phenomenological studies of strong interactions.
- Towards finding a consistent global embedding for the so-called Fibre Inflation, which has several attractive features in its minimalistic pheno-motivated design.

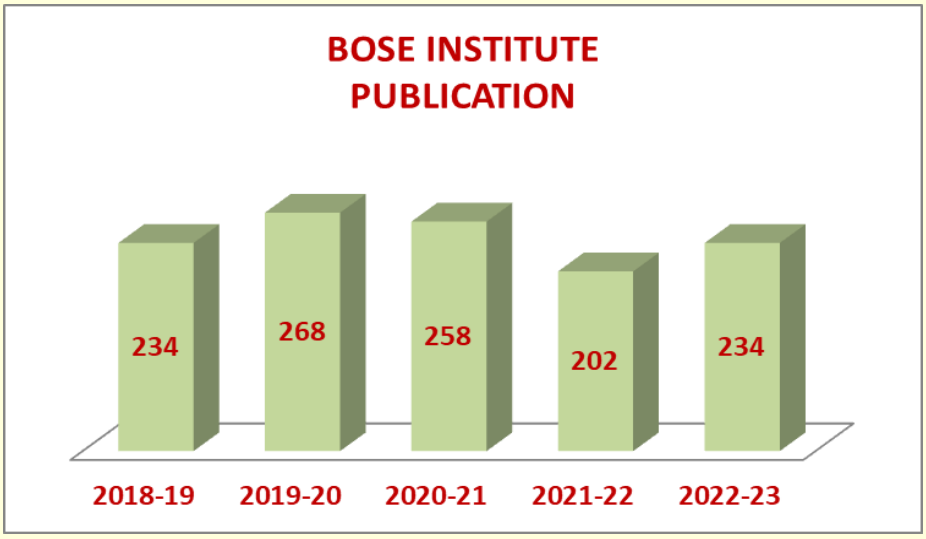
IMPORTANT COLLABORATIONS (NATIONAL AND GLOBAL) ESTABLISHED

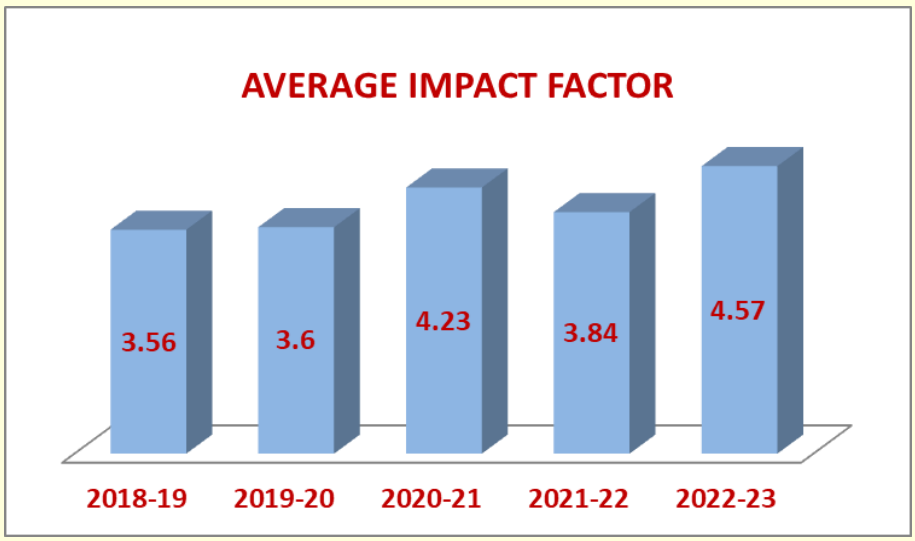


1. Project titled "India's participation in the construction of the Facility for Antiproton and Ion Research (FAIR) at Darmstadt, Germany" - Bose Institute is the share holder Institute. It is the nodal centre to coordinate all the present activities including the supply of In-Kind item, made in India, to FAIR.
2. CBM-MUCH project: Bose Institute is one of the Institute fom India participating in research and development of the gas-electron multiplier (GEM) detector for the Compressed baryonic matter (CBM) experiment to be performed at FAIR.
3. Project ALICE - A large Ion-Collider experiment) - Bose Institute is a one of the participating Institute in the ALICE-INDIA project. This experiment is being performed at Large Hadron Collider (LHC) at CERN, Switzerland.
4. National Clean Air Mission: Bose Institute is the "Institute of Repute" and Dr. Abhijit Chatterjee, Bose Institute, is working as the Nodal Scientist and Knowledge Partner for the state of West Bengal under this national mission.
5. DBT: Multi-dimensional research to enable systems medicine: acceleration using a cluster approach at Kalyani, West Bengal.
6. Indo-Swiss: Next generation advanced therapies for fight b-hemoglobinopathies via rational intervention in g-globin regulatory network.
7. Funded by SERB, Bose Institute is setting up a state-of-the-art CryoEM Regional/National facility in Eastern Region. Transforming the structure-guided drug discovery and therapeutics research landscape in India.
8. National Carbonaceous Aerosols Programme (NCAP): Carbonaceous Aerosols Emissions, Source appointment and Climate effects with IIT Bombay and other institutions.
9. DST: Improvement and broad-scale implementation of different biotechnology-oriented programmes for the socio-economic upliftment of Scheduled Tribe community of West Bengal.
10. DBT: 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.

ACADEMIC INPUTS

TOTAL PUBLICATIONS 2022-23	234
AVERAGE PUBLICATION IMPACT FACTOR 2022-23	4.57
BOOKS/BOOK CHAPTERS/INVITED REVIEWS	33
CONFERENCE PROCEEDINGS	12
PH.D. AWARDED 2022-23	29
NO. OF MANPOWER TRAINED (B.TECH., M.TECH., M.SC., DIPLOMA ETC)	47
NO. OF SEMINARS, TRAINING, CONFERENCES, WORKSHOPS, WEBINARS ETC.	27

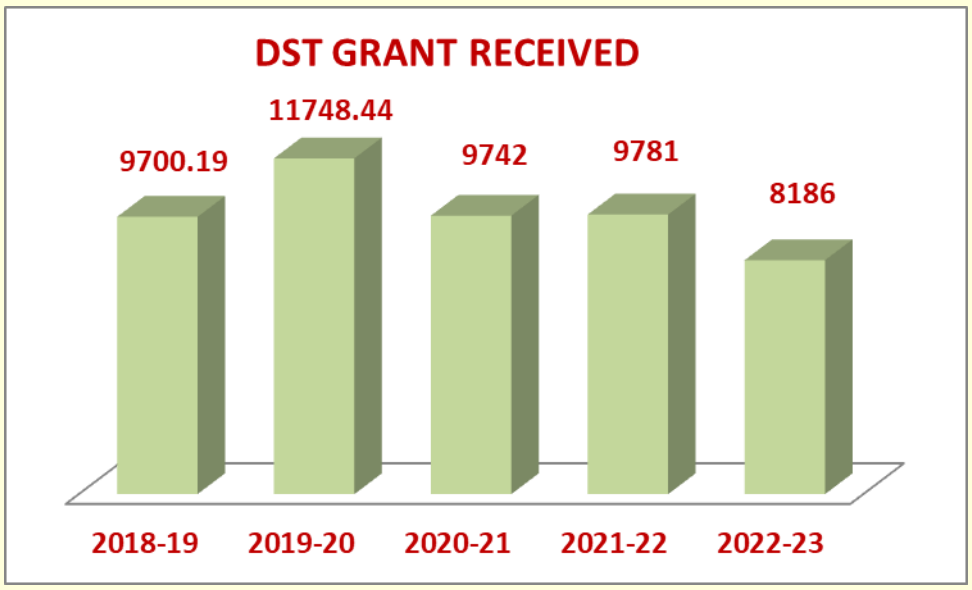


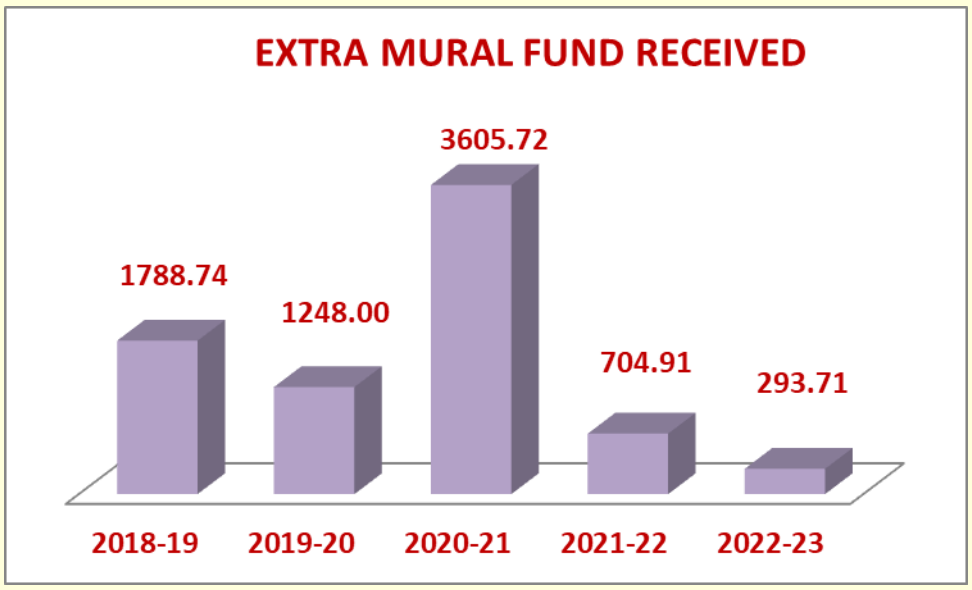


FINANCIAL INPUTS

(Rupees in Lakh)

DST GRANT RECEIVED 2022-23	8186
EXTRA MURAL GRANT RECEIVED 2022-23	293.71
NO. OF ON-GOING EXTRA MURAL PROJECTS 2022-23	36
AVERAGE EXTRA MURAL PROJECTS PER FACULTY	1.15





LIST OF PERSONNEL (ADMINISTRATION)

Prof. (Dr.) Uday Bandyopadhyay, Director

Prof. Rajarshi Ray, Registrar (Officiating)

Noreen Bhattacharjee, Deputy Registrar	Achintya Mukherjee, Accounts Officer
Sougato Banerjee, Assistant Registrar	Vikash Kumar, Audit & Finance Officer

Mantu Bhattacharya	Tarun Kumar Maji	Vineet Kumar Tandon
Supriya Das	Kamal Sing	Debdas Nandi
Somnath Das	Nilanjana Bhattacharjee	Satyaswaroop Behara
Ananya Malgope	Nitin Sharma	Dr. Ishani Chatterjee
Sumanta Ghosh	Arjun Das	Ruby Sarkar
Sudam Ch. Jana	Babli Marrick	Gopa Dasgupta
Debasish Koley	Angshuman Bhowmik	Sukanta Chakraborty
Sujata Roy	Biplab Malakar	Arpita Bose
Animesh Jana	Ratan Saha	Shaubhik Ghosh
Atanu Deb	Tuhin Saha	Bipul Kr. Nag
Sachchidananda Ram	Kanai Hazra	Sanat Kumar Dhara
Khairul B. Mollah	Sk. Md. Kalu	Prafulla Bhuiya
Duryodhan Nayak	Sarda Devi	Raj Kumari Balmiki
Bablu Mondal	Rajbrat Ram	Hemanta Kr. Sahoo
Goutam Behera	Gourango Paramanick	Tapas Chakraborty

PH.D. AWARDED

Biochemistry

- **Soham Seal:** Studies on a cyclophilin from *Staphylococcus aureus*. Supervisor: Prof. Subrata Sau.
- **Sayandeep Gupta:** Understanding the Mechanism of RNA-Protein Interaction Involved in the Protein Translocation in Archaea. Supervisor: Dr. Abhrajyoti Ghosh.
- **Chandrima Bhattacharyya:** Exploring the Microbial Diversity in Tea Rhizosphere and an Assessment of Resident Plant Growth Promoting Rhizobacteria (PGPR). Supervisor: Dr. Abhrajyoti Ghosh.
- **Shayantan Mukherji:** Microbiology of Sundarban Mangrove Ecosystem: Insights into Diversity, Distribution and Function of Resident Microbial Communities. Supervisor: Dr. Abhrajyoti Ghosh.

Bioinformatics

- **Sreyashi Majumdar**: Systemic Discovery of Asthma Biomarkers for Therapeutics. Supervisor: Dr. Sudipto Saha.

Biophysics

- **Dipita Bhattacharyya:** Structural And Mechanistic Insight into Biologically Active Peptides and Proteins: Understanding their Membrane Association, Aggregation and Cytotoxicity. Supervisor: Prof. Anirban Bhunia.
- **Sk Abdul Mohid:** Biophysical Studies of *de-novo* Designed Antimicrobial peptides: Correlation with Biological membranes. Supervisor: Prof. Anirban Bhunia.

- **Nilanjan Banerjee:** Involvement of G-quadruplex and i-motif structures in the expression of oncogenes in cancer cell proliferation, differentiation and angiogenesis. Supervisor: Prof. Subhrangsu Chatterjee.
- **Tanaya Roychowdhury:** Deciphering Epigenetic Regulation of Metastatic Gene Expression Underlying tumorigenesis. Supervisor: Prof. Subhrangsu Chatterjee.
- **Bhavna Pandey**: Structural Insights of Protein-Protein Interactions in p53-PC4 GluRs-HipA Complexes. Joint supervisors: Prof. Gautam Basu and Dr. Smarajit Polley.
- **Chandradeep Basu:** Stabilization of Peptidyl-Prolyl and Helical Motifs in Designed Peptides. Supervisor: Prof. Gautam Basu.

Chemistry

- **Ayan Biswas:** Information-theoretic Analysis of some Model Biological Networks. Supervisor: Prof. Suman Banik.
- **Mintu Nandi:** Effect of Stochasticity in Kinetics of some Physico-Chemical Processes. Supervisor: Prof. Suman Banik.
- **Arkajyoti Dutta:** Study on the Robustness of Two Component Systems in *Mycobacterium Tuberculosis*. Supervisor: Prof. Jayanta Mukherjee.

Environmental Sciences

- **Abhinandan Ghosh:** Physicochemical Characterization of size Segregated Atmospheric Aerosols over Tropical Urban and High Altitude Himalayan Stations in Eastern India. Supervisor: Dr. Abhijit Chatterjee.

Molecular Medicine

- **Tapasi Manna:** Development of Synthetic Methodologies and Synthesis of Oligosaccharides of Bacterial Cell Wall Antigens. Supervisor: Prof. Anup Kumar Misra.
- **Monalisa Kundu:** Synthetic studies of bacterial cell wall oligosaccharides. Supervisor: Prof. Anup Kumar Misra.
- **Baijayanti Ghosh:** Protein Quality Control Machinery In Modulation Of Spinocerebellar Ataxia Type 3 Pathogenesis. Supervisor: Prof. Atin Kumar Mandal.
- **Shibjyoti Debnath:** Defining the anti-cancer role and elucidating the mechanism behind the selective anti-cancer ability of the plant derived flavonoid Eriodictyol. Supervisor: Prof. Kaushik Biswas.

Microbiology

- **Madhu Manti Patra:** An Investigation into the mechanism of action of a *Mycobacterium Smegmatis* repressor that Controls the expression of dinB2, a gene encoding a DNA Repair Enzyme. Supervisor: Prof. Sujoy Kumar Das Gupta.
- **Poulami Ghosh:** Understanding the mechanism by which glycerol and glucose control mycobacterial growth. . Supervisor: Prof. Sujoy Kumar Das Gupta.

- **Sabyasachi Bhattacharya:** Microbiology of the Sediments of the Arabian Sea Oxygen Minimum Zone. Supervisor: Dr. Wriddhiman Ghosh.
- **Sibun Parida:** A Comparative Genomics Approach to Identify the Molecular Drivers in Disease Progression. Supervisor: Dr. Zhumur Ghosh.

Physics

- **Sananda Raychaudhuri:** Study Of The Accretion Phenomena And The Outflows In Giant Elliptical Galaxies And Implications On AGN Feedback. Joint Supervisors: Prof. Dhruba Gupta and Dr. P. Joardar.
- **Shreya Roy:** Characterisation of Gaseous and Scintillator Detectors for High Energy Physics and Cosmic Ray Experiments. Supervisor: Prof. Supriya Das.
- **Shib Shankar Singha:** Optical Properties and Applications of Molybdenum Disulphide (MoS2). Supervisor: Prof. Achintya Singha.

Plant Biology

- **Pratiti Dasgupta:** Genome-wide study of changes in Histone H3K27 modification and its correlation with differential gene expression in *Oryza sativa* L. under cold stress. Supervisor: Prof. Shubho Chaudhuri.
- **Shinjini Sengupta:** Reduction of phytic acid level in rice seed by RNAi- mediated down-regulation of inositol 1,3,4-trisphosphate-5/6-kinase (*ITPK*) gene. Supervisor: Prof. Gaurab Gangopadhyay.
- **Debabrata Dutta:** Validation of few genic SSR markers and candidate genes to screen two inter-specific hybridization-derived breeding populations of Sesame with particular reference to plant architecture and oil. Supervisor: Prof. Gaurab Gangopadhyay.

AWARDS/HONOURS/MEMBERSHIP

Biochemistry

Dr. Abhrajyoti Ghosh

- Received IGSTC (Indo German Science and Technology Centre) grant on 20.06.2022 to attend Indo-German bilateral workshop on "Agricultural Management Practice Effects on Soil and Plant-associated bacterial communities and their resistome" at Leibniz Institute of Agricultural Engineering and Bio-economy e.V. (ATB), Potsdam, Germany.

Chemistry

Dr. Debaraj Mukherjee

- Awarded Bronze Medal with citation by the Chemical Research Society of India (CRSI) at Jawaharlal Nehru University (JNU), New Delhi by the President CRSI Padma Shri Prof. V. K Singh, IIT Kanpur during February 2 – 5, 2023. The Bronze Medal award is given to young researchers who have made significant contributions to research in Chemical Science.

Environmental Sciences

Dr. Sanat Kumar Das

- Memberships: (1) Subject Expert Committee - Earth & Atmospheric Sciences Areas of "Fund for Improvement of S&T infrastructures in Universities and Higher Educational institutions" (FIST) Program of Department of Science and Technology (DST), Ministry of Science and Technology, Govt. of India. (2) Institute of Repute (IoR) under the National Clean Air Mission, the Ministry of Environment, Forest and Climate Change (MoEF-CC); and Central Pollution Control Board (CPCB).

Microbiology

Dr. Wriddhiman Ghosh

- With Dr. Aninda Mazumdar of CSIR National Institute of Oceanography co-edited the topical monograph "Systems Biogeochemistry of major Marine Biomes", published by The John Wiley and Sons, Inc. in April 2022.

Molecular Medicine

Prof. Kaushik Biswas

- Elected Fellow of the West Bengal Academy of Science and Technology (WAST), FAScT from January, 2023.

Physics

Prof. Achintya Singha

- A member of the Expert Committee of Teachers Associateship for Research Excellence (EC-TARE), Science and Engineering Research Board (SERB), Government of India, since July 2021.
- A member of the Board of Studies of the Department of Physics in Midnapur College, since February 2020.
- A member of the Question Paper Setting Committee for Joint Entrance Examination Test 2023 (JEST-2023).

Prof. Soumen Roy

- Regular Associate of the International Centre for Theoretical Physics (UNESCO), Trieste, Italy.
- Editorial Board member of: (1) PLOS ONE, (2) Indian Journal of Physics (Springer), (3) Frontiers in Physics.
- Reviewer, (Mathematics & Computer Science Panel), National Research, Development and Innovation Office, Hungary.
- Visited the International Centre for Theoretical Physics (UNESCO), Trieste, Italy from October 16, 2022 to November 26, 2022 .
- Visited *Istituto Superiore di Sanita* (National Institute of Health), Rome, Italy, during November 10-11, 2022.

Dr. Saikat Biswas

- Selected as the organizing committee member of CBM theme meeting at NISER during 3-4 February 2023.
- Selected as a member of the organizing committee of the ALICE school.

Dr. Sidharth Kumar Prasad

- Serving as the Deputy spokesperson of the ALICE-STAR India Collaboration.
- Served as the Physics coordinator of the ALICE-STAR-India Collaboration
- Served as one of the committee member for the annual (December - 2022) review of Prime Minister's Research Fellowship (PMRF) candidates.

Sk. Mustak Ali

- Received full financial support from JINA-CEE to deliver a talk at AwRI, Budapest, Hungary during June 12-17, 2022.
- Received the award for best oral presentation in the Students' Symposium "Recent Trends in Natural Sciences, 2022" at Bose Institute, Kolkata, November 28-29, 2022.

Sayak Chatterjee

- Selected to receive the CBM Juniors travel grant to participate in the QM2022, Poland (04.04.2022 - 10.04.2022).
- Received the financial support from the organizer to attend the Quark Matter, QM2022 in Poland.
- Received the Young Researcher Grant from INFN, Italy to attend the 15th Pisa Meeting on Advanced Detectors.
- Invited as a judge to adjudicate the Senior School Science Exhibition, 2022 at La Martiniere for Boys, Kolkata.
- Received the award for best oral presentation in the Students' Symposium "Recent Trends in Natural Sciences, 2022" at Bose Institute, Kolkata, November 28-29, 2022.

Arindam Sen

- Received the financial support from the organizer to attend the Quark Matter, QM2022 in Poland.
- Received the Young Researcher Grant from INFN, Italy to attend the 15th Pisa Meeting on Advanced Detectors.
- Selected to attend the Asia-Europe-Pacific School of High-Energy Physics in Korea, 2022.
- Received the full financial support from the organizer to attend the ICPAQGP-2023, in Puri, Odisha.

Plant Biology

Prof. Shubho Chaudhuri

- Elected Fellow of the West Bengal Academy of Science & Technology (WAST).

Senior Scientist

Prof. Gaurisankar Sa

- Scientific Advisory Committee Member of TATA Medical Centre (Mumbai)
- Scientific Advisory Committee Member of ICMR- Vector Control Research Centre (Puducherry).
- Editor-in–Chief: *International J Immunology*
- Sectional Editor: *Frontiers in Immunology,* Frontiers in Oncology, Scientific Reports, Proceeding of National Academy of Science, India, Section-B, Head & Face Medicine; Austin J. Clinical Immunology, J Cancer Research & Molecular Medicine.

Prof. Tanya Das

- In the Reviewing board of numerous International journals like J. Immunol, Cancer Research, J Biol Chem, Oncogene etc.

LIST OF PUBLICATIONS

Journals:

1. Abhishek Singh, T., Kundu, M., Chatterjee, S., Kumar Pandey, S., Thakur, N., Tejwan, N., . . . Sil, P. C. (2022). Synthesis of Rutin loaded nanomagnesia as a smart nanoformulation with significant antibacterial and antioxidant properties. *Inorganic Chemistry Communications, 140*. doi:10.1016/j.inoche.2022.109492 June 2022, 109492 Available online 20 April 2022 Impact Factor-3.428.

2. Acharya, S., Adamová, D., Adler, A., Adolfsson, J., Aglieri Rinella, G., Agnello, M., . . . Collaboration, A. (2022). Investigating the role of strangeness in baryon–antibaryon annihilation at the LHC. *Physics Letters, Section B: Nuclear, Elementary Particle and High-Energy Physics, 829*. doi:10.1016/j.physletb.2022.137060 Issue: 10 June 2022 Available online 4 April 2022 Impact Factor-4.95.

3. Acharya, S., Adamová, D., Adler, A., Adolfsson, J., Aglieri Rinella, G., Agnello, M., . . . Collaboration, A. (2022). Measurement of prompt Ds+-meson production and azimuthal anisotropy in Pb–Pb collisions at sNN=5.02TeV. *Physics Letters, Section B: Nuclear, Elementary Particle and High-Energy Physics, 827*. doi:10.1016/j.physletb.2022.136986 Issue: 10 April 2022, Impact Factor-4.95.

4. Acharya, S., Adamová, D., Adler, A., Adolfsson, J., Aglieri Rinella, G., Agnello, M., . . . Collaboration, A. (2022). Nuclear modification factor of light neutral-meson spectra up to high transverse momentum in p–Pb collisions at sNN=8.16 TeV. *Physics Letters, Section B: Nuclear, Elementary Particle and High-Energy Physics, 827*. doi:10.1016/j.physletb.2022.136943 Issue: 10 April 2022, Impact Factor-4.95.

5. Acharya, S., Adamová, D., Adler, A., Adolfsson, J., Aglieri Rinella, G., Agnello, M., . . . Collaboration, A. (2022). Production of Λ and KS0 in jets in p–Pb collisions at sNN=5.02 TeV and pp collisions at s=7 TeV. *Physics Letters, Section B: Nuclear, Elementary Particle and High-Energy Physics, 827*. doi:10.1016/j.physletb.2022.136984 Issue: 10 April 2022 Impact Factor-4.95.

6.	Acharya, S., Adamová, D., Adler, A., Adolfsson, J., Aglieri Rinella, G., Agnello, M., . . . Collaboration, A. (2022). Production of light (anti)nuclei in pp collisions at √s=5.02 TeV. *European Physical Journal C, 82*(4). doi:10.1140/epjc/s10052-022-10241-z Published: 04 April 2022 Impact Factor-4.994.
7.	Acharya, S., Adamová, D., Adler, A., Aglieri Rinella, G., Agnello, M., Agrawal, N., . . . Zurlo, N. (2022). Polarization of Λ and ¯Λ Hyperons along the Beam Direction in Pb-Pb Collisions at √sNN=5.02 TeV. *Physical Review Letters, 128*(17). doi:10.1103/PhysRevLett.128.172005 Published: 29 April 2022 Impact Factor- 9.185.
8.	Bhattacharjya, S., Mohid, S. A., & Bhunia, A. (2022). Atomic-Resolution Structures and Mode of Action of Clinically Relevant Antimicrobial Peptides. *International Journal of Molecular Sciences, 23*(9). doi:10.3390/ijms23094558 Published: 20 April 2022 Impact Factor- 6.208.
9.	Bose, I. (2022). Emergent phenomena in living systems: A statistical mechanical perspective. *Journal of Biosciences, 47*(2). doi:10.1007/s12038-021-00247-2 Published: 11 April 2022 Impact Factor- 2.795.
10.	Chakrabarti, P., & Chakravarty, D. (2022). Intrinsically disordered proteins/regions and insight into their biomolecular interactions. *Biophysical Chemistry, 283*. doi:10.1016/j.bpc.2022.106769 Issue: April 2022, Impact Factor- 3.628.
11.	Chatterjee, S., & Sil, P. C. (2022). ROS-Influenced Regulatory Cross-Talk With Wnt Signaling Pathway During Perinatal Development. *Frontiers in Molecular Biosciences, 9*. doi:10.3389/fmolb.2022.889719 Published: 19 April 2022 Impact Factor- 6.113.
12.	Datta, S. K. (2022). Breeding of Bougainvillea: past, present, and future. *Nucleus (India)*. doi:10.1007/s13237-022-00388-1 Published: 21 April 2022 Impact Factor-6.253.
13.	Dattagupta, S. (2022). Energy conductance across a mesoscopic junction in a nonequilibrium spin-boson model under the influence of telegraph noise. *Physical Review E, 105*(4). doi:10.1103/PhysRevE.105.044128 Published: 20 April 2022 Impact Factor-2.707.
14.	De, S., Jose, J., Pal, A., Choudhury, S. R., & Roy, S. (2022). Exposure to Low UV-B Dose Induces DNA Double-Strand Breaks Mediated Onset of Endoreduplication in Vigna radiata (L.) R. Wilczek Seedlings. *Plant and Cell Physiology, 63*(4), 463-483. doi:10.1093/pcp/pcac012 Issue 4, April 2022 Impact Factor-5.783.
15.	Debnath, S., Sarkar, A., Mukherjee, D. D., Ray, S., Mahata, B., Mahata, T., . . . Biswas, K. (2022). Eriodictyol mediated selective targeting of the TNFR1/FADD/TRADD axis in cancer cells induce apoptosis and inhibit tumor progression and metastasis. *Translational Oncology, 21*. doi:10.1016/j.tranon.2022.101433 Epub 2022 Apr 21. Impact Factor-4.803.
16.	Ganguly, S., Purohit, A., Ghosh, S., Chaudhuri, R. K., Das, S., & Chakraborti, D. (2022). Clean gene technology to develop selectable marker-free pod borer-resistant transgenic pigeon pea events involving the constitutive expression of Cry1Ac. *Applied Microbiology and Biotechnology, 106*(8), 3051-3067. doi:10.1007/s00253-022-11922-1 Epub 2022 Apr 20. Impact Factor-5.560.

17. Mahalanobish, S., Kundu, M., Ghosh, S., Das, J., & Sil, P. C. (2022). Fabrication of phenyl boronic acid modified pH-responsive zinc oxide nanoparticles as targeted delivery of chrysin on human A549 cells. *Toxicology Reports, 9*, 961-969. doi:10.1016/j.toxrep.2022.04.017 Published: 2022 Apr 22 CiteScore-7.2.

18. Nag, P., Paul, S., Shriti, S., & Das, S. (2022). Defence response in plants and animals against a common fungal pathogen, Fusarium oxysporum. *Current Research in Microbial Sciences, 3*. doi:10.1016/j.crmicr.2022.100135 Available online 19 April 2022 CiteScore-1.1.

19. Patra, B., Ghosh, B., Banerjee, S., & Sinha, T. P. (2022). Optical and dielectric mechanism of complex double perovskite oxides xLaAlO3 – (1-x)Ba(Mg1/2 W1/2)O3. *Physica B: Condensed Matter, 631*. doi:10.1016/j.physb.2021.413430 Issue: 15 April 2022 Impact Factor-2.988.

20. Raha, S., Biswas, S., Doherty, J., Mondal, P. K., Holmes, J. D., & Singha, A. (2022). Lattice dynamics of Ge1–xSnx alloy nanowires. *Nanoscale, 14*(19), 7211-7219. doi:10.1039/d2nr00743f Published:07 April 2022 Impact Factor-8.307.

21. Roy, S. C. (2022). Discovery of X-rays—Its Impact in India and History of X-ray Research in Colonial India. *Quantum Beam Science, 6*(2). doi:10.3390/qubs6020016 Published: 22 April 2022 Cite Score 3.0.

22. Sarkar, A., Paul, S., Singh, C., Chowdhury, N., Nag, P., Das, S., . . . Das, S. (2022). A novel plant lectin, NTL-125, interferes with SARS-CoV-2 interaction with hACE2. *Virus Research, 315*. doi:10.1016/j.virusres.2022.198768 Available online 7 April 2022, Impact Factor-6.286.

23. Sharma, A., Kundu, M., Ghosh, N., Chatterjee, S., Tejwan, N., Singh, T. A., . . . Sil, P. C. (2022). Synthesis of carbon dots from taurine as bioimaging agent and nanohybrid with ceria for antioxidant and antibacterial applications. *Photodiagnosis and Photodynamic Therapy, 39*. doi:10.1016/j.pdpdt.2022.102861 Epub 2022 Apr 12. Impact Factor-3.577.

24. Shit, P., Sahaji, S., & Misra, A. K. (2022). Synthesis of selenoglycosides and selenium linked disaccharides using reductive cleavage of diselenides. *Carbohydrate Research, 516*. doi:10.1016/j.carres.2022.108554 Available online 6 April 2022 Impact Factor-2.975.

25. Acharya, S., Adamová, D., Adler, A., Adolfsson, J., Aglieri Rinella, G., Agnello, M., . . . Collaboration, A. (2022). Measurement of K∗(892)± production in inelastic pp collisions at the LHC. *Physics Letters, Section B: Nuclear, Elementary Particle and High-Energy Physics, 828*. doi:10.1016/j.physletb.2022.137013 Issue: 10 May 2022 Impact Factor-4.95.

26. Acharya, S., Adamova, D., Adler, A., Adolfsson, J., Rinella, G. A., Agnello, M., . . . Collaboration, A. (2022). Direct observation of the dead-cone effect in quantum chromodynamics. *Nature, 605*(7910), 440-+. doi:10.1038/s41586-022-04572-w Published: 18 May 2022 Impact Factor-63.580.

27. Acharya, S., Adamova, D., Adler, A., Rinella, G. A., Agnello, M., Agrawal, N., . . . Collaboration, A. (2022). Measurements of the groomed and ungroomed jet angularities in pp collisions at root s=5.02 TeV. *Journal of High Energy Physics*(5). doi:10.1007/jhep05(2022)061 Published: May 10, 2022 Impact Factor-6.376.

28. Barman, A., Patra, M. M., & Das Gupta, S. K. (2022). The respiratory lipoquinone, menaquinone, functions as an inducer of genes regulated by the Mycobacterium smegmatis repressor MSMEG_2295. *Microbiology (United Kingdom), 168*(5). doi:10.1099/mic.0.001192 Published: 16 May 2022 Impact Factor-2.8.

29. Bhattacharjee, S., Saha, B., Bhattacharyya, P., & Saha, S. (2022). LHSPred: A web based application for predicting lung health severity. *Biomedical Signal Processing and Control, 77*. doi:10.1016/j.bspc.2022.103745 Available online 12 May 2022 Impact Factor-5.076.

30. Bisht, R. S., Chatterjee, S., Raha, S., Singha, A., Kabiraj, D., Kanjilal, D., & Raychaudhuri, A. K. (2022). Disorder-induced crossover of Mott insulator to weak Anderson localized regime in an argon-irradiated NdNiO3 film. *PHYSICAL REVIEW B, 105*(20). doi:10.1103/PhysRevB.105.205120 Published: 16 May 2022 Impact Factor-3.908.

31. Calcuttawala, F., Shaw, R., Sarbajna, A., Dutta, M., Sinha, S., & Das Gupta, S. K. (2022). Apoptosis like symptoms associated with abortive infection of *Mycobacterium smegmatis* by mycobacteriophage D29. *PLoS ONE, 17*(5 May). doi:10.1371/journal.pone.0259480 Published: May 17, 2022 Impact Factor-3.752.

32. Das, D., Dattagupta, S., & Gupta, S. (2022). Quantum unitary evolution interspersed with repeated non-unitary interactions at random times: the method of stochastic Liouville equation, and two examples of interactions in the context of a tight-binding chain. *Journal of Statistical Mechanics-Theory and Experiment, 2022*(5). doi:10.1088/1742-5468/ac6256 Published 9 May 2022 Impact Factor-2.234.

33. Das, S., Roy, S., & Bhattacharyya, D. (2022). Understanding the role of non-Watson-Crick base pairs in DNA–protein recognition: Structural and energetic aspects using crystallographic database analysis and quantum chemical calculation. *Biopolymers*. doi:10.1002/bip.23492 Published 26 May 2022 Impact Factor-2.240.

34. Dey, S., Sarkar, A., Chowdhury, S., Singh, R., Mukherjee, A., Ghosh, Z., & Kundu, P. (2022). Heightened miR6024-NLR interactions facilitate necrotrophic pathogenesis in tomato. *Plant Molecular Biology*. doi:10.1007/s11103-022-01270-z Epub 2022 May 2. Impact Factor-5.197.

35. Dutta, D., Harper, A., & Gangopadhyay, G. (2022). Transcriptomic analysis of high oil-yielding cultivated white sesame and low oil-yielding wild black sesame seeds reveal differentially expressed genes for oil and seed coat colour. *Nucleus (India)*. doi:10.1007/s13237-022-00389-0 Published: May 2022 Impact Factor-1.8.

36. Dutta, D., Prasad, R., & Gangopadhyay, G. (2022). Inter-specific hybrid sesame with high lignan content in oil reveals increased expression of sesamin synthase gene. *Nucleus (India), 65*(1), 7-18. doi:10.1007/s13237-021-00354-3 Published: 19 May 2021 Impact Factor-1.8.

37. Ghosh, N., Chatterjee, S., Biswal, D., Pramanik, N. R., Chakrabarti, S., & Sil, P. C. (2022). Oxidative stress imposed in vivo anticancer therapeutic efficacy of novel imidazole-based oxidovanadium (IV) complex in solid tumor. *Life Sciences, 301*. doi:10.1016/j.lfs.2022.120606 Available online 1 May 2022, Impact Factor-6.78.

38. Ghosh, S., Kundu, M., Dutta, S., Mahalanobish, S., Ghosh, N., Das, J., & Sil, P. C. (2022). Corrigendum to "Enhancement of anti-neoplastic effects of cuminaldehyde against breast cancer via mesoporous silica nanoparticle based targeted drug delivery system" (Life Sciences (2022) 298, (S0024320522002259), (10.1016/j.lfs.2022.120525)). *Life Sciences, 300*. doi:10.1016/j.lfs.2022.120608 Epub 2022 May 5. , Impact Factor-6.78.

39. Giri, J., Basu, M., Roy, S., Mishra, T., Jana, K., Chande, A., & Ukil, A. (2022). Translationally Controlled Tumor Protein-Mediated Stabilization of Host Antiapoptotic Protein MCL-1 Is Critical for Establishment of Infection by Intramacrophage Parasite Leishmania donovani. *Journal of immunology (Baltimore, Md. : 1950), 208*(11), 2540-2548. doi:10.4049/jimmunol.2100748 Issue: May 13, 2022 Impact Factor-5.426.

40. Jain, S., Bhowmick, A., Jeong, B., Bae, T., & Ghosh, A. (2022). Unravelling the physiological roles of mazEF toxin–antitoxin system on clinical MRSA strain by CRISPR RNA-guided cytidine deaminase. *Journal of Biomedical Science, 29*(1). doi:10.1186/s12929-022-00810-5 Published: 07 May 2022 Impact Factor-12.771 .

41. Joardar, N., Jana, K., & Babu, S. P. S. (2022). Crude protein fraction with high thioredoxin reductase (TrxR) enzyme activity from filarial parasite *Setaria cervi* counters lipopolysaccharide (LPS)-induced inflammation in macrophages. *Parasitology Research, 121*(5), 1379-1388. doi:10.1007/s00436-022-07495-7 Published: 2022 May Impact Factor-2.383.

42. Maiti, A., Manna, S. K., Halder, S., Mandal, M., Karak, A., Banik, D., . . . Mahapatra, A. K. (2022). A benzothiazole-based dual reaction site fluorescent probe for the selective detection of hydrazine in water and live cells. *Organic and Biomolecular Chemistry*. doi:10.1039/d2ob00709f Published: 23 May 2022 Impact Factor-3.890.

43. Mandal, M., Guria, U. N., Halder, S., Karak, A., Banik, D., Jana, K., . . . Mahapatra, A. K. (2022). A dual-channel chemodosimetric sensor for discrimination between hypochlorite and nerve-agent mimic DCP: application on human breast cancer cells. *Organic and Biomolecular Chemistry*. doi:10.1039/d2ob00721e Published: 18 May 2022 Impact Factor-3.890.

44. Mukherjee, S., Dutta, M., Ghosh, A., & Chatterjee, A. (2022). A year-long study on PM2.5 and its carbonaceous components over eastern Himalaya in India: Contributions of local and transported fossil fuel and biomass burning during premonsoon. *Environmental Research, 212*. doi:10.1016/j.envres.2022.113546 Epub 2022 May 31. Impact Factor-8.431.

45. Nag, P., Mondal, N., Sarkar, J., & Das, S. (2022). *Paraburkholderia bengalensis* sp. nov. isolated from roots of Oryza sativa, IR64. *Archives of Microbiology, 204*(6). doi:10.1007/s00203-022-02960-4 Published: 2022 May 25 Impact Factor-2.8.

46. Roy, M., Bhakta, K., & Ghosh, A. (2022). Minimal Yet Powerful: The Role of Archaeal Small Heat Shock Proteins in Maintaining Protein Homeostasis. *Frontiers in Molecular Biosciences, 9*. doi:10.3389/fmolb.2022.832160 Published:12 May 2022 Impact Factor- 6.113.

47. Salazar, B., Ortiz, A., Keswani, C., Minkina, T., Mandzhieva, S., Pratap Singh, S., . . . Sansinenea, E. (2022). Bacillus spp. as Bio-factories for Antifungal Secondary Metabolites: Innovation Beyond Whole Organism Formulations. *Microbial Ecology*. doi:10.1007/s00248-022-02044-2 Published : 2022 May 23 Impact Factor-4.608.

48. Sheikh, M. S., Ghosh, A., Roy, A., Bhandari, S., Sundaram, S., Mallick, T. K., . . . Sinha, T. P. (2022). High Open-Circuit Voltage in Double Perovskite Oxide A2NdSbO6 (A = Ba, Sr) Photoanode-Based Dye-Sensitized Solar Cells. *Journal of Electronic Materials*. doi:10.1007/s11664-022-09681-w Online Publication: May 15, 2022 Impact Factor-2.047.

49. Tripathi, H. S., Dutta, A., & Sinha, T. P. (2022). Tailoring structural and electrochemical properties in Sr2+ incorporated nanostructured BiFeO3 for enhanced asymmetric solidstate supercapacitor. *Electrochimica Acta, 421*. doi:10.1016/j.electacta.2022.140505 Available online 7 May 2022 Impact Factor-7.336

50. Acharya, S., Adamová, D., Adler, A., Adolfsson, J., Aglieri Rinella, G., Agnello, M., . . . Collaboration, A. (2022). Observation of a multiplicity dependence in the pT-differential charm baryon-to-meson ratios in proton–proton collisions at s=13 TeV. *Physics Letters, Section B: Nuclear, Elementary Particle and High-Energy Physics, 829*. doi:10.1016/j.physletb.2022.137065 Issue: 10 June 2022, Impact Factor-4.95.

51. Acharya, S., Adamová, D., Adler, A., Adolfsson, J., Aglieri Rinella, G., Agnello, M., . . . Collaboration, A. (2022). Neutral to charged kaon yield fluctuations in Pb – Pb collisions at sNN=2.76 TeV. *Physics Letters, Section B: Nuclear, Elementary Particle and High-Energy Physics, 832*. doi:10.1016/j.physletb.2022.137242 Available online 9 June 2022, Impact Factor-4.95.

52. Acharya, S., Adamova, D., Adler, A., Adolfsson, J., Rinella, G. A., Agnello, M., . . . Collaboration, A. (2022). Forward rapidity J/psi production as a function of charged-particle multiplicity in pp collisions at root s=5.02 and 13 TeV. *Journal of High Energy Physics*(6). doi:10.1007/jhep06(2022)015 Published: 06 June 2022 Impact Factor-6.376.

53. Acharya, S., Adamova, D., Adler, A., Adolfsson, J., Rinella, G. A., Agnello, M., . . . Collaboration, A. (2022). Inclusive, prompt and non-prompt J/psi production at midrapidity in p-Pb collisions at root s(NN)=5.02 TeV. *Journal of High Energy Physics*(6). doi:10.1007/jhep06(2022)011 Published: 03 June 2022 Impact Factor-6.376.

54. Acharya, S., Adamova, D., Adler, A., Adolfsson, J., Rinella, G. A., Agnello, M., . . . Collaboration, A. (2022). Investigating charm production and fragmentation via azimuthal correlations of prompt D mesons with charged particles in pp collisions at root s=13 TeV. *European Physical Journal C, 82*(4). doi:10.1140/epjc/s10052-022-10267-3 Published: 03 June 2022 Impact Factor-4.994.

55. Acharya, S., Adamova, D., Adler, A., Adolfsson, J., Rinella, G. A., Agnello, M., . . . Collaboration, A. (2022). Multiplicity dependence of charged-particle jet production in pp collisions at root s=13 TeV. *European Physical Journal C, 82*(6). doi:10.1140/epjc/s10052-022-10405-z Published: 07 June 2022 Impact Factor-4.994.

56. Acharya, S., Adamova, D., Adler, A., Adolfsson, J., Rinella, G. A., Agnello, M., . . . Collaboration, A. (2022). Multiplicity dependence of charged-particle jet production in pp collisions at root s=13 TeV. *European Physical Journal C, 82*(6). doi:10.1140/epjc/s10052-022-10405-x Published: 07 June 2022 Impact Factor-4.994.

57. Acharya, S., Adamová, D., Adler, A., Aglieri Rinella, G., Agnello, M., Agrawal, N., . . . Zurlo, N. (2022). Hypertriton Production in p -Pb Collisions at sNN =5.02 TeV. *Physical Review Letters, 128*(25). doi:10.1103/PhysRevLett.128.252003 Published 23 June 2022 Impact Factor- 9.185.

58. Ali, S. M., Gupta, D., Kundalia, K., Saha, S. K., Tengblad, O., Ovejas, J. D., . . . Szwec, S. (2022). Resonance Excitations in ^{7}Be(d,p)^{8}Be* to Address the Cosmological Lithium Problem. Physical Review Letters, 128(25). doi:10.1103/*PhysRevLett.128.252701* Published 21 June 2022 Impact Factor- 9.185.

59. Bandyopadhyay, S., Halder, S., & Sengupta, R. (2022). Conditions for local transformations between sets of quantum states. *Physical Review A,* 105(6). doi:10.1103/PhysRevA.105.062212 Published 23 June 2022 Impact Factor-2.971.

60. Banik, P., & Bhadra, A. (2022). A pure hadronic model description of the observed neutrino emission from the tidal disruption event AT2019dsg. *European Physical Journal C, 82*(6). doi:10.1140/epjc/s10052-022-10486-8 Published: 09 June 2022 Impact Factor-4.994.

61. Banik, P., & Ghosh, S. K. (2022). Probing the Origin of Cosmic Rays in Cygnus Cocoon Using Ultrahigh-energy Gamma-Ray and Neutrino Observations. *Astrophysical Journal Letters, 931*(2). doi:10.3847/2041-8213/ac7157 Published 2022 June 1 Impact Factor-8.811.

62. Basak, S., & Kundu, P. (2022). Plant metacaspases: Decoding their dynamics in development and disease. *Plant Physiology and Biochemistry, 180*, 50-63. doi:10.1016/j.plaphy.2022.03.024 Published : 1 June 2022, Impact Factor-5.437.

63. Bhar, A., Jain, A., & Das, S. (2022). Natural therapeutics against SARS CoV2: the potentiality and challenges. *Vegetos*. doi:10.1007/s42535-022-00401-7 Published: 15 June 2022 Impact Factor-0.207.

64. Bose, R., Sengupta, M., Basu, D., & Jha, S. (2022). The rolB-transgenic *Nicotiana tabacum* plants exhibit upregulated ARF7 and ARF19 gene expression. *Plant Direct, 6*(6). doi:10.1002/pld3.414 Published: 18 June 2022 Impact Factor-3.369.

65. Fox, B. G., Thorn, R. M. S., Dutta, T. K., Bowes, M. J., Read, D. S., & Reynolds, D. M. (2022). A case study: The deployment of a novel in situ fluorimeter for monitoring biological contamination within the urban surface waters of Kolkata, India. *Science of the Total Environment, 842*. doi:10.1016/j.scitotenv.2022.156848 Epub 2022 Jun 21 Impact Factor-10.754.

66. Ghosal, K., Pal, S., Ghosh, D., Jana, K., & Sarkar, K. (2022). In vivo biocompatible shape memory polyester derived from recycled polycarbonate e-waste for biomedical application. *Biomaterials Advances, 138*. doi:10.1016/j.bioadv.2022.212961 Available online 2 June 2022 Impact Factor-15.863.

67. Ghosal, P., & Ray, R. (2022). Probability distribution for black hole evaporation. *Physical Review D, 105*(12). doi:10.1103/PhysRevD.105.124016 Published 8 June 2022 Impact Factor-5.407.

68. Ghosh, R., Jawed, J. J., Roy, N., Mandal, S., Majumdar, S. B., & Majumdar, S. (2022). Regulatory role of Transcription factor-EB (TFEB) in parasite control through alteration of antigen presentation in visceral leishmaniasis. *Experimental Parasitology, 239*. doi:10.1016/j.exppara.2022.108286 Available online 2 June 2022, Impact Factor-2.132.

69. Ghosh, S., Kundu, M., Dutta, S., Mahalanobish, S., Ghosh, N., Das, J., & Sil, P. C. (2022). Enhancement of anti-neoplastic effects of cuminaldehyde against breast cancer via mesoporous silica nanoparticle based targeted drug delivery system. *Life Sciences, 298*. doi:10.1016/j.lfs.2022.120525 Issue: 1 June 2022, , Impact Factor-6.78.

70. Manna, P., Dewanjee, S., Joardar, S., Chakraborty, P., Bhattacharya, H., Bhanja, S., . . . Sil, P. C. (2022). Carnosic acid attenuates doxorubicin-induced cardiotoxicity by decreasing oxidative stress and its concomitant pathological consequences. *FOOD AND CHEMICAL TOXICOLOGY, 166*. doi:10.1016/j.fct.2022.113205 Available online 5 June 2022 Impact Factor-5.572.

71. Mohid, S. A., Biswas, K., Won, T., Mallela, L. S., Gucchait, A., Butzke, L., . . . Bhunia, A. (2022). Structural insights into the interaction of antifungal peptides and ergosterol containing fungal membrane. *Biochimica et Biophysica Acta - Biomembranes, 1864*(10). doi:10.1016/j.bbamem.2022.183996 Available online 23 June 2022 Impact Factor-4.019.

72. Mukherjee, D., Saha, D., Acharya, D., Mukherjee, A., & Ghosh, T. C. (2022). Interplay between gene expression and gene architecture as a consequence of gene and genome duplications: evidence from metabolic genes of *Arabidopsis thaliana*. *Physiology and Molecular Biology of Plants, 28*(5), 1091-1108. doi:10.1007/s12298-022-01188-2 Issue: Epub 2022 Jun 2. Impact Factor-3.442.

73. Panda, J., Das, S., Kumar, S., Tudu, B., & Sarkar, R. (2022). Investigation of antibacterial, antioxidant, and anticancer properties of hydrothermally synthesized cobalt ferrite nanoparticles. *Applied Physics A: Materials Science and Processing, 128*(7). doi:10.1007/s00339-022-05700-z Published: 07 June 2022 Impact Factor-2.983.

74. Rana, A., Kundu, M., & Misra, A. K. (2022). Convenient synthesis of mixed S–Se-linked pseudodisaccharides by sulfur and selenium exchange. *TETRAHEDRON, 115*. doi:10.1016/j.tet.2022.132804 Issue: 4 June 2022 Impact Factor-2.388 .

75. Sarkar, S., Sadhukhan, P., Das, D., Basyach, P., Das, J., Das, M. R., . . . Manna, P. (2022). Glucose-Sensitive Delivery of Vitamin K by Using Surface-Functionalized, Dextran-Capped Mesoporous Silica Nanoparticles To Alleviate Hyperglycemia. *Acs Applied Materials & Interfaces, 14*(23), 26489-26500. doi:10.1021/acsami.2c05974 Published : 06 June, 2022 Impact Factor-10.383.

76. Acharya, S., Adamova, D., Adler, A., Adolfsson, J., Aglieri Rinella, G., Agnello, M., . . . Collaboration, A. (2022). Publisher Correction: Direct observation of the dead-cone effect in quantum chromodynamics (Nature, (2022), 605, 7910, (440-446), 10.1038/s41586-022-04572-w). *Nature, 607*(7920), E22. doi:10.1038/s41586-022-05026-z Published: 07 July 2022 Impact Factor-63.580.

77. Acharya, S., Adamová, D., Adler, A., Adolfsson, J., Aglieri Rinella, G., Agnello, M., . . . Collaboration, A. (2022). General balance functions of identified charged hadron pairs of (π,K,p) in Pb–Pb collisions at sNN= 2.76 TeV. *Physics Letters, Section B: Nuclear, Elementary Particle and High-Energy Physics, 833*. doi:10.1016/j.physletb.2022.137338 Available online 21 July 2022 Impact Factor-4.95.

78. Acharya, S., Adamová, D., Adler, A., Adolfsson, J., Aglieri Rinella, G., Agnello, M., . . . Collaboration, A. (2022). KS0KS0 and KS0K± femtoscopy in pp collisions at s=5.02 and 13 TeV. *Physics Letters, Section B: Nuclear, Elementary Particle and High-Energy Physics, 833*. doi:10.1016/j.physletb.2022.137335 Available online 21 July 2022 Impact Factor-4.95.

79. Acharya, S., Adamová, D., Adler, A., Adolfsson, J., Aglieri Rinella, G., Agnello, M., . . . Collaboration, A. (2022). Exploring the NΛ–NΣ coupled system with high precision correlation techniques at the LHC. *Physics Letters, Section B: Nuclear, Elementary Particle and High-Energy Physics, 833*. doi:10.1016/j.physletb.2022.137272 Available online 4 July 2022 Impact Factor-4.95.

80. Banerjee, S., Mandal, M., Halder, S., Karak, A., Banik, D., Jana, K., & Mahapatra, A. K. (2022). An ICT-guided ratiometric naphthalene-benzothiazole-based probe for the detection of cyanide with real-time applications in human breast cancer cells. *Analytical Methods, 14*(33), 3209-3217. doi:10.1039/d2ay00898j Publication Date:July 25, 2022 Impact Factor-3.532.

81. Bhattacharjee, S., Saha, B., Bhattacharyya, P., & Saha, S. (2022). Classification of obstructive and non-obstructive pulmonary diseases on the basis of spirometry using machine learning techniques. *Journal of Computational Science, 63*. doi:10.1016/j.jocs.2022.101768 Available online 6 July 2022 Impact Factor-3.817.

82. Choudhary, N., Srivastava, P., Dutta, M., Mukherjee, S., Rai, A., Kuniyal, J. C., . . . Sharma, S. K. (2022). Seasonal Characteristics, Sources and Pollution Pathways of PM10 at High Altitudes Himalayas of India. *Aerosol and Air Quality Research, 22*(7). doi:10.4209/aaqr.220092 Published in Issue 7, July 2022 Impact Factor-4.53.

83. Das, A. K., Hossain, U., Ghosh, S., Biswas, S., Mandal, M., Mandal, B., . . . Sil, P. C. (2022). Amelioration of oxidative stress mediated inflammation and apoptosis in pancreatic islets by Lupeol in STZ-induced hyperglycaemic mice. *Life Sciences, 305*. doi:10.1016/j.lfs.2022.120769 Available online 2 July 2022 , Impact Factor-6.78.

84. Das, A., Gangarde, Y. M., Pariary, R., Bhunia, A., & Saraogi, I. (2022). An amphiphilic small molecule drives insulin aggregation inhibition and amyloid disintegration. *International Journal of Biological Macromolecules, 218*, 981-991. doi:10.1016/j.ijbiomac.2022.07.155 Available online 27 July 2022 Impact Factor-8.025.

85. Das, M. C., Samaddar, S., Jawed, J. J., Ghosh, C., Acharjee, S., Sandhu, P., . . . Bhattacharjee, S. (2022). Vitexin alters *Staphylococcus aureus* surface hydrophobicity to obstruct biofilm formation. *Microbiological Research, 263*. doi:10.1016/j.micres.2022.127126 Available online 14 July 2022 Impact Factor-5.07.

86. Dasgupta, P., Prasad, P., Bag, S. K., & Chaudhuri, S. (2022). Dynamicity of histone H3K27ac and H3K27me3 modifications regulate the cold-responsive gene expression in Oryza sativa L. ssp. indica. *Genomics, 114*(4). doi:10.1016/j.ygeno.2022.110433 Impact Factor-18.010

87. Datta, R., Pradhan, S. K., Masanta, S., Majumdar, S., & De, S. K. (2022). Short range spin-spin correlation, spin-phonon coupling and isostructural phase transition in hetero-tri-spin 3d-5d-4f double perovskite Sm2CoIrO6. *JOURNAL OF SOLID STATE CHEMISTRY, 314*. doi:10.1016/j.jssc.2022.123391 Available online 6 July 2022, Epub 2022 Jul 18. Impact Factor-3.656.

88. *Ghosh, S. B., Gupta, T., Ardra, A. V., Bhowmik, A. D., Saha, S., Guha, T., & Mukherjee, A. (2022). Activating strong nonlocality from local sets: An elimination paradigm. Physical Review A, 106(1). doi:10.1103/PhysRevA.106.L010202 Published 25 July 2022 Impact Factor-2.971.*

89. Ivy, N., Mukherjee, T., Bhattacharya, S., Ghosh, A., & Sharma, P. Arsenic contamination in groundwater and food chain with mitigation options in Bengal delta with special reference to Bangladesh. *Environmental Geochemistry and Health*. doi:10.1007/s10653-022-01330-9 Published 2022 Jul 16 Impact Factor-4.932.

90. Kapoor, T. S., Venkataraman, C., Sarkar, C., Phuleria, H. C., Chatterjee, A., Habib, G., & Apte, J. S. (2022). Estimation of real-time brown carbon absorption: An observationally constrained Mie theory-based optimization method. *Journal of Aerosol Science, 166*. doi:10.1016/j.jaerosci.2022.106047 Available online 8 July 2022 Impact Factor-4.586.

91. Kundalia, K., Gupta, D., Ali, S. M., Saha, S. K., Tengblad, O., Ovejas, J. D., . . . Moro, A. M. (2022). Study of elastic and inelastic scattering of ^{7}Be + ^{12}C at 35 MeV. *Physics Letters, Section B: Nuclear, Elementary Particle and High-Energy Physics, 833*. doi:10.1016/j.physletb.2022.137294 Available online 13 July 2022 Impact Factor-4.95.

92. Mahalanobish, S., Saha, S., Dutta, S., Ghosh, S., & Sil, P. C. Melatonin counteracts necroptosis and pulmonary edema in cadmium-induced chronic lung injury through the inhibition of angiotensin II. *Journal of Biochemical and Molecular Toxicology*. doi:10.1002/jbt.23163 First published: 17 July 2022 Impact Factor-3.568.

93. Mazumder, S., Bindu, S., De, R. D. N., Debsharma, S., Pramanik, S., & Bandyopadhyay, U. (2022). Emerging role of mitochondrial DAMPs, aberrant mitochondrial dynamics and anomalous mitophagy in gut mucosal pathogenesis. *Life Sciences, 305*. doi:10.1016/j.lfs.2022.120753 Epub 2022 Jul 3 , Impact Factor-6.78.

94. Panda, J., Das, S., Kumar, S., Tudu, B., & Sarkar, R. (2022). Investigation of antibacterial, antioxidant, and anticancer properties of hydrothermally synthesized cobalt ferrite nanoparticles. *Applied Physics a-Materials Science & Processing, 128*(7). doi:10.1007/s00339-022-05700-z Published: July 2022 Impact Factor-2.983.

95. Paul, D., Basak, P., & Ghosh Dastidar, S. (2022). Remote communication between unstructured and structured regions of Bcl-2 tunes its ligand binding capacity: Mechanistic insights. *Computational Biology and Chemistry, 100*. doi:10.1016/j.compbiolchem.2022.107736 Available online 19 July 2022 Impact Factor-3.737.

96. Saha, M., Dutta, S. P., Mukherjee, G., Basu, A., Majumder, D., & Sil, A. K. (2022). Cloning, expression and characterization of PURase gene from Pseudomonas sp. AKS31. *Archives of Microbiology, 204*(8). doi:10.1007/s00203-022-03110-6 Published : 2022 Jul 18 Impact Factor-2.667.

97. Sarkar, A., Paul, S., Singh, C., Chowdhury, N., Nag, P., Das, S., . . . Das, S. (2022). A novel plant lectin, NTL-125, interferes with SARS-CoV-2 interaction with hACE2. *Virus Research, 315*. doi:10.1016/j.virusres.2022.198768 Published: 2022 Jul 2 Impact Factor-6.286.

98. Acharya, B., Alexandre, J., Benes, P., Bergmann, B., Bertolucci, S., Bevan, A., . . . Vives, O. (2022). Search for highly-ionizing particles in pp collisions at the LHC's Run-1 using the prototype MoEDAL detector. *European Physical Journal C, 82*(8). doi:10.1140/epjc/s10052-022-10608-2 Published: 10 August 2022 Impact Factor-4.994.

99. Acharya, S., Adamová, D., Adler, A., Adolfsson, J., Aglieri Rinella, G., Agnello, M., . . . Collaboration, A. (2022). Characterizing the initial conditions of heavy-ion collisions at the LHC with mean transverse momentum and anisotropic flow correlations. *Physics Letters, Section B: Nuclear, Elementary Particle and High-Energy Physics, 834*. doi:10.1016/j.physletb.2022.137393 Available online 24 August 2022 Impact Factor-4.95.

100. Acharya, S., Adamova, D., Adler, A., Rinella, G. A., Agnello, M., Agrawal, N., . . . Collaboration, A. (2022). Study of very forward energy and its correlation with particle production at midrapidity in pp and p-Pb collisions at the LHC. *Journal of High Energy Physics*(8). doi:10.1007/jhep08(2022)086 Published: 05 August 2022 Impact Factor-6.376.

101. Aggarwal, V. K., Sett, S., Sau, J., Ghatak, A., Kumar, M., Singha, A., & Raychaudhuri, A. K. (2022). Phonons and Thermal Properties of Ge Nanowires: A Raman Spectroscopy Investigation and Phonon Simulations. *Journal of Physical Chemistry C, 126*(35), 15046-15056. doi:10.1021/acs.jpcc.2c04746 Publication Date:August 24, 2022 Impact Factor-4.177.

102. Bej, P., Ghosal, A., Roy, A., Mal, S., & Das, D. (2022). Creating quantum correlations in generalized entanglement swapping. *Physical Review A,* 106(2). doi:10.1103/PhysRevA.106.022428 Published 23 August 2022 Impact Factor-2.971.

103. Bose, D., Roy, L., & Chatterjee, S. (2022). Peptide therapeutics in the management of metastatic cancers. *Rsc Advances, 12*(33), 21353-21373. doi:10.1039/d2ra02062a Publication Date:August 02, 2022 Impact Factor-4.036.

104. Chatterjee, H. S., Maity, S., Halder, S., Ghosh, P., Jana, K., Mahapatra, P. K., & Sinha, C. Biological activity of non-radical vs. stable radical of a pyridazine-sulfonamide aminophenol-type compound. *New Journal of Chemistry*. doi:10.1039/d2nj03308a Publication Date:August 24, 2022 Impact Factor-3.069.

105. Chatterjee, S., Ghosh, S., & Mandal, N. C. (2022). Potential of an endophytic fungus Alternaria tenuissima PE2 isolated from Psidium guajava L. for the production of bioactive compounds. *South African Journal of Botany, 150*, 658-670. doi:10.1016/j.sajb.2022.08.016 Available online 26 August 2022 Impact Factor-3.111.

106. Chaudhary, D., Singh, A., Marzuki, M., Ghosh, A., Kidwai, S., Gosain, T. P., . . . Singh, R. (2022). Identification of small molecules targeting homoserine acetyl transferase from *Mycobacterium tuberculosis* and *Staphylococcus aureus*. *Scientific Reports, 12*(1). doi:10.1038/s41598-022-16468-w Published: 13 August 2022 Impact Factor-4.997.

107. Chowdhury, S., Ghosh, S., & Gond, S. K. Anti-MRSA and clot lysis activities of Pestalotiopsis microspora isolated from *Dillenia pentagyna* Roxb. *Journal of Basic Microbiology*. doi:10.1002/jobm.202200294 First published: 24 August 2022 Impact factor (2021):2.650.

108. Datta, S. K. (2022). Breeding of Bougainvillea: past, present, and future. *Nucleus (India), 65*(2), 239-254. doi:10.1007/s13237-022-00388-1 August 2022 Impact Factor :- 6.253.

109. Dutta, M., & Chatterjee, A. (2022). A deep insight into state-level aerosol pollution in India: Long-term (2005–2019) characteristics, source apportionment, and future projection (2023). *Atmospheric Environment, 289*. doi:10.1016/j.atmosenv.2022.119312 Available online 2 August 2022 Impact Factor-5.755.

110. Dutta, S., Chakraborty, P., Basak, S., Ghosh, S., Ghosh, N., Chatterjee, S., . . . Sil, P. C. (2022). Synthesis, characterization, and evaluation of in vitro cytotoxicity and in vivo antitumor activity of asiatic acid-loaded poly lactic-co-glycolic acid nanoparticles: A strategy of treating breast cancer. *Life Sciences, 307*. doi:10.1016/j.lfs.2022.120876 Published:2022 Aug 10 , Impact Factor-6.78.

111. Ghosh, S., Mahalanobish, S., & Sil, P. C. (2022). Diabetes: discovery of insulin, genetic, epigenetic and viral infection mediated regulation. *Nucleus (India), 65*(2), 283-297. doi:10.1007/s13237-021-00376-x August 2022 Impact Factor :- 6.253

112. Karak, A., Mandal, M., Halder, S., Banerjee, S., Banik, D., Maiti, A., . . . Mahapatra, A. K. Switching to a 'turn-on' fluorescent probe for rapid detection of hydrazine in human breast cancer cells using a test-strip. *Analytical Methods*. doi:10.1039/d2ay01157c Published 23 Aug 2022 Impact Factor-3.532.

113. Mahatha, A. C., Banerjee, S. K., Ghosh, A., Lata, S., Saha, S., Basu, J., & Kundu, M. (2022). A systems approach to decipher a role of transcription factor RegX3 in the adaptation of Mycobacterium tuberculosis to hypoxic stress. *Microbiology (United Kingdom), 168*(8). doi:10.1099/MIC.0.001229 Published: 2022 Aug Impact Factor-2.8.

114. Majumder, N., Dutta, M., Chatterjee, A., Bakshi, S., Sanyal, P., Paul, M., . . . Mukhopadhayay, S. K. Ionic composition, source identification of rainwater, and its contribution to nutrient deposition in monsoon, over Sundarban Mangrove forest. *Journal of Atmospheric Chemistry*. doi:10.1007/s10874-022-09441-4 Published: 17 August 2022.

115. Mondal, B., Mukherjee, A., Mazumder, M., De, A., Ghosh, S., & Basu, D. (2022). Inducible expression of truncated NAC62 provides tolerance against *Alternaria brassicicola* and imparts developmental changes in Indian mustard. *Plant Science, 324*. doi:10.1016/j.plantsci.2022.111425 Epub 2022 Aug 23 Impact Factor-5.363.

116. Mukherji, S., Bakshi, U., & Ghosh, A. (2022). Draft genome sequences of hydrocarbon degrading Haloferax sp. AB510, Haladaptatus sp. AB618 and Haladaptatus sp. AB643 isolated from the estuarine sediments of Sundarban mangrove forests, India. *3 Biotech, 12*(9). doi:10.1007/s13205-022-03273-5 Epub 2022 Aug 3 Cite Score-5.2.

117. Shit, P., & Misra, A. K. (2022). Synthesis of the pentasaccharide repeating unit corresponding to the capsular polysaccharide of *Escherichia coli* O20:K83:H26. *TETRAHEDRON, 122*. doi:10.1016/j.tet.2022.132948 Available online 8 August 2022 Impact Factor-2.388.

118. Shriti, S., Paul, S., & Das, S. Overexpression of CaMYB78 transcription factor enhances resistance response in chickpea against Fusarium oxysporum and negatively regulates anthocyanin biosynthetic pathway. *Protoplasma*. doi:10.1007/s00709-022-01797-4 Published: 2022 Aug 10. Impact factor 4.640.

119. Singh, R., Purkait, B., Abhishek, K., Saini, S., Das, S., Verma, S., . . . Das, P. (2022). RETRACTION: Universal minicircle sequence binding protein of Leishmania donovani regulates pathogenicity by controlling expression of cytochrome-b (Retraction of Vol 6, art no 13, 2016). *Cell and Bioscience, 12*(1). doi:10.1186/s13578-022-00875-7 Published: 22 August 2022 Impact Factor-9.597.

120. Thakur, N., Kundu, M., Chatterjee, S., Singh, T. A., Das, J., & Sil, P. C. (2022). Morin-loaded nanoceria as an efficient nanoformulation for increased antioxidant and antibacterial efficacy. *Journal of Nanoparticle Research, 24*(9). doi:10.1007/s11051-022-05552-x Published: 19 August 2022 Impact Factor-2.533.

121. Acharya, S., Adamová, D., Adler, A., Adolfsson, J., Aglieri Rinella, G., Agnello, M., . . . Zurlo, N. (2022). First study of the two-body scattering involving charm hadrons. *Physical Review D, 106*(5). doi:10.1103/PhysRevD.106.052010 Published 23 September 2022 Impact Factor-5.407.

122. Acharya, S., Adamová, D., Adler, A., Adolfsson, J., Aglieri Rinella, G., Agnello, M., . . . Collaboration, A. (2022). Production of K∗(892)0 and φ(1020) in pp and Pb-Pb collisions at sNN =5.02 TeV. *Physical Review C, 106*(3). doi:10.1103/PhysRevC.106.034907 Published 14 September 2022 Impact Factor-3.09.

123. Chowdhury, S., Mukherjee, A., Basak, S., Das, R., Mandal, A., & Kundu, P. (2022). Disruption of tomato TGS machinery by ToLCNDV causes reprogramming of vascular tissue-specific TORNADO1 gene expression. *Planta, 256*(4). doi:10.1007/s00425-022-03985-1 Published: 2022 Sep 12 Impact Factor-4.54.

124. Dattagupta, S. (2022). Imprint of dynamic localisation in frequency-dependent conductivity in a paradigmatic quantum system. *Pramana-Journal of Physics, 96*(4). doi:10.1007/s12043-022-02429-5 Published: 20 September 2022 Impact Factor-2.669.

125. Dutta, A., & Paul, S. (2022). A predicted two to tango interaction between muc1 and sox2: a unique opportunity to target cancer stem cells. *World Cancer Research Journal, 9*. doi:10.32113/wcrj_20223_2244 .

126. Firdous, S., Ghosh, A., & Saha, S. (2022). BCSCdb: a database of biomarkers of cancer stem cells. *Database : the journal of biological databases and curation, 2022*. doi:10.1093/database/baac082 Published: 28 September 2022 Impact Factor-4.776.

127. Islam, C. A., Mustafa, M. G., Ray, R., & Singha, P. (2022). Consistent approach to study gluon quasiparticles. *Physical Review D, 106*(5). doi:10.1103/PhysRevD.106.054002 Published 6 September 2022 Impact Factor-5.407.

128. Manna, T., & Misra, A. K. (2022). Synthesis of the sialic acid-containing tetrasaccharide repeating unit corresponding to the cell wall O-antigen of *Escherichia coli* O131 strain. *Carbohydrate Research, 521*. doi:10.1016/j.carres.2022.108668 Available online 5 September 2022 Impact Factor-2.975.

129. Mondal, A., Paul, D., Dastidar, S. G., Saha, T., & Goswami, A. M. (2022). In silico analyses of Wnt1 nsSNPs reveal structurally destabilizing variants, altered interactions with Frizzled receptors and its deregulation in tumorigenesis. *Scientific Reports, 12*(1). doi:10.1038/s41598-022-19299-x Published: 02 September 2022 Impact Factor-4.997.

130. Nesa, J., Jana, S. K., Sadat, A., Biswas, K., Kati, A., Kaya, O., . . . Mandal, A. K. (2022). Antimicrobial potential of a ponericin-like peptide isolated from Bombyx mori L. hemolymph in response to *Pseudomonas aeruginosa* infection. *Scientific Reports, 12*(1). doi:10.1038/s41598-022-19450-8 Published: 15 September 2022 Impact Factor-4.997.

131. Pal, A., Chakrabarti, P., & Dey, S. (2022). ProDFace: A web-tool for the dissection of protein-DNA interfaces. *Frontiers in Molecular Biosciences, 9*. doi:10.3389/fmolb.2022.978310 Published: 06 September 2022 Impact Factor- 6.113.

132. Ray, D., Chatterjee, A., & Raha, S. (2022). Water droplets embedded with nascent carbon particles hold higher photo-thermal efficiency than aged ones. *Chemical Physics Letters, 806*. doi:10.1016/j.cplett.2022.140057 Available online 17 September 2022 Impact Factor-2.719.

133. Saran, N., & Saha, S. (2022). Survey of mycobacterial fluoroquinolone resistance protein conservon (mfp conservon) in *Mycobacteriaceae* and identification of its promoter activity. Gene Reports, 29. doi:10.1016/j.genrep.2022.101684 Published:23 September 2022 Impact Factor-1.51.

134. Sarkar, D., Maity, N. C., Shome, G., Varnava, K. G., Sarojini, V., Vivekanandan, S., . . . Bhunia, A. Mechanistic insight into functionally different human islet polypeptide (hIAPP) amyloid: the intrinsic role of the C-terminal structural motifs. *Physical Chemistry Chemical Physics*. doi:10.1039/d2cp01650h Published: 05 September 2022 Impact Factor-3.945.

135. Tejwan, N., Sadhukhan, P., Sharma, A., Singh, T. A., Hatimuria, M., Pabbathi, A., . . . Sil, P. C. (2022). pH-responsive and targeted delivery of rutin for breast cancer therapy via folic acid-functionalized carbon dots. *Diamond and Related Materials, 129*. doi:10.1016/j.diamond.2022.109346 Available online 6 September 2022 Impact Factor-3.806.

136. Thakur, N., Sadhukhan, P., Kundu, M., Abhishek Singh, T., Hatimuria, M., Pabbathi, A., . . . Sil, P. C. (2022). Folic acid-functionalized cerium oxide nanoparticles as smart nanocarrier for pH-responsive and targeted delivery of Morin in breast cancer therapy. *Inorganic Chemistry Communications, 145*. doi:10.1016/j.inoche.2022.109976 Available online 9 September 2022 Impact Factor-3.428.

137. Tyagi, S., Narayana, S., Singh, R. N., Srivastava, C. P., Twinkle, S., Das, S. K., & Jeer, M. (2022). Migratory behaviour of Brown planthopper, Nilaparvata lugens (St∑l) (Hemiptera: Delphacidae), in India as inferred from genetic diversity and reverse trajectory analysis. *3 Biotech, 12*(10). doi:10.1007/s13205-022-03337-6 Epub 2022 Sep 8.

138. Brender, J. R., Ramamoorthy, A., Gursky, O., & Bhunia, A. (2023). Intrinsic disorder and structural biology: Searching where the light isn't. *Biophysical Chemistry, 292*. doi:10.1016/j.bpc.2022.106912 Impact factor-3.628 Available online 25 October 2022 Impact Factor- 3.628.

139. Chatterjee, S., Bhaduri, P. P., & Chattopadhyay, S. (2023). J/ψ yields in low energy nuclear collisions at SPS and FAIR: A baseline estimation. *Nuclear Physics A, 1029*. doi:10.1016/j.nuclphysa.2022.122554 Available online 12 October 2022, Impact factor-1.558

140. Chatterjee, S., Sen, A., Das, S., & Biswas, S. (2023). Visual investigation of possible degradation in GEM foil under test. *Nuclear Instruments and Methods in Physics Research, Section A: Accelerators, Spectrometers, Detectors and Associated Equipment, 1045*. doi:10.1016/j.nima.2022.167573 Available online 14 October 2022, Impact factor-1.335.

141. Das, D., & Bandyopadhyay, S. (2022). Quantum communication using a quantum switch of quantum switches. *Proceedings of the Royal Society A: Mathematical, Physical and Engineering Sciences, 478*(2266). doi:10.1098/rspa.2022.0231 Published:05 October 2022 Impact Factor-3.213.

142. Datta, R., Pradhan, S. K., Masanta, S., Majumdar, S., & De, S. K. (2022). Short range spin-spin correlation, spin-phonon coupling and isostructural phase transition in hetero-tri-spin 3d-5d-4f double perovskite Sm2CoIrO6. *JOURNAL OF SOLID STATE CHEMISTRY, 314*. doi:10.1016/j.jssc.2022.123391 Pulished : October 2022 Impact Factor: 3.656.

143. Gaine, T., Tudu, P., Ghosh, S., Mahanty, S., Bakshi, M., Naskar, N., . . . Chaudhuri, P. (2022). Differentiating Wild and Apiary Honey by Elemental Profiling: a Case Study from Mangroves of Indian Sundarban. *Biological Trace Element Research, 200*(10), 4550-4569. doi:10.1007/s12011-021-03043-z October 2022 Impact Factor: 4.081 (2021).

144. Jain, S., Bhowmick, A., & Pandey, A. K. (2022). A rapid One-Pot RNA isolation method for simplified clinical detection of SARS-COV-2 infection in India. *Frontiers in Cellular and Infection Microbiology, 12*. doi:10.3389/fcimb.2022.962057 Published: 04 October 2022 Impact Factor-6.073.

145. Khamaru, M., Nath, D., Mitra, D., & Roy, S. Assessing combinatorial diversity of aureochrome bZIPs through genome-wide screening. *Cells Tissues Organs*. doi:10.1159/000527593 Published online: October 19, 2022 Impact Factor-2.208.

146. Mandal, M., Karak, A., Halder, S., Banerjee, S., Maiti, A., Jana, K., . . . Kar, A. (2021). A ratiometric styryl bridging triphenylamine-indolinium based fluorescent dye for detection of cyanide with a large emission shift in human breast cancer cells and test strips. *Supramolecular Chemistry, 33*(10), 605-615. doi:10.1080/10610278.2022.2135439 Published online: 19 Oct 2022 Impact Factor-2.23.

147. Mondal, N., Roy, C., Chatterjee, S., Sarkar, J., Dutta, S., Bhattacharya, S., . . . Ghosh, W. Thermal Endurance by a Hot-Spring-Dwelling Phylogenetic Relative of the Mesophilic Paracoccus. *Microbiology Spectrum*. doi:10.1128/spectrum.01606-22 Published: 26 October 20 Impact Factor-9.043.

148. Mukherji, S., Imchen, M., Mondal, S., Bhattacharyya, A., Siddhardha, B., Kumavath, R., & Ghosh, A. (2022). Anthropogenic impact accelerates antibiotic resistome diversity in the mangrove sediment of Indian Sundarban. *Chemosphere, 309*. doi:10.1016/j.chemosphere.2022.136806 Available online 8 October 2022 Impact Factor-8.943.

149. Ray, D., & Raha, S. Atmospheric dynamics impact on urban-ozone variability over the Indo-Gangetic Plain under very low anthropogenic emission. *International Journal of Environmental Science and Technology*. doi:10.1007/s13762-022-04580-3 Published: 15 October 2022 Impact Factor-3.519.

150. Roychoudhury, S., Das, D., Das, S., Jha, N. K., Pal, M., Kolesarova, A., . . . Slama, P. (2022). Clinical Potential of Himalayan Herb Bergenia ligulata: An Evidence-Based Study. *Molecules, 27*(20). doi:10.3390/molecules27207039 Published: 18 October 2022 Impact Factor-4.927.

151. Sen, A., Chatterjee, S., Das, S., & Biswas, S. (2023). Characterization of a new RPC prototype using conventional gas mixture. *Nuclear Instruments and Methods in Physics Research, Section A: Accelerators, Spectrometers, Detectors and Associated Equipment, 1045*. doi:10.1016/j.nima.2022.167572 Available online 14 October 2022 Impact factor 1.335.

152. Sircar, G., Ghosh, N., & Saha, S. (2022). Designing Next-Generation Vaccines Against Common Pan-Allergens Using In Silico Approaches. *Monoclonal Antibodies in Immunodiagnosis and Immunotherapy, 41*(5), 231-242. doi:10.1089/mab.2021.0033 Published Online:28 Oct 2022 Impact Factor-0.268.

153. Yadav, K. K., Ojha, M., Pariary, R., Arakha, M., Bhunia, A., & Jha, S. (2022). Zinc oxide nanoparticle interface moderation with tyrosine and tryptophan reverses the pro-amyloidogenic property of the particle. *Biochimie, 193*, 64-77. doi:10.1016/j.biochi.2021.10.011 Epub 2021 Oct 23 Impact Factor-4.079.

154. Aneva, I. Y., Habtemariam, S., Banach, M., Sil, P. C., Sarkar, K., Sahebnasagh, A., . . . Kashani, H. R. K. (2022). Can We Use mTOR Inhibitors for COVID-19 Therapy? *Combinatorial Chemistry and High Throughput Screening, 25*(11), 1805-1808. doi:10.2174/1386207325666211130140923 Impact Factor-1.714.

155. Banerjee, N., Chatterjee, O., Roychowdhury, T., Basu, D., Dutta, A., Chowdhury, M., . . . Chatterjee, S. (2023). Sequence driven interaction of amino acids in de-novo designed peptides determines c-Myc G-quadruplex unfolding inducing apoptosis in cancer cells. *Biochimica et Biophysica Acta - General Subjects, 1867*(2). doi:10.1016/j.bbagen.2022.130267 Available online 2 November 2022 Impact factor-4.117.

156. Barman, A., Shaw, R., Bhawsinghka, N., & Das Gupta, S. K. (2022). A CRISPRi-based investigation reveals that multiple promoter elements drive gene expression from the genome of mycobacteriophage D29. *Microbiology (United Kingdom), 168*(11). doi:10.1099/mic.0.001276 Published: 30 November 2022 Impact Factor-2.8.

157. Bhunia, S., Halder, S., Naskar, K., Dutta, B., Sahoo, D., Jana, K., & Sinha, C. (2022). Spectrophotometric Determination of Trace Amount of Total FeII/FeIIIand Live Cell Imaging of a Carboxylato Zn(II) Coordination Polymer. *Inorganic Chemistry*. https://doi.org/10.1021/acs.inorgchem.2c02915 Published: November 29, 2022 Impact Factor-5.436.

158. Chandra, A., Halder, S., Bhunia, S., Pal, S., Jana, K., & Sinha, C. (2023). Zn(II)-dicarboxylato-terpyridyl coordination polymer - A 'Turn on' fluorogenic platform for Al3+ sensing in aqueous medium and life cell imaging. *Journal of Molecular Structure, 1275*. doi:10.1016/j.molstruc.2022.134559 Available online 16 November 2022 Impact factor-3.841.

159. Chatterjee, S., Sen, A., Das, S., & Biswas, S. (2023). Effect of relative humidity on the long-term operation of a single mask triple GEM chamber. *Nuclear Instruments and Methods in Physics Research, Section A: Accelerators, Spectrometers, Detectors and Associated Equipment, 1046*. doi:10.1016/j.nima.2022.167747 Available online 11 November 2022 Impact factor-1.335.

160. Das, A. K., Das, D., Mal, S., Home, D., & Majumdar, A. S. (2022). Resource-theoretic efficacy of the single copy of a two-qubit entangled state in a sequential network. *Quantum Information Processing, 21*(12). doi:10.1007/s11128-022-03728-x Published: 16 November 2022 Impact Factor-1.965.

161. Debsharma, K., Dey, S., Das, D., Halder, S., Ortega-Castro, J., Sarkar, S., . . . Sinha, C. (2022). Designing of a Zn(ii)-isonicotinohydrazido thiophenyl based 2D coordination polymer: structure, augmented photoconductivity and superior biological activity. CrystEngComm. doi:10.1039/d2ce01128j First published:14 Nov 2022 Impact Factor-3.756.

162. Gaur, D., Kumar, N., Ghosh, A., Singh, P., Kumar, P., Guleria, J., . . . Sharma, D. (2022). Ydj1 interaction at nucleotide-binding-domain of yeast Ssa1 impacts Hsp90 collaboration and client maturation. *PLoS Genetics, 18*(11). doi:10.1371/journal.pgen.1010442 Published: November 9, 2022 Impact Factor-5.109.

163. Jana, S. K., Shit, P., & Misra, A. K. (2022). Straightforward Synthesis of the Pentasaccharide Repeating Unit of the O -Antigenic Polysaccharide from the Enteropathogenic *Escherichia coli* O142. *Synthesis (Germany)*. doi:10.1055/s-0041-1738428 Impact Factor 2021: 3.019 Pub: 17 November 2022.

164. Joshi, C. R., Acharya, M., Sheikh, M. S., Plombon, J., & Gupta, A. (2022). Effect of cobalt substitution on the structural, ferroelectric, and magnetic properties of bismuth ferrite thin films. *Journal of Applied Physics, 132*(19). doi:10.1063/5.0116794 Published Online: 16 November 2022 Impact Factor-2.877

165. Ray Chaudhuri, N., & Ghosh Dastidar, S. (2022). Allosteric Boost by TAB1 on the TAK1 Kinase Favorably Sculpts the Thermodynamic Landscape of Activation. *Journal of Chemical Information and Modeling*. doi:10.1021/acs.jcim.2c00778 Published: 2022 Nov 14 Published: 2022 Nov 14 Impact factor 6.162.

166. Shit, P., Sahaji, S., & Misra, A. K. (2022). Convergent synthesis of the hexasaccharide repeating unit of the capsular polysaccharide of Klebsiella serotype K-34. *TETRAHEDRON*. doi:10.1016/j.tet.2022.133159 Available online 19 November 2022 Impact Factor-2.388.

167. Tripathi, H. S., Karmakar, R., Bhowmik, T. K., Halder, S., Dutta, A., & Sinha, T. P. (2022). RCoO3 {R=Pr, Nd and Sm} electrode-based for efficient solid-state symmetric supercapacitor. *Solid State Sciences, 134*. doi:10.1016/j.solidstatesciences.2022.107065 Available online 19 November 2022 Impact Factor-3.752.

168. Acharya, S., Adamová, D., Adler, A., Adolfsson, J., Aglieri Rinella, G., Agnello, M., . . . Zurlo, N. (2023). Measurement of anti-3He nuclei absorption in matter and impact on their propagation in the Galaxy. *Nature Physics, 19*(1), 61-71. doi:10.1038/s41567-022-01804-8 Published: 12 December 2022 Impact Factor- 5- year Impact Factor (2021) - 22.019.

169. Acharya, S., Adamová, D., Adler, A., Adolfsson, J., Aglieri Rinella, G., Agnello, M., . . . The, A. c. (2022). Measurement of beauty production via non-prompt D0 mesons in Pb-Pb collisions at √sNN = 5.02 TeV. *Journal of High Energy Physics, 2022*(12). doi:10.1007/JHEP12(2022)126 Published: 21 December 2022 Impact Factor-6.376.

170. Acharya, U., Das, T., Ghosh, Z., & Ghosh, A. (2022). Defense Surveillance System at the Interface: Response of Rice towards Rhizoctonia solani during Sheath Blight Infection. *Molecular Plant-Microbe Interactions, 35*(12), 1081-1095. doi:10.1094/MPMI-07-22-0153-R Published Online:12 Dec 2022 Impact Factor-3.422.

171. Bhat, M. A. (2023). Single pion and single photon simulation of photon multiplicity detector in ALICE. *Pramana - Journal of Physics, 97*(1). doi:10.1007/s12043-022-02484-y Published: 14 December 2022 Impact factor-2.669.

172. Biswas, P., Swaroop, S., Dutta, N., Arya, A., Ghosh, S., Dhabal, S., . . . Bhattacharjee, A. (2023). IL-13 and the hydroperoxy fatty acid 13(S)HpODE play crucial role in inducing an apoptotic pathway in cancer cells involving MAO-A/ROS/p53/p21 signaling axis. *Free Radical Biology and Medicine, 195*, 309-328. doi:10.1016/j.freeradbiomed.2022.12.103 Epub 2022 Dec 30 Impact factor-8.101.

173. Das, S. K., Palni, P., Sannigrahi, J., Alam, J. E., Aung, C. W., Bailung, Y., . . . Win, T. Z. (2022). Dynamics of hot QCD matter - Current status and developments. *International Journal of Modern Physics E, 31*(12). doi:10.1142/S0218301322500975 Published : December 2022 Impact Factor: 0.924.

174. Ghosh, A., & Saha, S. (2022). Meta-analysis of sputum microbiome studies identifies airway disease-specific taxonomic and functional signatures. *Journal of Medical Microbiology, 72*(12). doi:10.1099/jmm.0.001617 Published: Dec, 2022 Impact Factor: 3.2.

175. Ghosh, N., Kundu, M., Ghosh, S., Das, A. K., De, S., Das, J., & Sil, P. C. (2023). pH-responsive and targeted delivery of chrysin via folic acid-functionalized mesoporous silica nanocarrier for breast cancer therapy. *International Journal of Pharmaceutics, 631*. doi:10.1016/j.ijpharm.2022.122555 Epub 2022 Dec 28. Impact factor-6.51.

176. Halder, S., Kumar, R. A., Maity, R., & Sinha, T. P. (2023). A tailored direct-to-indirect band structure transition in double perovskite oxides influences its photocatalysis efficiency. *Ceramics International, 49*(5), 8634-8645. doi:10.1016/j.ceramint.2022.12.096 Available online 14 December 2022, Impact factor-5.532.

177. Hall, D., Basu, G., & Ito, N. (2022). Computational biophysics and structural biology of proteins—a Special Issue in honor of Prof. Haruki Nakamura's 70th birthday. *Biophysical Reviews, 14*(6), 1211-1222. doi:10.1007/s12551-022-01039-0 December 2022 Impact Factor-3.33.

178. Hossain, M., Pal, S., Masanta, S., Dasgupta, K., Maity, T., Sarkar, K., . . . Pal, P. (2023). Large area planar UV–Visible photodetectors using wide bandgap WO3–δ films. *Optical Materials, 135*. doi:10.1016/j.optmat.2022.113322 Available online 12 December 2022 Impact factor-3.754 .

179. Kumar Das, A., Ghosh, N., Mandal, A., & Sil, P. C. (2023). Glycobiology of cellular expiry: Decrypting the role of glycan-lectin regulatory complex and therapeutic strategies focusing on cancer. *Biochemical Pharmacology, 207*. doi:10.1016/j.bcp.2022.115367 Available online 5 December 2022 Impact factor-6.1.

180. Mehta, S. K., Ananthavel, A., Reddy, T. V. R., Ali, S., Mehta, S. B., Kakkanattu, S. P., . . . Betsy, K. B. (2023). Indirect Response of the Temperature, Humidity, and Rainfall on the Spread of COVID-19 over the Indian Monsoon Region. *Pure and Applied Geophysics, 180*(1), 383-404. doi:10.1007/s00024-022-03205-7 Published: 26 December 2022 Impact factor- 2.641.

181. Mukherjee, S., Bhakta, K., Ghosh, A., & Ghosh, A. (2023). Ger1 is a secreted aspartic acid protease essential for spore germination in Ustilago maydis. *Yeast, 40*(2), 102-116. doi:10.1002/yea.3835 First published: 23 December 2022 Impact factor- 3.325.

182. Nandi, S., Saha, D., Home, D., & Majumdar, A. S. (2022). Wigner-approach-enabled detection of multipartite nonlocality using all different bipartitions. Physical Review A, 106(6). doi:10.1103/PhysRevA.106.062203 Published 2 December 2022 Impact Factor-2.971.

183. Nelson, V. K., Paul, S., Roychoudhury, S., Oyeyemi, I. T., Mandal, S. C., Kumar, N., . . . Pal, M. (2022) Heat Shock Factors in Protein Quality Control and Spermatogenesis. In*: Vol. 1391. Advances in Experimental Medicine and Biology* (pp. 181-199): Springer. First Online: 07 December 2022 Impact Factor-3.65

184. Rana, A., Manna, T., & Kumar Misra, A. (2023). Synthesis of selenium linked disaccharides using glycosyl selenocyanates as selenium precursors. *Tetrahedron Letters, 116*. doi:10.1016/j.tetlet.2022.154300 Available online 7 December 2022 Impact factor- 2.032 .

185. Samanta, S. K., Maiti, K., Halder, S., Guria, U. N., Mandal, D., Jana, K., & Mahapatra, A. K. (2022). A 'double locked' ratiometric fluorescent probe for detection of cysteine in a viscous system and its application in cancer cells. *Organic and Biomolecular Chemistry, 21*(3), 575-584. doi:10.1039/d2ob01813f First published 06 Dec 2022 Impact factor: 3.89.

186. *The ALICE Collaboration*. Acharya, S., Adamová, D., Adler, A., Adolfsson, J., Aglieri Rinella, G., Agnello, M., . . . The, A. C. (2022). Measurement of anti-3He nuclei absorption in matter and impact on their propagation in the Galaxy. Nat. Phys. (2022). https://doi.org/10.1038/s41567-022-01804-8 Impact Factor-19.684.

187. Acharya, S., Adamová, D., Adler, A., Adolfsson, J., Aglieri Rinella, G., Agnello, M., . . . Zurlo, N. (2023). Inclusive quarkonium production in pp collisions at √s = 5.02 TeV. *European Physical Journal C, 83*(1). doi:10.1140/epjc/s10052-022-10896-8 Published: 23 January 2023 Impact Factor- 4.994 (2021).

188. Bhowmik, T. K., Halder, S., & Sinha, T. P. (2023). Tailoring the magnetic landscape in Al-doped LaMnO3: an experimental and computational perspective. *Physica Scripta, 98*(2). doi:10.1088/1402-4896/acae41 Published 5 January 2023 Impact factor-3.081.

189. Das Laha, S., Das, D., Ghosh, T., & Podder, S. (2023). Enrichment of intrinsically disordered residues in ohnologs facilitates abiotic stress resilience in Brassica rapa. *Journal of Plant Research, 136*(2), 239-251. doi:10.1007/s10265-022-01432-6 Published: 06 January 2023 Impact factor-3.157 .

190. Dhar, R., Chakraborty, M., & Dutta, T. K. (2023). A comprehensive assessment of the antimicrobial and immunomodulatory effects of frequently consumed fermented foods: insights in the management of COVID-19. *Journal of Applied Microbiology, 134*(1). doi:10.1093/jambio/lxac034 Impact Factor-4.059 Volume 134, Issue 1, January 2023.

191. Kumar, R. A., Dutta, A., & Sinha, T. P. (2023). Structural and dielectric properties of microwave dielectric materials xBa(Zn1/3Ta2/3)O3 - (1-x)La(Zn1/2Ti1/2)O3. *Journal of Electroceramics, 50*(1), 1-10. doi:10.1007/s10832-022-00300-y Published: 04 January 2023 Impact factor- 2.182.

192. Rando, C., Grasso, G., Sarkar, D., Sciacca, M. F. M., Cucci, L. M., Cosentino, A., . . . La Rosa, C. (2023). GxxxG Motif Stabilize Ion-Channel like Pores through Cα−H···O Interaction in Aβ (1-40). *International Journal of Molecular Sciences, 24*(3). doi:10.3390/ijms24032192 Published: 22 January 2023 5-Year Impact Factor: 6.208 (2021).

193. Roy, A., Basu, D., Bose, D., Dutta, A., Dastidar, S. G., & Chatterjee, S. (2023). Identification and characterization of a flexile G-quadruplex in the distal promoter region of stemness gene REX1. *International Journal of Biological Macromolecules, 231*. doi:10.1016/j.ijbiomac.2023.123263 Available online 14 January 2023 Impact factor 8.025.

194. Saha, S., Chanda, S., Dutta, A., & Sinha, T. P. (2023). Insulator-To-metal transition in RCoO3(R = Pr, Nd). *Journal of Advanced Dielectrics*. doi:10.1142/S2010135X23500030 Published: 12 January 2023 SCImago Journal Rank (SJR): 0.378.

195. Saikh, S. R., & Das, S. K. (2023). Fog-Induced Alteration in Airborne Microbial Community: a Study over Central Indo-Gangetic Plain in India. *Applied and Environmental Microbiology, 89*(1). doi:10.1128/aem.01367-22 9 January 2023 Impact factor 5.005.

196. Shit, P., Kundu, M., & Kumar Misra, A. (2023). Straightforward stereoselective synthesis of 1-thio-β-D-mannosides and 1-thio-β-L-rhamnosides. *Tetrahedron Letters*. doi:10.1016/j.tetlet.2023.154391 Available online 27 January 2023 Impact factor 2.032.

197. Sinha, K., Ghosh, J., & Sil, P. C. (2022). Machine Learning in Drug Metabolism Study. *Current Drug Metabolism, 23*(13), 1012-1026. doi:10.2174/1389200224666221227094144 Published on: 06 January, 2023 Impact Factor-5 - Year: 3.685.

198. Acharya, S., Adamová, D., Adler, A., Adolfsson, J., Aglieri Rinella, G., Agnello, M., . . . Collaboration, A. (2023). Constraining hadronization mechanisms with Λc+/D0 production ratios in Pb–Pb collisions at sNN=5.02 TeV. *Physics Letters, Section B: Nuclear, Elementary Particle and High-Energy Physics, 839*. doi:10.1016/j.physletb.2023.137796 Impact factor - 4.95 (2021) Available online 28 February 2023 Impact Factor-4.95.

199. Aziz Momin, M. S., & Biswas, A. (2023). The role of gene regulation in redundant and synergistic information transfers in coherent feed-forward loop. *Journal of Statistical Mechanics: Theory and Experiment, 2023*(2). doi:10.1088/1742-5468/acb42e Published 16 February 2023 Impact Factor- 2.234.

200. Banerjee, S., Banerjee, S., Sarkar, K., & Sil, P. C. (2023). Thevetia peruviana (Yellow Oleander). In *Exploring Poisonous Plants: Medicinal Values, Toxicity Responses, and Therapeutic Uses* (pp. 307-338): CRC Press. Book Chaper First Published 2023.

201. Chatterjee, S., Sen, A., Das, S., & Biswas, S. (2023). Charging-up effect and uniformity study of a single mask triple GEM detector. *Nuclear Instruments and Methods in Physics Research, Section A: Accelerators, Spectrometers, Detectors and Associated Equipment, 1049*. doi:10.1016/j.nima.2023.168110 Available online 7 February 2023, Impact factor-1.335.

202. Das, M., Halder, A., Chatterjee, R., Gangopadhyay, A., Dey, T. K., Roy, S., . . . Chakrabarti, J. (2023). In Vitro Structure–Activity Relationship Study of a Novel Octapeptide Angiotensin-I Converting Enzyme (ACE) Inhibitor from the Freshwater Mussel Lamellidens marginalis. *International Journal of Peptide Research and Therapeutics, 29*(2). doi:10.1007/s10989-023-10495-5 Published: 04 February 2023 Impact factor-2.191.

203. De, S., Paul, S., Manna, A., Majumder, C., Pal, K., Casarcia, N., . . . Bishayee, A. (2023). Phenolic Phytochemicals for Prevention and Treatment of Colorectal Cancer: A Critical Evaluation of In Vivo Studies. *Cancers, 15*(3). doi:10.3390/cancers15030993 Published: 3 February 2023 5-Year Impact Factor: 6.886 (2021).

204. Ghosal, P., Ghosal, A., Das, D., & Maity, A. G. (2023). Quantum superposition of causal structures as a universal resource for local implementation of nonlocal quantum operations. *Physical Review A, 107*(2). doi:10.1103/PhysRevA.107.022613 Published 15 February 2023 Impact Factor 2.971.

205. Kundu, S. K., Biswas, S., Chattopadhyay, S., Das, S., Dubey, A. K., Ghosh, C., . . . Prasad, S. K. (2023). Development of a water-based cooling system for the Muon Chamber detector system of the CBM experiment. *Nuclear Instruments and Methods in Physics Research, Section A: Accelerators, Spectrometers, Detectors and Associated Equipment, 1050*. doi:10.1016/j.nima.2023.168143 Available online 16 February 2023 Impact Factor-1.335.

206. Pandey, B., Sinha, K., Dev, A., Ganguly, H. K., Polley, S., Chakrabarty, S., & Basu, G. (2023). Phosphorylation-Competent Metastable State of Escherichia coli Toxin HipA. *Biochemistry, 62*(5), 989-999. doi:10.1021/acs.biochem.2c00614 Impact Factor- *3.321* Publication Date:February 20, 2023.

207. Shit, P., Kundu, M., & Misra, A. K. (2023). Expeditious preparation of 1,6-anhydro-1-thio-β-D-hexopyranose derivatives. *Carbohydrate Research, 525*. doi:10.1016/j.carres.2023.108765 Available online 14 February 2023, Impact factor 2.975.

208. Shriti, S., & Das, S. (2023). Chickpea R2R3 Transcription Factor CaMYB78 Enhances Abiotic Stress Tolerance in Tobacco. *Journal of Plant Growth Regulation*. doi:10.1007/s00344-023-10916-1 Published: 10 February 2023 Impact factor 4.640.

209. Won, T., Mohid, S. A., Choi, J., Kim, M., Krishnamoorthy, J., Biswas, I., . . . Lee, D. (2023). The role of hydrophobic patches of de novo designed MSI-78 and VG16KRKP antimicrobial eptides on fragmenting model bilayer membranes. *Biophysical Chemistry, 296*, 106981. doi:https://doi.org/10.1016/j.bpc.2023.106981 Available online 24 February 2023 Impact Factor-3.628.

210. Abdus Salam, S., Crinò, C., & Shukla, P. (2023). On K3-fibred LARGE Volume Scenario with de Sitter vacua from anti-D3-branes. *Journal of High Energy Physics, 2023*(3). doi:10.1007/JHEP03(2023)132 Published: March 17, 2023 Impact factor -6.376 (2021).

211. Ahmed, A., Sakander, N., & Mukherjee, D. (2023). Lewis Acid Catalysed Regioselective Access of Novel C-2 Homo-Pyranose Nucleosides From 2-Acetoxy Methyl Glycals. ChemistrySelect, 8(10), e202300578. doi:https://doi.org/10.1002/slct.202300578 First published: 07 March 2023 Journal Impact Factor (Clarivate):2.307.

212. Ahmed, A., Sakander, N., & Mukherjee, D. (2023). Lewis Acid Catalysed Regioselective Access of Novel C-2 Homo-Pyranose Nucleosides From 2-Acetoxy Methyl Glycals. ChemistrySelect, 8(10). doi:10.1002/slct.202300578 First published: 07 March 2023 Journal Impact Factor (Clarivate): 2.307 .

213. Banerjee, C., Nag, S., Goyal, M., Saha, D., Siddiqui, A. A., Mazumder, S., . . . Bandyopadhyay, U. (2023). Nuclease activity of Plasmodium falciparum Alba family protein PfAlba3. *Cell Reports, 42*(4). doi:10.1016/j.celrep.2023.112292 published:2023 Mar 21 Journal Impact Factor-9.995.

214. Dutta, M., Ghosh, A., Sharma, S. K., Mandal, T. K., & Chatterjee, A. (2023). CCN activation of ultrafine biogenic-WSOC under restricted anthropogenic emissions: A study over eastern Himalaya in India. *Atmospheric Research, 287*, 106704. doi:https://doi.org/10.1016/j.atmosres.2023.106704 Available online 9 March 2023 Impact Factor-5.965.

215. Ghosh, S., Paul, S., Halder, S., Shit, M., Karmakar, A., Nandi, J. B., . . . Sinha, C. (2023). Trace level CN^- measurement by 'turn-on' emission using Coumarinyl-Benzothiazolyl Schiff base probe in living and non-living environment. *JOURNAL OF THE INDIAN CHEMICAL SOCIETY, 100*(4), 100957. doi:https://doi.org/10.1016/j.jics.2023.100957 Available online 5 March 2023 Impact Factor 0.243.

216. Masanta, S., Nayak, C., Agarwal, P., Das, K., & Singha, A. (2022). Monolayer Graphene-MoSSe van der Waals Heterostructure for Highly Responsive Gate-Tunable Near-Infrared-Sensitive Broadband Fast Photodetector. *ACS Applied Materials and Interfaces*. doi:10.1021/acsami.2c20707 Publication Date:March 7, 2023 Impact Factor-10.383.

217. Masanta, S., Nayak, C., Maitra, S., Rudra, S., Chowdhury, D., Raha, S., . . . Singha, A. (2022). Engineering Multifunctionality in MoSe2 Nanostructures Via Strategic Mn Doping for Electrochemical Energy Storage and Photosensing. *ACS Applied Nano Materials*. doi:10.1021/acsanm.2c05592 Publication Date:March 31, 2023 Impact Factor-6.140.

218. Pati, S., Mukherjee, S., Dutta, S., Guin, A., Roy, D., Bose, S., . . . Sa, G. (2023). Tumor-Associated CD19+CD39- B Regulatory Cells Deregulate Class-Switch Recombination to Suppress Antibody Responses. *Cancer immunology research, 11*(3), 364-380. doi:10.1158/2326-6066.CIR-21-1073 Published-March, 2023 Impact Factor 12.020.

219. Rana, A., & Misra, A. K. (2023). Synthesis of the acidic pentasaccharide repeating unit of the cell wall O-antigen of Providencia alcalifaciens O45:H25 strain. *TETRAHEDRON, 137*. doi:10.1016/j.tet.2023.133379 Available online 24 March 2023 Journal Impact Factor-2.388

220. Roy, S., Maiti, B., Banerjee, N., Kaulage, M. H., Muniyappa, K., Chatterjee, S., & Bhattacharya, S. (2022). New Xanthone Derivatives as Potent G-Quadruplex Binders for Developing Anti-Cancer Therapeutics. *ACS Pharmacology and Translational Science*. doi:10.1021/acsptsci.2c00205 Publication Date:March 24, 2023 CiteScore 2021: 5.1.

221. Saha, R., Haldar, S., Pradhan, S. S., Jana, K., & Sarkar, K. (2023). Superior gene transfection efficiency in triple negative breast cancer by RAFT-mediated amino acid-based cationic diblock copolymers. *Journal of Materials Chemistry B*. doi:10.1039/d2tb02681c First published : 22 Mar 2023 Journal Impact Factor- 7.571.

222. Sarkar, A., Das, T., Das, G., & Ghosh, Z. (2023). MicroRNA mediated gene regulatory circuits leads to machine learning based preliminary detection of acute myeloid leukemia. *Computational Biology and Chemistry, 104*. doi:10.1016/j.compbiolchem.2023.107859 First published :2023 Mar 31 Journal Impact Factor- 3.737.

223. SenGupta, K., Karmakar, B., Roy, S. *et al.* Analyzing airborne fungal concentration in Kolkata, India: temporal distribution, the effect of atmospheric parameters and health impact. *Air Qual Atmos Health* (2023). https://doi.org/10.1007/s11869-023-01316-1 Published18 March 2023 Impact Factor- 5.804.

224. Shukla, P. On stable type IIA de-Sitter vacua with geometric flux. *Eur. Phys. J. C* 83, 196 (2023). https://doi.org/10.1140/epjc/s10052-023-11361-w Published 06 March 2023 Impact Factor- 4.994.

225. Singh, G. K., Qadri, A. M., Paul, D., Gupta, T., Mukherjee, S., & Chatterjee, A. (2023). Investigation of sources and atmospheric transformation of carbonaceous aerosols from Shyamnagar, eastern Indo-Gangetic Plains: Insights from δ13C and carbon fractions. *Chemosphere, 326*, 138422. doi:https://doi.org/10.1016/j.chemosphere.2023.138422 Available online 14 March 2023 Impact Factor-8.943.

226. Inclusive photon production at forward rapidities in pp and p-Pb collisions at 5.02 TeV; S. Acharya et al. (ALICE Collaboration); Accepted for publication in The European Physical Journal C; arXiv:2303.00590 [nucl-ex].

227. Measurements of the groomed and ungroomed jet angularities in pp collisions at √s = 5.02 TeV; S. Acharya et al. (ALICE Collaboration); *Journal of High Energy Physics 05 (2022) 061*

228. Development of a water based cooling system for the Muon Chamber detector system of the CBM experiment; Authors: S. K. Kundu, S. Biswas, S. Chattopadhyay, S. Das, A. K. Dubey, C. Ghosh, A. Kumar, A. Roy, J. Saini, S. Seth, and S. K. Prasad; *Nucl. Instrum. Meth. A 1050 (2023) 168143; arXiv: 2204.09752 [physics.ins-det].*

229. Evaluation of epigenetic landscape in tumorigenesis: noncoding RNAs as new target. Laboni Roy$, Oishika Chatterjee$, Debopriya Bose, Ananya Roy, Subhrangsu Chatterjee*. *Drug Discovery Today* 2023. I.F.- 7.4.

230. New Xanthone Derivatives as Potent G-Quadruplex Binders for Developing Anti- Cancer Therapeutics. Soma Roy, Bappa Maiti, Nilanjan Banerjee, Mangesh H. Kaulage, Kalappa Muniyappa, Subhrangsu Chatterjee, and Santanu Bhattacharya*.*ACS Pharmacol. Transl. Sci.* 2023. I.F.- 6.0.

231. The cofactors and domains of a staphylococcal capsule-producing enzyme preserve its structure, stability, shape, and dimerization ability.Tushar Chakraborty 1, Nilanjan Banerjee 2, Debasmita Sinha1, Soham Seal 1, Subhrangsu Chatterjee 2, Subrata Sau 1. *J Biochem.* 2023 Feb 7. I.F.=2.7

232. Identification and characterization of a flexible G-quadruplex in the distal promoter region of Stemness gene REX1. Ananya Roy 1, Debadrita Basu 2, Debopriya Bose 1, Anindya Dutta 1, Shubhra Ghosh Dastidar 2, Subhrangsu Chatterjee* 3. *Int J Biol Macromol*. 2023 Mar 15; 231:123263. doi: 10.1016/j.ijbiomac.2023.123263. Epub 2023 Jan 14. I.F.=8.2

233. Nikki Choudhary, Priyanka Srivastava , Monami Dutta , Sauryadeep Mukherjee, Akansha Rai , Sakshi Gupta, Jagdish Chandra Kuniyal , Renu Lata , Abhijit Chatterjee , Manish Naja , Tuhin Kumar Mandal and Sudhir Kumar Sharma. Wintertime Variation in Carbonaceous Components of PM10 in the High Altitudes of Himalayas. ***Enviromental. Science (IF: 3.3).,*** 19, https://doi.org/10.3390/ecas2022-12802, 2022.

234. Lata S, Mahatha AC, Mal S, Gupta UD, Kundu M, Basu J (2022) Unraveling novel roles of the *Mycobacterium tuberculosis* transcription factor Rv0081 in regulation of the nucleoid-associated proteins Lsr2 and EspR, cholesterol utilization, and subversion of lysosomal trafficking in macrophages. *Molecular Microbiology* 117: 1104-1120. IF: 3.98.

Books:

235. Pandey, V. C., Gajić, G., Sharma, P., & Roy, M. (2022). *Adaptive Phytoremediation Practices: Resilience to Climate Change*.

236. Nucleic Acid Biology and its Application in Human Diseases, Springer Nature (Singapore), 2023. Editor & Writer, ISBN: 978-981-19-8520-1.

Book Chapters:

237. Banerjee, S., Banerjee, S., Sarkar, K., & Sil, P. C. (2023). Thevetia peruviana (Yellow Oleander). In *Exploring Poisonous Plants: Medicinal Values, Toxicity Responses, and Therapeutic Uses* (pp. 307-338).

238. Bhattacharjee, S., Saha, B., & Saha, S. (2022). Classification of lung diseases using machine learning techniques. In *Artificial Intelligence Technologies for Computational Biology* (pp. 75-93).

239. Biswas, K., & Bhunia, A. (2022) Probing the Functional Interaction Interface of Lipopolysaccharide and Antimicrobial Peptides: A Solution-State NMR Perspective. In*: Vol. 2548. Methods in Molecular Biology* (pp. 211-231).

240. Chowdhury, S., Kabir, A. B. M. R., Debnath, A. J., Hossain, S. A., & Sinha, D. (2022). An overview of extremophiles as microbial armament for bioremediation. In *Extremophiles: A Paradox of Nature with Biotechnological Implications* (pp. 245-268): De Gruyter

241. Das, A. K., Ghosh, S., & Sil, P. C. (2022). Vitamin K. In *Antioxidants Effects in Health: The Bright and the Dark Side* (pp. 561-582).

242. Fernandes, S., Mandal, S., Sivan, K., Peketi, A., & Mazumdar, A. (2022). Biogeochemistry of marine oxygen minimum zones with special emphasis on the northern indian ocean. In *Systems Biogeochemistry of Major Marine Biomes* (pp. 3-24): Wiley Blackwell. DOI:10.1002/9781119554356.ch1 PUB:1 April 2022

243. Ghosh, J., & Sil, P. C. (2023). Mechanism for arsenic-induced toxic effects. In *Handbook of Arsenic Toxicology* (pp. 223-252): Elsevier.

244. Ghosh, N., Chatterjee, S., & Sil, P. C. (2022). Evolution of antioxidants over times (including current global market and trend). In *Antioxidants Effects in Health: The Bright and the Dark Side* (pp. 3-32).

245. Goyal, V., Kohli, I., Ambastha, V., Das, P., Singh, P. K., Varma, A., . . . Joshi, N. C. (2022). Synthetic biology tools: Engineering microbes for biotechnological applications. In *New and Future Developments in Microbial Biotechnology and Bioengineering: Sustainable Agriculture: Advances in Microbe-based Biostimulants* (pp. 369-398).

246. Haldar, S., Mondal, S., Kumari, A., Ghosh, A., Chattopadhyay, D., & Ghosh, A. (2022). Rhizosphere microbiome engineering. In *Current Developments in Biotechnology and Bioengineering: Designer Microbial Cell Factories: Metabolic Engineering and Applications* (pp. 377-396).

247. Karmakar, A., Das, A. K., Ghosh, N., & Sil, P. C. (2022). Superoxide dismutase. In *Antioxidants Effects in Health: The Bright and the Dark Side* (pp. 139-166).

248. Mahalanobish, S., Ghosh, N., & Sil, P. C. (2022). NLRP3 inflammasome-assisted pathogenesis in chronic obstructive pulmonary disorder. In *Advances in Health and Disease. Volume 57* (pp. 37-65).

249. Mandal, A., Hossain, U., & Sil, P. C. (2022). Antioxidants and cardiovascular diseases. In *Antioxidants Effects in Health: The Bright and the Dark Side* (pp. 613-640).\

250. Mandal, S., Mondal, N., Bhattacharya, S., Ghosh, W., & Bhadra, B. (2022). Biogeochemistry of marine petroleum systems. In *Systems Biogeochemistry of Major Marine Biomes* (pp. 133-150): Wiley Blackwell. First published: 01 April 2022.

251. Mazumdar, A., & Ghosh, W. (2022). Preface. *Systems Biogeochemistry of Major Marine Biomes*, ix. doi:10.1002/9781119554356.fmatter First published: 01 April 2022

252. Mazumdar, A., & Ghosh, W. (2022). *Systems biogeochemistry of major marine biomes*: Wiley Blackwell.

253. Mondal, N., Mandal, S., & Ghosh, W. (2022). Geomicrobiology at a physicochemical limit for life: Deep-sea hypersaline anoxic basins. In *Systems Biogeochemistry of Major Marine Biomes* (pp. 241-261): Wiley Blackwell.

254. Nelson, V. K., Paul, S., Roychoudhury, S., Oyeyemi, I. T., Mandal, S. C., Kumar, N., . . . Pal, M. (2022) Heat Shock Factors in Protein Quality Control and Spermatogenesis. In: Vol. 1391. Advances in Experimental Medicine and Biology (pp. 181-199). First Online: 07 December 2022

255. Sarkar, J., Mondal, N., Mandal, S., Chatterjee, S., & Ghosh, W. (2022). Deep subsurface microbiomes of the marine realm. In *Systems Biogeochemistry of Major Marine Biomes* (pp. 111-131): Wiley Blackwell.

256. Sarkar, K., & Sil, P. C. (2022). Antioxidants and immune functions. In *Antioxidants Effects in Health: The Bright and the Dark Side* (pp. 719-740).

257. Sarkar, M. B., & Sarkar, A. (2022). Biological control activity of biosurfactant for the management of root disease in crop plants. In Applications of Biosurfactant in Agriculture (pp. 303-320).

258. Sarkar, M. B., & Sarkar, A. (2022). Biological control activity of biosurfactant for the management of root disease in crop plants. In *Applications of Biosurfactant in Agriculture* (pp. 303-320): Elsevier. Available online 22 July 2022

259. Sarkar, S., & Sil, P. C. (2023). Curcumin and its role in cancer prevention. In *Curcumin and Its Role in Health and Disease* (pp. 1-46): Nova Science Publishers, Inc.

260. ALICE paper draft entitled "Measurement of the angle between jet axes in pp collisions at$\sqrt{s}$ = 5.02 TeV" is reviewed by our Institute members (Sanjay K. Ghosh, Supriya Das, Sidharth K. Prasad, Saikat Biswas, Abhi Modak, Prottoy Das, Debjani Banerjee)

261. ALICE paper draft entitled "Measurement of the angle between jet axes in Pb–Pb collisions at $\sqrt{s_{NN}}$ = 5.02 TeV" is reviewed by our Institute members (Sanjay K. Ghosh, Supriya Das, Sidharth K. Prasad, Saikat Biswas, Abhi Modak,Prottoy Das, Debjani Banerjee)

262. Nucleic Acid-Based Strategies to Treat Neurodegenerative Diseases, Suman Panda,Oishika Chatterjee, Subhrangsu Chatterjee. Pages 105-133.

263. Human Diseases Induced by Oxidative Damage in DNA, Suman Panda, Oishika Chatterjee, Gopeswar Mukherjee, Subhrangsu Chatterjee. Pages 135-166.

264. Nucleic Acid in Nanotechnology, Debopriya Bose, Laboni Roy, Ananya Roy, Subhrangsu Chatterjee. Pages 167-211.

265. Nucleic Acid in Diagnostics, Anindya Dutta, Nilanjan Banerjee, Madhurima Chaudhuri, Subhrangsu Chatterjee. Pages 213-269.

266. Nucleic Acid Sensors and Logic Gates, Debopriya Bose, Ananya Roy, Laboni Roy, Subhrangsu Chatterjee. Pages 271-319.

267. Nucleic Acid Therapeutics in Cancer Biology, Pallabi Sengupta, Nilanjan Banerjee, Anindya Dutta, Madhurima Chaudhuri, Subhrangsu Chatterjee. Pages 321-348.

Conference Proceedings:

268. Biswas, R., Choudhury, S., Prasad, S. K., & Das, S. (2022). *Deciphering Quark and Gluon Jet Modifications in Heavy-Ion Collisions with γ -Tagged Jets*.

269. Chatterjee, S. (2022). *Feasibility Studies of J/ ψ Measurement with CBM Detector Setup at FAIR SIS100 Energies*.DOI:10.1007/978-981-19-2354-8_89

270. Bhat, M.A. (2022). Inclusive Photon Production at Forward Rapidities Using PMD in p–Pb Collisions at *s*NN−−−√=8.16 TeV with ALICE. In: Mohanty, B., Swain, S.K., Singh, R., Kashyap, V.K.S. (eds) Proceedings of the XXIV DAE-BRNS High Energy Physics Symposium, Jatni, India. Springer Proceedings in Physics, vol 277. Springer, Singapore. https://doi.org/10.1007/978-981-19-2354-8_73 First Online: 06 October 2022

271. Mili, R., Das, N. R., Tandon, A., Mokhtar, S., Mukherjee, I., & Paul, G. (2022). *Pose Recognition in Cricket using Keypoints*. Conference Paper. 2 December 2022 through 4 December 2022.

272. Modak, A., & The, A. C. (2022). *System-size dependence of particle production at mid- and forward rapidity with ALICE*. Conference paper. 6 July 2022through 13 July 2022

273. Singha, P., Ray, R., Aminul Islam, C., & Mustafa, M. G. (2022). A Beyond Mean Field Approach to Yang-Mills Thermodynamics. First Online: 06 October 2022

274. Banerjee, D., & collaboration, A. (2022). *Measurement of intra-jet properties and their multiplicity dependence in small collision systems with ALICE*. July 2022

275. Acharya, S., Adamová, D., Adler, A., Aglieri Rinella, G., Agnello, M., Agrawal, N., . . . Collaboration, A. (2022). *Antihelium-3 fluxes near Earth using data-driven estimates for annihilation cross section*.

276. Multiplicity dependence of charged-particle jet production in pp collisions at 13 TeV with ALICE; arXiv: 2210.04511 [hep-ex]; Contribution to ISMD 2022; Debjani Banerjee for the ALICE Collaboration

277. Modification of intra-jet properties in high multiplicity pp colli- sions at 13 TeV with ALICE; Proceedings for the conference Hot QCD Matter 2022; arXiv: 2208.13440 [nucl-th]; Debjani Baner jee for the ALICE Collaboration.

278. Measurement of charged-particle jet properties in p–Pb collisions at 5.02 TeV with ALICE; arXiv: 2208.01389 [nucl-ex]; Contri- bution to Hot QCD Matter 2022, arXiv: 2208.13440 [nucl-th]; Prottoy Das for the ALICE Collaboration

279. Multiplicity dependence of intra-jet properties in small collision systems with ALICE; PoS LHCP2022 (2023) 303; Contribution to: LHCP2022; Prottoy Das for the ALICE collaboration

Internal Notes:

280. Charged-particle jet properties and their multiplicity dependence in pp collisions at 13 TeV with ALICE; ALICE Analysis Note, ID Number: ANA-1303, 2022; Debjani Banerjee, Prottoy Das and Sidharth Kr. Prasad.

281. Charged jet properties in p–Pb collisions at 5.02 TeV; ALICE Analysis Note, ID Number: ANA-1310, 2022; Prottoy Das, Debjani Banerjee and Sidharth Kr. Prasad

282. Measurement of inclusive photon multiplicity at forward rapidities in pp, pPb and Pbp collisions at √sNN = 5.02 TeV with AL- ICE; ALICE Analysis Note, ID: ANA-1214, 2022; Abhi Modak, Sudipan De and S. K. Prasad

SL NO	FUNDING AUTHORITY	DATE OF COMMENC-EMENT	DATE OF TERMINATION	PRINCIPAL INVESTIGATOR	TITLE OF THE PROJECTS	GRANT SANCTIONED
1	DBT	09-Jan-17	08-Jul-22	DIRECTOR, BOSE INSTITUTE	Multi-dimensional Reserch to Enable Systems Medicine: Acceleration using a Cluster Approach' at Kalyani, West Bengal	14,05,32,000
2	DBT	16-Jul-18	15-Jul-22	Prof. Pallob Kundu	Developing an optimized toolkit for induicible genome editing and regulation of gene expression in tomato plant: implicaitons in adjusting complex traits via synthetic biology approach	78,06,800
3	DBT	24-Sep-18	23-Sep-22	Prof. Gaurisankar Sa	Development of delivery system for miR-325-3p for immunotherapy of cancer	79,29,800
4	DBT-NOW	02-Sep-15	18-Aug-22	Prof. A. N. Lahiri Majumder	Unraveling the role of PLC in plant drought and heat stress tolerance: Exploring the potential of PI metabolism to improve crop yield	1,26,87,600
5	IFCC	01-Aug-16	31-Jul-22	Prof. Sanjay K. Ghosh	CBM MUCH	28,80,40,000

6	MoEFCC	30-Mar-16	29-Mar-24	Dr. Abhijit Chatterjee	National Carbonaceous Aerosols Programme (NCAP) WGIII: Carbonaceous Aerosols Emmissions, Source appointment and Climate effects	1,06,08,000
7	SERB	15-Sep-18	14-Sep-22	Prof. Achintya Singha	Fabrication of Infreared Photo-detector based on 2D systems and Tuning the Detection Windows by coupling with Nanostructures	50,33,714
8	SERB(DST)	03-May-07	02-May-22	Prof. Pinakpani Chakrabarti	Award of J.C. Bose Fellowship to Prof. Pinakpani Chakrabarti	40,00,000
9	SERB(DST)	01-Apr-17	17-Dec-25	Prof. Joyoti Basu	Award of J.C. Bose Fellowship to Prof. Joyoti Basu	54,00,000
10	CSIR	01-Aug-19	31-Mar-23	Prof. Gaurisankar Sa	Developmental and functional aspects of newly identified CD8+ T-regulatory cells in tumor microenvironment	21,00,000
11	DBT	20-Dec-18	16-Dec-22	Prof. Gaurisankar Sa	Investigation of the Transcriptional Regulation of miR-325 and Evaluating its Potential as a Therapeutic Agent for Cancer	80,00,000
12	CCRH	01-Aug-19	31-Mar-24	Prof. Gaurisankar Sa	Role of Silica in Cancer regression : A mechanistic study	11,59,830
13	SERB	05-Dec-18	04-Jun-22	Prof. Anirban Bhunia	Intracellular Dyamics of Small Molecules During Novel AMP-mediated Resilience in Planta: A Multidisciplinary Approach	30,70,000

14	SERB	06-Jul-19	05-Jan-23	Prof. Pallob Kundu	Convergent miRNA actions in coordination of stress-response to Alternaria solani infection in tomato lines	52,30,828
15	SERB	07-May-19	06-May-22	Prof. Srimonti Sarkar	Characterization of the cellular roles of the proteasome and its deubiquitinase GIRpn11 of the differently-diverged eukaryote Giardia lamblia	42,33,000
16	CSIR	01-Sep-19	31-Aug-22	Dr. Sanat Kr. Das	Physico-chemical factors influencing Aerosol Hygroscopicity during fog, its effect on Aerosol Radiative Properties and fog nowcasting: a study in the context of Regional Climate Change over Eastern India	30,52,000
17	CSIR	26-Aug-19	31-Aug-22	Dr. Anupama Ghosh	Deciphering the involvement of programmed cell death in the pathogenic development of *Ustilago maydis*	19,60,000
18	Indo-Swiss	24-Jun-19	23-Jun-23	Prof. Siddhartha Roy	Next generation advanced therapies for fight β-hemoglobinopathies via rational intervention in ϒ-globin regulatory network	1,16,21,600
19	DBT	09-Oct-19	08-Oct-22	Prof. Anirban Bhunia	Tailor Made Peptidomimetics Designing Against Human Islet Amyloid Polypeptide (hIAPP) Aggregation: A Therapeutic Approach Associated With Type-2 Diabetes	66,74,500

20	CSIR	26-Aug-19	31-Aug-22	Dr. Abhrajyoti Ghosh	Decipherig the cross-talk between rhizosphere microbiome and the plant: insights from tea rhizosphere microbiome, metabolome and culture dependent analyses	20,00,000
21	ICMR	28-Aug-19	27-Aug-22	Prof. Kaushik Biswas	Understand the epigenetic regulation of GM2-synthase gene in cancer	25,30,000
22	SERB	29-Jan-20	28-Jan-23	Prof. Anup Kumar Misra	Synthesis of the polysaccharide fragments of opportunistic human pathogens Providencia strains and their glycoconjugate derivatives	26,02,800
23	CSIR	12-Jan-21	11-Jan-24	Dr. Abhrajyoti Ghosh	Diversity and Distribution of Antibiotic Resistance Genes in the Sundarban mangrove estuary : coordination of anthropogenic and evolutionary influences	23,50,000
24	SERB	18-Dec-20	17-Dec-25	Dr. Smarajit Polley Prof. Atin K. 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	28,60,33,520
25	DBT-WB	17-Mar-21	16-Mar-24	Prof. Atin Kumar Mandal	Characterizing the interaction between Phosphodiesterase 8 (PDE8A) and 14-3-3 with CRAF: Gaining insights into CRAF regulation	21,40,000

26	DST	30-Mar-21	29-Mar-24	Prof. Pallob Kundu	Improvement and broad-scale implementation of different biotechnology-oriented programmes for the socio-economic upliftment of Scheduled Tribe community of West Bengal	14,01,59,760
27	DBT	27-Sep-19	26-Sep-22	Prof. Subhrangsu Chatterjee	Unraveling the mechanism of action of LINC00273 (Long intergenic Non Coding RNA) in inducing Epithelial to Masenchymal Transition in Cancer	69,28,000
28	DST & DAE		31-Mar-26	DIRECTOR, BOSE INSTITUTE	India's participation in the construction of the Facility for Antiporton and Ion Research (FAIR) at Darmstadt, Germany	6,15,00,00,000
29	SERB	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	52,72,400
30	SERB	24-Jan-22	23-Jan-25	Dr. Anupama Ghosh	Investigating the role of HSP20 in the pathogenic development of Ustilago maydis	29,61,495
31	DBT	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	1,87,54,131

32	DST & DAE	03-Nov-21	31-Oct-26	Prof. Supriya Das	Indian Participation in the ALICE Experiment at CERN	5,73,50,000
33	SERB	25-Mar-22	24-Mar-25	Dr. Sanat Kr. Das	Revealing bioaerosol movements within the area spanning eastern Himalayas and coastal Bay of Bengal	38,14,360
34	SERB	30-Nov-21	29-Nov-24	Prof. Debaraj Mukherjee	A Novel Approach to the Construction of N-alkylated Hydroxylaminolnterglycosidic Linkages from glycal epoxides: Application in the synthesis of esperamicin-calicheamicin cores	34,77,859
35	ICMR	01-Apr-23	31-Mar-26	Dr. Sudipto Saha	Epidemiological Survey on Tribal Comunities of Dinajpur District in North Bengal to Develop a Knowledgebase on Disease Predisposition for Estimating Disease Etiology	30,000
36	SERB	28-Jun-23	27-Jun-26	Prof. Shubho Chaudhuri	Molecular charecterization of facor(s) regulating transcription of MYB21 and MYB24 genes in Jasmonic acid signalling pathway during pollen development	43,99,747

PARTICIPATION IN CONFERENCES / SYMPOSIA / WORKSHOPS / INVITED TALKS DELIVERED

Biochemistry

Prof. Subrata Sau

- Presented a poster entitled 'Studies on the folding-unfolding mechanism of a capsule-producing enzyme from *Staphylococcus aureus*' was presented in the meeting of Society of Biological Chemists (I), Kolkata chapter at Sister Nivedita University, Kolkata during April 9-10, 2022.
- Presented a poster entitled 'Genetic studies on an anti-sigma factor from *Staphylococcus aureus*' was presented in the meeting of Society of Biological Chemists (I), Kolkata chapter at Sister Nivedita University, Kolkata during April 9-10, 2022.
- Presented orally on the topic entitled 'Studies on a Staphylococcal enzyme involved in the synthesis of a capsular polysaccharide sugar' at Bose Institute, Kolkata during November 28-29, 2022.
- Delivered talked on the topic entitled 'Genetic studies on an anti-sigma factor from *Staphylococcus aureus*' at Bose Institute, Kolkata during November 28-29, 2022.
- Presented a poster entitled 'Mechanistic investigation of the folding-unfolding pathway of a capsule synthesizing enzyme from *Staphylococcus aureus*' was presented in the meeting of Society of Biological Chemists (India) at the Biswa Bangla Convention Centre, Kolkata during December 8-11, 2022.
- Presented a poster entitled 'Genetic studies on an anti-sigma factor from *Staphylococcus aureus*' was presented in the meeting of Society of Biological Chemists (India) at the Biswa Bangla Convention Centre, Kolkata during December 8-11, 2022.

Prof. Srimonti Sarkar

- Delivered invited talk at The XVI National Conference of Indian Academy of Tropical Parasitology (Tropacon 2022) on the September 24, 2022.

Dr. Abhrajyoti Ghosh

- Participated as organizerthe 16th Asian Conference on Diarrhoeal Disease and Nutrition (ASCODD-2022) between November 11-13, 2022 at the Westin Kolkata Rajarhat jointly with ICMR-National Institute of Cholera and Enteric Diseases (NICED), Kolkata, India.
- Participated as organizer the 4th Annual Conference of the Biological Engineering Society (BESCON-2022) between November 4-6, 2022 at the Unified Campus of Bose Institute, Kolkata jointly with Indian Institute of Technology (IIT), Kharagpur, India.
- Delivered an invited lecture entitled "Anthropogenic impact accelerates engineering of the microbiome and antibiotic resistome of Sundarban mangrove" in the National Seminar on New Horizons in Biotechnology held between March 16-17, 2023 at the Department of Biotechnology, Haldia Institute of Technology, Haldia, India.
- Delivered an invited lecture entitled "Pollution induced engineering of microbiome and antibiotic resistome of Sundarban" in the 4th Annual Conference of the Biological Engineering Society (BESCON-2022) held between November 4-6, 2022 at the Unified Campus of Bose Institute, Kolkata jointly with Indian Institute of Technology (IIT), Kharagpur, India.

- Delivered an invited lecture entitled “Spatial dynamics and ecological dissemination mechanism of antibiotic resistome in the mangrove sediment of Sundarban, India” in the IGSTC-sponsored Indo-German bilateral workshop on “Agricultural Management Practice Effects on Soil- And Plant-associated bacterial communities and their resistome” at Leibniz Institute of Agricultural Engineering and Bio-economy e.V. (ATB), Potsdam, Germany, during June 20 – 22, 2022.
- Recipient of IGSTC (Indo German Science and Technology Centre) grant to attend Indo-German bilateral workshop on “Agricultural Management Practice Effects on Soil- And Plant-associated bacterial communities and their resistome” at Leibniz Institute of Agricultural Engineering and Bio-economy e.V. (ATB), Potsdam, Germany, during June 20 – 22, 2022.

Dr. Subhash Haldar

- Delivered an invited lecture at the International Conference on “Research and Technological Advancement in Heath Science and Sustainable Development” in Vidyasagar University on March 03, 2023.
- Delivered an invited lecture at the National Conference entitled “Technological Interventions in Life Sciences, Food, Agriculture & Allied Health Sciences – A Paradigm Shift towards a Better Future” in Swami Vivekananda University on May 23, 2022.

Bioinformatics

Prof. Shubhra Ghosh Dastidar

- Keynote at the workshop organized by JIS institute of Advanced studies and research, Kolkata, May 24, 2021.
- Popular Science talk to the school students in the Science Day event at Bose Institute, Falta Campus, February 28, 2022.
- Talk in the web-conference organized by ACTREC, Mumbai, March 10 – 11, 2022
- Plenary talk at the 15th National Seminar cum Workshop on ‘Genomics and Bioinformatics in the High-throughput era’ organized by Bioinformatics Facility, University of North Bengal, March 26-27, 2022.

Dr. Zhumur Ghosh

- Delivered a talk on Opportunities and Challenges of Predictive Approaches involving Regulatory Noncoding RNomics - shaping modern day therapeutics, at SERB sponsored karyashala organized by Department of Biotechnology, NIT Durgapur from December 12-18, 2022.

Dr. Sudipto Saha

- Delivered invited talk at the workshop on "Mass Spectrometry and its application" held by the Department of Biophysics, Molecular Biology, and Bioinformatics, University of Calcutta entitled "Application of Mass-spectrometry-based proteomics in the diagnosis and treatment of adult atopic asthma ", on December 23, 2023.
- Delivered invited talk at the workshop under the "Accelerate Vigyan' scheme of SERB (Ministry of Science and Technology, Govt of India) on "Machine learning based approach for the identification of biomarkers and for drug discovery" held by the Department of Biotechnology, National Institute of Technology Durgapur entitled "Machine learning based classification of lung diseases using different types of biomarkers", on December 18, 2022.
- Delivered invited talk at the webinar "Microbial Technology: Present and Future" held by the Deptt. of Microbiology of Vidyasagar University on "The role of Lung Microbiome in Airway Diseases", on August 13, 2022.

Biophysics

Prof. Anirban Bhunia

- NMRS webinar, organized by Nuclear Magnetic Resonance Society of India.
- Distinguished Speaker at a Seminar on 'Drug Development', organized by Guru Nanak Institute of Pharmaceutical Science and Technology (GNIPST), Kolkata.

Prof. Subhrangsu Chatterjee

- Presented poster on Schrodinger Drug Discovery at K K Birla, BITS Pilani, Goa Campus, India, during November 10-11, 2022. Achieved Best Poster Award.

Dr. Debjani Roy

- Speaker in a seminar organized by B. C. Roy College of Pharmacy and Allied health sciences held on September 20, 2022. Participated in a scientific discussion with students and faculty members of the college.

Dr. Smarajit Polley

- CEMBIOS Symposium, A Symposium on Cryo-Electron Microscopy in Biological Systems School of Biological Sciences, NISER; February 13 – 14, 2023, NISER, Bhubaneswar.

Chemistry

Prof. Jayanta Mukhopadhyay

- Mechanism of functions of delta factor from *B. subtilis*, SBC December, 2022., April 2021 Admas University (online presentation).
- Mechanism of inhibition of transcription, at Faculty Develop Programme, Mahatma Gandhi Medical Advanced Research Institute (MGMARI), SBV University, December 2022.

Prof. Debaraj Mukherjee

- Delivered invited talk on Recent Advances in chemical sciences (RACS-2022) at Department of Chemistry and Chemical Sciences, Central University of Jammu, November 10-11, 2022.
- Delivered invited talk on International Carbohydrate Conference (CARBO-XXXVI), Emerging Trends in Glycochemistry, Glycobiology & Technology at Department of Chemistry, Indian Institute of Technology-Bombay, December 5-7, 2022.
- Delivered CRSI Broze medal award lecture at JNU Delhi on February, 2023.

Environmental Sciences

Dr. Abhijit Chatterjee

- Delivered a popular lecture on "Kolkata's air quality: Current status" in a national meeting organized by Climate Trends on April 17, 2023.
- Delivered a popular lecture in a workshop on "National Clean Air Program" held at West Bengal Pollution Control Board, Kolkata on March 29, 2023 (Honorable Ministers-In-Charge of various departments, Principal Secretary to the Ministry of Environment, Forest and Climate Change, Honorable Mayor of Kolkata graced the occasion).
- Delivered a keynote address in a one-day meeting on NCAP activities over eastern India, held in Kolkata (Peerless Inn) on January 5, 2023 organized by ASAR and SwitchOn Foundation, India in presence of honourable Mayor, Kolkata.
- Delivered a popular lecture in "Air Pollution trends in India: Emerging concerns of Health and Environment" at University of Calcutta, Department of Environmental Science on December 1, 2022.

- Delivered a popular lecture in a National Conference on "Emerging Trends and Application of Green Technologies for Sustainable Development " (Green Tech-2022) " during 9-10 November, 2022 at the School of Chemical Engineering, Biotechnology & Food Technology, Haldia Institute of Technology, Haldia, West Bengal, India.

Dr. Sanat Kumar Das

- Expert member of Smart India Hackathon (SIH) Grand Finale 2022 at Nodal Center, Vardhman College of Engineering, Hyderabad, Telegana during August 25-26, 2022 .
- Organizing One-day program of School Students' Visit at Bose Institute on September 6, 2022.
- Invited talk at Zoology Survey of India, Andaman and Nicobar Regional Centre, Port Blair via online mode at the occasion of celebration of 'International Day for Prevention of Ozone Layer' on September 16, 2022.
- Attending Meeting of DST FIST subject expert meeting – Earth and Atmospheric Sciences at Indian National Science Academy (INSA), New Delhi on September 19, 2022.
- Attending Meeting of DST FIST subject expert meeting – Earth and Atmospheric Sciences at Kashmir University, Jummu and Kashmir on October 20, 2022.
- Session Judge at 5th Regional Science and Technology Congress, 2022-2023 for the decipline of 'Earth Sciences and Geoinformatics' and deliver a lecture in the Regional Science Congress 2022-2023 at Raja N. L. Khan Women's College, Midnapore, West Bengal during January 13-14, 2023.
- Participated workshop on 'Column Observations of Atmospheric Compositions' at IISER-Kolkata on January 20, 2023.

Microbiology

Dr. Zhumur Ghosh

- Delivered a talk on Opportunities and Challenges of Predictive Approaches involving Regulatory Noncoding RNomics - shaping modern day therapeutics, at SERB sponsored karyashala organized by Department of Biotechnology, NIT Durgapur from 12-18 December, 2022.

Dr. Wriddhiman Ghosh

- Invited Lecture in a One-day Colloquium on 20th August 2022 at the School of Health Sciences and Technology, University of Petroleum and Energy Studies, Dehradun, India: "Life in the physicochemical extremes: constraints, opportunities, and adaptations".
- Invited Lecture on 5th November 2022 at the 4th Annual Conference of the Biological Engineering Society, BESCON-2022, organized jointly by IIT Kharagpur and Bose Institute: "Habitat helps the ecologically disadvantaged: how natural bioengineering saves hot spring mesophiles".

Molecular Medicine

Prof. Atin Kumar Mandal

- Faculty development Program on July 18 – 22, 2022, Amity University, Kolkata.
- Advancement in Microbiology in the context of Louis Pasteur; December 27, 2022, Depertment of Microbiology, Bankura Sammilani College.

Prof. Kaushik Biswas

- Participated in a Live On-Air Popular Bengali Television Program named "Bignyan Prosonge" in Doordarshan Bangla on "Cancer Research and the Applications of Contemporary Molecular Biology tools in Cancer Research" on March 29, 2023 at 4:30 pm (https://www.youtube.com/watch?v=k1cbqKV7Tog).
- Presented an invited talk titled "Understanding the Epigenetic Regulation of the GM2-synthase gene in Cancer" in the Symposium on Human Disease and Therapeutics : A Lifelong Quest organized by JIS Institute of Advanced Studies and Research on February 24, 2023.

- Presented an invited talk titled "Acetylation-mediated loss of Sp1-HDAC1 cause de-repression of the GM2-synthase gene in Cancer" as part of the DST-SERB sponsored Karyashala organized by the Dept. of Biotechnology, National Institute of Technology (NIT), Durgapur on December 15, 2022.
- Presented an invited talk titled "Epigenetic Regulation of GM2-synthase gene in Cancer" in the 91st SBC-I Annual Meeting held in Kolkata on December 8-11, 2022.

Dr. Nirmalya Sen

- Participated and delivered talk on PGC1 alpha acts as a coactivator of ERG fusion; driving antioxidant program under metabolic stress in prostate cancer(PCa). CENTRAL CALCUTTA SCIENCE & CULTURE ORGANISATION FOR YOUTH, on December 4, 2022.
- Deliverd invited lecture on Writing and Communications: Practices, Ethics and Tricks.DST-SERB Sponsored Workshop on 'Designing Competitive Grant Proposal', University of Burdwan, on February 11, 2023.
- Invited Poster and visited on ETS1 is the key to acquired resistance and metastasis in Triple negative breast cancer", 15th Young Investigator Meeting, by India Biosciences (DBT) at IIT Gandhinagar and Ahmedabad University, February 13-15, 2023..

Physics

Prof. Somshubhro Bandyopadhyay

- Local state discrimination and quantum nonlocality – invited talk at the workshop on Quantum Metrology and Quantum Information held at CDAC-Kolkata on August 25-26, 2022.
- Quantum science at Bose Institute – invited talk at the DST Brainstorming session on Quantum science and Technologies at RRI, Bangalore, on November 11, 2022.

Prof. Dhruba Gupta

- Delivered an invited plenary talk on "*The ^{7}Be + d reaction in the context of the cosmological lithium problem*" at the ISOLDE Workshop and Users Meeting, CERN, Geneva, Switzerland, November 30-December 2, 2022 (online).

Students attended the 66th DAE symposium on nuclear physics at Cotton University, Guwahati, Assam during December 1 - 5, 2022.

- **Sk M. Ali** gave a talk on "Measurement of the ^{7}Be(d,^{3}He)^{6}Li and the Cosmological Lithium Problem".
- **S. Maity** gave a talk on "Breakup of deuteron from ^{7}Be + d reaction at 5 MeV/u".
- **K. Kundalia** presented a poster titled "The ^{7}Be + ^{12}C reaction to study the ^{15}O nucleus".

Students attended the Students' Symposium on 'Recent Trends in Natural Sciences' at Bose Institute during November 28 - 29, 2022.

- **Sk M. Ali** gave an oral presentation on "Study of nuclear reactions related to the Cosmological Lithium Problem" and got the best oral presentation prize.
- **K. Kundalia** gave an oral presentation on "Study of alpha-cluster transfer reactions with ^{7}Be".
- **R. Mitra** presented a poster titled "Breakup of the radioactive nucleus ^{7}Be on ^{12}C".
- **S. Maity** presented a poster titled "Breakup of deuteron from ^{7}Be + d reaction at 5 MeV/u"

- **Sk M. Ali** gives a talk titled "Measurement of (d,p) and (d,^{3}He) reactions with ^{7}Be in the context of Li abundance anomaly" at the "Astrophysics with Radioactive Isotopes (AwRI)" conference in Budapest, Hungary during June 12-17, 2022. He received full financial support from the Joint Institute for Nuclear Astrophysics - Center for the Evolution of the Elements (JINA-CEE).

Prof. Achintya Singha

- Delivered 26thinvited lecture in Siksha 'O' Anusandhan, Weekly Academic Lectures (SOAWAL - 2022) organized by Department of Chemistry, in Siksha 'O' Anusandhan, Deemed to be University, Bhubaneswar, Odisha, India on February 26, 2022.
- Invited talk in UGC approved refresher course RCPHYS22-23 on Contemporary Issues in Physics being organized jointly by the Department of Physics and UGC-HRDC, Jadavpur University, Kolkata, India.
- Invited lecture in the celebration of the National Science Day 2023, organised by Indian Chemical Society on February 27, 2023 at the N R Sen Auditorium, University of Calcutta, 92, Acharya Prafulla Chandra Road, Kolkata 700 009.

Prof. Soumen Roy

- Visited and delivered invited tal on Istituto Superiore di Sanita (National Institute of Health), Rome, Italy, on November 11, 2022.
- Visited and delivered invited tal on International Centre for Theoretical Physics, Trieste, Italy on October 26, 2022.

Dr. Saikat Biswas

- Attended Bose Institute-FAIR Steering committee meeting on June 21, 2022 and presented the status of the Indian in-kind item.
- Delivered an invited Special Lecture, titled "Advanced gaseous detectors for heavy-ion experiments and ALICE 3" on November 9, 2022, in the Vth ALICE-STAR-India school on Quark Gluon Plasma, organized by IOP, Bhubaneswar
- Attended FAIR-IKMG meeting (online) on November 16, 2022 and presented the status of Indian in-kind items.
- Delivered a talk, titled "Performance studies of GEM detector for future Heavy-Ion experiments" in the XXV DAE-BRNS HEP Symposium at IISER Mohali, Punjab on December 14, 2022.
- Delivered a talk, titled "RPC activities for the India-based Neutrino Observatory and Present RPC activities at Bose Institute" on December 15, 2022, in the First MuonID Mexico Meeting.
- Delivered a talk on "FAIR: Universe in the laboratory" at Serampore College on March 22, 2023.
- Attended Bose Institute-FAIR Steering committee meeting on February 28, 2023 and presented the status of Indian in-kind item.
- Represented Bose Institute in Mega Science Expo, IISF 2022 at MANIT, Bhopal during January 21-24, 2023.

Dr. Sidharth Kumar Prasad

- Delivered a talk titled "Status report and general discussion on PMD" in the ALICE-STAR-India Collaboration meeting organized during April 25 – 28, 2022.
- Delivered a talk titled "PMD status and update: Physics analysis" in the ALICE-STAR-India Collaboration meeting organized during September 5 – 7, 2022.

- Delivered an invited talk on "Jet measurements at LHC" in the DAE-BRNS symposium on Contemporary and Emerging Topics in High Energy and Nuclear Physics (CETHENP 2022) organized by VECC, Kolkata during November 15–17, 2022.
- Delivered an invited plenary talk on "Jets in relativistic heavy-ion collisions" in ICPAQGP conference on February 09, 2023.
- ALICE-STAR-IndiaCollaborationMeeting(Online), September 05–08, 2022 (Organizing committee member).
- Vth ALICE-India School on Quark-Gluon Plasma, November 01 – 12, 2022 (Organizing committee member).
- Organized following webinars on behalf of ALICE-STAR-India Collaboration:
    - Thermodynamics of strong interaction matter from Lattice QCD calculations; Speaker: Prof. Frithoj Karsch, Professor, Physics Bielefeld University, Germany; Date: 22/04/2022
    - Jet interactions in the QGP: what have we learned, and where are we going ?; Speaker: Prof. Peter Jacobs, Senior Sta Scientist, Lawrence Berkeley National Laboratory, USA; Date: 20/07/2022.
    - Imagingnuclearstructurewithheavyioncollisions;Speaker:Prof. Jiangyong Jia, Professor, Stony Brook University, USA; Date: 27/09/2022.
    - Phenomenological approach for the interplay between QGP fluids, and jets or Non-equilibrium components from large to small systems; Speaker: Prof. Yasuki Tachibana Akita International University, Japan; Date: 01/11/2022.
- Served as Analysis Review Committee (ARC) member in the ALICE experiment for the analysis Dijet invariant mass in pp and pPb collisions at 5.02 TeV with ALICE, PCs: Oskari Antti Matti Saarimaki.
- Served as Analysis Review Committee (ARC) member in the ALICE experiment for the analysis Jet Constituent Yields in 5.02 TeV Pb–Pb Collisions using ALICE, PCs: Charles Hughes.
- Served as the convener of the PWG-JE session in the ALICE-STAR-India collaboration meeting on April 27, 2022.
- Chaired the session "PWG-JE" in the ALICE-STAR-India col- laboration meeting organized during September 05-08, 2022 at VECC Kolkata.
- Served as one of the conveners for the Heavy Ions and QCD working group of the DAE-HEP symposium 2022 being organized by IISER, Mohali during December 12-16, 2022
- Served as a convener of one of the sessions of the DAE-BRNS symposium on "Contemporary and Emerging Topics in High En- ergy and Nuclear Physics (CETHENP 2022)" organized by VECC, Kolkata during November 15–17, 2022.

Sayak Chatterjee

- Presented a poster on "New method of linseed oil coating for Bakelite RPCs for Heavy-ion experiments" at the 29th International Conference on Ultra-relativistic Nucleus-Nucleus Collisions (QM 2022) on 8.4.2022.
- Presented a poster on "Prospects of dilepton and charmonium measurements with CBM experiment" at Quark Matter 2022 (Online) 06.04.2022.
- Presented a talk titled "Beam energy scan via di-muon channel at SIS100" at the PWG-DIL session of 39th CBM Collaboration meeting, 19.05.2022.

- Presented two posters on "Effect of relative humidity on the long-term operation of a single mask triple GEM chamber" and "Visual investigation of possible degradation in GEM foils under test" at the 15th Pisa meeting on Advanced detectors-Edition 2022, May 22-28, 2022.
- Presented at the PWG DIL session of the 40th CBM Collaboration meeting on 11.10.2022 titled "J/ψ yields in low energy nuclear collisions at FAIR: a baseline estimation"
- Presented at the CETHENP 2022 conference on 15.11.2022 titled "Dimuon measurement at CBM experiment"
- Delivered a talk titled "Peeping into the realm of elementary particles" at the Department of Physics of St. Paul's Cathedral Mission College on 12.11.2022.
- Delivered a talk on "Performance Studies of Gas Electron Multiplier Detector for the Muon Chamber of High Rate CBM Experiment at FAIR" on November 29, 2022, in the Recent Trends in Natural Sciences 2022, Bose Institute Students' Symposium (November 28-29, 2022).
- Presented at CBM theme meeting at NISER on "Feasibility study of dimuon detection using Muon Chamber for CBM experiment at FAIR", during February 3-4, 2023.
- Attended 15th Pisa meeting on Advanced Detectors-Edition 2022, May 22-28, 2022, in Pisa, Italy.

Arindam Sen

- Presented a talk on "Particle identification by Energy Loss using STS" at the 39th CBM Collaboration Meeting, 16-20 May 2022 on 19.05.2022.
- Presented a poster on "Characterisation of a new RPC prototype using conventional gas" at the 15th Pisa meeting on Advanced detectors-Edition 2022, May 22-28, 2022.
- Delivered a talk on "Development of Resistive Plate Chamber for the CBM experiment at FAIR" on November 28, 2022, in the Recent Trends in Natural Sciences 2022, Bose Institute Students' Symposium (November 28-29, 2022).
- Presented a poster titled "Bakelite RPC prototype with new method of linseed oil coating" in the XXV DAE-BRNS HEP Symposium at IISER Mohali, Punjab on December 15, 2022.
- Presented a poster titled "Investigation on the detector current variation for a single mask triple GEM prototype" in the XXV DAE-BRNS HEP Symposium at IISER Mohali, Punjab on December 16, 2022.
- Presented a poster titled "A new method of linseed oil coating in bakelite RPC" in the International Conference on Physics and Astrophysics of Quark Gluon Plasma (ICPAQGP-2023), 7-10 February 2023 at Puri, Odisha.
- Attended 15th Pisa meeting on Advanced Detectors-Edition 2022, May 22-28, 2022, in Pisa, Italy.

Ms. Debjani Banerjee

- Presented a poster on "Charged-particle jet properties and their multiplicity dependence in pp collisions at 13 TeV with ALICE" in Quark Matter 2022, April 06, 2022.
- delivered a talk on "Modification of intra-jet properties in high multiplicity pp collisions at 13 TeV with ALICE" in Hot QCD Matter 2022 conference, May 12-14, 2022, Goa, India.
- Presented a poster on "Multiplicity dependence of Intra-jet properties in small collision systems with ALICE" on behalf of ALICE Collaboration inthe International Conference on High Energy Physics 2022 held at Bologna Italy during July 6 – 13, 2022.
- Delivered a flash talk on "Multiplicity dependence of charged- particle jet production in pp collisions at 13 TeV with ALICE" on behalf of ALICE Collaboration at the 51st International Symposium on Multiparticle Dynamics (ISMD 2022) on August 02, 2022.

- Presented a poster on "Multiplicity dependence of charged-particle jet production in pp collisions at 13 TeV with ALICE" on behalf of ALICE Collaboration at the 51st International Symposium on Multiparticle Dynamics (ISMD 2022) on August 01, 2022.
- Presented a poster on "Multiplicity dependence of intrajet properties in proton-proton collisions at = 13 TeV with ALICE" in the Symposium on Recent Trends in Natural Sciences 2022 during November 28-29, 2022, at Bose Institute, Kolkata, India
- Delivered a talk on "Multiplicity dependence of intra-jet properties in pp collisions at 13 TeV with ALICE" in the DAE-HEP BRNS Symposium on December 12, 2022, at IISER, Mohali, India.
- (On behalf of ALICE experiment) presented a poster on "Multiplicity dependence of intrajet properties in pp collisions at $\sqrt{s}$ = 13 TeV with ALICE" at ICPAQGP conference on February 08, 2023.
- (On behalf of ALICE experiment) presented a poster on "Multiplicity dependence of charged-particle jet properties in pp and p-Pb collisions with ALICE" in the 11th International Conference on Hard and Electromagnetic Probes of High- Energy Nuclear Collisions (HP 2023); March 26 - 31, 2023, Aschaffenburg.

Mr. Prottoy Das

- Presented a poster on "Centrality dependence of jet properties in p–Pb collisions at 5.02 TeV with ALICE" in Quark Matter 2022, April 06, 2022.
- Delivered a talk on "Measurement of charged- particle jet properties in p–Pb collisions at 5.02 TeV with ALICE" in Hot QCD Matter 2022 conference, May 12-14, 2022, Goa, India.
- Presented a poster on "Multiplicity dependence of intra-jet properties in small collision systems with ALICE" in 10th LHC Physics conference (LHCP 2022), May 16- 20, 2022, Taipei (Online).
- Delivered a contributory talk on "Investigating jet modification in high multiplicity proton-proton collisions at 13 TeV using PYTHIA 8 event generator" in the DAE- BRNS symposium on "Contemporary and Emerging Topics in High Energy and Nuclear Physics (CETHENP 2022)" organized by VECC, Kolkata during 15–17 November 2022.
- Presented a poster on "Measurement of leading charged-particle jet properties in p–Pb collisions at 5.02 TeV with ALICE" in the Symposium on Recent Trends in Natural Sciences 2022 during November 28-29, 2022, at Bose Institute, Kolkata, India.
- Presented a poster on "Measurement of leading charged-particle jet properties in p–Pb collisions at 5.02 TeV with ALICE" in the DAE-HEP BRNS Symposium on December 13, 2022, at IISER, Mohali, India.
- Presented a posters on "Investigating jet modification in high multiplicity proton-proton collisions at 13 TeV using PYTHIA 8 event generator" in the DAE-HEP BRNS Symposium on December 16, 2022, at IISER, Mohali, India.
- (On behalf of ALICE experiment) delivered a talk on "Measurements of leading charged-particle jet properties in p-Pb collisions at 5.02 TeV with ALICE" at ICPAQGP conference on February 07, 2023.

Mr. Abhi Modak

- Delivered a talk on "Inclusive photons multiplicity at forward rapidities in p–Pb collisions at 5.02 TeV with ALICE" in Hot QCD Matter 2022 conference, May 12-14, 2022, Goa, India.
- Delivered a talk on "System-size dependence of particle production at mid and forward rapidity with ALICE" on behalf of ALICE Collaboration inthe International Conference on High Energy Physics 2022 held at Bologna Italy during July 6 – 13, 2022.

- Presented a poster on "Inclusive photons multiplicity at forward rapidities in pp and p–Pb collisions at 5.02 TeV with ALICE" in the Symposium on Recent Trends in Nat- ural Sciences 2022 during November 28-29, 2022, at Bose Institute, Kolkata, India.
- Delivered a talk on "Inclusive photon multiplicity at forward rapidities in pp and p–Pb collisions at 5.02 TeV with ALICE" in the DAE-HEP BRNS Symposium on December 13, 2022, at IISER, Mohali, India.
- (On behalf of ALICE experiment) delivered a talk on "Measurements of inclusive photons and charged particles in hadronic and heavy-ion collisions with ALICE" at ICPAQGP conference on February 10, 2023.

Md. Asif Bhat

- Participated in XXV DAE-BRNS HEP Symposium at IISER Mohali during December 12 – 16, 2022 and presented a poster on "Estimation of Bjorken initial energy density in pp collisions".
- Participated in 66th. DAE Symposium in Nuclear Physics at IIT Indore during December 1 – 5, 2022 and presented a poster on "Single pion and single photon simulation for photon multiplicity detector in ALICE".

Rudrapriya Das

- Participated in ICFA School on 'Instrumentation in Elementary Particle Physics' at TIFR, Mumbai during February 12-25, 2023.

Plant Biology

Prof. Shubho Chaudhuri

- Particupated on 91st Annual Meeting of Society of Biological Chemist. Kolkata, 2022 on Elucidating the regulatory role of Arabidopsis thaliana ARID-HMG protein AtHMGB15 in pollen development. Sonal Sachdev, Ruby Biswas, Adrita Roy and Shubho Chaudhuri.

Prof. Gaurab Gangopadhyay

- Organized and coordinated the study tour of the Botany UG and PG students of BKC College, Kolkata, at the laboratories of the Division of Plant Biology, UAC, Bose Institute on 02.06.2022.
- Invited as a special guest in the National Conference on "Biotechnology and one health", organized by the Brainware University, Barasat, Kolkata; delivered a lecture on the topic "The transition of sesame from an orphan crop to the next generation oilseed crop" on 11.06.2022.
- Organized and coordinated the study tour of the Botany PG students of Serampore College, Kolkata, at the laboratories of the Division of Plant Biology, UAC, Bose Institute on 14.06.2022.
- Organized the signing of MOU between Bose Institute and Tea Board India at the UAC, Bose Institute on 26.08.2022.
- Acted as the resource person (internal) for the one-day programme of the school students' visit to the Bose Institute under Scientific Social Responsibility (SSR) sponsored by Science and Engineering Research Board (SERB), Govt. of India on 06.09.2022.
- Invited as a special guest on the occasion of "World Science Day", organized by the Department of Botany, R.K.M.V.C. College, Rahara, Kolkata; delivered a lecture on the topic "The journey of plant science from the need to nifty – My Perception" on 10.11.2022.
- Organized the visit of the Tissue Culture Laboratory of the UG students of two colleges (Gurudas College and City College) at the laboratories of the Division of Plant Biology, UAC, Bose Institute on 22.12.2022.
- Coordinated the visit of the IAS trainees at the UAC and MC of Bose Institute on 24.01.2023.

- Acted as the resource person (internal) for the one-day programme of the College students' visit to the Bose Institute under Scientific Social Responsibility (SSR) program sponsored by Science and Engineering Research Board (SERB), Govt. of India on 02.02.2023.
- Invited to deliver a lecture at the Department of Genetics, University of Calcutta for the M.Sc. students and research scholars on 24.02.2023; delivered a talk entitled "From Totipotency to Transgenic plants – A case study in Pineapple".
- Nominated by the Director, BI to act as the nodal officer of Bose Institute for the West Bengal State Science and Technology Congress, 28.02.2023 - 01.03.2023 at the Science City, Kolkata.
- Organized the visit of the post graduate students (Botany and Microbiology) of the Mizoram University as a Curriculum Stipulated Study Tour at the UAC, Bose Institute on 16.03.2023; delivered a lecture on the topic entitled "Crop improvement: From traditional to the state-of-art techniques".
- Organized the visit of the post graduate students (Botany) of the M.C. College (Gauhati University), Barpeta, Assam for a study tour at the UAC, Bose Institute on 21.03.2023.
- Acted as the 'Session Chair' in 'Technical Session IV-Scientific Deliberations' in the 1st Botanical Congress organized by the Botanical Society of Bengal and Department of Botany, University of Calcutta on 23.03.2023.

Dr. Anupama Ghosh

- Delivered a talk entitled 'Insights into the physiological roles of small heat shock proteins in a biotrophic plant pathogen *Ustilago maydis*' in National Seminar on New Horizons in Biotechnology (NHBT 2023) held at Haldia Institute of Technology, during March 16-17, 2023.
- Delivered a talk on 'Insights into the physiological role of an intrinsically disordered small heat shock protein Hsp12' in the Yeast India 2023, fundamentals to application of yeast and fungi held at IISER Mohali during March 10-13, 2023.
- Organized and participated in a one-day program of the visit of college students to Bose Institute as a part of the Scientific Social Responsibility (SSR) activity of the SERB funded project, CRG/2021/000332 on February 02, 2023.
- 4th – 6th November 2022: Delivered a talk on 'Small heat shock proteins play key role in framing the morphological development in *Ustilago maydis*' in the 4th Biological Society Engineering Conference BESCON 2022 held at Bose Institute, Kolkata, during November 4-6, 2022.

Senior Scientists

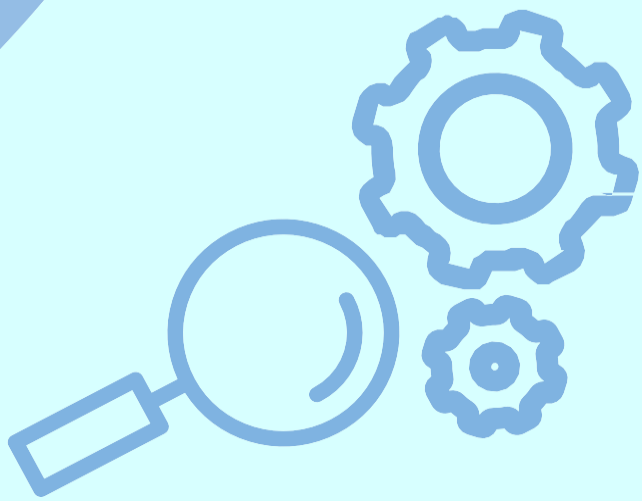
Prof. Sujoy Kumar Das Gupta

- Delivered invited lecture on-line on the topic. "Adaptive Immunity in Bacteria –Revisiting Lamarckism - a decade of CRISPR Technology" organized by the UGC sponsored human resource development center at North Bengal University on September 10, 2022.
- Delivered invited lecture on the topic "The DNA stories" at a One-Day lecture session organized by THK Jain College, Department of Microbiology commemorating the 100th birth anniversary of Prof. Har Govind Khorana on the November 25, 2022.

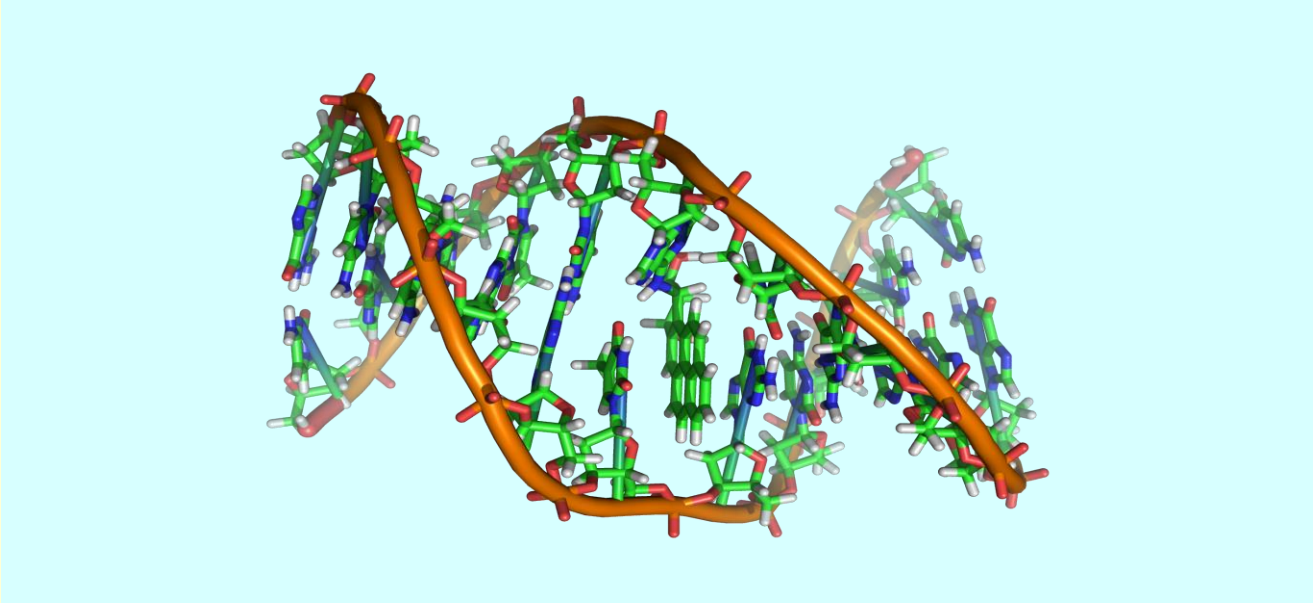
Prof. Gaurisankar Sa

- 14 + 5 Chaired.

SCIENTIFIC REPORT
DEPARTMENT OF BIOCHEMISTRY



BOSE INSTITUTE CELEBRATED 106TH FOUNDATION DAY



Overview

Since its inception in 1974, research at the Department of Biochemistry has focused on understanding the properties of various biological macromolecules and their interactions with other cellular components. The department's mission has been aimed at finding scientific solutions to various national needs and also to educate and train the next generation of researchers. Our scientists are studying how organisms respond to various kinds of stress, how macromolecular complexes gain specificity, how the biology of pathogenic microbes differs from that of the host, how to contain microbial virulence, and how to alleviate processes contributing to neurodegenerative diseases. Our administrative and technical support staff are a vital part of our research ecosystem. Students who join this department can look forward to a vibrant and supportive research environment. We are proud of our alumni, many of whom have achieved greatness in their chosen research fields.

List of Personnel:

Faculty Members: Prof. Pinakpani Chakrabarti (J. C. Bose Fellow), Prof. Subrata Sau, Prof. Srimonti Sarkar, Prof. Ajit Bikram Datta, Dr. Abhrajyoti Ghosh, Dr. Subhash Haldar.

Research Scientist : Dr. Tanaya Chatterjee, *DST-(WOS-A)*.

Students : JRF/SRF : Avishikta Chatterjee, Pritha Mondal, Trisha Ghosh, Debasmita Sinha, Sangita Mondal, Anurupa Sett, Babai Hazra, Manish Sarkar, Ankita Das, Mousam Roy, Sayandeep Gupta, Tushar Chakraborty, Kaustav Bhakta, Arghya Bhowmick, Agnita Acharya, Jagriti Das, Nabanita Patra. Sirsha Samanta, Shuvronil Chakraborty, **Senior Project Associate:** Dr. Debarun Acharya. **CSIR RA:** Dr. Shyantan Mukherjee, RA : Dr. Dhruba Bhattacharya, Dr. Triparna Mukherjee, Dr. Swapan Kr. Jana, **Project Assistant** (J. C. Bose Fellowship of Prof. Pinakpani Chakrabarti) : Jesmita Dhar, Supriyo Bera.

Staff Members: Dipak Ch. Konar, Atanu Pramanik, Rama Chatterjee (Superannuated on 31.05.2022).

25th National Science Exhibition

Participation of Bose Institute, Kolkata at the 25th National Science Exhibition organized by Central Calcutta Science and Culture Organization for Youth in Central Park, Salt Lake from 24.08.22 to 27.08.22.

Prof. Subrata Sau

Professor
Department of Biochemistry

Name of the participants:
Tushar Chakraborty, SRF
Debasmita Sinha, SRF

Research Background and Vision:

To design and screen the novel antibacterial agents, we investigated the structure, function, folding mechanism, and stability of some virulence factors of *Staphylococcus aureus* and *Escherichia coli* using various biochemical, biophysical, and genetic tools. Of the factors, CapF and CapG are involved in capsule biosynthesis, whereas RsbW prevents the activity of alternative sigma factor σ^B and phosphorylates the anti-sigma factor antagonist RsbV. Conversely, FKBP22, a peptidyl-prolyl *cis-trans* isomerase, shows substantial similarity to the Mip-like virulence factors. While CapF, CapG, RsbW, σ^B, and RsbV are expressed by *S. aureus*, FKBP22 is produced by *E. coli*..

Research Highlights/Accomplishments:

- Zn^{2+} ion is indispensable for preserving the structure, stability, shape, surface hydrophobicity, Cys accessibility, and NADPH binding affinity of CapF.
- A polyhistidine-tagged CapG was purified to near homogeneity.
- Arg 11, Arg 32, and Lys 44 are essential for interaction between RsbW and σ^B.
- FKBP22 mutants were constructed by replacing its Ile 17, Ile 42, and Ile 65 with an Ala residue.

Future Plan:

- Roles of domains and NADPH on the structure, stability, shape, and dimerization ability of CapF will be investigated.
- Structure, folding mechanism, stability, and oligomerization ability of CapG will be studied.
- Roles of Arg 11, Arg 32, and Lys 44 on the structure, dimerization ability, stability, and phosphorylation activity of RsbW will be studied.
- FKBP22 point mutants carrying Ala at positions 17, 42, and 65 will be purified and characterized.

Scientific Activities:

Student Awarded Ph.D.	Publication	Book Chapter / Invited Review	Participation in Conference / Symposia/ Workshop and Delivered Invited Talk	Extramural Funding	Patent Applied/ Granted	Award / Honour / Membership
01	00	00	05	00	00	00

Prof. Srimonti Sarkar

Professor
Department of Biochemistry

Name of the participants:
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-JRF

Research Background and Vision:

We study the human gut pathogen *Giardia lamblia*. It causes the widely-prevalent diarrhoeal disease, giardiasis. As there are no vaccines against *Giardia*, chemotherapy is the only treatment option. Two classes of anti-giardial drugs are currently available- the nitroheterocyclic compounds and the benzimidazoles. While these effectively treat ~80% of infections, instances of treatment-refractory giardiasis have been rising steadily. To address this emerging challenge, we aim to identify new therapeutic targets by focusing on cellular processes that are not only crucial for parasite survival, but exhibit considerable mechanistic divergence from the analogous host process. We have identified unique features in the parasitic machinery for two processes that play key roles in the parasite's survival within the host- vesicular transport and protein degradation.

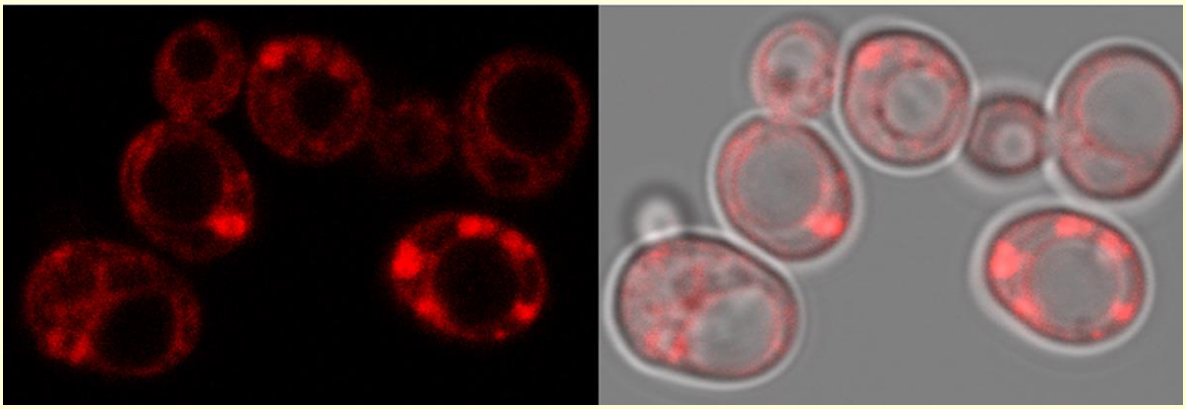
Research Highlights/Accomplishments:

- We were the first to report the existence of the ESCRT pathway in *Giardia lamblia*. But the identity of the target proteins, which are to be sorted into the lumen of *Giardia*'s lysosome with the help of this ESCRT pathway, remained unknown. Using a genome-wide approach, we have identified a set of potential proteins that can serve as the cargo of the ESCRT machinery of this parasite.
- We have mapped the inter-subunit interactions that enable the formation of the multi-subunit TRAPP tethering complex of *Giardia lamblia*. We have also identified key differences in the interaction profile of the TRAPP subunits of *Giardia*, *vis-à-vis* that of its opisthokont hosts.

- We have identified a cellular pathway that controls the change in the shape of the vacuole of *Saccharomyces cerevisiae*in the presence of ethanol.

Future Plan:

- Delineate the surfaces of individual subunits that mediate the inter-subunit interactions within the TRAPP tethering complex of *Giardia lamblia*.
- Using the ESCRT cargo protein(s) as a tool, identify the process of cargo recognition by the ESCRT complex, and the subsequent cargo sorting mechanism that leads to the delivery of such cargo proteins into the lumen of *Giardia*'s lysosome.
- Since vacuole shape change is an important determinant of yeast's survival in the presence of ethanol, we aim to test if modulation of this process can be used to increase ethanol production by *Saccharomyces cerevisiae*.



Visualizing the change in the endosomal morphology of a mutant yeast strain in response to ethanol

Scientific Activities:

Student Awarded Ph.D.	Publication	Book Chapter / Invited Review	Participation in Conference / Symposia/ Workshop and Delivered Invited Talk	Extramural Funding	Patent Applied/ Granted	Award / Honour / Membership
00	00	00	01	00	00	00

Prof. Ajit Bikram Datta

Professor
Department of Biochemistry

Research Background and Vision:

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.

Research Highlights/Accomplishments:

- Identified structural regions in the non-canonical ubiquitin activating enzyme Uba6 in its SCCH domain that may impart its E2 specificity in addition to the Ufd domain.
- Initiated structural studies on chimeric E1 proteins.
- Most E2s, unlike Rad6A/B, have intrinsic preference for their ubiquitin chain building property and are not E3-dependent.

Future Plan:

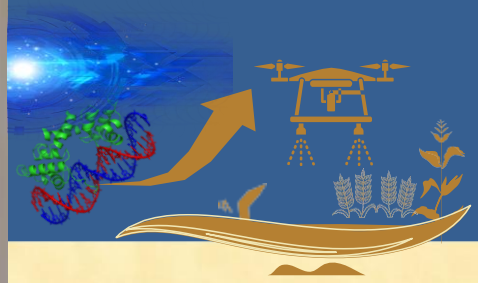
- Identification of Uba6 regions important for its E2 specificity and recognition.
- Generating a battery of Uba6 and Uba1 proteins with altered specificity.
- Understanding the basis of mono-ubiquitinating activity of few E2s including Ube2T.

List of National Collaborations:

Prof M. Dasgupta, Dept of Biochemistry, University of Calcutta, Project: Understanding the structure-function relationship of Symbiosis receptor kinase.

Dr. Abhrajyoti Ghosh

Associate Professor
Department of Biochemistry



Name of the participants:
Arghya Bhowmick, CSIR-*Adhoc*
Koustav Bhakta, Institute Fellow
Sangita Mondal, UGC-*Adhoc*
Jagriti Das, DBT-JRF
Agnita Acharya, INSPIRE Fellow
Sirsha Samanta, UGC-Fellow
Dr. Dhruba Bhattacharya, SERB-NPDF

Research Background and Vision:

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:

- Anthropogenic impact accelerates antibiotic resistome diversity in the mangrove sediment of Indian Sundarban.
- Rhizosphere impact bacterial community structure in the tea (Camellia sinensis (L.) O. Kuntze.) estates of Darjeeling, India.
- Minimal Yet Powerful: The Role of Archaeal Small Heat Shock Proteins in Maintaining Protein Homeostasis.

Research Accomplishments:

- Publication titled “Anthropogenic impact accelerates antibiotic resistome diversity in the mangrove sediment of Indian Sundarban.” in Chemosphere (Year, Issue & Page- 2022, 309&

136806) is highlighted in Nature India as "Genes defying antibiotics found in bacteria in Sundarban sediments" https://www.nature.com/articles/d44151-023-00041-z.

- Recipient of Vigyan Sera Protiva award in the VIGYAN UTSOV organized by Central Calcutta Science & Culture Organisation for Youth (CCSCOY) in co-operation with the Department of Science & Technology and Biotechnology, Govt of West Bengal (4th December 2022).
- Recipient of IGSTC (Indo German Science and Technology Centre) grant to attend Indo-German bilateral workshop on "Agricultural Management Practice Effects on Soil- And Plant-associated bacterial communities and their resistome" at Leibniz Institute of Agricultural Engineering and Bio-economy e.V. (ATB), Potsdam, Germany (20th – 22nd June 2022).
- Mr. Arghya Bhowmick received DBT-CTEP to attend the EMBO workshop 2022 on Molecular Biology of Archaea held at Goethe University in Frankfurt, Germany from 1st August 2022 to 4th August 2022 (16th July 2022).
- Mr. Arghya Bhowmick received CSIR travel grant to attend the EMBO workshop 2022 on Molecular Biology of Archaea held at Goethe University in Frankfurt, Germany from 1st August 2022 to 4th August 2022 (3rd August 2022).
- Mr. Arghya Bhowmick received EMBO travel grant to attend the EMBO workshop 2022 on Molecular Biology of Archaea held at Goethe University in Frankfurt, Germany from 1st August 2022 to 4th August 2022 (4th August 2022).
- Mr. Koustav Bhakta received SERB-ITS to attend "Gordon Research Conference" on Folding and Misfolding: Effects of Evolution and Environment at Four Points Sheraton in California, United States from 23rd October 2022 to 28th October 2022 (9th September 2022).
- Mr. Koustav Bhakta received DBT-CTEP to attend "Gordon Research Conference" on Folding and Misfolding: Effects of Evolution and Environment at Four Points Sheraton in California, United States from 23rd October 2022 to 28th October 2022 (27th September 2022).
- Mr. Koustav Bhakta presented his work titled "Protection and Perfection: Insights into the Protein Folding Mechanism of Heat Shock Proteins in Archaea" at the student symposium held on 106th foundation day of Bose Institute. He received an award for the best oral presentation from Prof. Asutosh Sharma (DST secretary) (30th November 2022).
- Mr. Arghya Bhowmick received EMBO Scientific Exchange Grant for a scientific visit to the laboratory of Prof. Sonja-Verena Albers at the University of Freiburg, Germany (13th December 2022).

Future Plan:

- Heat shock response in thermoacidophilic crenarchaeon *Sulfolobus acidocaldarius* and first implications for cross-stress adaptation: insights from transcriptome analysis.
- Investigating the role of heat shock proteins and type-II toxin-antitoxin systems in the adaptation of archaeal model organism under stress conditions.
- Understanding the cross-talk between microbes in the environment and their hosts in natural and managed ecosystems with a history of anthropogenic disturbances.

Scientific Activities:

Student Awarded Ph.D.	Publication	Book Chapter / Invited Review	Participation in Conference / Symposia/ Workshop and Delivered Invited Talk	Extramural Funding	Patent Applied/ Granted	Award / Honour / Membership
03	06	01	06	02	00	00

Dr. Subhash Haldar

Assistant Professor
Department of Biochemistry

Name of the participants:
Shuvronil Chakraborty

Research Background and Vision:

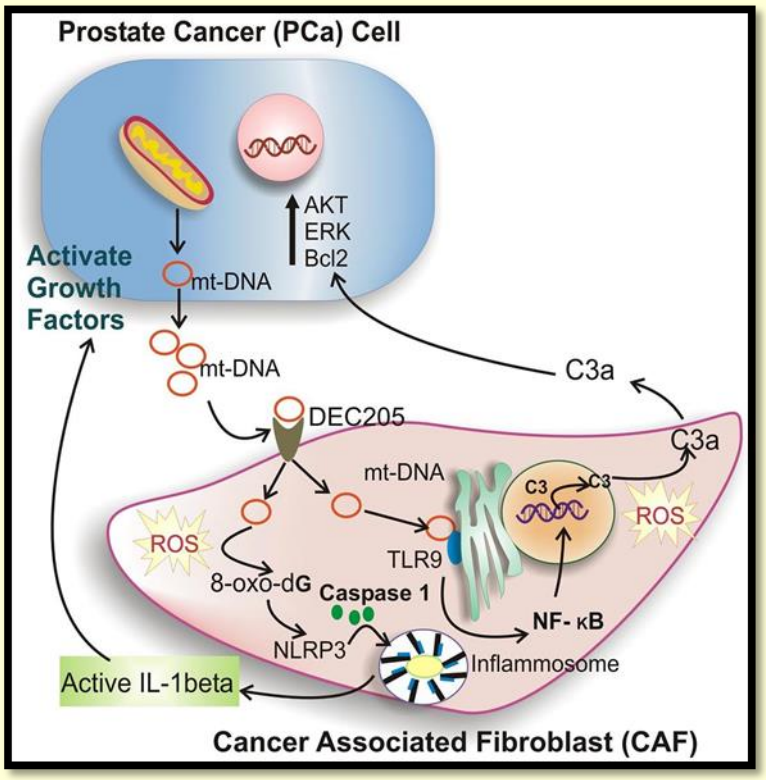
Epigenetic alterations are very common in different cancers, which influence cancer cell's metabolic energy yielding pathways, and play a crucial role in cancer progression and metastasis. However, very limited studies available regarding epigenetic alteration mediated metabolic factors involved in different chemotherapy resistant cancers. To maintain aggressiveness, cancer cells always support certain cells in tumor microenvironment (TME) to be self-sustainable and therapy resistant, called cancer stem cells. The dynamic crosstalk between different cells in TME always favors and supply factors required for the maintenance of stemness, which are epigenetically modulated depending on metabolic changes in TME.

Research Highlights/Accomplishments:

- Cell-free mitochondrial DNA copy number, size, and mutations in mtDNA genes as potential prognostic biomarkers in different cancers and targetable prostate cancer therapeutic candidates impacting stromal-epithelial interactions essential for chemotherapy response.
- Understanding stromal telomere length regulation mechanism within the tumor microenvironment associated in facilitating cancer treatment, diagnosis, and prognosis..

Future Plan:

- Study the role of epigenetic changes induced by chemotherapy.
- Examine the role of inflammasome activation in chemoresistance prostate tumor microenvironment.
- Study the role of FYN in chemoresistance cancer pathogenesis.



Mechanisms of cancer progression in tumor microenvironment by cell free mtDNA.

Scientific Activities:

Student Awarded Ph.D.	Publication	Book Chapter / Invited Review	Participation in Conference / Symposia/ Workshop and Delivered Invited Talk	Extramural Funding	Patent Applied/ Granted	Award / Honour / Membership
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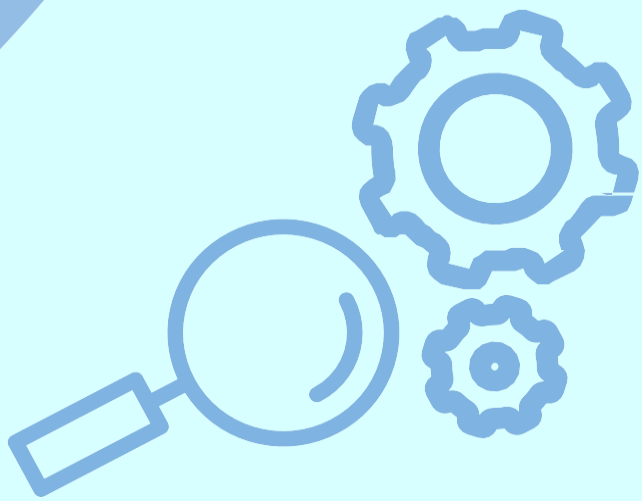
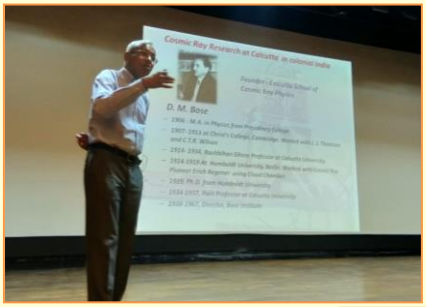
SCIENTIFIC REPORT
DIVISION OF BIOINFORMATICS



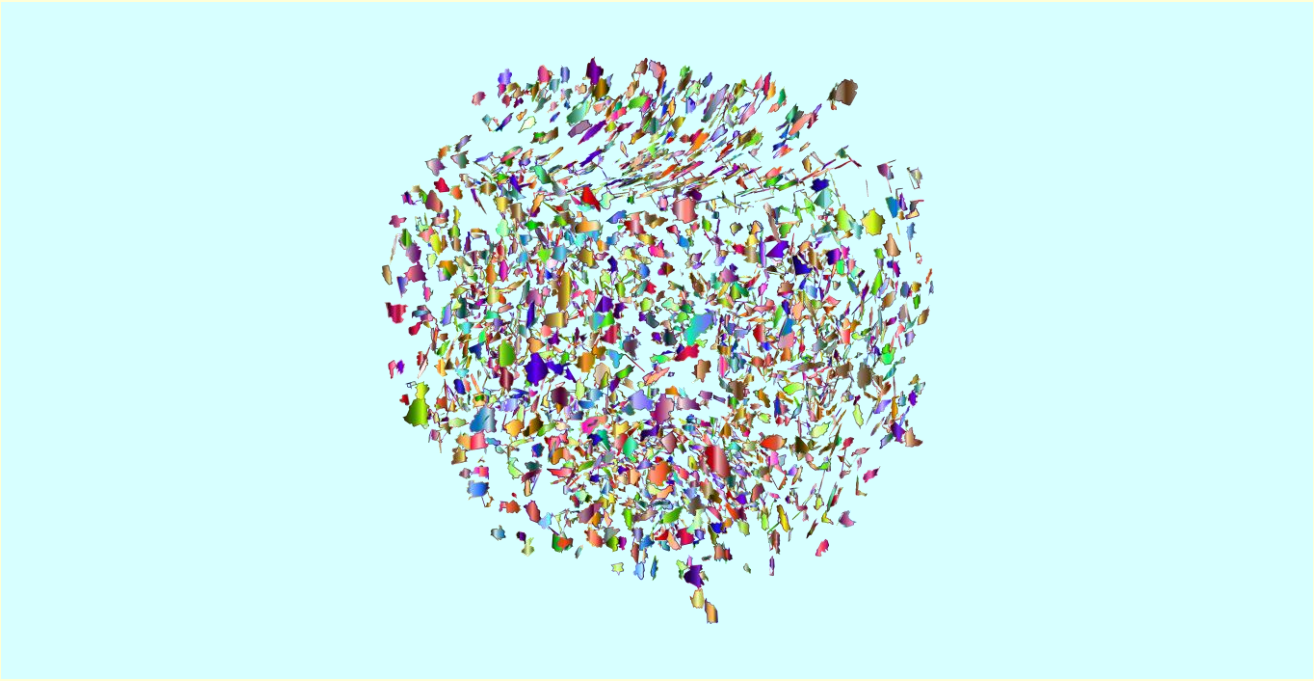
Bose Institute Colloquium



Prof. Naba K Mondal, INSA Senior Scientist, visited Bose Institute on March 15, 2023 and delivered the Bose Institute Colloquium. He also visited the J.C. Bose Museum, at Main Campus, Bose Institute.

Prof. Michael T. McMahon, F.M. Kirby Research Center for Functional Brain Imaging, Kennedy Krieger Institute, Baltimore, MD, USA delivered Bose Institute Colloquium held on February 15, 2023 at Unified Academic Campus, Salt-Lake.

Before the Colloquium, Prof. McMahon visited J.C. Bose Museum at Bose Institute, Main Campus.



Overview

Today's Division of Bioinformatics started its journey three decades ago as a DBT funded BTIS Network's center at Bose Institute to offer Bioinformatics facility and skill-set. Later the full time research was started at the center and thereby it evolved as a 'Centre of Excellence in Bioinformatics', as graded by the DBT. The Bose institute has upgraded this center into its regular Division. The broader objectives of the research carried out in this division are to provide fundamental insights into Biology, to rationalize complex experimental observations, to make applications with long term goal to come up with scientific strategies for modern therapeutic approaches. The division has decent infrastructure of bioinformatics and computational biology research. The scientific expertise of the division covers stem cell bioinformatics and regulatory RNAs, oncogenomics, proteomics, drug design, structural bioinformatics and macromolecular dynamics etc. The products of the divisions include databases software in addition to the human resource development; it routinely conducts training and workshops for students in order to spread scientific and technical skills in bioinformatics.

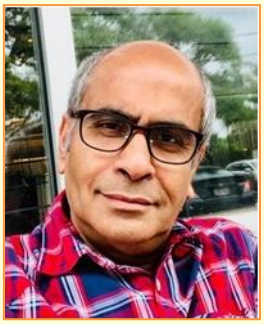
List of Personnel:

Faculty Members: Prof. Shubhra Ghosh Dastidar, Dr. Zhumur Ghosh, Dr. Sudipto Saha.

Students: JRF/SRF: Gourab Das, Troyee Das, Byapti Ghosh, Pritha Sengupta, Satakshi Bagchi, Soumya Mal, Saran N, Abhirupa Ghosh, Jagannath Das, Paramita Roy, Shazia Firdous, Debarati Paul, Debadrita Basu, Nibedita Ray Chaudhuri, Dibakar Roy, Premananda Basak, Megha Ghosh, Jit Ghosh, Stuti Ghosh, ***Women Scientist:*** Dr. Arpana Mukherjee.

Staff Members: Sanjib Kumar Gupta, Sujata Roy, Birendra Kumar Bari.

BIC Seminar XV



Dr. Asish Chaudhuri, Research Consultant on Neurodegenarstive Diseases, L E K Consulting, USA and Former Senior Staff Scientist, Buck Institute for Aging, Novato, California, USA, delivered BIC Seminar XV: Insights into the mechanism of aging on 10.02.2023 at Unified Academic Campus, Bose Institute, Kolkata, organized by Division of Bioinformatics. The session was chaired by Prof. Tapan Kumar Dutta, Bose Institute.

Lecture on "Mental Stress and its Management"

As a part of the celebration of the 75th year of Independence of India, “Azadi Ka Amrit Mahotsav” Bose Institute organized Lecture entitled "Mental stress and its management" by **Dr. Devasis Ghosh** (Sr. Consultant Mental Health) on May 4, 2022, at Bose Institute Unified Academic Campus, Salt Lake.

Prof. Shubhra Ghosh Dastidar

Professor
Division of Bioinformatics

Name of the participants:
Debadrita Basu, SRF
Debatrati Paul, SRF
Nibedita Ray Chaudhuri, SRF
Premananda Basak, SRF
Megha Ghosh, JRF
Jit Ghosh, JRF

Research Background and Vision:

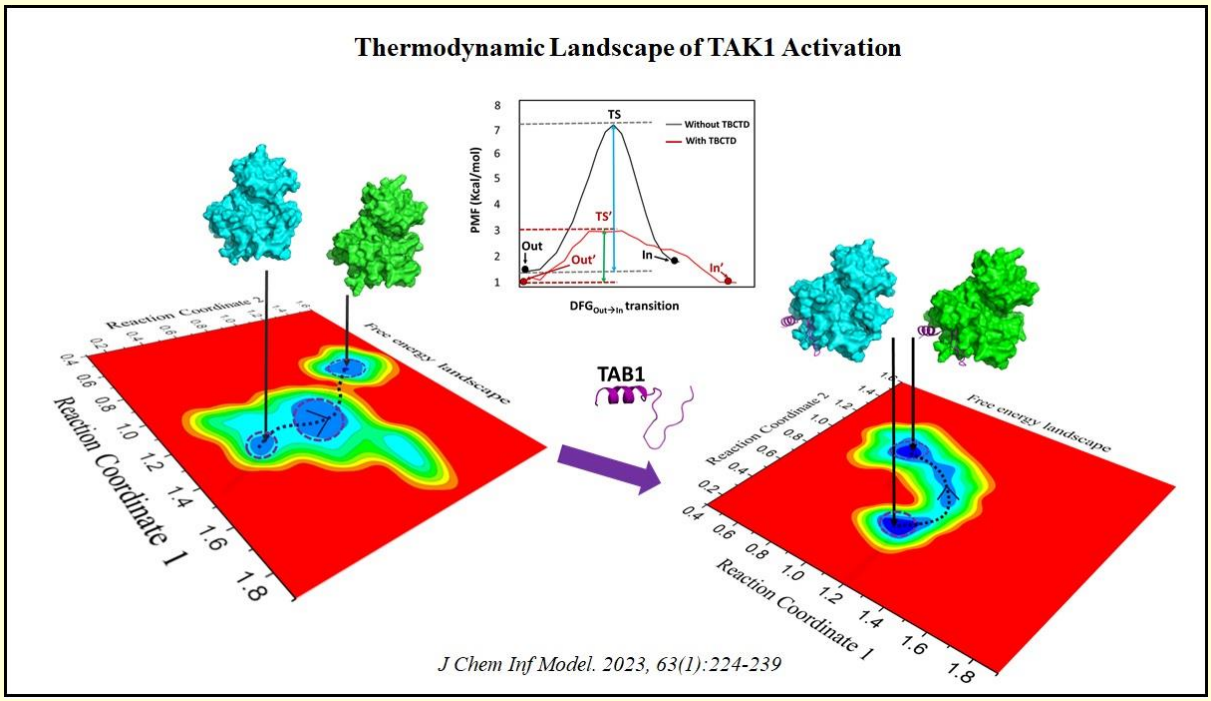
The fundamental mechanisms working behind the biochemical or biological processes are associated with the molecular level changes. While experimental methods can identify the shapes of the molecular structures with its all-atom description, the computational methods can facilitate to visualize and witness the dynamic changes occurring at the molecular level to meet the functions. It requires high end computation in substantially large and parallel computing facilities to simulate the molecular events using the fundamental principles of Chemistry, Physics, Mathematics, Statistics, Life sciences. Our group investigates the interactions between biological macromolecules and macromolecule-drugs to elucidate the fundamental molecular mechanisms in biology and to find novel strategies to combat molecular changes that lead to diseases.

Research Highlights/Accomplishments:

- Elucidated the molecular mechanisms of TAK1 kinase allostery induced by TAB1 using conformation sampling, statistical thermodynamic methods and high-end computations, a fundamental insight that would be useful to exploit it allosteric drug design.
- Deciphered the mechanism of a group of ligands competing with Colchicine to bind Tubulin to diverge in functions, as some become anti mitotic and some others become vascular disrupting agents; all are the critical insights for drug-design targeting tubulin.
- Demonstrated the molecular mechanisms through which post translation modification on structurally disordered region can control on the functions of structurally ordered region of Bcl2, a protein which high relevance for cancer and its therapy.

Future Plan:

- Implementation of machine learning based approaches to analyse conformational ensemble to identify biologically active conformations, complementing the conformational sampling techniques.
- Exploring the allosteric changes in Kinases and identification of allosteric sites with therapeutic implications.
- Investigating the structural and dynamical polymorphism in protein aggregates with the aim to find molecular mechanisms to perturb the aggregations for therapeutic benefits.



Scientific Activities:

Student Awarded Ph.D.	Publication	Book Chapter / Invited Review	Participation in Conference / Symposia / Workshop and Delivered Invited Talk	Extramural Funding	Patent Applied / Granted	Award / Honour / Membership
01	05	–	05	01	–	01

Dr. Zhumur Ghosh

Associate Professor
Division of Bioinformatics

Name of the participants:
Troyee Das, CSIR-JRF
Byapti Ghosh, DST Inspire Fellow
Gourab Das, ICMR SRF
Pritha Sengupta, UGC JRF
Satakshi Bagchi, UGC JRF
Soumya Mal, ICMR SRF
Dr. Arpana Mukherjee, SERB WOS-A

Research Background and Vision:

- 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.

- 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.

Research Highlights/Accomplishments:

- Elucidated the role of miRNAs and long noncoding RNAs as regulators during fertilization and early stages of murine development and identifying potential noncoding RNA-mRNA interaction which is having significant role in determining fertility.

- Explored the miRNome and the transcriptome of normal and Acute Myeloid Leukemia (AML) samples to elucidate the significant set of miRNA-target mRNA pairs present within AML-Peripheral Blood and AML- Bone Marrow samples from both tissue and cell lines. This will be serving as the backbone to develop a prediction model for a non-invasive mode of preliminary AML diagnosis in future.

- Identification of repurposed drug candidates for COVID-19 based on a high-throughput approach incorporating patient gene expression patterns. These drugs not only prevent E protein oligomerization in both its wild type and a mutational state but can also regulate gene targets responsible for inducing COVID symptoms. Further these are potentially effective for a wider spectrum of asymptomatic to severely symptomatic COVID patients.

Future Plan:

- Validating the presence of common and or exclusive lncRNA-SNPs in ovarian, breast and cervical cancer.
- Detecting the role of miRNAs as modulators inducing oncogenicity in stem cell derivatives and development of a prediction model to predict the purity of stem cell derivatives.
- Studying the role of noncoding RNAs in neurodegeneration.

Scientific Activities:

Student Awarded Ph.D.	Publication	Book Chapter / Invited Review	Participation in Conference / Symposia/ Workshop and Delivered Invited Talk	Extramural Funding	Patent Applied/ Granted	Award / Honour / Membership
01	03	00	01	01	00	00

Dr. Sudipto Saha

Associate Professor
Division of Bioinformatics

Name of the participants:
Saran N, SRF-extended
Abhirupa Ghosh, DBT BINC SRF
ShaziaFirdous, SRF, UGC
Jagnnath Das, JRF, DBT
Paramita Roy, JRF, DST, Inspire fellow
Dibakar Roy, JRF, UGC
Stuti Ghosh, JRF, UGC

Research Background and Vision:

Lung microbiome dysbiosis can cause chronic asthma, COPD, and lung cancer. We study the interaction between the lung microbiome, and its metabolites with the host innate immune cells (epithelial cells and macrophages) in obstructive pulmonary diseases using bioinformatics and multi-omics based approaches. Our study shall illuminate a new direction in obstructive pulmonary diseases pathogenesis and management.

Research Highlights/Accomplishments:

- A meta-analysis of sputum microbiome studies from our lab identifies airway disease-specific taxonomic and functional signatures
- A survey of mycobacterial fluoroquinolone resistance protein conservon (mfpconservon) was performed in Mycobacteriaceae and we have identified its promoter activity
- A web based application named LHSPred was developed for predicting lung health severity and a database of biomarkers of cancer stem cells named BCSCdbwas published from our lab.

Future Plan:

- Identification of mitochondrial protein biomarkers associated with obstructive pulmonary diseases like asthma and COPD.
- Study the interaction between lung microbiome, its metabolites and host innate immune cells in obstructive pulmonary diseases.
- Identification Pan-Cancer multi-omics prognostic biomarkers.

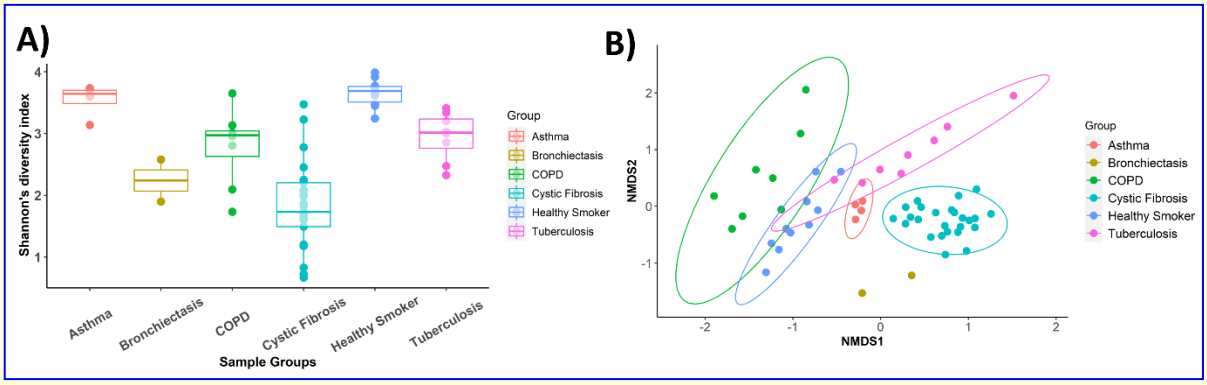


Figure : The diversity plots of the sputum microbiome of five airway diseases and healthy smokers show disease-specific taxonomic signatures. A) Shannon's diversity (alpha diversity metrics) indices of groups are represented as boxplots where dots represent each sample. **B)** Beta diversities are represented as NMDS plots of Bray-Curtis distances where dots are the samples and ellipses are clusters indicating each group.

Scientific Activities:

Student Awarded Ph.D.	Publication	Book Chapter / Invited Review	Participation in Conference / Symposia/ Workshop and Delivered Invited Talk	Extramural Funding	Patent Applied/ Granted	Award / Honour / Membership
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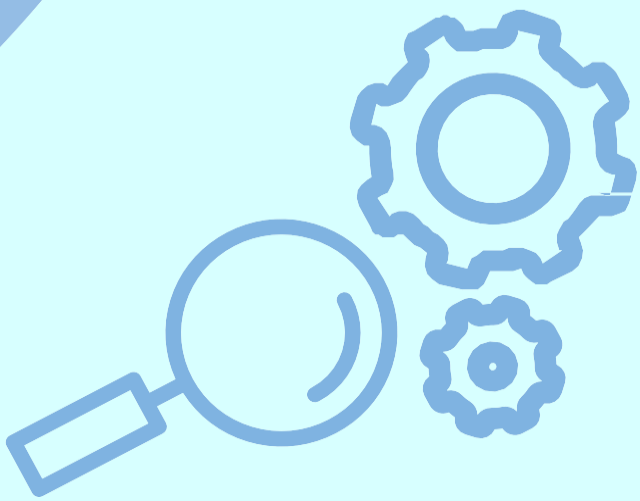
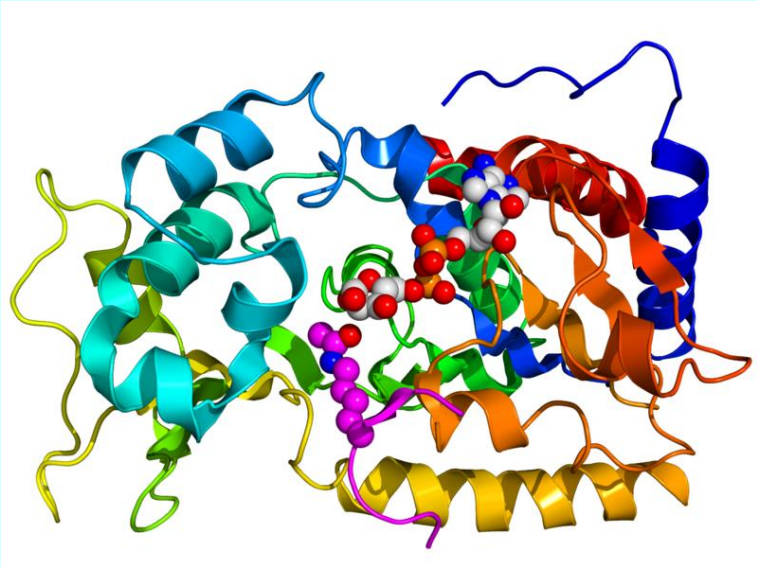
SCIENTIFIC REPORT
DEPARTMENT OF BIOPHYSICS



Dr. R.K. Joshi, Scientist-F, DST Visited Bose Institute

Dr. R.K. Joshi, Scientist-F, Autonomous Institution Division, Department of Science & Technology, GoI and **Mr. Rohit Kumar,** Deputy Secretary (Finance), Department of Science & Technology, Govt. of India visited Bose Institute Main Campus and J.C. Bose Museum on 08.08.2022 in presence of Director, BI and Registrar(O), BI.



Overview

The Department of Biophysics was established in September 1983. Although a relatively young Department and small in size, the department is very active in research primarily focused on Molecular Biophysics, Biophysical Chemistry and Structural Biology. The primary mission of the Department is to understand biological systems at a molecular level from a vantage point of physics, physical chemistry and computational chemistry, chemical and structural biology. This includes a detailed description in terms of molecular structure, conformation and dynamics and their interactions using both experimental and theoretical tools. In addition to generating fundamental knowledge in the field, the mission is to work in a collaborative fashion with other disciplines on fundamental as well as applied problems and solve them using cutting edge tools / methodologies.

List of Personnel:

Faculty Members: Prof. Anirban Bhunia, Prof. Subhrangsu Chatterjee, Dr. Debjani Roy, Dr. Smarajit Polley.

Research Scientists*:* Prof. Siddhartha Roy, J. C. Bose Fellow; Prof. Gautam Basu, Dr. Moitri Basu, DST Inspire Faculty.

Students : RA/JRF/SRF/Project Assistant : Anindya Dutta, Nilanjan Banerjee, Sudakshina Ganguly, Bhawna Pandey, Dr. Madhumita Chakraborty, Humaira Ilyas, Sk. Abdul Mohid, Pallabi Sengupta, Suman Panda, Chandradeep Basu, Dwijit Guha Sarkar, Nilanjana Maji, Dr. Trina Dutta, Dibakar Sarkar, Dipita Bhattacharyay, Pranita Roy, Ranit Pariary, Karishma Biswas, Shruti Mukherjee, Swarnali Kar, Prateeka Borar, Ananya Roy, Dr. Swati Bhowmick, Deeparna Sutradhar, Samrat Mitra, Debapriya Bose, Dr. Payel Bhatterjee, Laboni Roy, Ipsita Chakraborty, Dipanwita Roy, Dr. Raka Ghosh, Oishika Chatterjee Arkadeep Sarkar and Dr. Himal Kanti Ganguly.

Staff Members: Basudeb Marick, Barun Majumder, Tanmoy Debnath, Soumya Shankha Biswas, Swapan Joghsharma, Sudhir Turi, Nagnarayan Yadav.

Hindi Diwas and Pakhwada

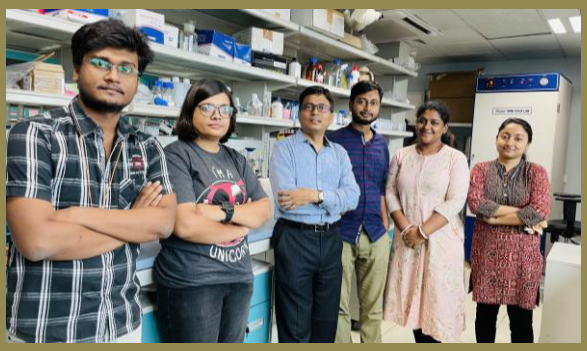
Bose Institute organized "Hindi Diwas and Pakhwada" during September 14 to September 28, 2022. "Hindi Diwas" was observed on September 14, 2022 in the main auditorium of UAC. The Director, BI welcomed all the scientists and staff of the Institute with his Inaugural Address. The Registrar (Officiating), the Deputy Registrar, the Chair, Hindi Implementation Committee and Members of Bose Institute, Kolkata were present and delivered short speeches about Hindi Diwas. The participation certificates for Hindi writing competitions of previous years were distributed. The following two weeks were celebrated as "Hindi Pakhwada". Essay/Poem/Story/Article writing competition in Hindi were organized during these weeks.

9th Indian National Exhibition Cum-Fair 2022

Bose Institute participated in the "9th Indian National Exhibition Cum-Fair 2022" organized by Bengal Human Resource Development Foundation during August 4 – 8, 2022 at KMDA Ground, Patuli, Garia, Kolkata.

Prof. Anirban Bhunia

Professor
Department of Biophysics



Name of the participants:
Ranit Pariary
Dibakar Sarkar
Shruti Mukherjee
Dipanwita Roy
Karishma Biswas

Research Background and Vision:

Biological membranes are an important functional interface for a plethora of physiological reactions, taking place within the cell. Thus, all biological membranes serve as an indispensable platform for several surface proteins, membrane-integrated proteins/peptides and other ions and signalling molecules. The determination of molecular structure and dynamics of biomembranes and the associated functional peptides and proteins is, in fact, one of the most significant challenges in contemporary science. In this connection, vesicles and liposomes mimicking the lipid bilayer structure have been used to study membrane-protein/peptide interaction. Recently, nanodiscs, composed of lipid bilayer and membrane scaffold proteins (MSP), represent a more native environment than liposomes/ bicelles or detergent micelles. Recent developments of NMR spectroscopy have facilitated in-depth characterization of the dynamics of interactions at the atomic-resolution. This precise structural knowledge is very much crucial to correlate with their membrane-directed functioning. Dr Bhunia's laboratory involves several biophysical techniques, including cutting-edge solid- as well as solution-state NMR spectroscopic techniques to characterize the membrane-associated functioning of several biologically active peptides and proteins.

Research Highlights/Accomplishments:

- Understanding the structure-function correlation of rationally designed antimicrobial peptide against Pseudomonas-associated corneal keratitis.
- Membrane induced amyloid pathogenicity.

- Molecular mechanism of amyloidosis in the presence of metals and sequence context.

Future Plan:

- Structure-function analysis of antimicrobial peptides to treat fungal ocular infections.
- Designing of new antimicrobial peptides to develop transgenic plants against plant microbes.
- Unravelling the molecular mechanism of Amyloid fibril formation and designing of inhibitors.

Scientific Activities:

Student Awarded Ph.D.	Publication	Book Chapter / Invited Review	Participation in Conference / Symposia/ Workshop and Delivered Invited Talk	Extramural Funding	Patent Applied/ Granted	Award / Honour / Membership
02	15	00	02	02	00	00

Prof. Subhrangsu Chatterjee

Professor
Department of Biophysics

Name of the participants:
Anindya Dutta
Oishika Chatterjee
Dr.Priyanka Bhadra
Ananya Roy
Laboni Roy
Debopriya Bose
Dr. Trina Sengupta
Suman Panda

Research Background and Vision:

My group is involved in the understanding of Calcium Tunneling in cancer cells using G-quadruplex structures in the Promoter Region of ORAI1 gene. Our lab is also engrossed in understanding the inference of SWI/SNF protein ALT mediated pathway to develop cancer malignancy. We have seen that G4 mediated down regulation of SMARCAL1 exalts the expression of PML bodies which are the marker of cellular stress, thus fueling replication stress in ALT positive osteosarcoma. We also cultivated that promoter G quadruplex MAPK12 protein in triple negative breast cancer tunes its transcriptional fate to dictate the proliferation and the stemness of the cancer cells.

Research Highlights/Accomplishments:

- Inference of SWI/SNF protein, i.e. SMARCAL1 ALT mediated pathway to develop cancer malignancy.
- Regulation of transcriptional fate of MAPK12 protein in triple negative breast by targeting its promoter G4.
- Sequence driven interaction of amino acids in de-novo designed peptides determines c-Myc G4 unfolding inducing apoptosis in cancer cells.

Future Plan:

- Involvement of LINC00273 in cancer metastasis and stemness via miRNA sponging in Triple Negative Breast Cancer.

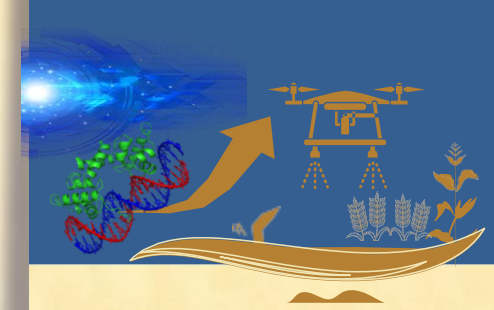
- Understanding of Calcium Tunneling in cancer cells targeting G4 structures in thepromoter of ORAI1.
- Unraveling a specific switchable tetraplex elements in the heterogeneous nuclear ribonucleoprotein K promoter.

Scientific Activities:

Student Awarded Ph.D.	Publication	Book / Book Chapter	Participation in Conference / Symposia/ Workshop and Delivered Invited Talk	Extramural Funding	Patent Applied/ Granted	Award / Honour / Membership
02	06	07	01	01	00	00

Dr. Debjani Roy

Assistant Professor
Department of Biophysics



Name of the participants:
Dr. Souvik Basak and
Dr. Amit Halder and
their group members,
Dr. B.C. Roy College of
Pharmacy and Allied Health
Sciences, Durgapur

Research Background and Vision:

We are working on the protein fibrillation pathways. We are interested in the development of protein fibrillation inhibitors which have long been recognized as potential therapeutics for ageing diseases. The most part of this work was attributed to big database screening and in vitro validations of these screened efficacious inhibitors. We are trying to develop a unified method for accelerating hit-to-lead strategies. This study emanated from our previously developed methods and subsequently predicted repositioning drug scaffolds. An insight garnered from this network medicine approach integrates multiple types of biological regulators to the genetics of ageing diseases.

Research Highlights/Accomplishments:

- Submitted a grant to the department of Science and Technology and Biotechnology (DSTBT), Government of West Bengal (GOWB) entitled "Use of exosomal microRNAs to diagnose and predict the progression of Parkinson's Disease" on November 30, 2022.
- Identified several new next generation therapeutics for Alzheimer Disease.
- *In vitro* (Thioflavin T and Congo Red assays) validations of repositioning drugs as protein fibrillation inhibitors.

Aims and Objectives:

1. In vitro Diagnostic device development for human diseases.

- Design of an instrument involving human tissue in a microfluidic platform.
- Biosensor development using microRNA-mRNA-TFs and pathways.

2. Method development for Drug Development

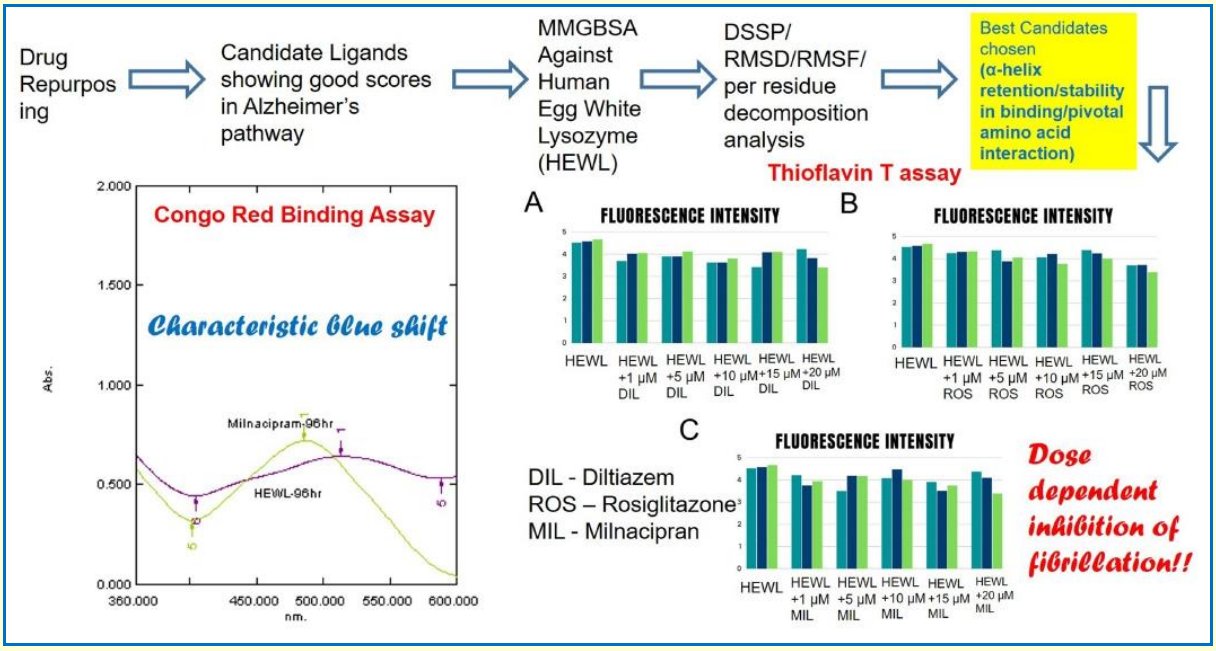
- Identification and characterization of exosomes.

3. Big data analysis

- Bimolecular structure prediction and study their interactions,
- Database and Library design for studying improved interactions.
- Analysis of next-generation sequence data.
- FPGA based device development involving Internet of things for remote control.

Future Plan:

- Use of microRNAs to facilitate the drug action.
- Synthesis and in vivo validations of predicted next generation therapeutics for Alzheimer disease and Breast Cancer.
- Melatonin and circadian rhythm disorders and its implications in ageing.



Scientific Activities:

Student Awarded Ph.D.	Publication	Book / Book Chapter	Participation in Conference / Symposia/ Workshop and Delivered Invited Talk	Extramural Funding	Patent Applied/ Granted	Award / Honour / Membership
00	00	00	01	00	00	00

Dr. Smarajit Polley

Assistant Professor
Department of Biophysics

Name of the participants:
Prateeka Borar
Pranita Ray
Deeparna Sutradhar
Samrat Mitra
Afreen Haque

Research Background and Vision:

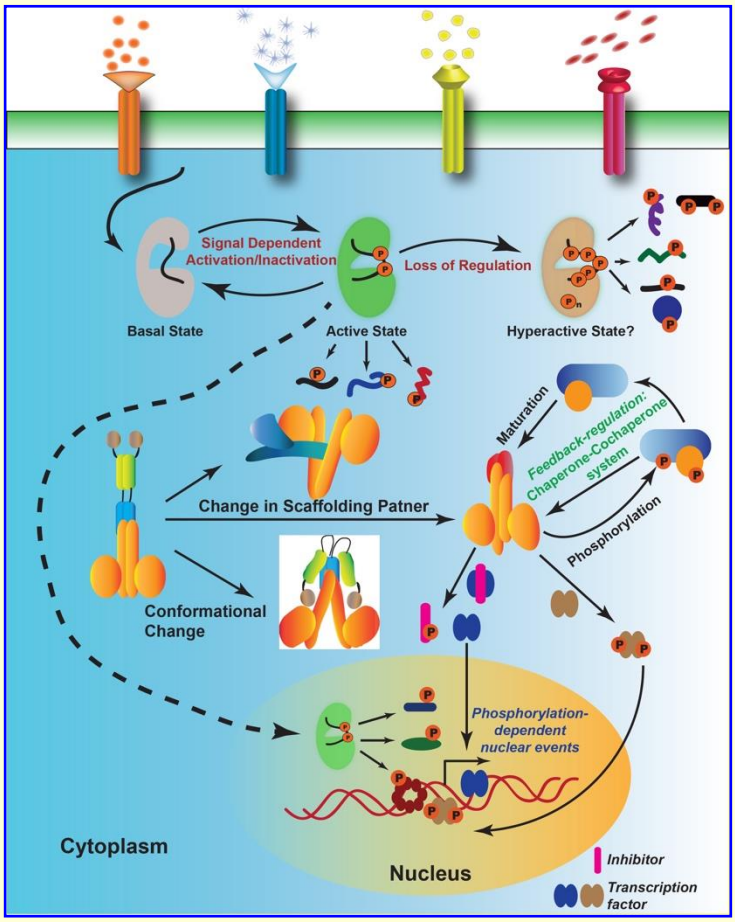
Multicellularity is the most complex form of life. Well-being of multicellular organisms depend upon delicate balance and fine-tuned regulation of inter- and intra-cellular signaling pathways. Eukaryotic Protein kinases (EPKs) and transcription factors are at the centre of attention in the laboratory. EPKs provide the regulatory framework for most, if not all, signaling pathways ineukaryotic cells.They bestow*de novo* physico-chemical properties and functionality to protein substrates by adding phosphate group(s). We work primarily on two modelkinase systems: a) Inhibitor of kappa B Kinases (IKK), gateway to NF-κB activation and b) Dual Leucine Zipper Kinase 1 (DLK1), crucial for axonal regeneration.We primarily use biochemical, chemical and structural biology (mainly CryoEM, and X-ray crystallography) tools to understand the mechanistic details of these kinases, and their scaffolding partners (like NEMO, JIP) and substrates (like p53, IκBα).

Research Highlights/Accomplishments:

- We have established a novel mechanism of phosphorylation by EPKs, not shown before in any EPK.
- Identification of multiple novel substrates of IKK2 *in vitro*.
- Optimization of CryoEM data collection of IKK and other kinases.

Future Plan:

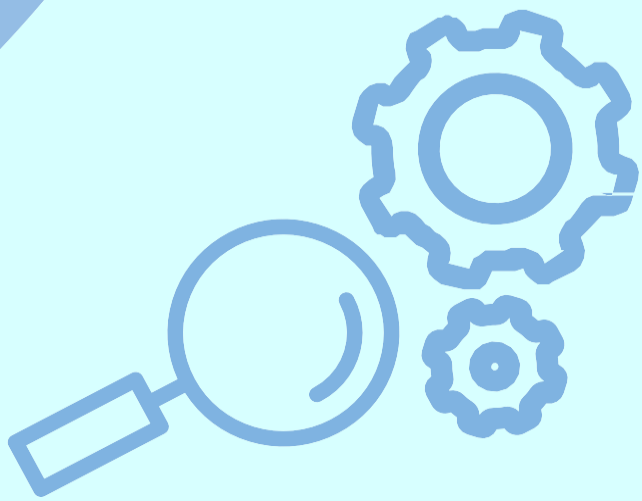
- Determination of CryoEM structures of IKK2.
- Determination of CryoEM structures of TF-nucleosome complexes.
- Study the roles of phosphorylation on the above-mentioned substrates of IKK2.



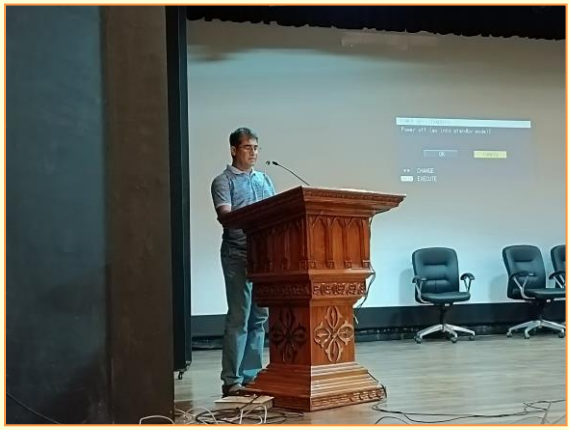
Scientific Activities:

Student Awarded Ph.D.	Publication	Book Chapter / Invited Review	Participation in Conference / Symposia/ Workshop and Delivered Invited Talk	Extramural Funding	Patent Applied/ Granted	Award / Honour / Membership
01	02	00	01	01	00	00

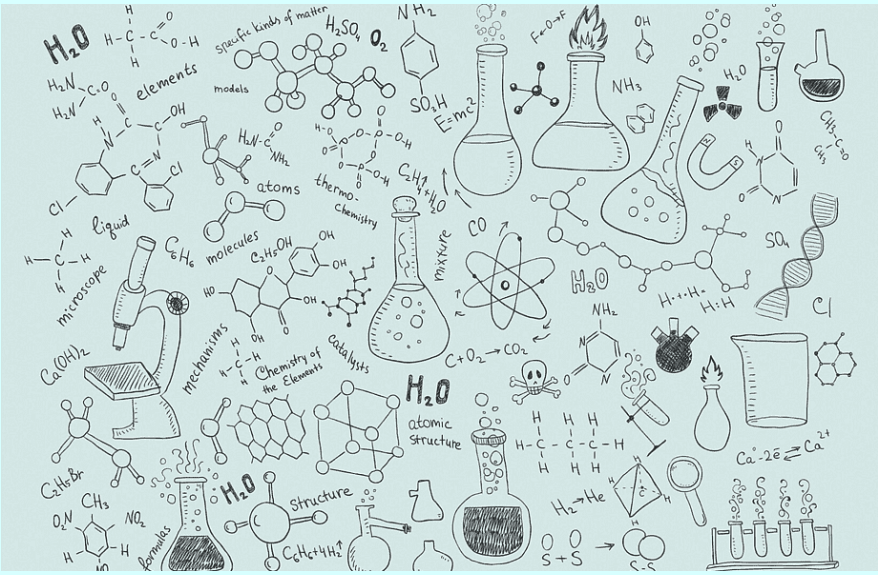
SCIENTIFIC REPORT
DEPARTMENT OF CHEMISTRY



Observation of Plantation, Closing ceremony of Special Campaign 2.0 Rashtriya Ekta Diwas (National Unity Day) and Vigilance Awareness Week



Plantation, Closing ceremony of Special Campaign 2.0, Rashtriya Ekta Diwas (National Unity Day) and Vigilance Awareness Week, observed in Bose Institute, Unified Academic Campus.



Overview

The Department of Chemistry was established in 1917, at the time of inception of the Institute. A major part of Shambhu Nath Dey's seminal work on the discovery of Cholera toxin was performed in this department for which he was nominated for the Nobel Prize. Over the course of time the department has adopted interdisciplinary research using the application of chemical principles to explore biological phenomena.
Present research activities of the department are

- Host-pathogen interaction: *Mycobacterium tuberculosis* and *Helicobactor Pylori*
- Stress response and signaling in *Mycobacterium tuberculosis*
- Recombinant approach to prokaryotic transcription
- Mathematical modeling of signaling pathway.

List of Personnel:

Faculty Members: Prof. Suman Kumar Banik, Prof. Jayanta Mukhopadhyay, Prof. Debaraj Mukherjee.

Senior Scientists: Prof. Joyoti Basu, J. C. Bose National Fellow; Prof. Manikuntala Kundu, CSIR Emeritus Scientist.

Students : JRF/SRF/Project Assistant : Suruchi Lata, Amar Chandra Mahatha, Madhurima Chatterjee, Shreya Bagchi, Debayan Majumder, Tuhin Subhra Roy, Ritu Jaiswal, Sourajit Saha, Aniruddha Tewary, Thurbu Tshering Lepcha, Pankaj Jankiram Birari, Arkajyoti Datta, Soumya Mal, Soumya Mukherjee, Md. Sorique Aziz Momin, Nilanjana Hazra. ***RA :*** Arun Kumar Sharma.

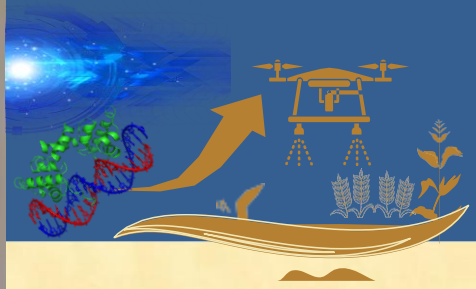
Staff Members: Debarati Kanjilal, Gaurab Kumar Roy, Mrityunjoy Kundu, Asoke Kr. Maity.

West Bengal State Science & Technology Congress

Prof. (Dr.) Uday Bandyopadhyay, Director, Bose Institute was invited and attended West Bengal State Science & Technology Congress on February 28, 2023 at Science City, Kolkata.

Prof. Suman Banik

Professor
Department of Chemistry



Name of the participants:
Tuhin Subhra Roy, SRF
Md. Sorique Aziz Momin, SRF
Dr. Mintu Nandi, IIEST, NPDF
Prof. Sudip Chattopadhyay, IIEST
Prof. Pinaki Chaudhury, CU

Research Background and Vision:

A living system survives in a continuously changing environment. In order to respond to the changes made in the surroundings, each living species has developed specialized gene regulatory networks (GRNs). One of the major functions of a GRN is to efficiently transduce the incoming signal. 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:

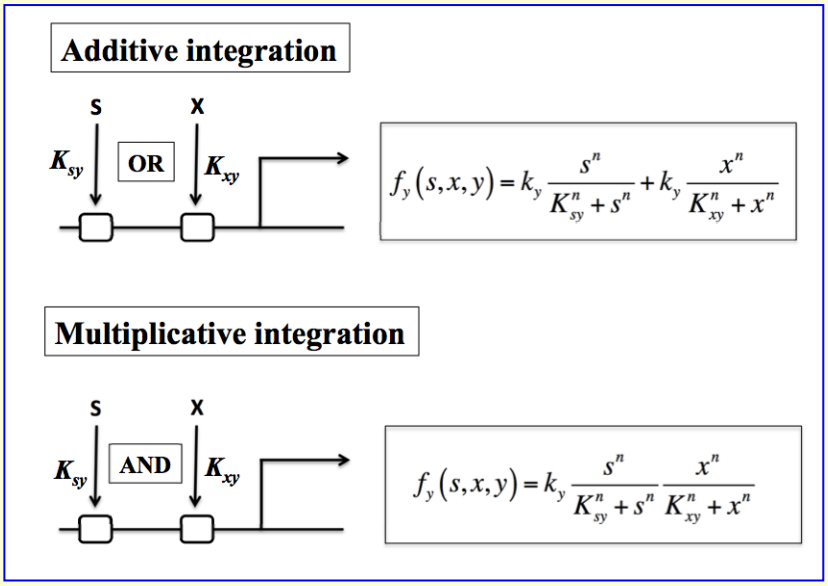
Our lab aims to develop theoretical frameworks to study signal transduction in GRNs using the tools of information theory. The broad focus of our research group is to understand the basis of signal transduction in biochemical networks within the purview of fluctuations in a single cell.

Work Achieved:

- Noise decomposition in coherent feed-forward loop motif.
- High noise profile of C1-FFL.

Future Plan:

- Role of bottleneck noise in two-step cascade.
- Role of sRNA-mRNA interaction in feed-forward loop.



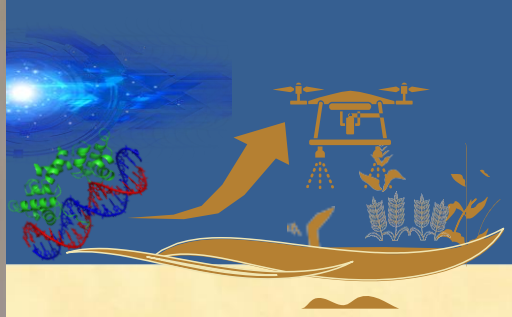
Integration of the upstream components at the promoter of master regulator of feed-forward loop motif. Additive and multiplicative integration mechanism for C1-FFL is shown along with mathematical expression.

Scientific Activities:

Student Awarded Ph.D.	Publication	Book Chapter / Invited Review	Participation in Conference / Symposia/ Workshop and Delivered Invited Talk	Extramural Funding	Patent Applied/ Granted	Award / Honour / Membership
02	00	00	00	00	00	00

Prof. Jayanta Mukhopadhyay

Professor
Department of Chemistry



Research Background and Vision:

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 shown that the binding of RNAP at the promoter stabilizes the transcriptional regulator, δ in *B. subtilis* at the -41 site of the promoter DNA through an interaction with its αCTD and successively facilitates the open complex formation. In another project, we have shown that RFA-1 inhibits RNA polymerase similar way as rifampin by binding to a site different than rifampin.

Research Highlights/Accomplishments:

- Propose a new model of transcription activation by δ of *B. subtilis*that is distinct from the models for Class I and Class II promoters in *E. coli*.
- N-terminal domain of B. subtilis δpossesses nuclease property
- Show that RFA-1 inhibits RNA polymerase similar way as rifampin by binding to a site different than rifampin.

Future Plan:

- Develop a chimeric RNA polymerase of *E. coli* that could function with B. subtilis δ.

- Identify the promoters of sigma factors of M. tuberculosis by SELEX.
- Study the sigma cycle in M. tuberculosis.

List of International and National Collaboration:

- Prof Graham Stuart, University of Surrey, UK, Project: ADP-ribosylation of DNA in Mycobacterium tuberculosis.

Scientific Activities:

Student Awarded Ph.D.	Publication	Book Chapter / Invited Review	Participation in Conference / Symposia/ Workshop and Delivered Invited Talk	Extramural Funding	Patent Applied/ Granted	Award / Honour / Membership
01	01	00	02	02	00	00

Prof. Debaraj Mukherjee

Professor
Department of Chemistry

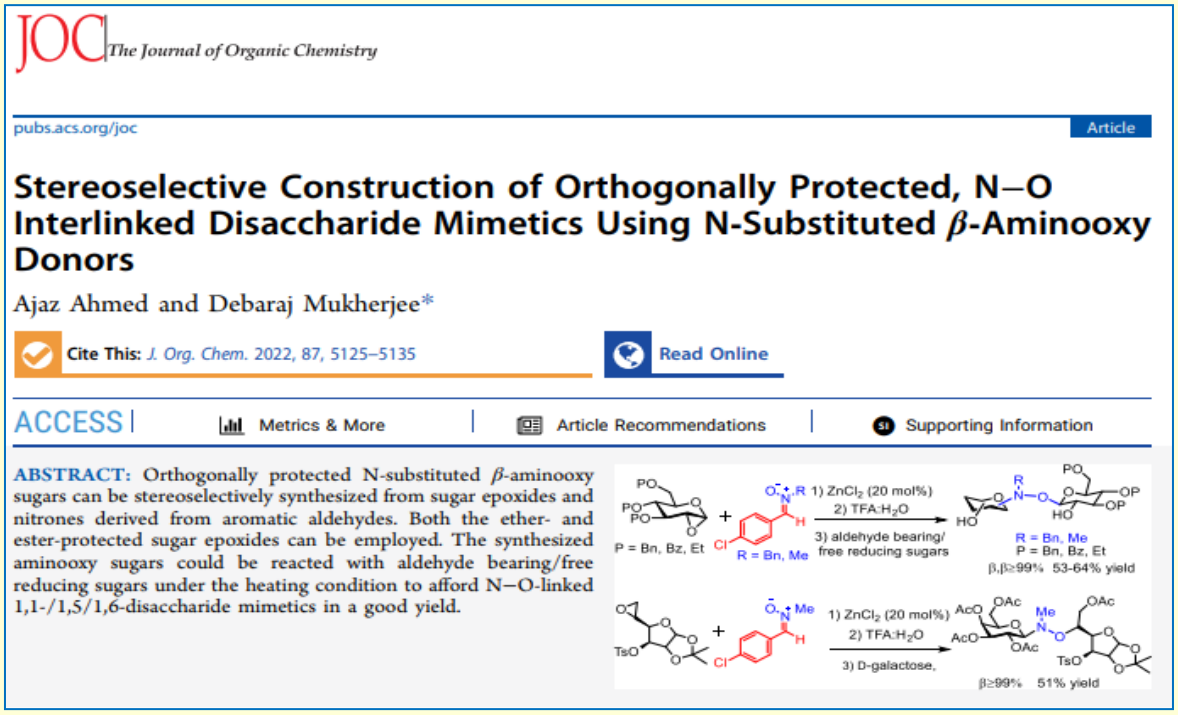
Name of the participants:
Sanchari Kundu
Mr. Ajaz Ahmed
Irshad Ahmed
Junaid Shafi Banday
Norein Sakandar
Bisma Rasool

Research Background and Vision:

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 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.

Summary of Research:

Some novel methods for glycosylation using sugar enol ethers as starting material have been developed and applied for the synthesis of fragments of anticancer antibiotics (Fig 1), medicinally important 2-deoxy-3-thio glycosides (Fig 2, 3). Further, sugar enol ethers were successfully employed for the stereo-divergent synthesis of fragments of the antiinflammatory drug Chafuroside-A (Fig 4), bioactive bicyclic pyran fused furanose scaffold (Fig 5) ,and C-2 homopyranose nucleoside (Fig 6).



JOC The Journal of Organic Chemistry

pubs.acs.org/joc Article

Stereoselective Construction of Orthogonally Protected, N–O Interlinked Disaccharide Mimetics Using N-Substituted β-Aminooxy Donors

Ajaz Ahmed and Debaraj Mukherjee*

Cite This: J. Org. Chem. 2022, 87, 5125–5135 Read Online

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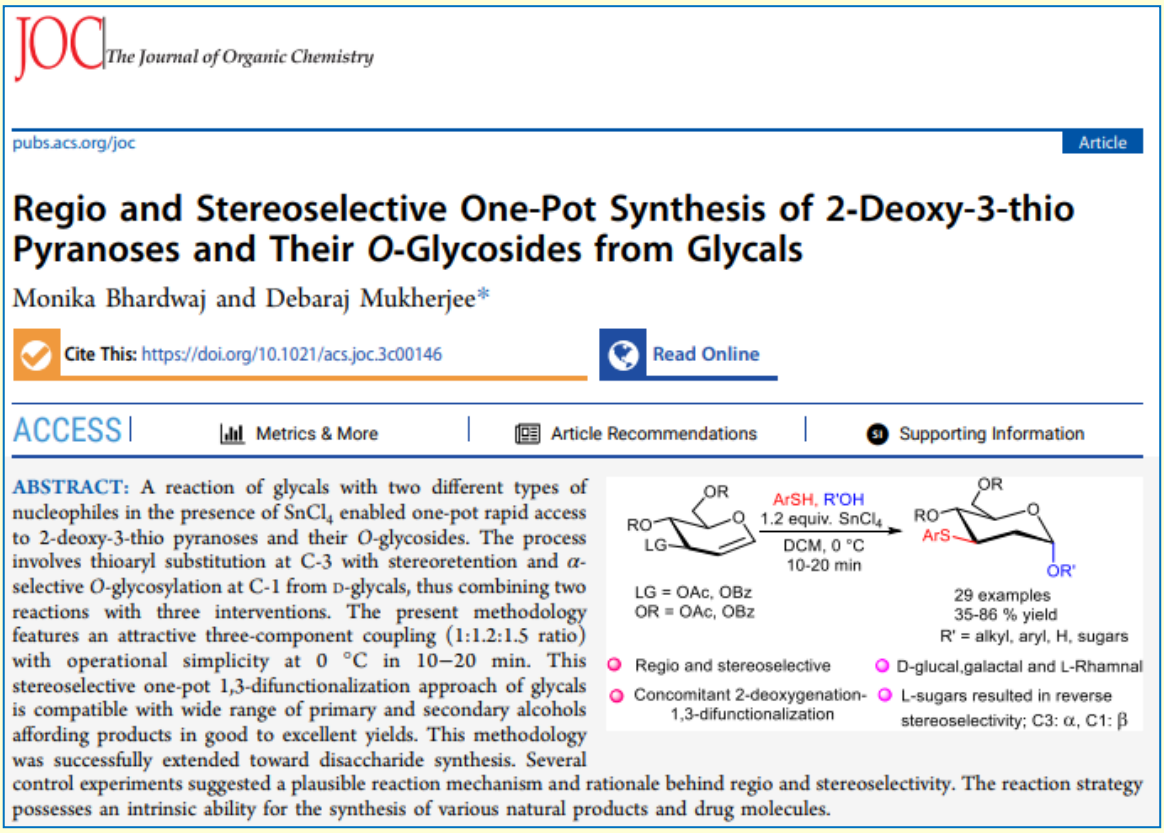
ABSTRACT: Orthogonally protected N-substituted β-aminooxy sugars can be stereoselectively synthesized from sugar epoxides and nitrones derived from aromatic aldehydes. Both the ether- and ester-protected sugar epoxides can be employed. The synthesized aminooxy sugars could be reacted with aldehyde bearing/free reducing sugars under the heating condition to afford N–O-linked 1,1-/1,5/1,6-disaccharide mimetics in a good yield.

Figure 1. The synthesis of N-O linked amino sugars



JOC The Journal of Organic Chemistry

pubs.acs.org/joc Article

Regio and Stereoselective One-Pot Synthesis of 2-Deoxy-3-thio Pyranoses and Their *O*-Glycosides from Glycals

Monika Bhardwaj and Debaraj Mukherjee*

Cite This: https://doi.org/10.1021/acs.joc.3c00146 Read Online

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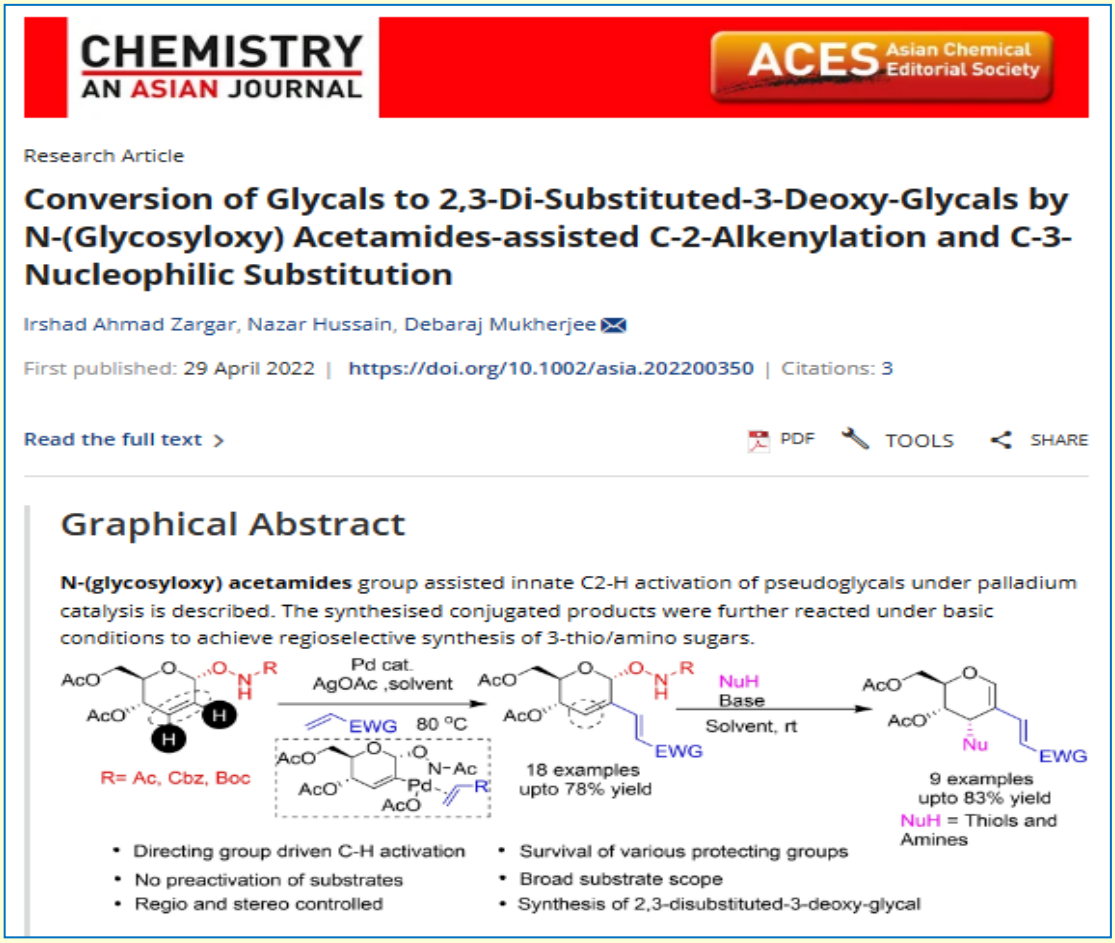
ABSTRACT: A reaction of glycals with two different types of nucleophiles in the presence of $SnCl_4$ enabled one-pot rapid access to 2-deoxy-3-thio pyranoses and their *O*-glycosides. The process involves thioaryl substitution at C-3 with stereoretention and α-selective *O*-glycosylation at C-1 from D-glycals, thus combining two reactions with three interventions. The present methodology features an attractive three-component coupling (1:1.2:1.5 ratio) with operational simplicity at 0 °C in 10–20 min. This stereoselective one-pot 1,3-difunctionalization approach of glycals is compatible with wide range of primary and secondary alcohols affording products in good to excellent yields. This methodology was successfully extended toward disaccharide synthesis. Several control experiments suggested a plausible reaction mechanism and rationale behind regio and stereoselectivity. The reaction strategy possesses an intrinsic ability for the synthesis of various natural products and drug molecules.

Figure 2. One-pot synthesis of 2-Deoxy-3-thio Pyranoes



CHEMISTRY AN ASIAN JOURNAL

ACES Asian Chemical Editorial Society

Research Article

Conversion of Glycals to 2,3-Di-Substituted-3-Deoxy-Glycals by N-(Glycosyloxy) Acetamides-assisted C-2-Alkenylation and C-3-Nucleophilic Substitution

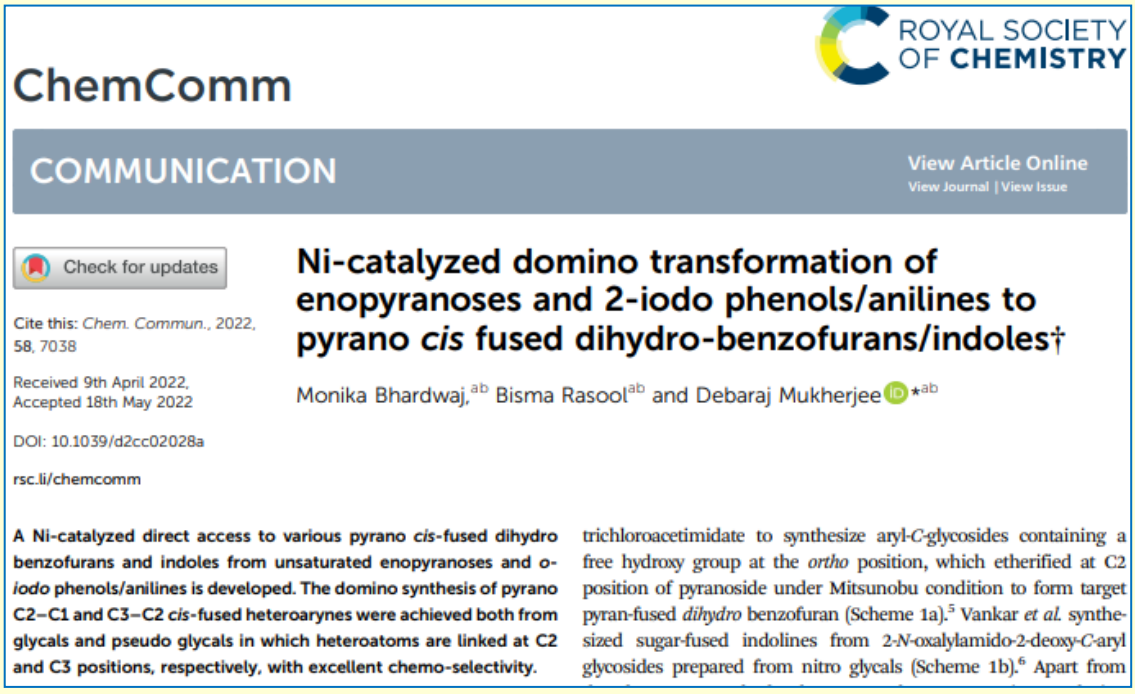
Irshad Ahmad Zargar, Nazar Hussain, Debaraj Mukherjee

First published: 29 April 2022 | https://doi.org/10.1002/asia.202200350 | Citations: 3

Graphical Abstract

N-(glycosyloxy) acetamides group assisted innate C2-H activation of pseudoglycals under palladium catalysis is described. The synthesised conjugated products were further reacted under basic conditions to achieve regioselective synthesis of 3-thio/amino sugars.

Figure 3. Synthesis of C-2-Alkenylation and C-3-Nucleophilic substitution



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Cite this: *Chem. Commun.*, 2022, 58, 7038

Received 9th April 2022,
Accepted 18th May 2022

DOI: 10.1039/d2cc02028a

rsc.li/chemcomm

Ni-catalyzed domino transformation of enopyranoses and 2-iodo phenols/anilines to pyrano *cis* fused dihydro-benzofurans/indoles†

Monika Bhardwaj,[ab] Bisma Rasool[ab] and Debaraj Mukherjee *[ab]

A Ni-catalyzed direct access to various pyrano *cis*-fused dihydro benzofurans and indoles from unsaturated enopyranoses and *o-iodo* phenols/anilines is developed. The domino synthesis of pyrano C2–C1 and C3–C2 *cis*-fused heteroarynes were achieved both from glycals and pseudo glycals in which heteroatoms are linked at C2 and C3 positions, respectively, with excellent chemo-selectivity.

trichloroacetimidate to synthesize aryl-*C*-glycosides containing a free hydroxy group at the *ortho* position, which etherified at C2 position of pyranoside under Mitsunobu condition to form target pyran-fused *dihydro* benzofuran (Scheme 1a).[5] Vankar *et al.* synthesized sugar-fused indolines from 2-*N*-oxalylamido-2-deoxy-*C*-aryl glycosides prepared from nitro glycals (Scheme 1b).[6] Apart from

Figure 4. The domino synthesis of pyrano C2-C1 and C3-C2 cis-fused heteroarnes.

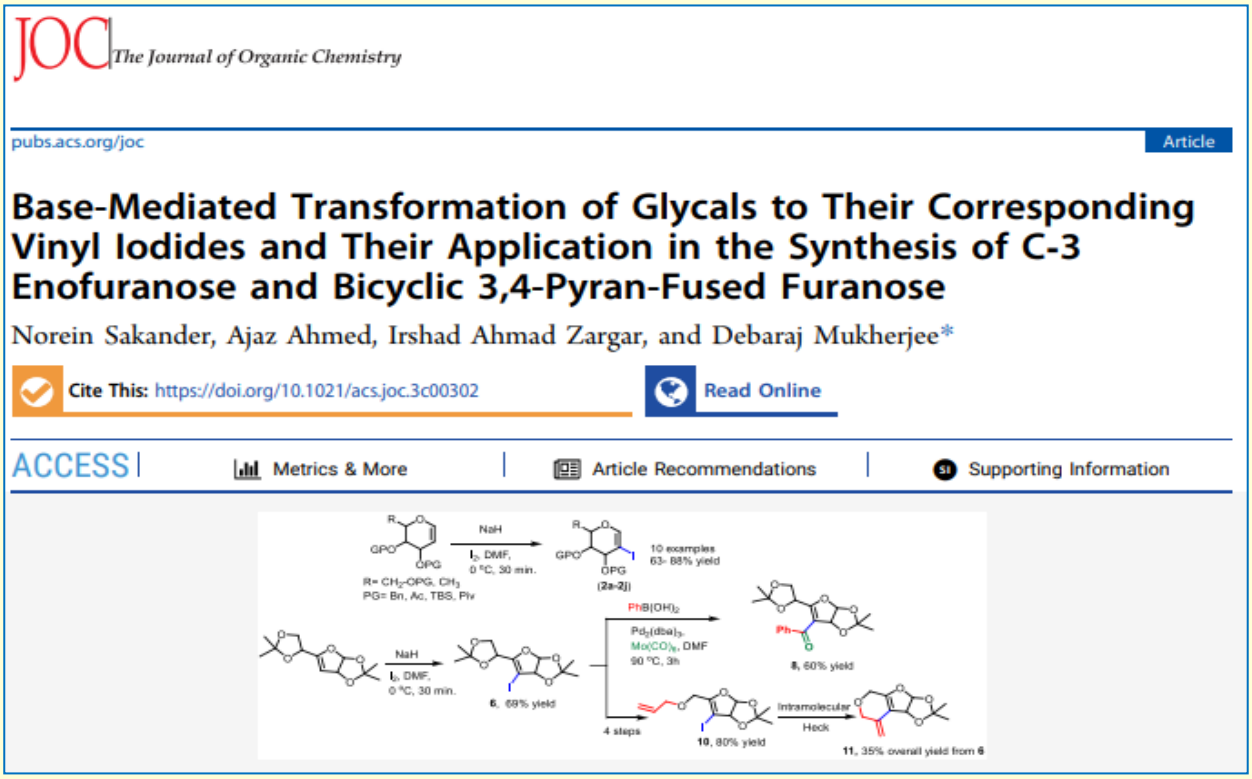


Figure 5. Synthesis of C-3-Vinyl Iodide and its application

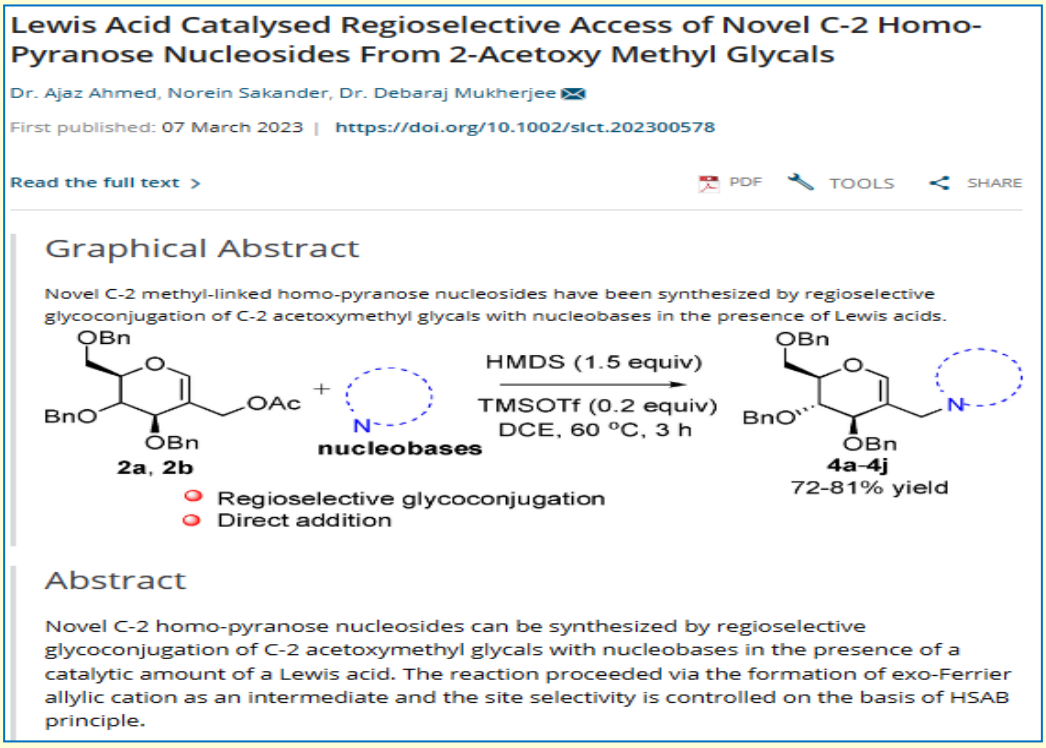


Figure 6. Explore of C-2 Homo-Pyranose nucleosides

Medicinal and Natural Product Chemistry

A novel plant-based lead molecule that can act against acute lung injury was developed from the modification of labdane-type natural product andrographolide (Fig 9). A rare anticancer antibiotic from Streptomyces sp. was isolated, characterized, and evaluated against MCF-7 and HCT-116 invitro, and 4T1 cell in-vivo (Fig 7). In a separate project design, Synthesis, biological investigations and molecular interactions of triazole linked tacrine glycoconjugates was carried out to develop an acetylcholinesterase inhibitor with reduced hepatotoxicity (Fig 8).

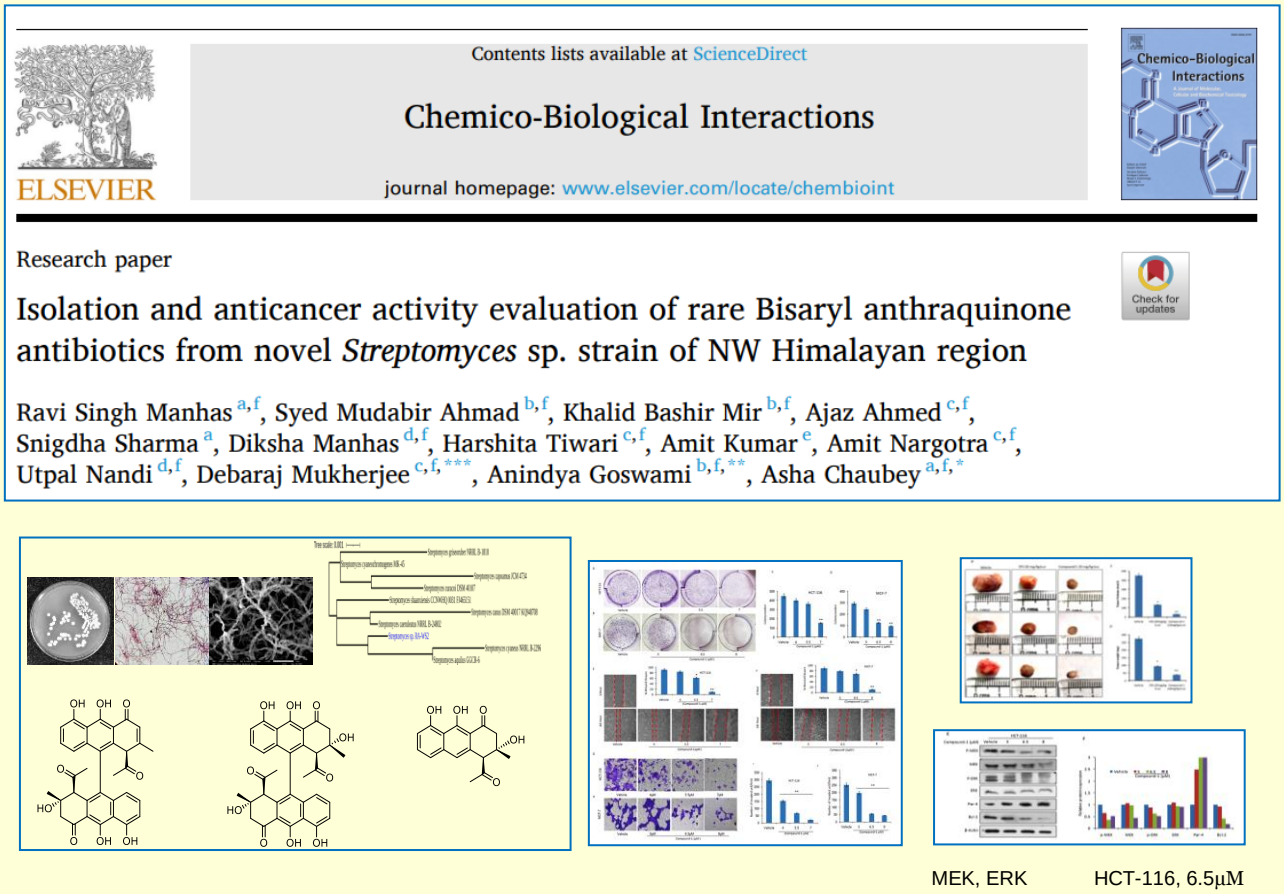


Figure 7. A rare anticancer antibiotic from Streptomyces sp. was isolated, characterized, and evaluated against MCF-7 and HCT-116 invitro, and 4T1 cell in-vivo

Bioorganic Chemistry 118 (2022) 105479

Contents lists available at ScienceDirect

Bioorganic Chemistry

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

Design, Synthesis, biological investigations and molecular interactions of triazole linked tacrine glycoconjugates as Acetylcholinesterase inhibitors with reduced hepatotoxicity

Harmandeep Kaur Gulati [a,1], Sushil Choudhary [c,e,1], Nitish Kumar [a,b], Ajaz Ahmed [d,e], Kavita Bhagat [a], Jatinder Vir Singh [a], Atamjit Singh [a], Ajay Kumar [c], Preet Mohinder Singh Bedi [a,b], Harbinder Singh [a], Debaraj Mukherjee [d,e,*]

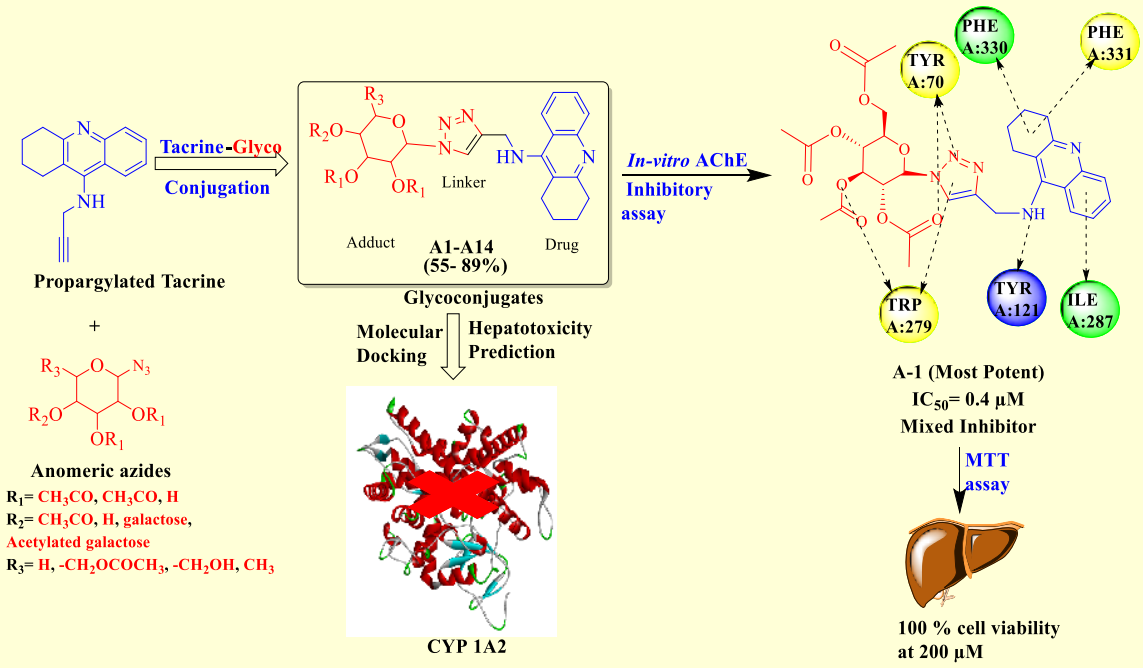


Figure 8. Design, Synthesis, biological investigations and molecular interactions of triazole linked tacrine glycoconjugates was carried out to develop an acetylcholinesterase inhibitor with reduced hepatotoxicity.

Journal of Molecular Structure 1286 (2023) 135568

Contents lists available at ScienceDirect

Journal of Molecular Structure

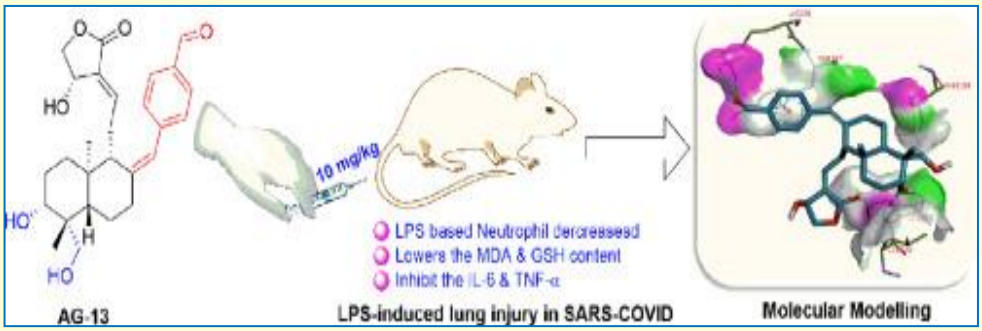
journal homepage: www.elsevier.com/locate/molstr

Stereoselective and regioselective Heck arylation at C-17 exocyclic double bond of andrographolide to generate labdane-based lead molecule against acute lung injury

Amit Kumar [a,b,2], Abhishek Gour [c,d,2], Sumit Dhiman [c], Nandagopal Hudait [e], Puneet Kumar [a,d], Deepika Vashishth [a], Sarabjit Kaur [b], Sheikh Tasduq Abdullah [c,d], Utpal Nandi [c,d], Debaraj Mukherjee [a,d,e,*,1]

[a] Natural Product and Medicinal Chemistry Division, CSIR-Indian Institute of Integrative Medicine, Jammu, 180001, India
[b] Department of Pharmaceutical Sciences, Guru Nanak Dev University, Amritsar, 143005, India
[c] Pharmacology Division, CSIR-Indian Institute of Integrative Medicine, Jammu, 180001, India
[d] Academy of Scientific and Innovative Research (AcSIR), Ghaziabad, 180001, India
[e] Department of Chemistry Unified Academic Campus Bose Institute EN-80, Sector V Bidhan Nagar Kolkata, 700 091, India

Graphical Abstract



Keywords:
Andrographolie
Heck arylation
Acute lung injury
Natural product
Semi-synthetic modification

Figure 9. The modification of labdane-type natural product andrographolide

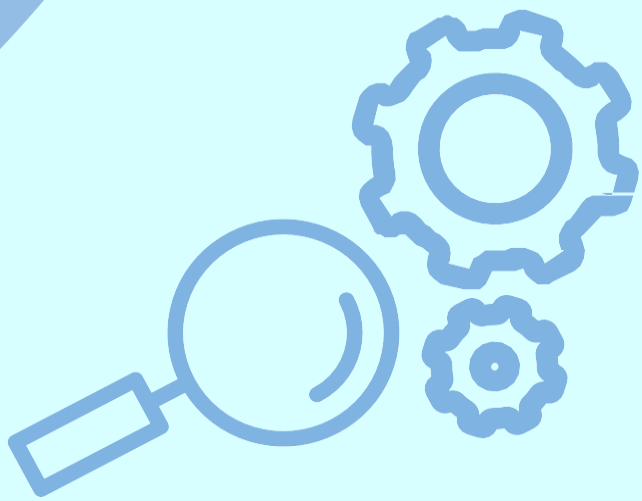
Future Plan:

- Synthesis of Asymmetric 1,2-Interlinked C-disaccharides.
- Metal-free stereoselective access to 1-3 and 1-1 S/O linked disaccharides.
- Synthesis of 2-halo-2-deoxy nucleoside directly from glycals and their invitro screening on The Japanese Encephalitis Virus.

Scientific Activities:

Student Awarded Ph.D.	Publication	Book Chapter / Invited Review	Participation in Conference / Symposia/ Workshop and Delivered Invited Talk	Extramural Funding	Patent Applied/ Granted	Award / Honour / Membership
01	11	02	02	00	00	01

SCIENTIFIC REPORT
ENVIRONMENTAL SCIENCES SECTION



One-Day School Students Visit Program

A One -Day program of visit of school students to the Unified Academic Campus and Main Campus, Bose Institute on September 6, 2022 under Scientific Social Responsibility (SSR) activities of SERB, DST, Govt. of India, proposed by Dr. Sanat Kumar Das, Associate Professor, Environmental Sciences Section, Bose Institute.

Overview

Environmental sciences section (ESS) was established in 1992. The ESS is working focusing on the local and regional air quality, air pollutants, chemical and physical atmospheric changes, and the regional climate change emphasizing on the eastern parts of Himalayas. Regular basis ground-based observation and monitoring are going on over different atmospheric environments at different strategic locations like high altitude Himalayan station, Darjeeling; typical urban metropolis, Kolkata; semi-urban atmosphere at Shyamnagar (north-24 pgs) and rural atmosphere over Falta near the coast of Bay of Bengal (south 24 pgs). ESS is also engaged in studying long-term variabilities in the atmospheric levels of several gaseous and particulate air pollutants along and across the Indo-Gangetic Plains collaborating with other institution/universities/organizations. ESS is also engaged in several national network program like "National carbonaceous Aerosol Program" of MoEFCC, "National Network Programme on Climate Change & Aerosol" of DST, "Biosphere-atmosphere exchange of Greenhouse gases (Metflux) of MoES, and a national mission of Govt. of India called "National Clean Air Mission" by MoEFCC. Because of the well expertise, knowledge and experience of the ESS in the field of atmospheric science, Bose Institute has been selected as the Nodal Institute and the Institute of Repute (IoR) in West Bengal for the National Clean Air Mission.ESS organizes several on-board ship experiments over the Bay of Bengal, Arabian Sea, Indian Ocean, and Southern Ocean for investigation of marine aerosols.

List of Personnel:

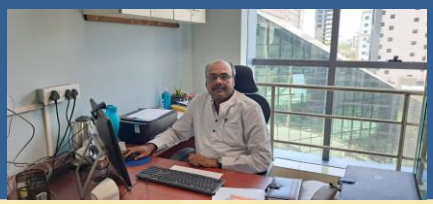
Faculty Members: Prof. Sanjay K. Ghosh (Chairman), Dr. Abhijit Chatterjee and Dr. Sanat K. Das.

Students: RA/SRF/JRF/Project Associate : Abhinandan Ghosh, Monami Dutta, Sauryadeep Mukherjee, Sabyasachi Majee, Dr. Debajyoti Ray, Dr Chirantan Sarkar, Shahina R. Shaikh, Piyal Halder.

Staff Members : Dr. Anandamay Adak.

Swacchta Pakhwada 2022

Bose Institute observed Swacchta Pakhwada 2022 in all its Campuses on May 02, 2022.



Dr. Abhijit Chatterjee

Associate Professor
Environmental Sciences Section

Name of the participants:
Dr. Abhinandan Ghosh, Ph.D awarded
Monami Dutta, SRF
Sauryadeep Mukherjee, SRF
Soumen Raul

M.Sc dissertation:
Miss Arunima Bhowmik, Department of Environmental Science, Asutosh College, Calcutta University

Collaborators:

i) National:

Dr Tuhin Kumar Mandal, Principal Scientist, NPL, New Delhi
Dr Sudhir Kumar Sharma, Senior Scientist, NPL, New Delhi
Prof Chandra Venkataraman, IIT, Bombay
Prof. Tarun Gupta, IIT, Kanpur
Prof. Mukesh Sharma, IIT, Kanpur
Prof S. N. Tripathi, IIT, Kanpur
Dr. Sachin Gunthe, IIT, Madras

ii) International:

Prof James Schauer, University of Wisconsin-Madison, USA
Prof. Benjamin de Foy, St Louis University, USA
Prof. Michael H. Bergin, Duke University, USA

Research Background and Vision:

My research activities during April 2022-march 2023 have been focused on the following:

A) ***Exploring eastern Himalaya:*** Understanding the aerosol pollution and air quality through long-term studies; Exploring the role of biogenic emissions from coniferous forest cover in cloud droplet formation; Source apportionment of ultrafine atmospheric aerosols; Ultrafine aerosol chemistry over Himalayan atmosphere

B) Aerosols characterization over tropical urban and semi-urban atmosphere at eastern Indo-Gangetic Plain (IGP): Major sources of aerosols using ^{13}C isotopes

C) Lab-based/chamber study on aerosol chemistry and physics: Photo-thermal efficiency of nascent and aged carbon particles sitting within water drops

D) India's aerosol pollution: Long-term trend (15 years), current scenario and future prediction: State-level study

E) Framing policies and strategies for air pollution mitigation over Kolkata metropolis under national Clean Air Program, Govt. of India.

Research Highlights/Accomplishments:

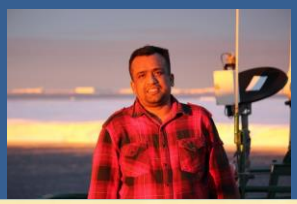
- A 20-years long-term study shows the paradigm shift in major sources of aerosol pollution over different states in India; Coastal states in India are going to be severely polluted in near future if no measures are taken, reducing the capacity of thermal power plant emissions alone could bring some vulnerable states into safe zone
- In absence of fossil fuel emissions, biogenic gases (VOCs) emitted from the Himalayan forest cover get easily oxidized by ozone and form ultrafine water-soluble organic aerosols. These aerosols have been found to be extremely good cloud condensation nuclei
- We observed that ultrafine and freshly emitted nascent carbon particles have 3-5 times higher photo-thermal efficiency compared to larger and aged carbon particles embedded within water droplets. This shows extremely important climatic implication in the context of light absorption by cloud particles while scavenging different types of carbon particles.

Future Plan:

- Aerosol pollution over Indo-Gangetic Plain and its effect on Himalayan Glaciers: Their temporal long-term variability, climatic implication and paradigm shift in river flow over Himalayan regions
- Finding the major factors for cloud droplet formation: Size of aerosols or chemistry of aerosols?
- Micro-level air pollution studies over Kolkata emphasizing the investigation on the slum areas: Sources or Sinks of carcinogenic aerosols and associated health risks

Scientific Activities:

Student Awarded Ph.D.	Publication	Book / Invited Review	Participation in Conference / Symposia/ Workshop and Delivered Invited Talk	Extramural Funding	Patent Applied/ Granted	Award / Honour / Membership
01	12	01	05	01	00	00



Dr. Sanat Kumar Das

Associate Professor
Environmental Sciences Section

Name of the participants:
Shahina Raushan Saikh
Abu Mushtaque
Antara Pramanick
Jashvant Kumar Prasad

Research Background and Vision:

The curiosity of knowing the weather is undoubtedly increasing day-by-day and therefore, accurate weather prediction is on demand. However, pollution plays a major role in creation of large uncertainty in the results obtained from different atmospheric models. The reason is uncontrolled and continuous changing its quantity and characteristics. As a result, a large fluctuation is observed in model predictions. The main objective of our investigation is the improvement of present understanding of alteration of cloud-precipitation system that changes the climate as well as agricultural system and thereby, ultimately affects our country's economy. In my lab, our research focuses on aerosols induced global warming, perturbation of cloud formation, and aggravation of air quality index that effects on human health. In recent years, our efforts on meteorological dependency on the variation of diversity of airborne microorganism will help for better understanding of bioaerosols' effect on life.

Research Highlights/Accomplishments:

- A movement of air-borne microorganisms over Indo-Gangetic Plain along with pollution-haze has been reported from west to east in winter
- Unique bacteria belonging 30% of the whole population are detectedin foggy atmosphere over Indo-Gangetic Plain due to plenty available of water droplets and nutrients in air.
- More than one-third of the air-borne bacteria growing only in foggy conditions are identified to be pathogenic, mainly targeting human respiratory and oral organs, and skin.

Future Plan:

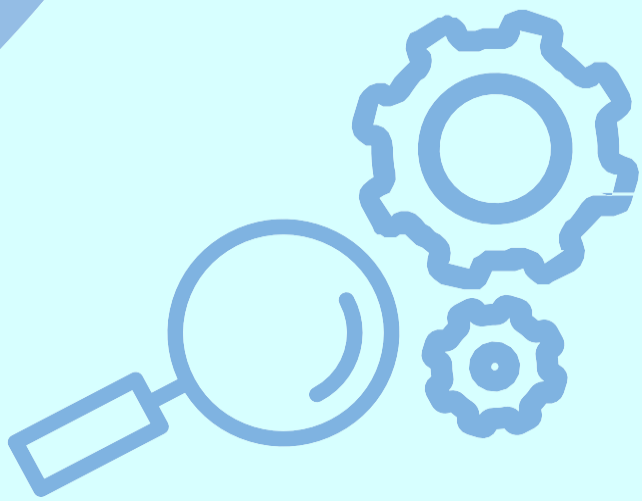
- What are types of air-borne, cloud-borne and rain-borne bioaerosols dominating over Eastern India that are responsible for its biodiversity from Himalayas to Sundarban?
- How do the microorganisms transported from Indian continental region to the Bay of Bengal?
- How much do different types of source of carbonaceous aerosols contribute towards regional warming over the Himalayas?

Figure: Atmospheric team of Bose Institute at Chulkathi island, the south-most island within Sundarban reserve mangrove forest during sample collection period in winter

Scientific Activities:

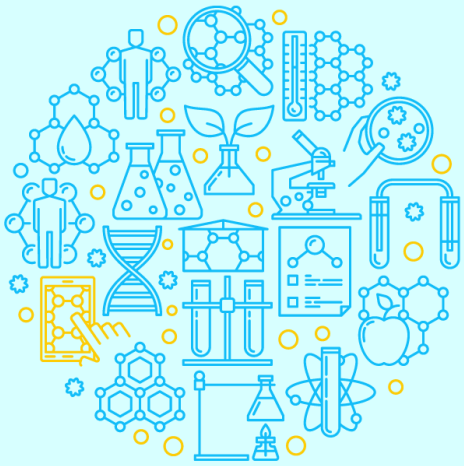
Student Awarded Ph.D.	Publication	Book Chapter / Invited Review	Participation in Conference / Symposia/ Workshop and Delivered Invited Talk	Extramural Funding	Patent Applied/ Granted	Award / Honour / Membership
00	03	00	07	02	00	00

SCIENTIFIC REPORT
DEPARTMENT OF MICROBIOLOGY



Observation of Constitution Day

Pledge taking ceremony at Unified Academic Campus, Bose Institute to observe the "Constitution Day" on November 26, 2022.



Overview

The Department of Microbiology was founded in 1942, not only as one of the first of its kind in India but in this subcontinent too, being a part of the century old Bose Institute. During early years, this department was very actively engaged in the area of antibiotic research. Later in the second half of last century, the main focus was industrial Microbiology, primarily on fermentation technology, mutational research and microbial bioleaching of mineral ores. However, with time, this department engaged both in applied and basic research and had addressed various problems in the area of infection biology, biocatalysis, drug design and detoxification apart from plant-microbe and mineral-microbe interactions. Currently this department is devoted to understand various aspects of microbiological processes in planetary health, environmental restoration and pathogenesis.

- Management of *Mycobacterium tuberculosis* with the perception of the molecular biology and metabolism of the TB pathogen, using its phages and plasmids as model systems, tools and probes. Strategic combating approaches include 'Phage inspired antibiotics for mycobacteria' and CRISPR-Cas9-based editing of genes for the down regulation enzymes inhibiting the growth of mycobacteria.
- Genomic and proteomic approaches to understand bacterial metabolism of health hazard aromatic pollutants, regulation of gene expression and *in silico* analyses of biomolecular evolution. Development of biosensors and bioprospecting of novel compounds from plant and microbe, besides studies on gut and environmental metagenome and understanding of host-pathogen relationships are the key strategic schemes of research.
- Studies on the molecular biology of sulfur-chemolithotrophic prokaryotes and their evolutionary dynamics to reveal opportunities and constraints of *in situ* metabolisms, and geochemical manifestations of the microorganisms of the Carbon-Sulfur-cycle within microbiomes of extreme environments that have active interfaces with the Earth's geological processes.

List of Personnel:

Faculty Members: Prof. Tapan Dutta (Chairman), Dr. Wriddhiman Ghosh.

Students : JRF/SRF: Shrestha Ghosh, Sabyasachi Bhattacharya, Apurba Sarkar, Subhrangshu Mandal, Moidu Jameela Rameez, Moushumi Bhattacharyya, Poulami Ghosh, Madhu Manti Patra, Saikat Deb, Megha Chakraborty, Rahul Shaw, Anik Barman, Mriganka Munshi Karmakar, Nibendu Mondal, Suman Basu, Rinita Dhar, Jagannath Sarkar, Sumit Chatterjee, Subhajit Dutta. ***RA :*** Dr. Avijit Das, ***Women Scientist :*** Dr. Madhumita Roy, Dr. Shreya Sengupta.

Staff Members: Prabir Kumar Haldar, Debashis Sarkar, Rabin Paul, Narayan Patali.

Research Scholar's Symposium 2022

Bose Institute organized Poster and Oral Session on Research Scholar's Symposium 2022 on "Recent Trends in Natural Sciences" during November 28 - 29, 2022, at Unified Academic Campus, Bose Institute.

Prof. Tapan Dutta

Professor
Department of Microbiology

Name of the participants:
Mousumi Bhattacharyya, SRF
Saikat Deb, SRF
Mriganka Munshi Karmakar, SRF
Megha Chakraborty, SRF
Suman Basu, SRF
Rinita Dhar, SRF

Research background and Vision:

The extensive exploitation of natural resources, urbanization, industrialization, mining, and exploration are at the forefront of global environmental pollution;"global warming", "acid rain", "global greenhouse gas emission", "high rate of morbidity and premature mortality" are the few by-products of so-called economic development behind the greedy needs of human. Microbial bioremediation of the toxic chemicals is an efficient tool harbouring exclusive and robust catabolic potentials in the degradation of a plethora of pollutants under eco-friendly conditions and offers solutions in combating pollution for sustainable environment and in health management. The cumulative information on microbial remediation processes, with respect to catabolic pathways, gene regulation, enzyme evolution and bioreporter-based detection of pollutants, can provide a wide window in evaluating key areas on environmental management. Moreover, the escalating field to synthesize the current knowledge on host pathogen relationships and therapeutic microbiology from extensive genomic and proteomic data assist to unveil the concept of pathogenesis in order to obstruct the health hazards of host.

Research Highlight/Accomplishment:

- Various bacterial strains belonging to the different genera were isolated capable of utilizing an array of endocrine-disrupting phthalate diesters, including butyl benzyl phthalate (BBP), di-*n*-octyl phthalate (DnOP) and its isomer di(2-ethylhexyl) phthalate (DEHP). In order to reveal their catabolic diversity and metabolic versatility, biochemical analysis of specific phthalate-degrading metabolic pathways in individual strains was evaluated by means of various chromatographic, spectrometric, and enzymatic analyses. Further, the genetic arrangement and

differential expression of involved putative catabolic genes/gene-clusters were unveiled based on the *de novo* whole genome sequence information and substrate-induced protein profiling by LC-ESI-MS/MS analysis followed by differential gene expression by RT-PCR and transcriptome analysis. Subsequently, the gene knockout experiments of key catabolic enzyme(s) validated the role and inducible regulation of the specific genes and operons in the assimilation of definite phthalate esters, eventually leads to the emerging interest of developing biosensor strains.

- A drug-sensitive *Pseudomonas aeruginosa* strain isolated from a high-altitude virgin soil sample showed a broad range of antibacterial activity against Gram-positive and Gram-negative bacteria. The antimicrobial compound, purified by affinity chromatography, ultrafiltration, and high-performance liquid chromatography, showed a molecular weight $(M + H)^+$ of 494.7667 daltons, as revealed by ESI-MS analysis. The MS-MS analysis divulged the compound as an antimicrobial pentapeptide and was further verified by evaluating the antimicrobial activity of the chemically synthesized pentapeptide. The extracellularly released pentapeptide, which is relatively hydrophobic in nature, is encoded in a symporter protein, as appraised from the whole genome sequence analysis of the strain. The influence of different environmental factors was examined to determine the stability of the antimicrobial peptide (AMP), which was also assessed for several other biological functions, including antibiofilm activity. Further, the antibacterial mechanism of the AMP was evaluated by a permeability assay.
- In another study, both culture-based and metagenomic approaches were used to detect rear gut isolates of Hilsa (*Tenualosa ilisha*, an anadromous fish), captured from both freshwater and seawater to investigate the community structure of intestinal microbiota. Culture-dependent approach allowed to isolate a total of 23 distinct bacterial species comprising of sixteen Gram negative, and seven Gram positive isolates, capable of producing various food digesting/processing enzymes, complementing physiological needs of host. While metagenomic approach explored a wide range of important gastro intestine-associated bacteria, primarily dominated by Proteobacteria, Firmicutes and Bacteroidetes. Importantly, a combination of both these approaches permitted to assess the gastrointestinal-associated bacterial diversity and their functional potential in one of the most preferred nutritious dietary fishes. Apart from microbial diversity, omega-3-fatty acids producing gene named *desA* was selected for cloning and purification from whole metagenome data. Exploration of metagenome data using various bioinformatics tools will facilitate functional characterization of various important enzymes and/or biosynthetic pathways of omega-3-fatty acids and flavors that are among the major future objectives.
- In another endeavour, to disclose the catabolic diversity and metabolic cross-talk between a different aromatic hydrocarbon degrading bacteria, biochemical and multi-omics approaches were employed to study the metabolism of benzonitrile and its hydroxyl derivatives (2-, 3-, and 4-hydroxybenzonitriles in a naphthalene degrading *Burkholderia* sp. strain BC1. This metabolic architecture and associated cross-talk events are being evaluated by analysing the differential gene expression and the induction profiles of respective catabolic pathway enzymes of individual pathways *vis-a-vis* substrate specificities, whereas, genomic and transcriptomic approaches are underway to unfold the processes.

Aims & Objectives:

- Unfolding of complex catabolic regulation in sphingomonads and development of whole cell chromosomal biosensor strain to detect hazardous polycyclic aromatic hydrocarbons.
- *Estrogenic phthalate-sensing bacterial biosensors in health and environment*.
- Functional characterization of various enzymes of interest from metagenome data of hilsa.

- Evaluation of metabolic architecture and associated cross-talk events in the bacterial degradation aromatic nitriles.

Future Plan:

- Evaluation of catabolic regulation of multiple PAHs-degrading modules in *Sphingobium* sp..
- Development of PAHs and estrogenic phthalates-sensing chromosomally manipulated biosensor strain..
- Characterization of important enzymes from hilsa metagenome and appraisal of catabolic architectures in the degradation of aromatic nitriles.

Scientific Activities:

Student Awarded Ph.D.	Publication	Book Chapter / Invited Review	Participation in Conference / Symposia/ Workshop and Delivered Invited Talk	Extramural Funding	Patent Applied/ Granted	Award / Honour / Membership
00	04	00	00	00	00	00

Dr. Wriddhiman Ghosh

Associate Professor
Department of Microbiology

Name of the participants:
Mahamadul Mondal, JRF
Nibendu Mondal, SRF.
Jagannath Sarkar, SRF
Sumit Chatterjee, SRF
Subhajit Dutta, SRF

Collaborators:
Dr. Aninda Mazumdar, *Geological Oceanography CSIR- National Institute of Oceanography, India*
Prof. Ranadhir Chakraborty *Department of Biotechnology University of North Bengal, India*

Research background and Vision:

Our Geomicrobiology Group undertakes fundamental research on the evolutionarily ancient metabolism called chemolithotrophy (use of inorganic salts by microorganisms as sole sources of energy and electrons), which is thought to have originated in the hot and reducing environments of the early Earth. Besides the quest for novel molecular mechanisms/pathways of sulfur-chemolithotrophy, our laboratory is engaged in revealing the *in situ* metabolisms, ecosystem constraints and opportunities, and geochemical manifestations, of the Carbon-Sulfur-cycle microorganisms within microbiomes having major interfaces with the Earth's geological processes. In doing so, we also explore the physicochemical windows of opportunity that sustain life at the entropic and bioenergetic extremities of the Earth's biosphere. Our activities are centered on the following biophysically-extreme habitats.

- The geochemically-special (pH-neutral, silica-poor, but boron-, sulfide-, sulfate- and thiosulfate-rich) hot spring systems of the Trans-Himalayan region (eastern Ladakh, India);
- the Himalayan and Trans-Himalayan lake systems that remain frozen for approximately one third of a year; and
- certain oxygen-stressed territories of the marine realm, such as the perennial and seasonal oxygen minimum zones of the Arabian Sea.

Methodologically, our investigations at the cross-roads of biology and geochemistry are conducted at various organizational levels of life - from biomacromolecules, genes/proteins, metabolic pathways, genomes and cell systems, to populations, metagenomes, communities and ecosystems. Outcomes of our studies have implications for understanding early metabolism, ancient ecosystems, origin of life,

overall planetary health, and habitability of biophysically-extreme biomes on Earth, as well as potential extraterrestrial locations.

Research Highlight/Accomplishment:

Our latest discoveries include

- the copious presence of phylogenetic relatives of mesophilic bacteria in hot spring habitats and their thermal endurance strategies;
- the geochemical and biophysical bases of the high habitability, and the bacterial mesophiles dominated ecology, of Trans-Himalayan hot spring systems;
- freezing induced fluctuations in the productivity and microbiome functioning of Trans-Himalayan lake systems;
- novel copiotrophic psychrophiles from Trans-Himalayan lake systems which hold the potentials of becoming superbugs for biodigestion at zero to sub-zero degree Celsius;
- the presence of aerobic microbial life, and its potential biogeochemical role, in extremely-oxygen-scarce marine sediments; and
- sedimentation rate and organic matter dynamics as the geological drivers of microbiome architecture across continental margins.

Scientific Activities:

Student Awarded Ph.D.	Publication	Book Chapter / Invited Review	Participation in Conference / Symposia/ Workshop and Delivered Invited Talk	Extramural Funding	Patent Applied/ Granted	Award / Honour / Membership
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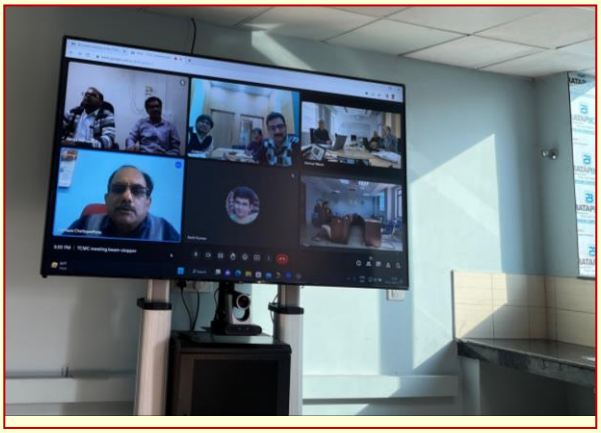
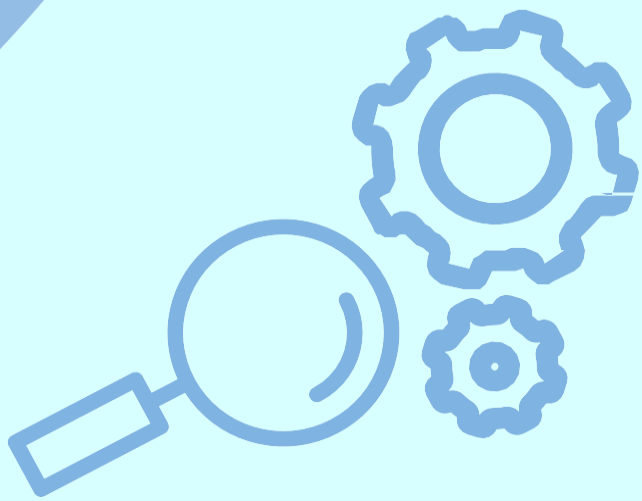
Inauguration of FAIR Video Conferencing Room



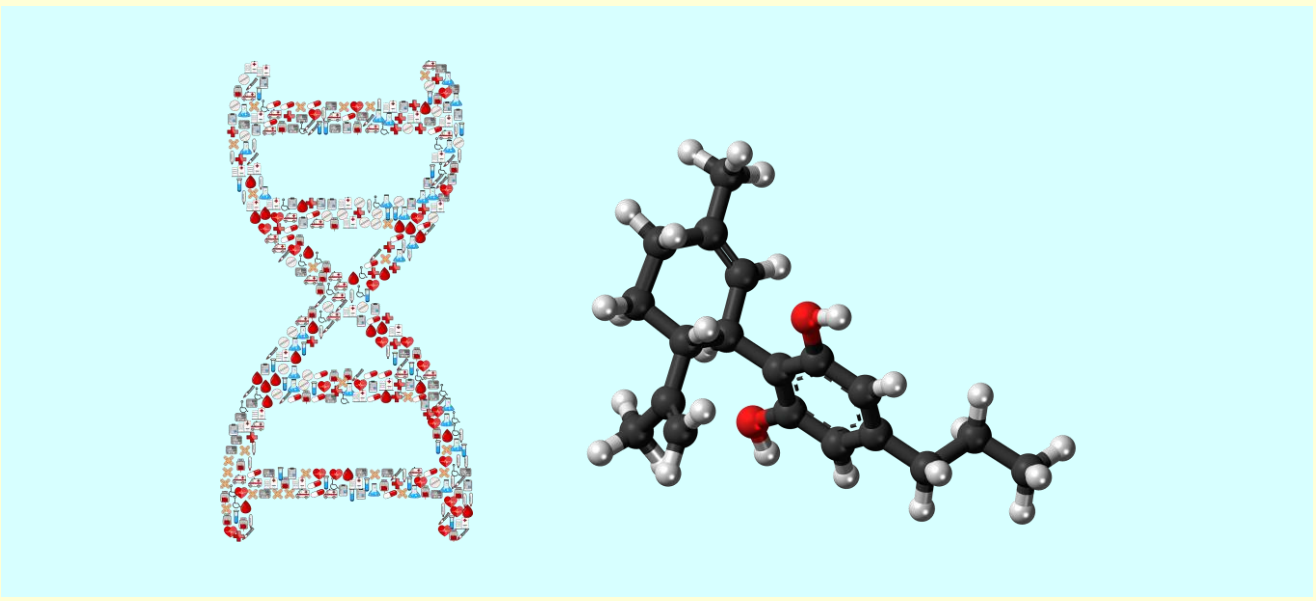
The FAIR video conferencing room was inaugurated by the Director, Bose Institute on 14 February, 2023. The program was followed by the TCMC meeting for beam stopper.

SCIENTIFIC REPORT
DIVISION OF MOLECULAR MEDICINE



International Day of Yoga

Bose Institute Observed International Day of Yoga at Unified Academic Campus, Bose Institute on June 21, 2022.



Overview

The primary mission of this division is to understand the molecular architecture of different cellular functions related to vital life processes, and also to unravel the complexities of a disease processes such as neurodegenerative disorders, cancer, gastrointestinal pathogenesis, metabolic disorders, malaria, filariasis etc. To achieve this, multidirectional chemical biology approaches have been initiated by the faculties of this division to understand the fundamental aspects and mechanism of tumor immunosuppression as well as glycobiology of tumor, protein misfolding-induced neuro-degenerative disorders both at the cellular and molecular levels. Approaches have been undertaken to identify natural products and natural product inspired synthetic bioorganic molecules towards the development of novel therapeutics. In addition, identification of new anti-malarial drug target, structure–function analysis of PfAlba, a family of *P. falciparum* DNA binding protein and evaluation of the role of mitochondrial pathology in stress-related gastric mucosal disorder and injury-induced by NSAIDS is also being carried out. The prime objective of the division is to generate knowledge through cutting edge basic research and their translational applications towards the development of therapeutics and disease diagnosis.

List of Personnel:

Faculty Members: Prof. Uday Bandyopadhyay, Prof. Gaurisankar Sa (*NASI Platinum Jubilee Senior Scientist)*, Prof. Tanya Das (*ICMR Emeritus Scientist),* Prof. Anup K Misra, Prof. Kaushik Biswas, Prof. Atin K Mandal, Dr. Kuladip Jana.

Students : JRF/SRF/RA : Dr. Aharna Guin, Dr. Soumita Mukherjee, Dr. Silpita Paul, Dr. Sarita Sarkar, Dr. Nivedita Roy, Dr. Deblina Guha, Dr. Papri Basak, Dr. Dipanwita Mukherjee, Chinmoy Banerjee, Shiladitya Nag, Arin Gucchait, Tapasi Manna, Monalisa Kundu, Pradip Shit, Satyajit Halder, Abhijit Rana, Baijayanti Ghosh, Sayantan Bose, Sendge Anil Khusal Rao, Anirban Manna, Somesh Roy, Abhishek K. Das, Subhadip Pati, Susweta Mahalonobis, Sharmistha Chatterjee, Elora Khamrui, Sourio Chakraborty, Apratim Dutta, Subhankhi Dhar, Mousumi Kundu, Samhita De, Noyel Ghosh, Naibedya Dutta, Sumon Mukherjee, Saikat Dutta, Dhiman Saha, Ankita Mandal, Udit Basak, Abhishek Sarkar, Subha Roy, Sounak Banerjee, Madhuparna Chakraborty, Gourab Shome, Upama Chowdhury, Chirantan Majumdar, Hossainur Rahaman Sareng.

Staff Members: Uttam Kr Ghosh, Arindam Basu, Debasish Majumder, Sanghamitra Das, Sourav Samanta, Kalyan Das, Sankar Prasad Bari, Purnendu Manna.

Delivered Invited Faculty Talk- 2023

Division of Molecular Medicine organized Invited Faculty Talk- 2023 delivered by Prof. Partha Pratim Majumder, National Science Chair and Founder Director, National Institute of Biomedical Genomics on January 04, 2023 at Unified Academic Campus, Bose Institute.

Prof. Anup Kumar Misra

Professor
Division of Molecular Medicine

Name of the participants:
Mr. Abhijit Rana, CSIR-SRF
Mr. Samim Sahaji, UGC-MANF
Ms. Puja Bag, Guest worker
Ms. Rittika Chakraborty,
Project trainee

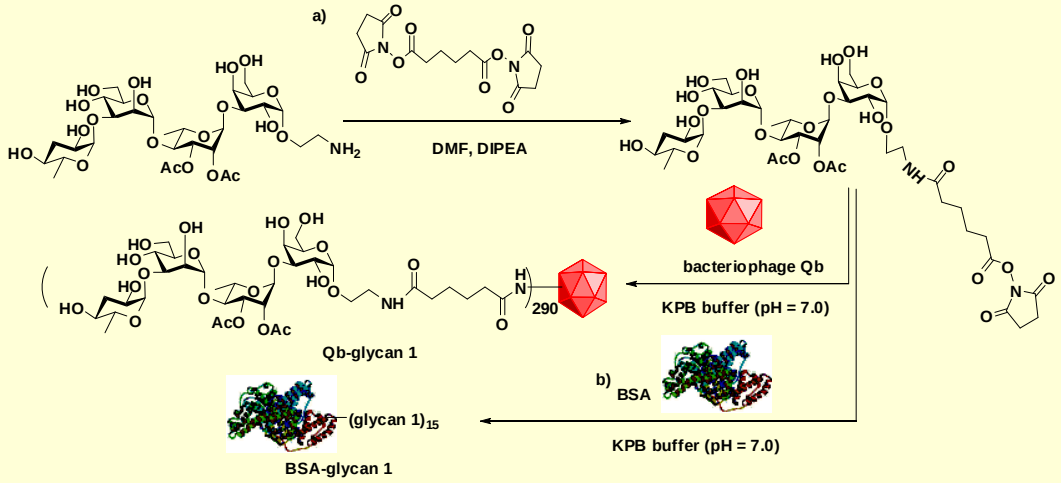
Research Background and Vision:

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

Aims and Objectives:

- Development of novel reaction methodologies for the stereoselective chemical glycosylations.
- Conjugation of oligosaccharides with suitable proteins to form glycoconjugates and their evaluation for possible antibacterial vaccine candidates.
- To develop natural products inspired small molecules having pharmaceutical potential.

Research Highlights/Accomplishments:



- Stereoselective synthesis of a series of complex oligosaccharides corresponding to the pathogenic bacterial cell wall polysaccharides.
- Preparation of a number of glycoconjugate derivatives and their immunochemical studies towards the development of vaccine leads against *Salmonella* and *meningococcal* infections.
- Design and synthesis of natural products inspired small molecules having anti-cancer, anti-filarial and anti-inflammatory activities.

Future Plan:

- Unveiling the untold mysteries of stereoselective chemical glycosylations.
- Extending the immunological studies of the glycoconjugate derivatives using animal models.
- Development of novel reaction methodologies relevant to the synthetic organic chemistry.
- Synthesis and biological evaluation of sugar conjugated natural products..

Scientific Activities:

Student Awarded Ph.D.	Publication	Book Chapter / Invited Review	Participation in Conference / Symposia/ Workshop and Delivered Invited Talk	Extramural Funding	Patent Applied/ Granted	Award / Honour / Membership
02	12	00	00	01	00	00

Prof. Atin Kumar Mandal

Professor
Division of Molecular Medicine

Name of the participants:
Dr. Soumita Mukherjee, DBT-RA
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

Research Background and Vision:

Proteostasis is finely balanced by the cellular Protein Quality Control (PQC) machinery consisting of molecular chaperones and degradation system. The PQC system is often perturbed by the environmental, cellular or genetic factors, resulted in development of various diseases including cancer, diabetes, hypertrophy and late-onset neurological disorders. The focus of my lab is to understand the molecular collaboration of chaperones and ubiquitin ligases in maintaining cellular protein homeostasis. We have found that Praja1, a highly expressed ubiquitin ligase in brain efficiently clears polyQ proteins, ataxin3 and huntingtin, henceforth, reduces their aggregation and toxicity of polyglutamine proteins. Praja1 level is downregulated in polyQ overexpression condition suggesting its role in manifestation of polyQ diseases when efficiency of PQC machinery is decreased in aging.

Research Highlights/Accomplishments:

- Generation of DNAJA1, DNAJA2 and DNAJB6 knock out cells by CRISPR-CAS9.
- Praja1 interacts with DNAJ chaperone proteins, DNAJB2 and DNAJB6.

Future Plan:

- Identify the interactome of Praja1 ubiquitin ligase.
- Elucidate the involvement of molecular chaperones in Praja1 mediated degradation of misfolded proteins.
- Identify the ubiquitin linkage associated with Praja1 mediate substrate degradation.

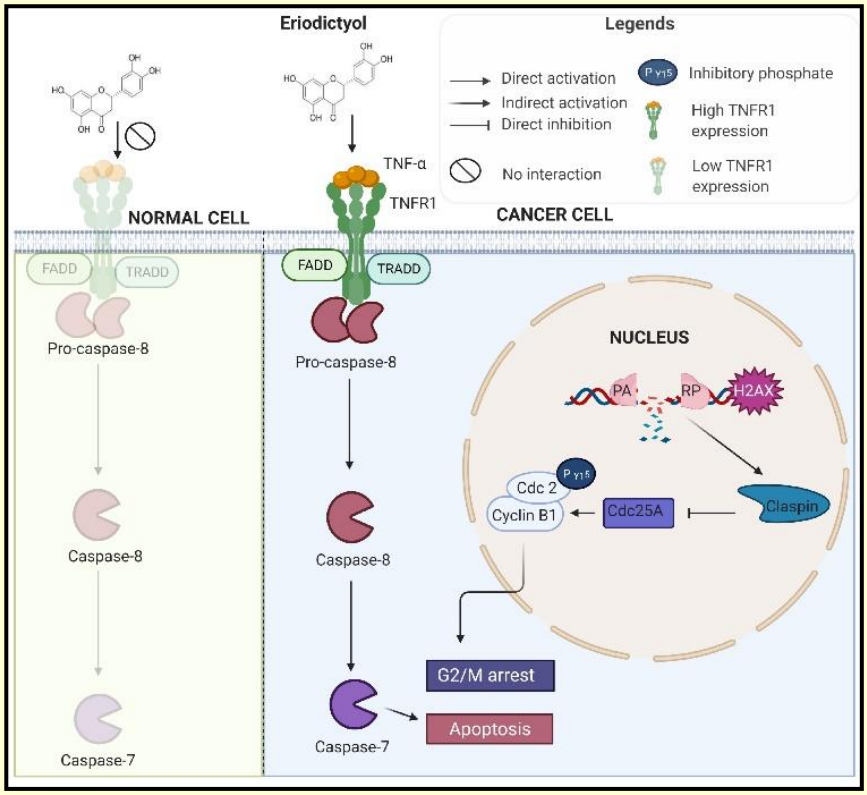
Scientific Activities:

Student Awarded Ph.D.	Publication	Book / Invited Review	Participation in Conference / Symposia/ Workshop and Delivered Invited Talk	Extramural Funding	Patent Applied/ Granted	Award / Honour / Membership
01	01	00	03	02	00	00

Prof. Kaushik Biswas

Professor
Division of Molecular Medicine

Name of the participants:
Shibjyoti Debnath, Ph.D.
Dr. Dipanwita Mukherjee, Ph.D.
Abhisek Banerjee, DST-SERB Project Associate
Elora Khamrui, UGC, SRF
Sounak Banerjee, UGC, SRF
Subha Ray, UGC, SRF
Aishwarya Ray, UGC, SRF
Sanchari Chatterjee, UGC, SRF
Shuvam Pal, UGC, SRF



Debnath, S. et.al., *Translational Oncology*, 2022, 21, 101433

Research Background and Vision:

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 are trying to find out how GM2 regulates expression of some tumor-suppressor miRNAs, leading to upregulation of their target oncogenes. We have also 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. In a totally disparate study, we were able to demonstrate a selective cytotoxic ability of the plant derived flavonoid, Eriodictyol in inhibiting proliferation, inducing cell cycle arrest and induction of cancer cell apoptosis sparing the normal cells, which we attributed to the selectivity of Eriodictyol in targeting TNFR1 in cancer cells which are minimally expressed in normal cells.

Research Highlights/Accomplishments:

- Identify GM2 as a possible regulator of tumor suppressor miR-615-5p in targeting oncogenic ID1 in tumorigenesis.
- Standardized the protocol for dCas9-guided targeting and immune-precipitation of the GM2-synthase TSS using "enChIP" assay.
- Demonstrated a selective cytotoxic role of Eriodictyol towards cancer cells over normal cells in terms of inducing apoptosis and cell cycle arrest..

Future Plan:

- Elucidating the mechanism of GM2-mediated downregulation of miR-615-5p in targeting oncogenic ID1 in tumorigenesis
- Identification of the proteome associated with the TSS of the GM2-synthase gene.

Scientific Activities:

Student Awarded Ph.D.	Publication	Book Chapter / Invited Review	Participation in Conference / Symposia/ Workshop and Delivered Invited Talk	Extramural Funding	Patent Applied/ Granted	Award / Honour / Membership
01	01	00	04	02	00	01

Dr. Nirmalya Sen

Assistant Professor
Division of Molecular Medicine

Name of the participants:
Debkumar pal
Dhruba Datta
Sujoy Midya
Atif Hasmi
Shreya Roy
Rajarshi Chattopadhyay
Ramandeep Kaur
Sangramjit Mondal
Aiindrila Dhara

Research Background and Vision:

We work on regulation of transcription factors in cancer. Currently we are interested in behavior of ETS family oncogenes during various metabolic and genotoxic stress.

- We identified metabolic axis involving PGC1 coactivator and Sirt1 like deacetylases in driving antioxidant function which may result in prostate cancer resistance.
- Since ETV1 and ERG fusion genes act via their DNA binding domains, our laboratory is deploying CRISPR based genome editing technology to study the effects of functional knock-outs in various cancers driven by these genes.
- We are mimicking the acquired drug resistance scenario using TNBC cell line models to understand pathophysiology of TNBC patients and the cause of relapse. Currently, we have identified ETS1 transcription factor driven mechanism in metastatic and drug resistant TNBC.

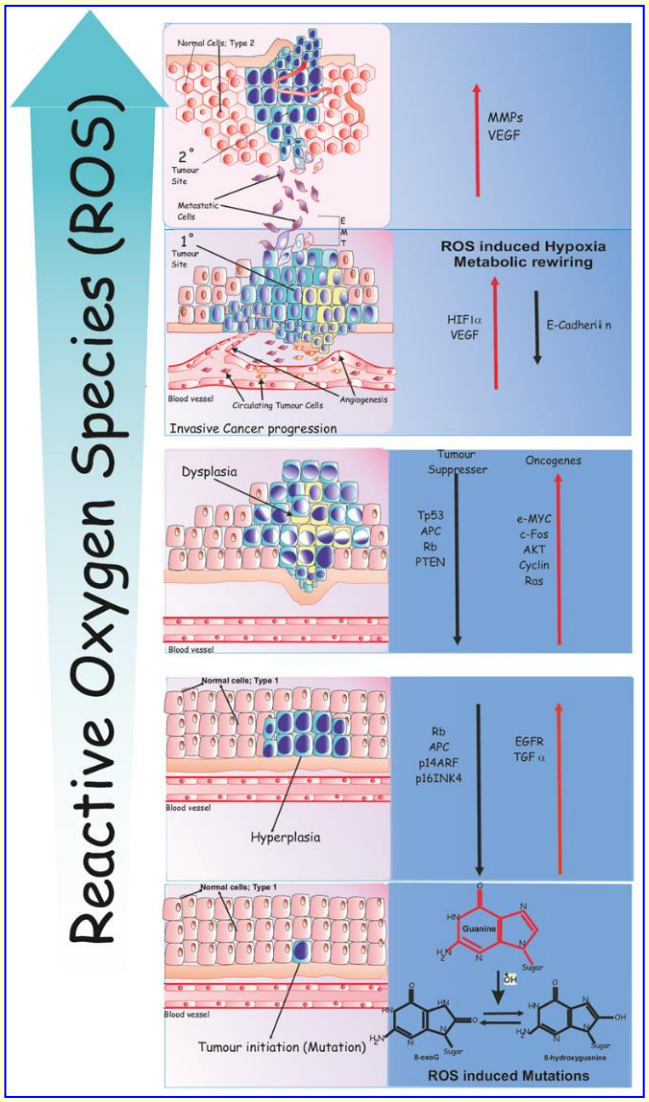
Research Highlights/Accomplishments:

- Identified PGC1 alpha as a coactivator of oncogenic transcription factor ERG under metabolic stress
- Identified novel anti-oxidant genes induced by ERG during castration resistance cancer progression

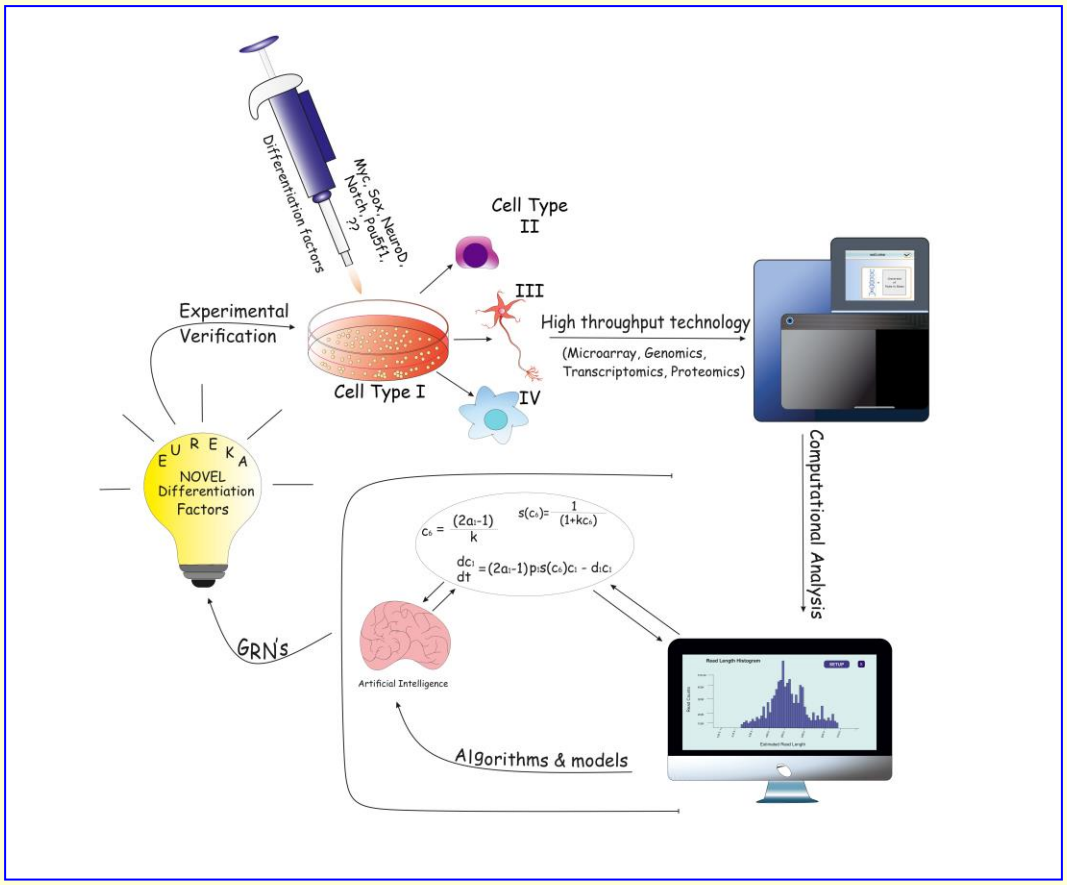
- Identified regulatory mechanism of ETS1 transcription factor in triple negative breast cancer during acquired chemotherapy resistance.

Future Plan:

- Identify biomarkers from pre and post chemotherapeutic TNBC patient sample via RNA sequencing
- Understand the role of ETV1 and ERG transcription factors in mitochondrial dynamics via CRISPR technology
- Study metabolic reprogramming during therapy resistance in cancers.



1) **From Book Chapter:** Reactive Oxygen Species & Cancer: Split Self Affair**,** By *Sen et al.*



2) **From book Chapter:** Computational approaches to determine stem cell fate, by *Sen et al*

Scientific Activities:

Student Awarded Ph.D.	Publication	Book Chapter / Invited Review	Participation in Conference / Symposia/ Workshop and Delivered Invited Talk	Extramural Funding	Patent Applied/ Granted	Award / Honour / Membership
00	02	02	03	01	00	00

Dr. Basudeb Maji

Assistant Professor
Division of Molecular Medicine

Name of the participants:
Sadiya Tanga
Arpita Hota
Arkadeep Karmakar
Sreehari Dinesh

Research Background and Vision:

I am developing programable gene editing methods for functional genomics. We combined chemical probes with recombinant CRISPR enzymes in developing such controlled genome engineering method. My another research area is developing synthetic biology platforms for in vivo drug discovery against infectious diseases.

Future Plan:

- Completing the lab setup.
- Developing an engineered microbe-based synthetic biology platform.
- Targeted gene therapy development as an anticancer method.

Scientific Activities:

Student Awarded Ph.D.	Publication	Book Chapter / Invited Review	Participation in Conference / Symposia/ Workshop and Delivered Invited Talk	Extramural Funding	Patent Applied/ Granted	Award / Honour / Membership
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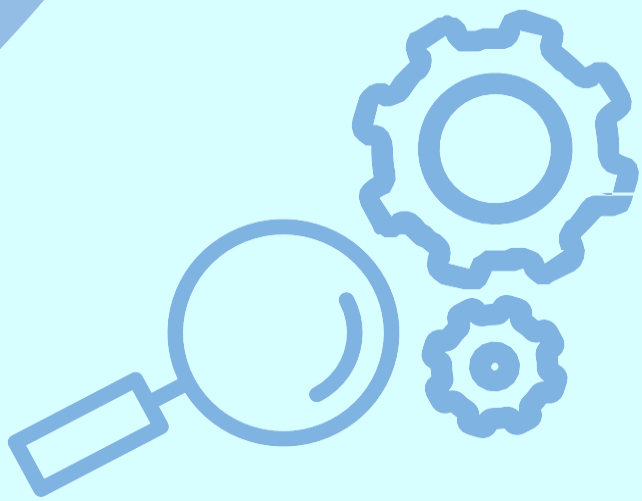
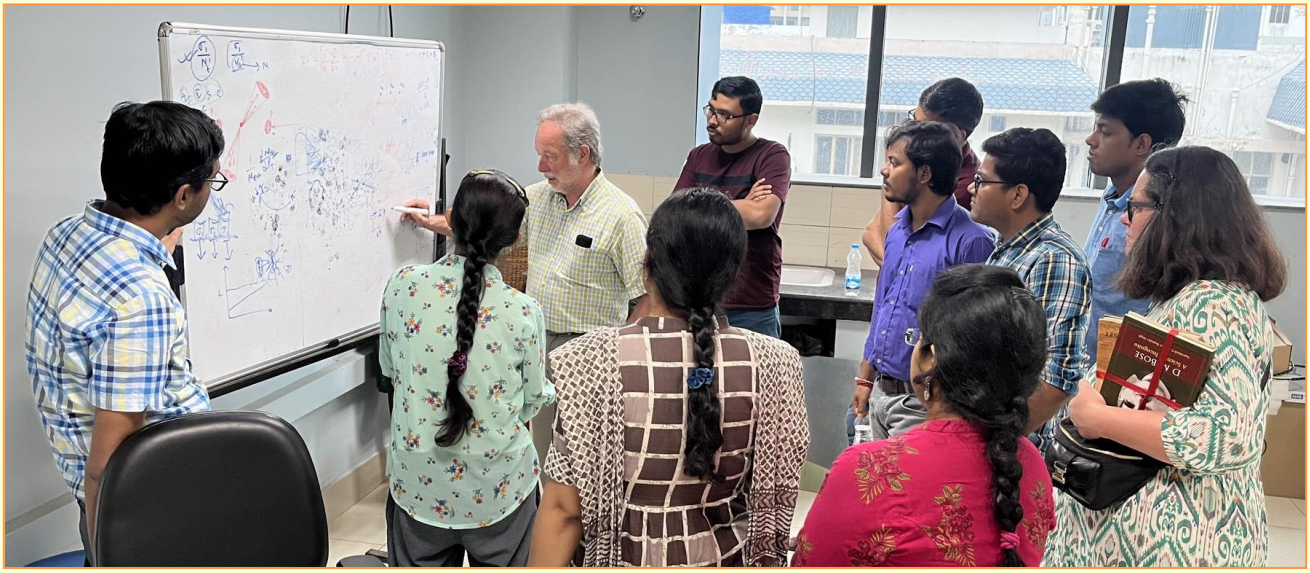
SCIENTIFIC REPORT
DEPARTMENT OF PHYSICS





Prof. Peter and Dr. Ana Senger from FAIR/GSI, Darmstadt visited Bose Institute and had discussions with scientists and students here.

Overview

The Department of Physics at Bose Institute shares and manifests the dream of its founder - Acharya J. C. Bose. For more than a century, it has been an active center for contemporary and high quality research in the frontier areas of Physics. The research activities in the department cover a wide range of areas in experimental as well as theoretical physics, along with several interdisciplinary areas. The areas of research at present are Quantum Information, Statistical Physics, Biophysics, Complex Systems, Condensed Matter Physics, Materials Science, Cosmic Rays, Nuclear Astrophysics, High Energy Physics and String Theory. We have active international collaborations with ALICE at LHC, CERN; ISOLDE, 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:

Faculty Members: Prof. Sanjay Kumar Ghosh; Prof. Somshubhro Bandyopadhyay; Prof. Rajarshi Ray; Prof. Dhruba Gupta (Chairman); Prof. Supriya Das; Prof. Achintya Singha; Prof. Soumen Roy; Dr. Sidharth Kumar Prasad; Dr. Saikat Biswas; Dr. Pramod Kumar Shukla.

Senior Scientists: Prof. Sibaji Raha, DAE - Raja Rammana Fellow; Prof. Sushanta Dattagupta, INSA Senior Scientist; Prof. Indrani Bose, NASI Senior Scientist; Prof. Barun Kr. Chatterjee, CSIR Emeritus Scientist; Prof. Dipankar Home, NASI Senior Scientist; Dr. Debajyoti Roy, R.A.- Raja Rammana Fellow.

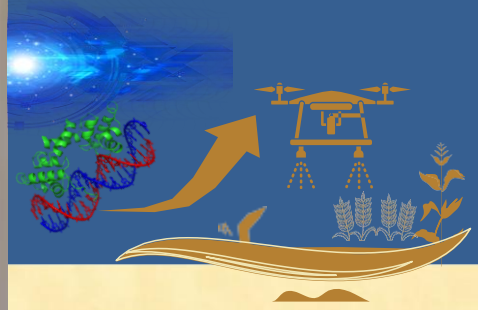
Students: RA/SRF/JRF/Project Associate : Dr. Rupa Sarkar; Dr. Amit Mukherjee; Dr. Prabir Banik; Dr. Debasree Chowdhury; Dr. Sumit Kr. Saha; Dr. Sanchari Thakur; Dr. Chirantan Sarkar; Dr. Soumitra Maity; Trishna Bhattacharyya; Kabita Kundalia; Sk. Mustak Ali; Sreyan Raha; Shreya Roy; Pratik Ghosal; Sayak Chatterjee; Deep Nath; Prottoy Das; Abhi Modak; Sahanaj Atar Banu; Debjani Banerjee; Arindam Sen; Md. Asif Bhat; Chumki Nayak; Sumana Gop; Tushar Kanti Bhowmik; Ranjan Sutradhar; Himadri Sekhar Tripathi; Ritankar Mitra; Rudrapriya Das; Ms. Swati Sharma; Suvadip Masanta; Debanjan Roy; Arijit Roy; Subhankar Maity; Pritam Sinha; Ramnarayan Bera; Mintu Haldar; Akash Gupta; Sayan Samanta; Subir Mandal.

Staff Members : Dr. Subhasish Banerjee; Shyam Sundar Mallick; Manas Datta; Subrata Das; Kaushik Maiti; Sujit Kr Basu; Raj Kumar Mourya; Amar Nath Hela; Kanak Baran Hazra.

Prof. Luciano Musa, Spokesperson, ALICE experiment at CERN, Geneva, visited Bose Institute on October 19, 2022.

Prof. Sanjay Kr. Ghosh

Professor
Department of Physics



Name of the participants:
Ms. Trishna Bhattacharyya
Dr. Prabir Banik

Research Background and Vision:

Discovery of quarks as an underlying substructure of hadrons (baryons and mesons) in the mid 60's has opened up new directions of research in particle physics. Quarks are strongly interacting objects, Quantum Chromodynamics (QCD) being the theory of strong interaction. The interesting characteristics of quark is that their interaction strength increases with the separation between them while becoming very small, leading to free quarks, at smaller separations. This in turn implies that at very high temperature and/or densities the quarks will no longer be confined inside hadrons and one may envisaged a phase transition from hadronic to quark matter.

In nature such a phase transition must have occurred in early universe, few microsecond after big bang, when the universe was hot. On the other hand such a scenario may also occur inside the Neutron stars where baryon density is extremely high, temperature being low. Presently at LHC, CERN, heavy ion collision experiments are exploring this early universe scenario. The high-density scenario will be explored in Facility for antiproton-ion research at GSI, Germany.

Theoretical studies also suggest that quark matter may also exist in the form of small lumps of low baryon number, usually called as strangelets. Theoretical studies also suggest, that these objects may reach the earth's surface and can be detected in cosmic ray detectors.

Understanding of the observed high energy Cosmic Rays is an active area of research. We are presently trying to understand their possible sources of production and acceleration using the available data.

We are involved in the research to have better understanding of vertical profile of the atmosphere and their variabilities using physical aspects of atmosphere, namely electric field and electromagnetic scattering.

Primary Objectives:

- Understanding the characteristics of strongly interacting system at high temperature and/or density using phenomenological models
- Understanding the possible mechanisms and sources of high energy cosmic rays and their interactions
- Understanding of physical aspect of atmospheric, such as atmospheric electric field, microphysical aspects of aerosol and cloud and their interaction using ground based and satellite observations.

Research Highlights/Accomplishments:

- In a recent work, we argue that the quiet sun can accelerate cosmic rays to TeV energies with an appropriate flux level in the solar chromosphere, as the solar chromosphere in its quiet state probably possesses the required characteristics to accelerate cosmic rays to TeV energies. Consequently, the mystery of the origin of observed gamma rays from the solar disc can be resolved consistently through the hadronic interaction of these cosmic rays with solar matter above the photosphere in a quiet state. The upcoming IceCube-Gen2 detector should be able to validate the proposed model in future through observation of TeV muon neutrino flux from the solar disk. The proposed idea should have major implications on the origin of galactic cosmic rays.
- A eecent findings reveal that leptonic mechanisms, together with pure hadronic mechanisms, make a considerable contribution to the understanding of the total electromagnetic spectrum of cosmic ray as well as the observed neutrino event. The estimate of expected muon neutrino events from the Cygnus Cocoon agrees with the one muon neutrino event detected so far in IceCube multiyear observations. Thus, our results are indicative of the potential of the Cygnus Cocoon to be a Galactic cosmic-ray source capable of accelerating at least up to PeV energies.
- A study is being performed to understand the Aerosol and cloud layer variability and their interaction over Darjeeling. Here we have studied the profiles of aerosol and cloud layers vis-vis temperature inversion. In addition, the stability conditions have been explored using Burnt Viasalam frequency. We have also studied the fluctuation in the observed boundary layer and compared with the high split results. LIDAR observations along with the observations from micro rain radar givs us an insight on the life cycle of the cloud.
- The present study investigates the long-term evolution of urban heat island intensity and its consequences over a twin city Kolkata and Howrah situated in the eastern part of India. This region is one of the most crowded regions of the world as together these cities are the resident place of around 16 million people. These twin cities are located at the east and west banks of the river Hoogly, near the coast of the Bay of Bengal. These cities are frequently affected by the tropical cyclones that form over the Bay of Bengal and the Indian Ocean. The heat island intensities and their consequences on the local climate are being studied by an ensemble of methods which includes observation and modeling framework. Surface heat island intensity (SUHI) is being studied by using long-term satellite observation derived from MODIS sensors for the year 2000 to 2020. Near-surface air temperature is being monitored by a framework of low-cost weather monitoring sensors. And the overall impact of urban heat island is being studied by Weather research and Forecast modeling (WRF) coupled with an Urban Canopy Model.

Major Achievements:

- Recent results are indicative of the potential of the Cygnus Cocoon to be a Galactic cosmic-ray source capable of accelerating at least up to PeV energies.
- A recent work shows that Sun may be acting as a Cosmic Ray TeV energy accelerator
- Profiles of aerosols and cloud layers have been investigated over a high-altitude urban atmosphere in the eastern Himalayas in India, for the first time, using a Raman LIDAR. The study was conducted post-monsoon season over Darjeeling, a tourist destination in north-eastern India..
- The 20 years analysis of surface heat island intensity (SUHI) over city metropolitan shows that the heat island intensity for both the cities is always positive like other megacities in eastern India. A significant positive trend was observed for both day and night time SUHI. The daytime SUHI is increasing at a rate of 0.03^{0}C/year whereas night-time SUHI is creasing at a higher rate of 0.04^{0}C/year

Future Plan:

- A systematic analysis of observed high energy gamma rays up to PeV energies to understand their origin and possible source of their acceleration to such high energies
- Understanding of surface heat island around Kolkata and Howrah using ground-based data and simulation with weather forecasting and research model.
- Understanding of atmospheric aerosols – size, shape and single scattering albedo through optical scattering

Scientific Activities:

Student Awarded Ph.D.	Publication	Book / Invited Review	Participation in Conference / Symposia/ Workshop and Delivered Invited Talk	Extramural Funding	Patent Applied/ Granted	Award / Honour / Membership
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Prof. Somshubhro Bandyopadhyay

Professor
Department of Physics

Name of the participants:

Group members:
Arkaprabha Ghosal
Debanjan Roy

Collaborators:
Pratik Ghosal, BI
Saronath Halder, CNT
Warsaw, Poland
Vincent Russo, ISARA
Tathagata Gupta, ISI, Kolkata
Ritabrata Sengupta, IISER
Berhampur

Research Background and Vision:

Information encoded in quantum systems is quantum information, and therefore, quantum information processing must obey the laws of quantum physics. The discovery of this simple idea has led to novel communication protocols including secure cryptography primitives, exceptionally fast algorithms and many applications in quantum many-body problems.

While quantum information and computation has been the cornerstone of cutting edge research in physics, mathematics, and computer science for many years now, especially because of the promise of revolutionizing the existing technology, our research, however, is mostly aimed at addressing fundamental problems in the resource theory of entanglement, entanglement distribution, quantum state discrimination, quantum channels, quantum protocols and interpretation of quantum mechanics.

Aims and Objectives

Presently we are working on problems in the following areas:

- Resource theory of entanglement
- LOCC state discrimination
- Quantum non-locality
- Quantum gravity induced entanglement of masses

Research Highlights/Accomplishments:

- Proved a novel property of quantum switches that shows a higher-order quantum switch constructed from two quantum switches can perform qubit communication better than the component switches. We demonstrate this communication advantage over quantum switches that are useful as a resource and those that are useless.
- We obtained necessary conditions for transforming a set of pure bipartite states into another using deterministic LOCC. These conditions are shown to be independent but not sufficient.

Future Plan:

- To obtain the exact entanglement cost and the corresponding optimal resource states in discriminating orthogonal two-qubit bases using LOCC.
- To explore quantum gravity induced entanglement of masses in many-body systems where symmetry is absent.
- To develop a theory based on the techniques of quantum information to address the information paradox in black holes.

Scientific Activities:

Student Awarded Ph.D.	Publication	Book / Invited Review	Participation in Conference / Symposia/ Workshop and Delivered Invited Talk	Extramural Funding	Patent Applied/ Granted	Award / Honour / Membership
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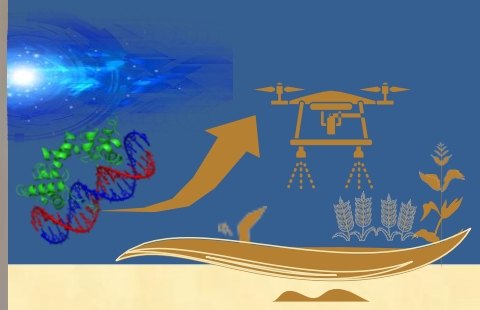


Prof. Rajarshi Ray

Professor
Department of Physics

Name of the participants:
Pratik Ghoshal
Pracheta Singha

Other Collaborators:
Chowdhury Aminul Islam
Munshi Golam Mustafa

Research Background and Vision:

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.

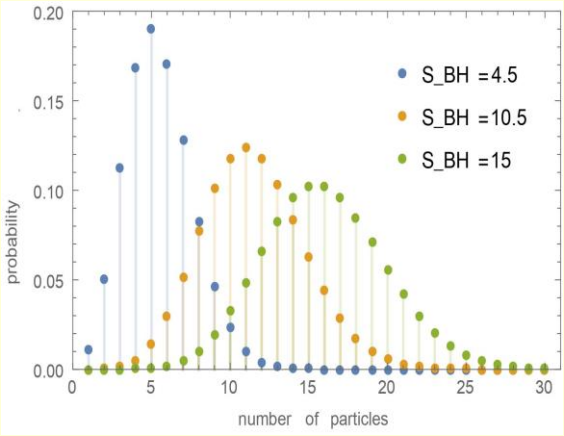


Figure illustrating the essence of our research work

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.

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.

Scientific Activities:

Student Awarded Ph.D.	Publication	Book / Invited Review	Participation in Conference / Symposia/ Workshop and Delivered Invited Talk	Extramural Funding	Patent Applied/ Granted	Award / Honour / Membership
02	02	00	00	00	00	00

Prof. Dhruba Gupta

Professor
Department of Physics

Name of the participants:
Dr. Rupa Sarkar, DST Women Scientist
Sk. Mustak Ali, SRF
Kabita Kundalia, SRF
Subhankar Maity, SRF
Ritankar Mitra, JRF
Sayan Samanta, JRF

Research Background and Vision:

I work in nuclear astrophysics. At present, rare isotope accelerators enable us to study pressing problems in nuclear astrophysics, the nuclear force and the origin of elements in the universe. The Big Bang Nucleosynthesis (BBN) theory is consistent with observation for the abundance of light nuclei except for ^{7}Li. Our interests include this anomaly of a factor of four known as the Cosmological Lithium problem and unsolved for decades. Our other interests include, the study of α-capture reaction $^{12}C(\alpha,\gamma)^{16}O$, utilizing transfer reactions. This reaction is crucial for stellar nucleosynthesis of elements heavier than carbon. The evolution of life in the universe also depends on it.

Research Highlights/Accomplishments:

- **Cosmological lithium problem (CLiP) through nuclear reactions involving ^{7}Be**
  For decades, CLiP is one of the most important unresolved problems in nuclear astrophysics. We searched for nuclear physics solutions to the CLiP through resonances at higher excitation energies in $^{7}Be(d,p)^{8}Be^{*}$ reaction for the first time. Nuclear physics solutions are found to be inadequate to solve the anomaly.

- **Measurement of the $^{7}Be(d,^{3}He)^{6}Li^{*}$ reaction and the ^{6,7}Li anomalies**
  The measurement of the $^{7}Be(d,^{3}He)^{6}Li^{*}$ reaction cross sections at 5 MeV/u is carried out. The population of the 2.186 MeV excited state of ^{6}Li in this reaction is measured for the first time. The S-factor of the (d,^{3}He) channel from the present work is about 50% lower than existing data at nearby energies. The (d,^{3}He) reaction rate is found to have ≤ 0.1% effect on the ^{6,7}Li abundances.

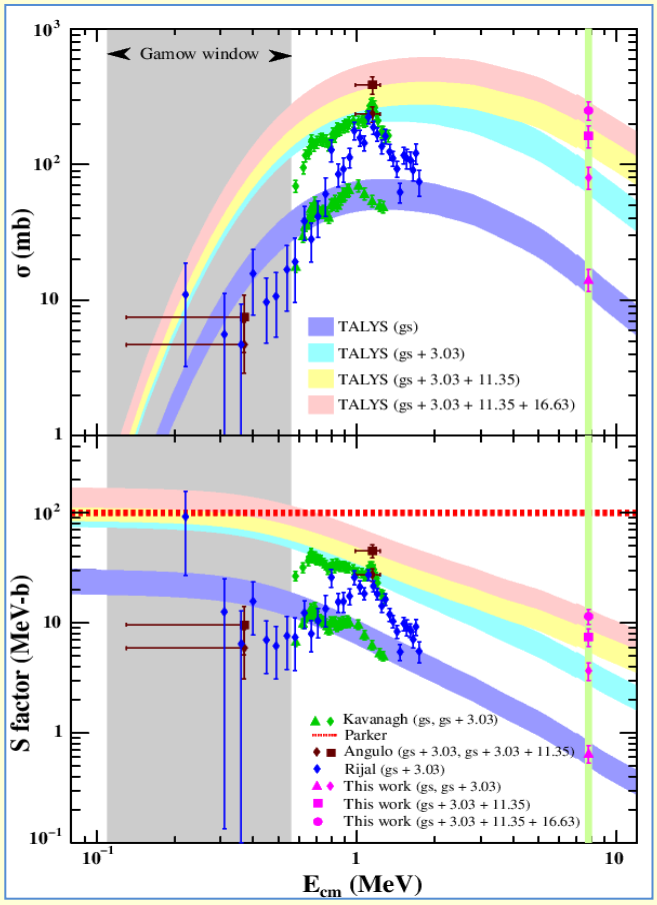


Figure 1: Excitation function and S-factor for ^{7}Be(d,p)^{8}Be*. (Sk. M. Ali et al., Phys. Rev. Lett. 128, 252701 (2022)

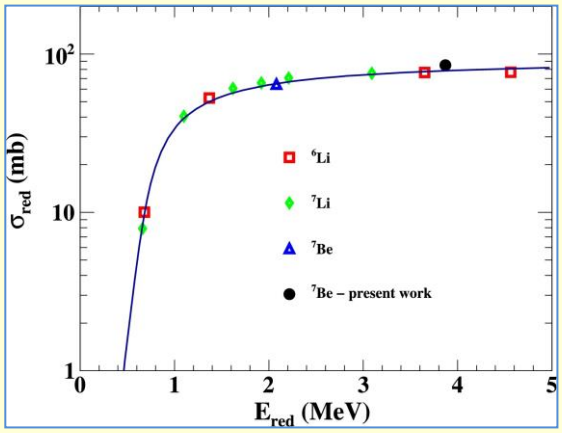


Figure 2: The reduced reaction cross sections for the ^{7}Be + ^{12}C system obtained in the present work along with reduced reaction cross sections of the lithium isotopes on ^{12}C. The solid curve represents Wong's expression (K. Kundalia et al., Phys. Lett. B 833, 137294 (2022)).

- **Elastic and inelastic scattering of ^{7}Be on ^{12}C to understand alpha-cluster transfer reactions in nuclear astrophysics**
  Elastic/inelastic scattering are extremely useful for studies on transfer reactions related to nuclear astrophysics. The inelastic scattering of ^{7}Be + ^{12}C is measured for the first time. The breakup cross section of ^{7}Be is estimated to be less than 10% of the reaction cross section, from coupled-channel analysis of the data. Transfer reaction channels are found to be more prominent than breakup.

Future Plan:

- **Indirect study of ^{12}C(α,γ)^{16}O via α-cluster transfer reaction with ^{7}Be**
  In nuclear astrophysics, the α-capture reaction ^{12}C(α,γ)^{16}O is being studied for decades as a key reaction in the helium-burning phase of stars. This reaction along with the preceding triple-α fusion reaction forming ^{12}C 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 is determined by this ratio after the helium-burning cycle. The evolution of life in the universe depends on this ratio as well. We plan to carry out a study of the above reaction, by the measurement of angular distributions of the ^{12}C (^{7}Be, ^{3}He)^{16}O transfer reactions.

- **Breakup of deuteron from ^{7}Be + d reaction at 5 MeV/u**
  The deuteron has been studied for decades in the context of breakup and stripping nuclear reactions. An earlier study of the deuteron breakup reactions on ^{7}Li shows that the stripping process is more important than the elastic breakup process. However, similar studies with the radioactive counterpart ^{7}Be does not exist. We plan to compare our earlier work on ^{7}Be(d,p) transfer reaction with the breakup of deuteron yielding a three-body final state ^{7}Be(d,pn), where the deuteron disintegrates into a proton and a neutron.

- **Breakup reactions from ^{7}Be + ^{12}C at 5 MeV/u**
  Breakup reactions involving loosely bound nuclei have profound impact in nuclear reactions and nuclear astrophysics. While stable nuclei with prominent cluster structures have been widely studied, experiments with radioactive nuclei are often difficult due to low beam intensities. We carried out an experiment at HIE-ISOLDE, CERN to study the breakup and transfer reactions with ^{7}Be + ^{12}C at 5 MeV/u. We will continue our analysis of the coincidence data from breakup of ^{7}Be over a wide angular range.

Scientific Activities:

Student Awarded Ph.D.	Publication	Symposium Publication	Participation in Conference / Symposia/ Workshop and Delivered Invited Talk	Extramural Funding	Patent Applied/ Granted	Award / Honour / Membership
01	02	04	04	00	00	00

Prof. Supriya Das

Professor
Department of Physics

Name of the participants:
Md. Asif Bhat, SRF
Rudrapriya Das, JRF

Research Background and Vision:

Within the experimental high energy physics group, we are involved in the study of matter at extreme temperature such was believed to be present immediately after the creation of the universe through big bang and/or density that occur in the core of neutron stars. Typically similar conditions are realized by colliding heavy-ions at relativistic speed using large particle accelerators. The system created in such collisions is then characterized by detecting the particles and radiation emerging from them using detectors. During the said period we have studied the jet modification in absence of QGP and investigated the role of multipartonic interaction and color reconnection in it. We have also started a work to study net baryon fluctuation in Au-Au collisions at FAIR energies to look for a predicted critical point in the phase diagram of QCD matter.

Research Highlights/Accomplishments:

- A new approach to calculate the energy density in hadronic collisions
- Study of jet modification in absence of QGP
- Study on charging up in GEM..

Future Plan:

- Improvement of particle identification framework in CBM
- Study of net proton fluctuation to characterize matter at high baryonic density

Scientific Activities:

Student Awarded Ph.D.	Publication	Book / Invited Review	Participation in Conference / Symposia/ Workshop and Delivered Invited Talk	Extramural Funding	Patent Applied/ Granted	Award / Honour / Membership
01	24	00	03	01	00	00

Prof. Achintya Singha

Professor
Department of Physics

Name of the participants:

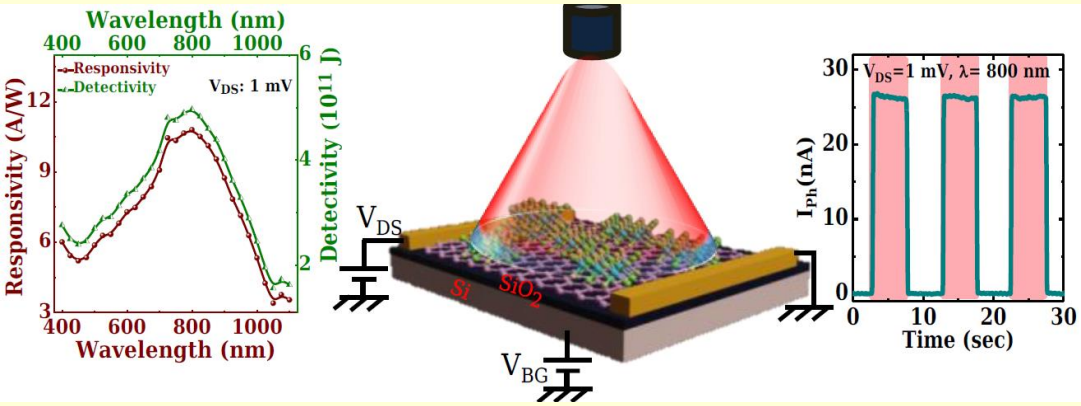
Dr.Subhasis Roy, under DST TARE project
Dr.Debasree Chowdhury, NPDF
Shib Shankar Singha, Guest Researcher
Tara Shankar Bhattacharya, Guest Researcher
Sreyan Raha, SRF
Himadri Sekhar Tripathi, SRF
Chumki Nayak, SRF
SuvadipMasanta, SRF
Pritam Sinha, JRF
Vidya Acharya, M.Sc. student (CU), short term trainee
Rwik Dutta, 4th year BS-MS (Dual Degree) program, IISER Bhopal, IASc Summer Research Fellow

Research Background and Vision:

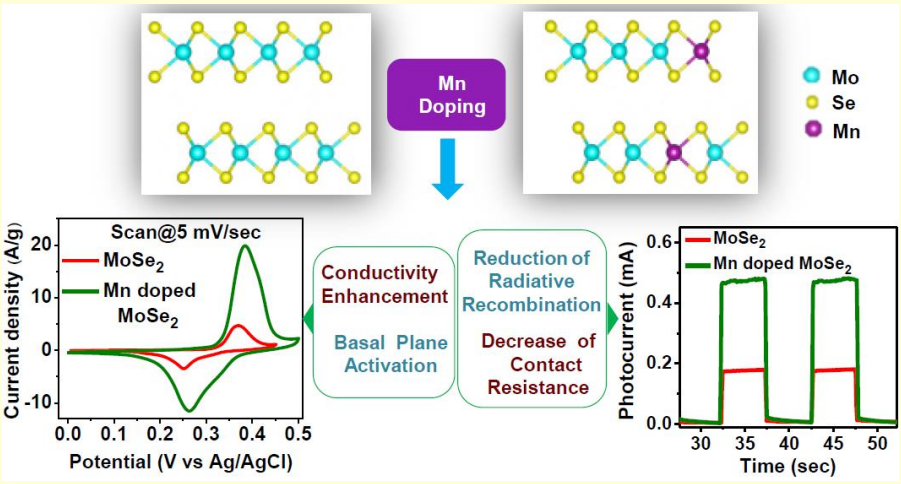
In recent times, two-dimensional (2D) transition metal dichalcogenides (TMDs) have garnered significant interest due to their unique physical and chemical properties. These atomically thin materials, composed of a transition metal sandwiched between chalcogen atoms, possess exceptional electronic, optical, and electrochemical properties. In optoelectronics, their direct bandgaps enable efficient light absorption and emission, making them suitable for photodetectors, LEDs, and solar cells. Additionally, 2D TMDs exhibit remarkable electrochemical performance, rendering them attractive for energy storage devices like batteries and supercapacitors.Recently, we have been focusing on engineering multifunctionality of 2D TMDCs for application in optoelectronics, energy harvesting and energy storage devices. We employ a variety of spectroscopic techniques such as micro-Raman spectroscopy, micro-photoluminescence spectroscopy, absorption spectroscopy, spectral response study, transport measurement techniques and electro chemical study to achieve our objectives. We also study fundamental properties of quantum material using temperature dependent Raman and optical spectroscopy.

Research Highlights/Accomplishments:

- We showed that making van der Waals heterostructure of alloy transition metal dichalcogenide MoSSe and graphene is a prolific strategy for achieving a highly responsive, gate-tunable, near-infrared sensitive, broadband and fast photodetector.



- We demonstrated the advanced functionalities of nanostructured $MoSe_2$ via strategic Mn doping for enhanced electrochemical charge storage and improved photosensing.



- We explored lattice dynamics, thermal and electronic properties of quantum materials.

Future Plan:

To study the following:

- Exciton -plasmon interaction in 2D semiconductor
- Lattice dynamics and optical properties in quantum materials
- Spin- valley physics in 2D transition metal dichalcogenides

Scientific Activities:

Student Awarded Ph.D.	Publication	Book / Invited Review	Participation in Conference / Symposia/ Workshop and Delivered Invited Talk	Extramural Funding	Patent Applied/ Granted	Award / Honour / Membership
01	06	00	03	01	00	00

Prof. Soumen Roy

Professor
Department of Physics

Name of the participants:
Deep Nath, SRF
Sumana Gop, SRF
Swati Sharma, JRF
Ramnarayan Bera, JRF
Akash Gupta, JRF
Arijit Roy, JRF

Research Background and Vision:

Aureochromes are light-oxygen-voltage (LOV) photoreceptors cum basic leucine zipper (bZIP) transcription factors (TFs), which are blue light-responsive. We focus on aureochromes from *Ectocarpus siliculosus,* given their full genome sequence. The light-regulated developmental responses therein are mediated by aureochromes. The bZIP effector and the LOV sensor both show overall sequence-structure conservation. We address the compatibility of dimerization partners by screening through heptad repeats. We examine the relative stability of these structures from a graph-theoretic viewpoint through metrics like average participation coefficient, and, energy of the graph, betweenness centrality. We also perform an information-theoretic analysis using hitherto understudied measures such as Kullback-Leibler divergence and network information centrality. All our findings consistently agree with each other.

National and International Collaborations:

Regular Associate at UNESCO's International Centre for Theoretical Physics (ICTP), Trieste, Italy.

Future Plan:

- Develop a mathematical understanding of how plaques develop on bacteria due to phages. This work would be driven by experimental findings and data.

- Apply information-theoretic methods to study proteins. In the longer run, we would also like to seek experimental validation of our results.

- Explore percolation in quantum networks from an information theoretic perspective.

Scientific Activities:

Student Awarded Ph.D.	Publication	Book Chapter / Invited Review	Participation in Conference / Symposia/ Workshop and Delivered Invited Talk / Visit Abroad	Extramural Funding	Patent Applied/ Granted	Award / Honour / Membership
00	02	00	04	00	00	03

Dr. Saikat Biswas

Associate Professor
Department of Physics

Name of the participants:
Sayak Chatterjee, SRF
Arindam Sen, SRF, INSPIRE Fellow
Subir Mandal, JRF, UGC
Pranjal Barik, Summer Trainee, Savitribai Phule Pune University
Ayan Dandapat, Short-term intern, IIT, Ropar
Rajat Paul, Summer Trainee, Savitribai Phule Pune University Shreesh Sahai, Short-term intern, Amity University, Uttar Pradesh),Mayukh Chatterjee, St. Xavier's College, Kolkata
Shreesh Sahai, Short-term intern, Amity University, Uttar Pradesh
Mayukh Chatterjee, St. Xavier's College, Kolkata
Aheesh Chandrakant Hegde, NISER

Research Background and Vision:

I am working on the Physics of particle detectors, specifically on the research of gaseous detectors and the scintillation detector for heavy ion and cosmic ray experiments.

The goal is to study the physics of Quark-Gluon Plasma (QGP) at low baryonic density and high temperature in the ALICE experiment, and also at low temperature and moderate to high baryon densities in the CBM experiment at FAIR. As both these experiments will use fast gaseous detectors, we are working on the R&D of these detectors. This R&D program includes research on Resistive Plate Chamber (RPC), Gas Electron Multiplier (GEM), Straw tube detector and Scintillation detector (for cosmic ray study).

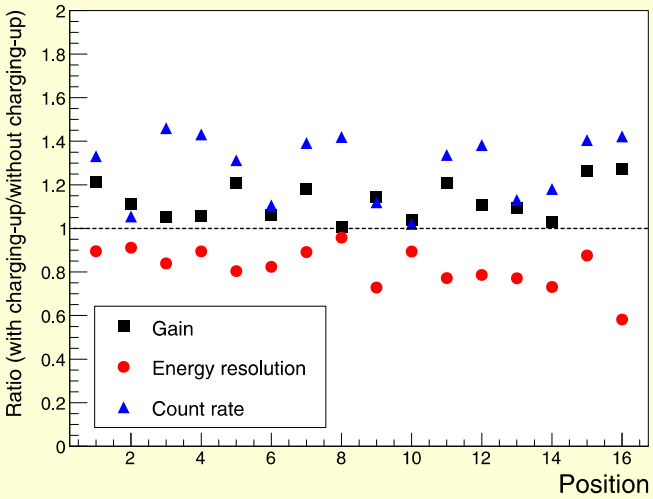
Research Highlights/Accomplishments:

- **Charging-up effect and uniformity of a single mask triple GEM detector is studied.** (With S. Chatterjee, A. Sen, S. Das)

The Gas Electron Multiplier (GEM) detector is one of the advanced members of the Micro Pattern Gas Detector (MPGD) family, used in High Energy Physics (HEP) experiments as a tracking device due to its high rate handling capability and good spatial resolution. The uniformity in the performance of the detector is an essential criterion for any tracking device.

The presence of the dielectric medium (Kapton) inside the active volume of the GEM chamber changes its behaviour when exposed to external irradiation. This phenomenon is known as the charging-up effect. The charging-up effect over the entire surface of a Single Mask (SM) triple GEM

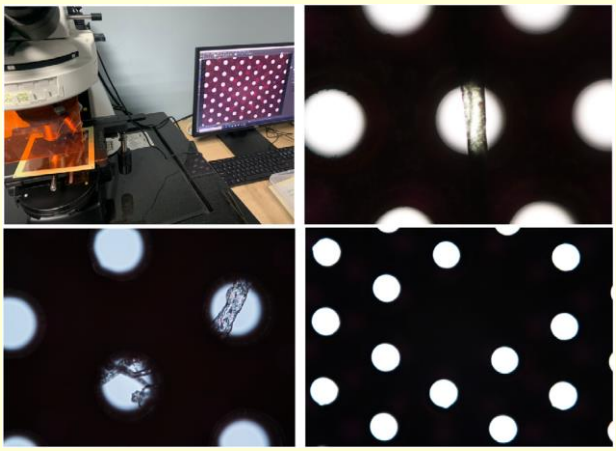
chamber of dimension 10 cm × 10 cm is studied. The study of uniformity in terms of gain, energy resolution and count rate for the same chamber is also carried out before and after the charging-up of the GEM foils.



Ratio of gain, energy resolution and count rate after and before the charging-up effect of the Single Mask triple GEM chamber at the sixteen different positions of the chamber. The error bars are smaller than the marker size.

- **Visual investigation of possible degradation in GEM foil under test is performed.** (With S. Chatterjee, A. Sen, S. Das)

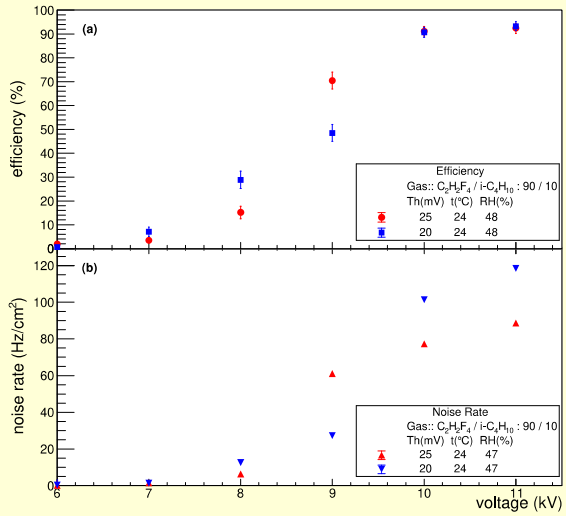
Visual investigation of a single mask GEM foil, showing low resistance (~ 40 kΩ) is carried out manually using an optical microscope. The visual inspection revealed several imperfections in the GEM foil. The GEM foil is cleaned using two different techniques, one by just using the Millipore water bath and the other one is with the ultrasonic frequency with Millipore water as the medium. The leakage current of the foil is measured under the continuous flow of the Ar/CO_2 gas mixture. The leakage current of the foil is found to be ~ 0.3 nA at a ΔV of 300 V across the GEM foil and at an RH of ~ 50% resulting a foil resistance of ~10^6 MΩ. The ultrasonic bath technique is found to be useful to clean the foil showing low resistance, which might be due to the accumulation of impurities in the foil. After the cleaning, the functionality of the GEM chamber gets completely restored.



Microscope setup for scanning the GEM foil (top left). Imperfections in the GEM foil at different magnifications (40X: top right, bottom left; 20X: bottom right).

- **Characterization of a new RPC prototype using conventional gas mixture is performed.** (With A. Sen, S. Chatterjee, S. Das)

Resistive Plate Chamber is a well-known gaseous detector in the field of High Energy Physics experiments for its good tracking capability, high efficiency, good time resolution, and low cost of fabrication. The main issue in Resistive Plate Chamber is its limitation in the rate handling capability. Several experimental groups have developed sophisticated techniques to increase the particle rate capability and reduce the noise rate of this detector. In bakelite Resistive Plate Chamber linseed oil coating on the inner electrode surface is done to get rid of surface roughness of the resistive electrodes. We developed a new method for linseed oil coating in case of bakelite Resistive Plate Chamber to achieve good efficiency. The detector is tested with Tetrafluoroethane ($C_2H_2F_4$) and Isobutane (i-C_4H_{10}) in 90/10 volume ratio. Both the current and noise rate are very low for this gas mixture compared to the 100% $C_2H_2F_4$ used earlier for the same detector. An efficiency of greater than 90% is found from 10 kV onwards with a maximum noise rate of 120 Hz/cm^2 at - 20 mV threshold.



(a) Efficiency as a function of the applied voltage, (b) Noise rate as a function of the applied voltage for C_2 H_2 F_4 and i-C_4 H_{10} gas mixture in 90/10 volume ratio..

Future Plan:

- Research and development of Gas Electron Multiplier (GEM) and Resistive Plate Chamber (RPC) detectors for the CBM experiment which includes mainly the ageing and stability studies.
- Development of gaseous detectors for imaging
- Study of cosmic ray using scintillation detectors and detection of neutrons.

Scientific Activities:

Student Awarded Ph.D.	Publication	Book Chapter / Invited Review	Participation in Conference / Symposia/ Workshop and Delivered Invited Talk / Visit Abroad	Extramural Funding	Patent Applied/ Granted	Award / Honour / Membership
00	13	00	25	01	00	11

Dr. Sidharth Kumar Prasad

Associate Professor
Department of Physics

Name of the participants:

Abhi Modak: SRF, Institute Fellow
Prottoy Das: SRF, Institute Fellow
Debjani Banerjee: SRF, DST Inspire Fellow
Mintu Haldar: UGC Fellow

Postdocs

Sanchari Thakur: ALICE Project
Sumit Kr. Saha: ALICE Project

Summer trainees:

Vipul Pant
Shivam Maharaj

Collaborations

A Large Ion Collider Experiment (ALICE) at CERN, Geneva
Compressed Baryonic Matter (CBM) experiment at GSI, Germany

Research Background and Vision:

Our research focuses on the study of a new state of matter with partonic degrees of freedom known a Quark Gluon Plasma (QGP) using nucleus-nucleus and hadronic collisions at relativistic speeds. Various properties of QGP are being investigated and their precise measurements are still some of the open questions in our field. We primarily focus on the study of hard probes (QCD jets) and photon production with the ALICE experiment at Large Hadron Collider (LHC), CERN. Instrumentation, detector development, development of computing algorithms and Monte Carlo simulations for detection and reconstruction of particles produced in these collisions are also integral parts of our research program.

Aims and Objectives

- Characterization of a new state of matter known as QGP produced in heavy ion collisions :
- Performing experiments through the participation and contributions in the large international experimental collaborations such as ALICE at CERN, Geneva and CBM at FAIR, GSI.
- Performing data analysis and Physics publications in scientific journals regarding characterization and understanding of QGP.
- Development of in-house facilities and expertise for detector R&D, instrumentation and computational techniques for big data analysis.

Research Highlights/Accomplishments:

- Measurements of inclusive photon multiplicity and pseudorapidity distributions in proton-proton and proton-Lead collisions at √s = 5.02 TeV using the ndigenously built Photon Multiplicity Detector (PMD) at forward rapidities in ALICE at CERN are completed. The manuscript containing the final outcome of this work is accepted by the international journal EPJC for publication.
- Multiplicity dependence of charged jet properties in proton-proton collisions at 13 TeV is studied using ALICE and the paper draft containing the final results is under review within the ALICE collaboration.
- Study of jet production and its properties in proton-proton and proton-lead collisions at 5.02 TeV is carried out using ALICE at LHC. Results are presented in national/international conferences. The draft of the manuscript highlighting the major outcome of this work in under review within the ALICE collaboration.
- Water based cooling system is developed for individual modules of CBM MUCH and used in the mini-CBM experiment at GSI, Germany. The manuscript highlighting the design, working principle and its performances is published in the journal Nuclear Instrumentation and Methods A.
- The effect of magnetic field on estimation of jet transport coefficient is studied using a simplified quasi-particle model. The manuscript is under journal review.
- Using Pythia-8 MC simulation, the role of multi-parton interaction and color reconnection in modification of jet shapes and fragmentation in high-multiplicity proton-proton collisions at 13 TeV is studied. The final outcomes of this study is nder journal review.

Future Plan:

- Physics analyses and publications of the LHC data to explore the physics of strongly interacting matter at extreme energy density and characterization of QGP properties.
- R&D and commissioning of a cooling system for the full station of the MUCH detector in the CBM experiment.
- R&D and physics/detector simulations related to the Forward Calorimeter (FoCal) of the ALICE experiment at LHC, CERN.

Scientific Activities:

Student Awarded Ph.D.	Journals Publication	Conference Proceedings	Books Chapter / Invited Reviews	Internal Notes	Participation in Conference / Symposia/ Workshop and Delivered Invited Talk	Extramural Funding	Award / Honour/ Member-ships
00	03	07	03	03	28	02	12

Dr. Pramod Kumar Shukla

Assistant Professor
Department of Physics

Name of the participants:
Collaborator:

S. Abdus Salam, Shahid Beheshti University, Tehran, Iran
C. Crinò, University of Trieste& INFN, Trieste, Italy
G. K. Leontaris, University of Ioannina, Greece

Research Background and Vision:

From the cosmo-phenomenological studies in the context of models developed in string theory framework, it has been experienced that satisfying the requirements for moduli stabilization along with the local constructions of chiral visible sector remains a challenging issue. In the standard approach of string model building, global issues (such as moduli stabilization, realizing inflationary aspects) and local issues (such as embedding MSSM-like spectrum) are studied quite independently. Although this helps in understanding both sectors significantly, the same appears to be too simplistic for realistic model building purposes, and an interplay of local and global effects needs to be considered at the same time within a single framework.

Addressing along the way some mathematical/phenomenological challenges, we have been working on a systematic study of type IIB string compactifications in LARGE volume scenarios (LVS) with the main objective of combining moduli stabilization along with realizing inflationary. This ongoing task has been targeted with a two-fold goal: the first one being more mathematical in which we have been interested in the construction of 'suitable' CalabiYau (CY) orientifolds using the toric-geometry-based package/tools, like Package for Analyzing Lattice Polytopes (PALP), System for Algebra and Geometry Experimentation (SAGE), Cohomology Computation of Algebraic Varieties (cohomCalg) and CalabiYau Tools Package (CYTools). And in the second part we construct explicit models addressing issues like moduli stabilization, flat vacua with (post-)inflationary aspects.

Aims and Objectives:

- To construct concrete (semi-)realistic models addressing cosmo-phenomenological issues in the framework of superstring compactifications using a class of suitable CY-three folds.
- To study and classify the CY dataset with large h^{1,1}(CY).
- To classify the rich landscape of the flux vacua along with seeking the origin of open-string moduli in the context of the F-theory compactification models, and subsequently to study their applications in inflationary model building.

Research Highlights/Accomplishments:

- Using a set of geometric fluxes, we have proposed the possibility of realizing de-Sitter (dS) vacua in a simple type IIA STU-like model based on toroidal orientifold compactifications to four-dimensions [P. Shukla, EPJC 83, 196 (2023)].On the similar lines, using a concrete K3-fibred CY threefold we have recently proposed dS uplifting of the LVS non-super symmetric AdSvacua in [S. Abdus Salam, C. Crinò and P. Shukla, JHEP) 03, 132 (2023)].
- The standard so-called Large volume scenario (LVS) framework for type IIB moduli stabilization needs non-perturbative effects. In a recent work [G. K. Leontaris and P. Shukla, JHEP 07, 047 (2022)] we have presented an alternative called as "perturbative LVS" which is a new scheme that includes only perturbative effects to fix all the moduli in an exponentially large volume of the compactifying CY threefold. We also presented some concrete CY threefold examples useful for model building with a detailed classified in [P. Shukla, JHEP 12, 055 (2022)].
- Recent attraction towards the “perturbatively flat flux vacua” (PFFVs) has motivated us to classify and invoke some insights based on the divisor topologies of the compactifying manifolds and we have found that models based on K3-fibred CY threefolds have generically more PFFVs as compared to those which do not arise from K3-fibred CY compactifications [F. Carta, A. Mininno and P. Shukla, JHEP 05, 101 (2022); F. Carta, A. Mininno and P. Shukla, JHEP 08, 297 (2022)].

Future Plan:

- To study the dynamics of open-string moduli along with their implications for addressing interesting issues such as de-Sitter realization and embedding inflationary models in some explicit global constructions.
- Superstring compactifications on toroidal real-six fold backgrounds lead to some four-dimensional effective theories which can be subsequently used for addressing a variety of issues related to realistic string model building; for example analysis of flux vacua, moduli stabilization

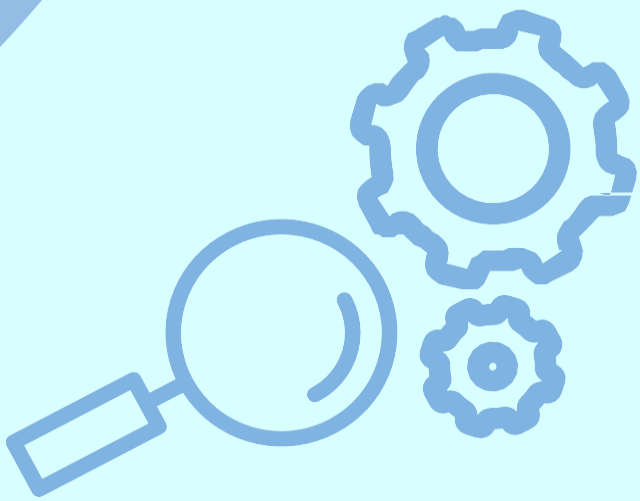
and de-Sitter/inflationary possibilities in the lights of swampland conjectures. On these lines, the one of the prime goals is to present a detailed and concrete non-geometric construction for all the classified toroidal orbifolds of the type T^6/(Z_N×Z_M) and T^6/Z_N.

- To study the F- theory uplifts of the type IIB global models with open-string moduli. These two aspects are very significant in the area of superstring/F-theory phenomenology in order to construct realistic models.

Scientific Activities:

Student Awarded Ph.D.	Publication	Book Chapter / Invited Review	Participation in Conference / Symposia/ Workshop and Delivered Invited Talk	Extramural Funding	Patent Applied/ Granted	Award / Honour / Membership
00	02	00	00	00	00	00

SCIENTIFIC REPORT
DIVISION OF PLANT BIOLOGY



Twenty postgraduate (Botany) students with their teachers from M.C. College (Gauhati University), Barpeta, Assam made a Study Tour on 21.03.2023 at Bose Institute. Research Scholars from the Division of Plant Biology (Mr. Raghuvir Singh and Ms. Saptadipa Banerjee) gave oral presentations; and technical staff of DPB gave theoretical and practical demonstrations of the instruments concerning the experiments on Plant Sciences.

Overview

The present Division of Plant Biology, conceived by Sir J.C. Bose as the Department of Botany, works towards fulfilling his dream of understanding the plants' responses through an interdisciplinary approach. This research helps to understand the intricate life processes of plants for sufficing the basic and essential needs of the human population. In this era of population outbursts and shrinkage of agricultural land, developing high-yielding plants with increased yield and combating environmental stress is a daunting task for the present plant scientists. The plant system offers a unique opportunity to explore properties like to totipotency - the plant equivalent feature of stem cells, stress resilience, and biodiversity. The mission of the scientists of this division directs towards achieving fundamental knowledge in the fields of plant stress biology, development biology, plant-pathogen interaction, and genomics-assisted molecular breeding. The goal remains to understand the plant system to the extent for the benefit of the human race and preserve the balance of nature.

List of Personnel:

Faculty Members: Prof. Shubho Chaudhuri, Prof. Gaurab Gangopadhyay (Chairman), Prof. Pallob Kundu, Dr. Anupama Ghosh.

Senior Scientists: Prof. Sampa Das, INSA Senior Scientist.

Students: RA/SRF/JRF/Project Associate : Dr. Sathi Paul, Dr. Alka Kumari, Dr. Sambit Datta, Rahul Dutta, Dibya Mukherjee, Udita Acharya, Aishee De, Surbhi Shriti, Subhasish Mukherjee, Shreya Chowdhury, Rohit Das, Jinia Chakrabarty, Shrabani Basak, Pratiti Dasgupta, Rwitie Mallik, Anisha Roy, Aroni Mitra, Ruby Biswas, Sonal Sachdev, Sayan Mal, Himadri Das, Ananya Mukherjee, Sayani De, Raghuvir Singh, Debabrata Dutta, Moumita, Bhowmik, Moumita Biswas Sarkar, Vivek Awon, Diptasree Kumar, Soumili Pal. Mushtaq Ahmad Najar, Saptadipa Banerjee. ***Women Scientist :*** Dr. Papri Nag, Dr. Lekha Bandopadhyay, Dr. Akansha Jain.

Staff Members : Ashim Kumar Nath, Dr. Chaitali Roy, Jadab Kumar Ghosh, Kaberi Ghosh, Jayasish Ghosh, Siddhartha Roy (Superannuated on 31.10.2022), Nadiram Kayal, Birendra Kumar Bari, Moumita Mondal Basu Roy.

Forty postgraduate (Botany and Microbiology) students with their teachers from Mizoram University (A Central University), Aizawl, made a Curriculum Stipulated Study Tour (CSST) on 16.03.2023 at Bose Institute. Prof. Gaurab Gangopadhyay, DPB, gave a presentation on recent plant science research at Bose Institute. Students from the Department of Microbiology (Mr. Sumit Chatterjee and Mr. Mahamadul Mondal) gave theoretical and practical demonstrations of the instruments concerning the Microbiology experiments, including a visit to the CIF.

Prof. Shubho Chaudhuri

Professor
Division of Plant Biology

Name of the participants:
Jinia Chakrabarty, SRF
Sonal Sachdev, SRF
Ruby Biswas, SRF
Vishal Roy, JRF
Sabini Basu, JRF
Ayantika Nandi, JRF
Rukshar Parveen, JRF

Research Background and Vision:

The stress adaptation in plants involves reprogramming of developmental process in response to various environmental cues. A basic requirement of this reprogramming involves alteration in the expression levels of several genes. In eukaryotes, accessibility of DNA sequences to the transcription machinery is critically determined by the degree of packaging of the DNA into chromatin structure. Emerging evidence has shown that epigenetic modifications and/or active chromatin remodelling play a regulatory role in changing the chromatin structure to generate 'open' or 'closed' chromatin configuration for the transcription. 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:

- To understand the role of chromatin architectural proteins in modulating chromatin structure *in planta*
- Investigating the genetic and epigenetic regulation involved in controlling the gene expression during stress response in plant.

Research Highlights/Accomplishments:

To understand the role of chromatin architectural proteins in modulating chromatin structure *in planta*

AtHMGB15 (At1g04880) which belongs to ARID/HMG group of chromatin architectural protein from Arabidopsis that shows highest expression in young and mature flowers. The unique feature of this novel class of HMG-box domain containing protein is the presence of two DNA binding domain in their primary structure: AT-rich interaction domain (ARID) and HMG box domain (HMG). Recent work from our group indicate.

- AtHMGB15 knockout plants have defective pollen development leading to large number of non-viable pollens resulting in low seed set in the mutants.

- Molecular analysis using transcriptome study shows defect in Jasmonic acid biosynthesis and signaling genes in *athmgb15* mutant.
- Our results suggest that AtHMGB15 acts as transcription activator and together with MYC2 transcription factor activate the transcription of two important transcription factors of JA signaling pathway, MYB21 and MYB24 during stamen and pollen development.
- Deletion of AtHMGB15 causes delayed Programmed Cell Death for the tapetal cell degradation causing defect in pollen cell wall development and viability.

Investigating the genetic and epigenetic regulation involved in controlling the gene expression during stress response in plant.

Low temperature a major abiotic stress, is known to adversely affect the growth and development of rice plants, *Oryza sativa*. Similar to other plant species originating in tropical and sub-tropical areas, indica rice is highly sensitive to low temperature that adversely affects its growth and grain productivity. Cellular reprogramming in response to cold stress involves alteration of gene expression. Our results indicate

- Genome-wide analysis of Histone H3K27 trimethylation and acetylation changes were suggest a positive correlation between the changes in H3K27 modifications and stress-responsive gene activation in *indica* rice.
- Integration of the chromatin immunoprecipitation followed high-throughput sequencing data, with transcriptome suggests that differential expression of various chromatin and DNA modifiers ensures increased DNA accessibility, thereby promoting transcription of the cold-responsive genes in *indica* rice.

Future Plan:

- Study the effect of AtHMGB15 on Program Cell Death during pollen development.
- Study the role of AtHMGB15 in Jasmonic acid mediated transcription regulation of MYB21 and MYB24
- Identification of AtHMGB15 interacting stamen specific factors that regulates the spatiotemporal expression of MYB21 and MYB24 during pollen development.
- Comparative transcriptome to identify cold induced gene expression of contrasting rice germplasms: cold sensitive IR36 and cold tolerant CB1, during early and late chilling stress response in seedling stage.
- Comparative genome-wide DNA methylation profiling in cold sensitive IR36 and cold tolerant CB1 seedlings during chilling stress response and elucidating its affect in differential gene expression.

Scientific Activities:

Student Awarded Ph.D.	Publication	Book Chapter / Invited Review	Participation in Conference / Symposia/ Workshop and Delivered Invited Talk	Extramural Funding	Patent Applied/ Granted	Award / Honour / Membership
01	01	00	01	01	00	00

Prof. Gaurab Gangopadhyay

Professor
Division of Plant Biology

Name of the participants:
Soumili Pal - SRF, DST-INSPIRE Fellow
Diptasree Kumar - SRF, WBDSTBT Project Fellow
Mushtaq Ahmad Najar - SRF (CSIR, Adhoc Fellow)
Saptadipa Banerjee - SRF (UGC, Adhoc Fellow)
Dr. Bratati Sikdar - Senior Project Associate (Intramural)

Certificate
Plant Germplasm Registration

It is certified that germplasm R6 of Sesame (INGR22090) developed by

Gaurab Gangopadhyay, Debabrata Dutta and Ranjana Prasad
Division of Plant Biology, Bose Institute (Main Campus), Kolkata, West Bengal

has been registered by Plant Germplasm Registration Committee (PGRC) of Indian Council of Agricultural Research on July 08, 2022.

Member-Secretary
PGRC

Chairman, PGRC
DDG (CS) ICAR

Research Background and Vision:

I am a plant biologist working on omics-assisted plant breeding and biotechnology. The main program is on sesame, the emerging oilseed crop. We have developed a few promising recombinants of sesame with high lignan content in oil and tolerance to charcoal rot disease. In the coming years, I'll concentrate on fundamental aspects of flowering. It'll help to combat the deadly Phytoplasma-induced flowering disease causing Phyllody. Besides this project, I have a few other research programs, like the *Fusarium*-tolerant over-expression line development of Pineapple and deciphering the pathways involved in the somatic embryogenesis of Darjeeling tea integrating metabolomics and transcriptomics analysis.

Research Highlights/Accomplishments:

- The germplasm of Sesame (INGR22090) developed by Gaurab Gangopadhyay and his students (Debabrata Dutta and Ranjana Prasad) has been registered by the Plant Germplasm Registration Committee (PGRC) of Indian Council of Agricultural Research (ICAR) on 08.07.2022.
- PI of the collaborative project (between Bose Institute and the Tea Board of India) entitled "The mystic flavor of the Darjeeling tea: Exploring the role of Phytobiome in regulation of biosynthetic pathways using omics approach" (Letter from TBI: No. DR-3(21)/PJ/Phytobiome dated 29.03.2023).

Future Plan:

- A molecular insight of Flowering and a Phytoplasma-induced flowering disease causing Phyllody in Sesame.
- Understanding the response of a few phyto-chemicals on bacterial quorum sensing and associated bio-film formation.

Identification of a deadly Phytoplasma-induced flowering disease causing Phyllody in Sesame

Scientific Activities:

Student Awarded Ph.D.	Publication	Book Chapter / Invited Review	Participation in Conference / Symposia/ Workshop and Delivered Invited Talk	Extramural Funding	Patent Applied/ Granted	Award / Honour / Membership
02	02	00	14	00	00	00

Prof. Pallob Kundu

Professor
Division of Plant Biology

Name of the participants:
Sayani De, SRF
Rohit Das, SRF
Shreya Chowdhury, SRF
Shrabani Basak, SRF
Sayan Mal, SRF
Himadri Das, SRF
Ananya Mukherjee, SRF
Raghubir Singh, SRF
Sushmita Talukdar, SRF
Riya Bajani, SRF

Research Background and Vision:

Plants' response to biotic stress is multifaceted. One of the significant aspects of this regulation is reprogramming the gene regulation cascade, which evolved to create unfavourable conditions for the pathogen. However, pathogen-elicited molecules could circumvent this molecular barrier and create disease. Several environmental factors also influence the pathogenic outcome. Using different pathogens and tomato plants as the model system, we investigate the key molecular players in shaping plant response to disease under ever-changing climatic conditions and the means for manipulating the plant-response pathway to bestow multi-disease tolerance to cultivable tomatoes.

We are using genomics, molecular biological, and plant biotechnological tools, and the following are our current research topics.

- **The mechanisms regulating *Alternaria* stress-responsive microRNA expression and the significance of specific miRNA-mRNA interaction in disease biology.**
- **The role of mediators of cell death, such as NB-LRRs and metacaspases, in disease development.**
- **The mechanisms of stress signal perception, regulation of expression, and biological functions of membrane-bound NAC transcription factors in tomatoes.**
- **Generation of stress-resilient crops of the future by biotechnological approaches**.

Research Highlights/Accomplishments:

- We have shown microRNA miR6024 acts as a negative regulator of a set of resistance (R) genes via direct interaction and generating phasiRNAs, dampening tomato plant immunity against necrotrophic pathogen *A. solani* [PMB, 2022].

- Cytosine methylation in the promoter of vascular development-related TRN1 suppressed its transcription in tomatoes' fully-developed leaves. Tomato leaf curl New Delhi virus (ToLCNDV) infection disrupts methylation machinery and reactivates TRN1 expression - likely causing abnormal leaf growth patterns and disease manifestation [Planta, 2022].

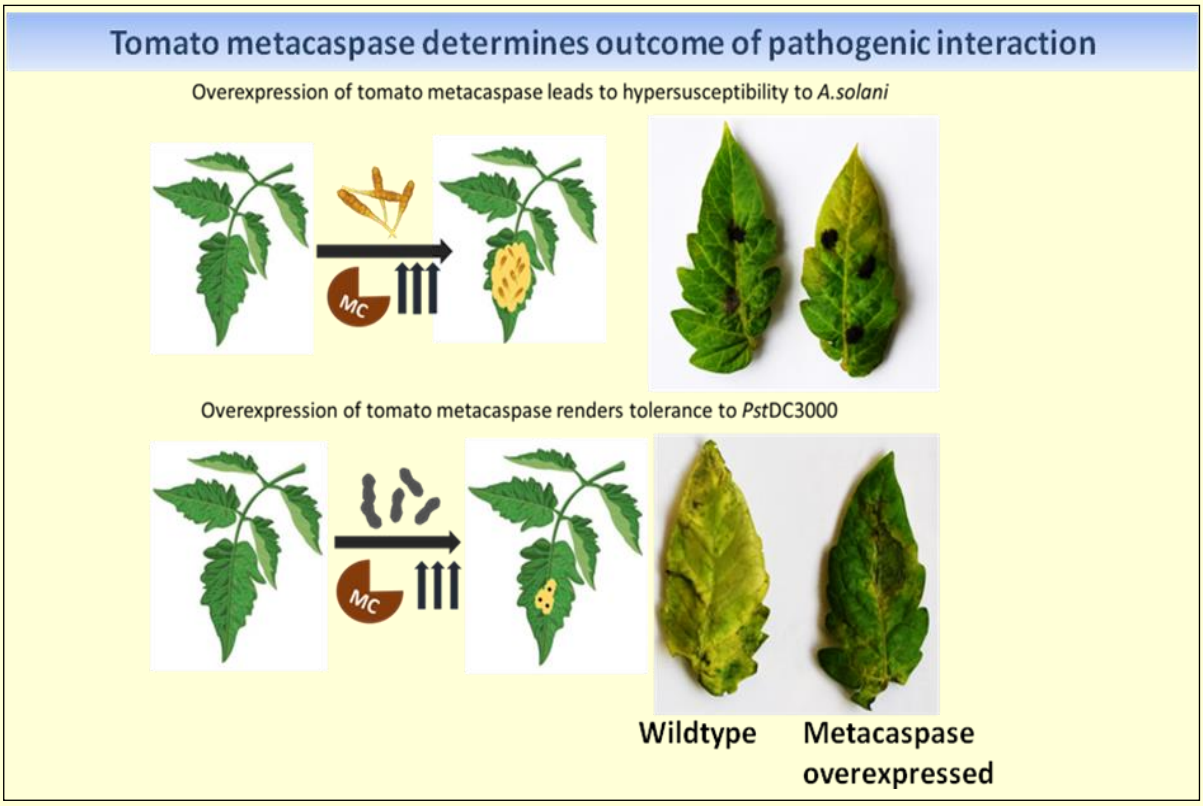
- We have shown that a metacaspase in tomato is stress-responsive, low pH-activable, and involved in hypersensitive response. Thus, the metacaspase seems to act as an intracellular stress sensor mediating cell death.

Future Plan:

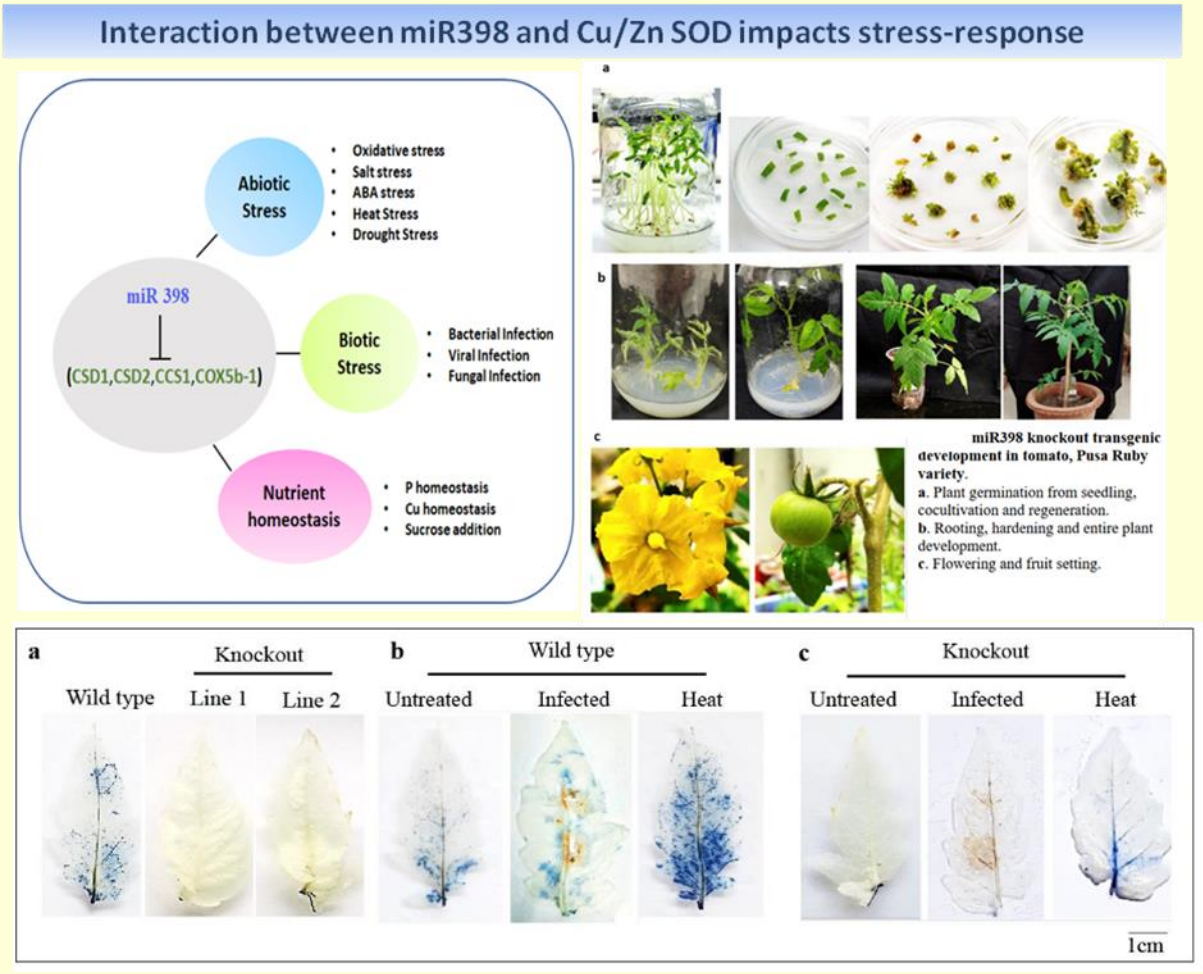
- We will investigate how environmental factors influence stress-responsive miRNA biogenesis.

- In our quest to find out the mechanism of activation of membrane-bound NAC transcription factor (SlNACMTF), we have confirmed the role of tomato rhomboid protease(s) in activating SlNACMTF3. We are investigating which rhomboid proteases are involved in the process and how stress stimuli instigate rhomboids in interacting with SlNACMTF3.

- We are developing several tomato-optimized CRISPR-dCas9-based tools for heat-inducible regulation of gene expression and multiplexing. Further optimization of these tools and exploring their applicability in modifying complex traits are in progress.



Overexpression of a metacaspase in detached tomato leaves followed by pathogen inoculation demonstrates hypersusceptibility to necrotrophic fungus *Alternaria solani* and tolerance to hemibiotrophic bacteria, *Pseudomonas syringae* DC3000.



Upper left panel, scheme showing outcome of miR398-SOD (Superoxide dismutase) transcript interactions. Upper right panel, stages of development of miR398 knockout plant using CRISPR-Cas9 technology. Lower panel, NBT staining picture of leaves showing the status of reactive oxygen species (ROS) level in wild type and miR398 knockout leaves with or without different treatments.

Scientific Activities:

Student Awarded Ph.D.	Publication	Book Chapter / Invited Review	Participation in Conference / Symposia/ Workshop and Delivered Invited Talk	Extramural Funding	Patent Applied/ Granted	Award / Honour / Membership
00	02	00	00	03	00	00

Dr. Anupama Ghosh

Associate Professor
Division of Plant Biology

Name of the participants:
Udita Acharya, SRF, Institute fellow
Subhasish Mukherjee, SRF, UGC Adhoc
Aroni Mitra, DBT-SRF
Anisha Roy, DBT-SRF
Rituparna Mondal, DBT-JRF
Ankita Kar, DBT-JRF
Atreyee Sarkar, UGC Adhoc

Research Background and Vision:

Our research involves identifying the molecular mechanisms of communication between a host and a pathogenic/beneficial microbe within a plant microbe interaction system. As a model biotrophic plant pathogen we are studying the corn smut fungus *Ustilago maydis*. We are currently investigating the biological function of a number of secreted proteins including ribonucleases, proteases and lipases from *Ustilago maydis* in connection to disease establishment by the pathogen. In addition, role of small heat shock proteins in the pathogenic development of the fungus is also being studied. Identifying the defense response by the host plant *Zea mays* against *U. maydis* infection is another major research area that is being explored. Our primary focus is on the host pathogen interface that is represented by the apoplast of the infected plant. In addition to these we are also studying the response of maize towards colonization with beneficial microbes isolated from various environments.

Research Highlights/Accomplishments:

- Involvement of an intrinsically disordered small heat shock protein, Hsp12 in stabilizing lipid vesicles has been demonstrated.
- Role of a secreted aspartic acid protease, Ger1 in the spore germination process of *U. maydis* has been shown.
- The key components of the apoplastic defense response of rice against sheath blight infection are deciphered.

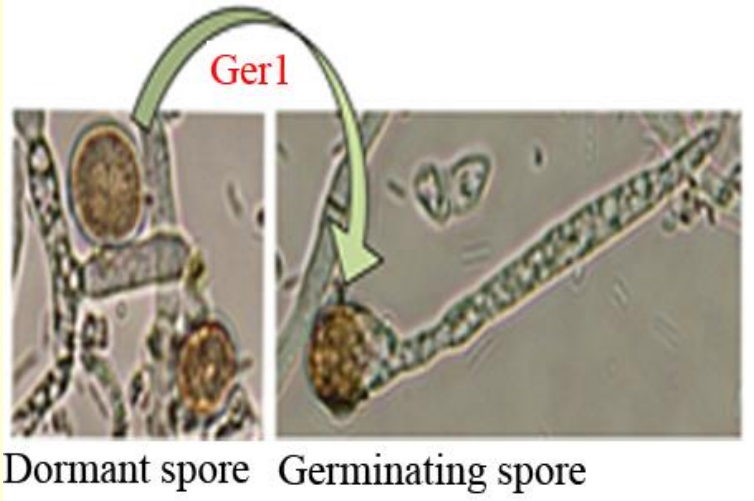


Figure showing the dormant and the germinating teliospores of Ustilago maydis. Ger1, a secreted aspartic acid protease from the fungus acts on the dormant spore to facilitate the germination process (Mukherjee et al, Yeast, Dec 2022, Vol 40 (2), 102-116).

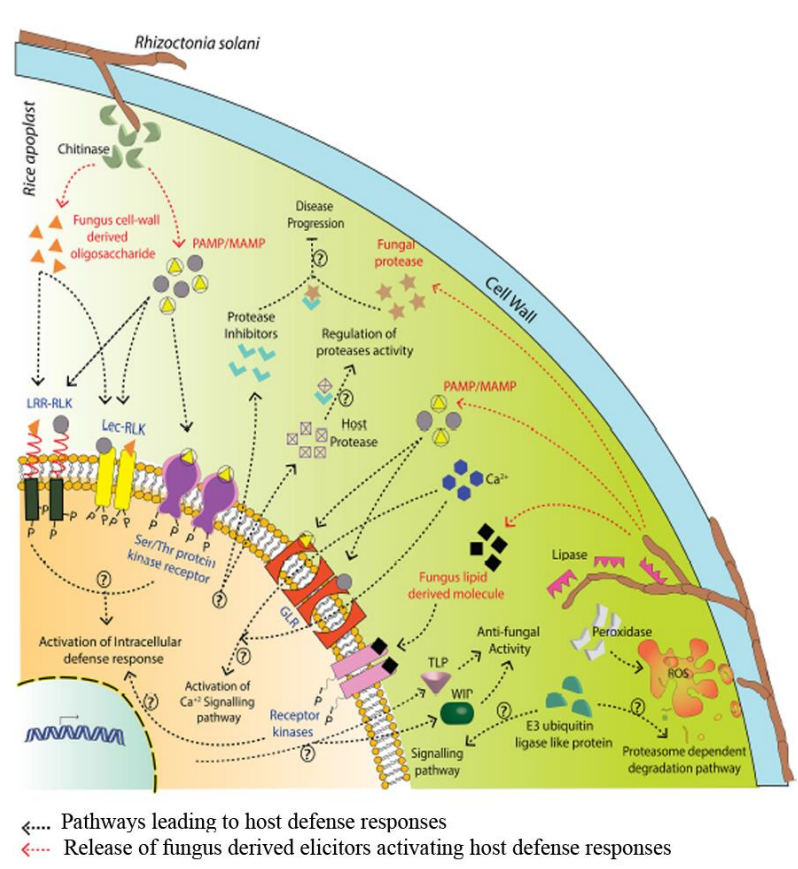


Figure demonstrates the defense responses operative within rice apoplast during sheath blight infection caused by *Rhizoctania solani*. (Acharya *et al*, MPMI, 2022, Vol 35 (12), 1081-1095)

Future Plan:

- Deciphering the role of a phosphatidylserine specific secreted lipase in the pathogenesis of *U. maydis*.
- Investigating the molecular signaling explaining the involvement of a small heat shock protein Hsp20 in regulating the morphological changes in *U. maydis*.
- Investigating the function of a cell wall stress responsive protein from *U. maydis*.

Scientific Activities:

Student Awarded Ph.D.	Publication	Book Chapter / Invited Review	Participation in Conference / Symposia/ Workshop and Delivered Invited Talk	Extramural Funding	Patent Applied/ Granted	Award / Honour / Membership
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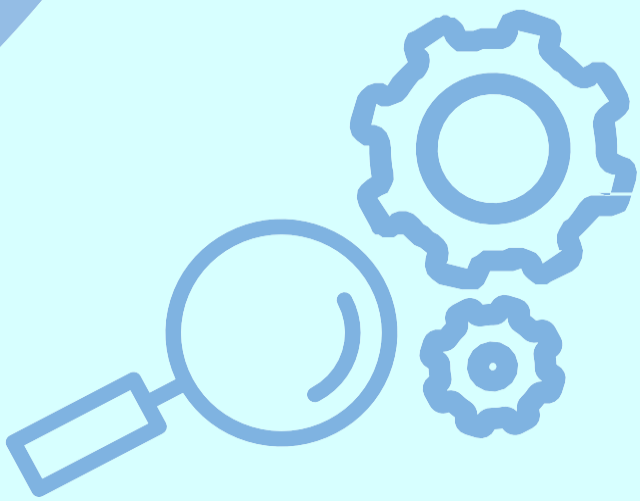
SCIENTIFIC REPORT
SENIOR SCIENTISTS



India International Science Festival 2022

Bose Institute participated in the Mega Science Technology & Industry Expo of 8th IISF-2022 held from January 21-24 2023 at MANIT, Bhopal. Faculty Members and Staff of Bose Institute presented the past and present scientific works of Bose Institute along with Publications and Diaries of J.C. Bose in the Pavilion.

Prof. Joyoti Basu

J. C. Bose National Fellow

Research Background and Vision:

Research in our laboratory was centred around understanding the interaction between *Mycobacterium tuberculosis* and host macrophages, and on understanding the regulatory factors which enable *M. tuberculosis* to survive under the conditions that it specifically encounters within the host. Molecular biological, immunological and biochemical approaches have been used in order to address these aspects of tuberculosis infection.

Research Highlights:

- We have elucidated the role of the secreted *M. tuberculosis* PPiA protein (Rv0009) in regulating cell signaling and the release of type I interferon from treated macrophages.
- We have shown that the transcription factor Rv0081 is a regulator that enables *M. tuberculosis* to utilize cholesterol as the sole source of carbon.

Summary of Work:

We have shown that PPiA interacts with the macrophage protein STING. The amino acid residues of PPiA involved in this interaction, have been identified. This interaction enables dimerization of STING, which enables downstream activation of TANK binding protein kinase 1 (TBK1) and interferon regulator factor (IRF) 3. These events culminate in the transcriptional activation of IFNβ.

In the second part of our work, we have elucidated that the transcription factor Rv0081 of *M. tuberculosis* is required for its survival where cholesterol is the sole source of carbon. Using a knockout mutant of Rv0081 and biochemical assays, we have established that Rv0081 binds and represses Lsr2, which itself is a repressor of the cholesterol catabolizing operon, thereby regulating the ability of *M. tuberculosis* to utilize cholesterol.

Prof. Manikuntala Kundu

CSIR Emeritus Scientist

Research Background and Vision:

Research in our laboratory focused on (a) understanding how the respiratory pathogen *Mycobacterium tuberculosis* utilizes signaling systems to sense the external environment and mount a response that enables it to survive within its intracellular niche and (b) understanding the mechanisms of interactions of *Helicobacter pylori* with gastric epithelial cells and the regulation of cell survival, death, invasion and cytokine release during *H. pylori* infection.

Research Highlights:

- We have elucidated the role of the response regulator RegX3, representing one half of the two component system SenX3-RegX3 in the response of *M. tuberculosis* to hypoxia.
- We have demonstrated that miR-671-5p/CDCA7L signaling is linked to the generation of reactive oxygen species (ROS) during H. pylori infection, triggering apoptosis.

Summary of Work:

RegX3 as a regulator of the response of M. tuberculosis to hypoxia

Two-component systems (TCSs) are required for the ability of *M. tuberculosis* to respond to stress. We have employed genome-wide microarray profiling to compare gene expression in a *ΔregX3* mutant with the wild-type under phosphate stress, in order to gain information on the probable RegX3 regulon. We pulled out a set of 128 hypoxia-associated genes, which could potentially be regulated by RegX3. We observed that *ΔregX3* was attenuated in terms of its ability to withstand

hypoxia, and this was reversed upon complementation with *regX3*, corroborating a role of RegX3 in the response of *M. tuberculosis* to hypoxia. Electrophoretic mobility shift assays (EMSAs) confirmed that RegX3 binds to the upstream regions of the hypoxia-associated genes Rv3334, whiB7, Rv0195, Rv0196 and Rv1960c. Gene expression analyses showed that the expression of these genes is regulated by RegX3 under hypoxia. Finally, we demonstrated that attenuation of survival of ΔregX3 under hypoxia is partly reversed upon overexpression of either Rv0195 or Rv3334, suggesting that the RegX3-Rv0195 and the RegX3-Rv3334 axis are involved in the adaptation of *M. tuberculosis* to a hypoxic environment.

Establishing a role of microRNA671-5p/CDCA7L/monoamine oxidase-A signaling in Helicobacter pylori mediated apoptosis in gastric epithelial cells

Helicobacter pylori is a gram-negative microaerophilic bacterium and is associated with gastrointestinal diseases ranging from peptic ulcer and gastritis to gastric cancer and mucosa-associated lymphoid tissue lymphoma. We have demonstrated that microRNA 671-5p is upregulated during *H. pylori* infection of AGS cells or of mice. We have validated that miR-671- targets the transcriptional repressor CDCA7L, which is downregulated during infection (in vitro and in vivo) concomitant with miR-671-5p upregulation. Further, we have established that the expression of monoamine oxidase A (MAO-A) is repressed by CDCA7L, and that MAO-A triggers the generation of reactive oxygen species (ROS). Consequently, miR-671-5p/CDCA7L signaling is linked to the generation of ROS during *H. pylori* infection. Finally, we have demonstrated that reactive oxygen species (ROS)-mediated caspase 3 activation and apoptosis that occurs during *H. pylori* infection, is dependent on the miR-671-5p/CDCA7L/MAO-A axis. We suggest that targeting miR-671-5p could offer a means of regulating the course and consequences of *H. pylori* infection.

Prof. Sujoy Kumar Das Gupta

CSIR Emeritus Scientist

Name of the participants:
Anik Burman, SRF
Rahul Shaw, SRF

Research Background and Vision:

My lab is interested to understand the molecular biology of Mycobacteria and its phages. Various species of Mycobacteria, *Mycobacterium tuberculosis* (Mtb), for example, can cause the deadly disease tuberculosis (TB). Even though Mtb was discovered over a hundred years ago, we have been unable to eradicate TB. Existing drugs often fail to act as these organisms become drug-resistant and sometimes tolerant. To develop novel therapies for TB, we need to understand mycobacterial molecular biology in detail. My lab addresses these issues with the help of Mycobacteriophages, the phages that infect and kill Mycobacteria. Our approach involves infecting Mycobacteria with Mycobacteriophages and studying the resulting molecular and metabolic changes. By taking this approach, we have gained considerable new information about mycobacterial metabolism, which could be used for drug development against Mtb

Aims and Objectives:

- In the area of mycobacteriophage research our objective is to investigate the mechanism by which the mycobacteriophage D29 expresses its genes in a regulated manner using transcriptomics, proteomic and molecular tools.
- Investigate how D29 phage inactivates its mycobacterial host and use the information derived for the development of drugs against TB.
- To study mycobacterial metabolism using gene replacement and CRISPR based gene knockout techniques.

Work Achieved:

Mycobacteriophages are phages that infect mycobacteria resulting in their killing. Although lysis is the primary mechanism by which mycobacteriophages cause cell death, others such as abortive infection may also be involved. We took recourse to perform immunofluorescence and electron microscopic studies using mycobacteriophage D29 infected Mycobacterium smegmatis cells to investigate this issue. We could observe the intricate details of the infection process using these

techniques such as adsorption, the phage tail penetrating the thick mycolic acid layer, formation of membrane pores, membrane blebbing, and phage release. We observed a significant increase in DNA fragmentation and membrane depolarization using cell-biological techniques symptomatic of programmed cell death (PCD). As Toxin-Antitoxin (TA) systems mediate bacterial PCD, we measured their expression profiles with and without phage infection. Of the three TAs examined, MazEF, VapBC, and phd/doc, we found that in the case of VapBC, a significant decrease in the antitoxin (VapB): toxin (VapC) ratio was observed following phage infection, implying that high VapC may have a role to play in the induction of mycobacterial apoptotic cell death following phage infection. This study indicates that D29 infection causes mycobacteria to undergo morphological and molecular changes that are hallmarks of apoptotic cell death.

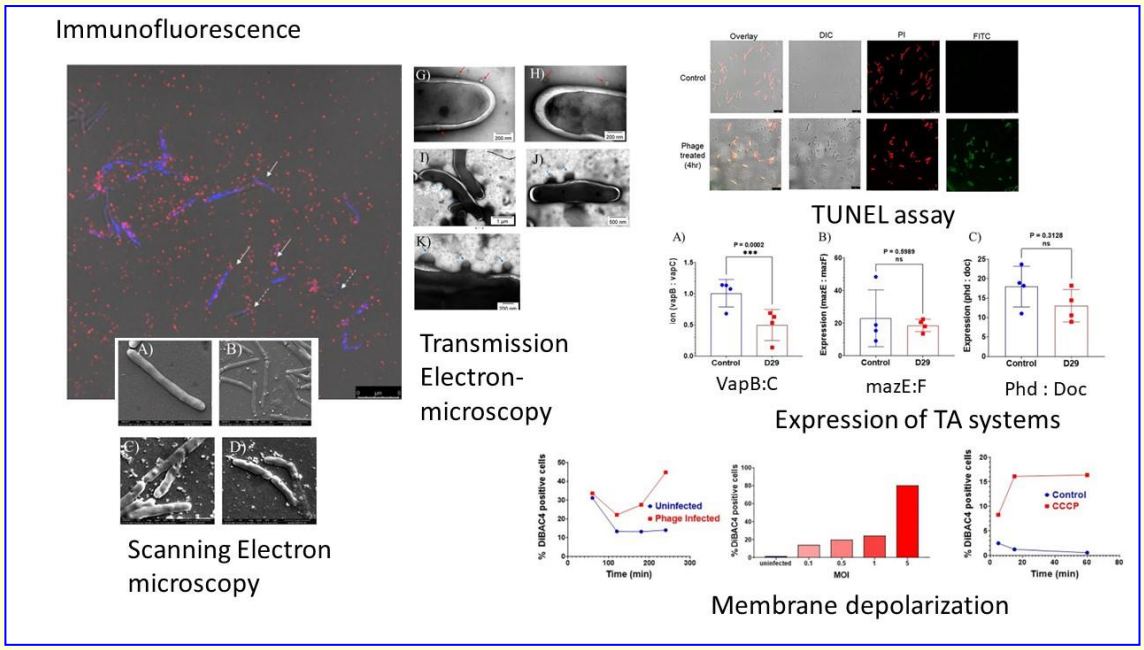


Figure: Apoptosis-like symptoms associated with abortive infection of Mycobacterium smegmatis (Msm) by mycobacteriophage D29. Immunofluorescence studies were performed using anti -Gp17 antibodies targeting the phage head. The red dots represent phage and blue (DAPI) stained shapes, Msm. Electron microscopy, SEM and TEM reveal adsorbed phage and bulged bodies representing possible membrane blebs. TUNEL assay was done to investigate DNA degradation induced by phage attack. Green fluorescence in cells indicates TUNEL positivity. Msm has three Toxin-Antitoxin (TA) systems VapBC, MazEF, and PhD.Doc. The VapB to VapC expression ratio was significantly altered upon phage infection.

Scientific Activities:

Student Awarded Ph.D.	Publication	Book / Invited Review	Participation in Conference / Symposia/ Workshop and Delivered Invited Talk	Extramural Funding	Patent Applied/ Granted	Award / Honour / Membership
02	04	00	02	00	00	00

Prof. Gaurisankar Sa

NASI Platinum Jubilee Senior Scientist

Name of the participants:
Subhadip Pati
Suman Mukherjee
Saikat Dutta
Subhanki Dhar
Dwaipayan Chakraborty
Tania Sarkar

Research Background and Vision:

Anticancer immunotherapies involving the use of immune-checkpoint inhibitors (e.g., anti-CTLA4/-PD1) has emerged as new therapeutic pillars. While often many patients have innate-/acquired-resistance to immunotherapies. Avoidance of immune system is one of the major hallmarks in cancer progression that successively transforms immune-surveillance (tumor-eradication) to immune-tolerance (tumor-progression). Modulation of immune cells to harness the power of effective immune responses has been long-term goals for promising strategies of cancer immune therapy. However, long-term follow-up in a pooled meta-analysis exhibited long-term survival in approximately 20% of patients treated with immune checkpoint inhibitors, and a large fraction of patients experience aggressive disease progression after treatment. Earlier we reported that $FOXP3^{+}$ Treg cells augmentation in cancer patients causes immunosuppression, neo-angiogenesis and metastasis. Recent research has thus focused on the development of effective immunotherapeutic strategies that target tolerogenic-immune cells to become immunogenic and restore cancer immune surveillance to bypass the innate or acquired resistance to immunotherapies.

Aims and Objectives:

- To understand the immune landscape of tumor-microenvironment for the development of innate or acquired resistance to immunotherapies.
- To understand the reason for failure of antibody response against tumor-antigen in cancer patients.
- To understand the immunometabolomics in cancer patients to manipulate diet during therapy.
- To develop suitable combinations of chemotherapy, immunotherapy and rejuvenation-therapy to determine the efficacy of such therapy modules through clinical trials.

Research Highlights/Accomplishments:

- Presence of high-level of tumor-associated $CD4^+CD25^+CD127^-CTLA4^+FOXP3^+$ T-regulatory (tTreg) cells in the tumor-site results in poor prognosis of cancer patient.
- This tTregs use altered energy metabolisms to survive and expand in highly competitive tumor microenvironment.
- This tTregs exploit several immunosuppressive strategies such as induction of T-effector cell death, dysfunction of dendritic cells, and modulation of anti-tumorigenic (M1) macrophages towards tolerogenic (M2) macrophages which prevents the natural immune system to act against tumor and thus develops the resistance to immunotherapies.
- Tumor associated immunoregulatory B-regulatory cells deregulate H-chain class-switch recombination that finally leads to the inhibition in the development of class-switched memory and high-affinity antibody-producing plasma B cell in tumor-microenvironment.
- Lentivirus clone containing miR-325 generated an immunogenic response against tumor by restricting the immuno-suppression that is caused by tTregs in tumor-bearer.

Future Plan:

- Determination of the status of the immune system in cancer patients for logistic application of immunotherapy.
- Development of adeno-associated virus (AAV)-mediated *in-vivo* delivery system for miR-325 for clinical trials
- To develop combinatorial therapy modules of chemotherapy, immunotherapy for clinical trials.

Scientific Activities:

Student Awarded Ph.D.	Publication	Book / Invited Review	Participation in Conference / Symposia/ Workshop and Delivered Invited Talk	Extramural Funding	Patent Applied/ Granted	Award / Honour / Membership
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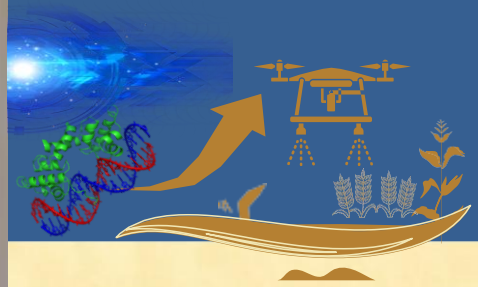
Prof. Tanya Das

ICMR Emeritus Scientist



Name of the participants:
Udit Basak
Sourio Chakraborty

Research Background and Vision:

Cancer stem cells: The root of all evils

Despite chemotherapy killing most cancer cells, drug-surviving cells 'obtain' increased stemness and chemo-resistance, making relapse-free breast cancer survival exceedingly difficult. Breast cancer stem cells (CSCs) constitute a chemotherapy-resistant subpopulation that is responsible for tumor initiation, metastasis and recurrence. Moreover, CSCs protect themselves from the active immune system at the early elimination phase and is able to initiate tumor progression during tumor initiation as well as during metastasis and relapse even after chemotherapy. However, how these small population of cells protect themselves from the active immune cells at the early elimination phase, establishes the whole tumor and propagate cancer remain poorly understood.

Aims and Objectives:

- Mapping the mechanism underlying reciprocal cross-regulation between FOXC1 and OCT4 that ensures acquisition of chemo-resistance in breast cancer cells: Identification of inhibitory microRNA(s).
- To delineate the role of differential p53 signatures in stemness regulation of breast cancer.
- To explore whether breast cancer stem cells generate immune-suppressive T regulatory cells by secreting TGFβ to evade immune-elimination.
- Unveiling the mechanism underneath the contribution of M1 macrophages in promoting cancer stem cell survival and their phagocytic escape.

Research Highlights/Accomplishments:

- We, for the first time propose the role of FOXC1 in resistance acquisition in CSCs causing relapse after chemotherapy, as well as identified a potential therapeutic alternative, hsa-miR-5688, for assuring relapse-free survival of breast cancer patients (Figure 1).

- We observed that while WTp53/ETS1 complex binds to the p53-consensus sequence, thereby inhibiting stemness expression, GOF $p53^{R273H}$/ETS1 complex utilizes ETS1 DNA-responsive elements to promote stemness expression. Our results also showed that NSC59984, which degrades mutant p53 protein, inhibits GOF $p53^{R273H}$-mediated transcription of stemness genes, sensitizes bCSCs to Doxorubicin and synergistically triggers apoptosis in the resistant cells.

- Our results confirmed that during tumor initiation as well as after chemotherapy, when non-stem cancer cells are not present in the tumor microenvironment, CSCs, albeit present in low numbers, generate suppressive $CD4^{+}CD25^{+}FOXP3^{+}$ Treg cells in a contact-independent manner by shedding high levels of immune-suppressive Treg-polarising cytokine TGFβ, thus escaping immune-elimination and initiating the tumor or causing tumor relapse.

- We also have demonstrated that while M1-macrophages induced apoptosis in non-stem breast cancer cells, they not only failed to do so in CSCs, but also increased CSC pool *via* both self-renewal of CSCs and de-differentiation of NSCCs. M1-macrophages also furnished lower phagocytic potential towards CSCs as compared to non-stem cancer cells due to overexpression of anti-phagocytic marker CD47 in CSCs. These findings raise serious 'doubt' about otherwise 'established' anti-tumor effect of M1-subset and instead, bolster the possibility that M1-macrophage might be favouring the 'root cause' of carcinogenesis – the cancer stem cells

Future Plan:

- Explore the detail mechanism underlying contri9bution of CSCs in tumor relapse.
- Determination of the complete mechanism of CSC-Treg cell interaction in cancer patients.
- To identify inhibitor(s) hindering CSC-Treg cell cross-talk to help in logistic application of cancer immunotherapy.
- To develop combinatorial therapy modules of chemotherapy, immunotherapy for clinical trials.

Scientific Activities:

Student Awarded Ph.D.	Publication	Book / Invited Review	Participation in Conference / Symposia/ Workshop and Delivered Invited Talk	Extramural Funding	Patent Applied/ Granted	Award / Honour / Membership
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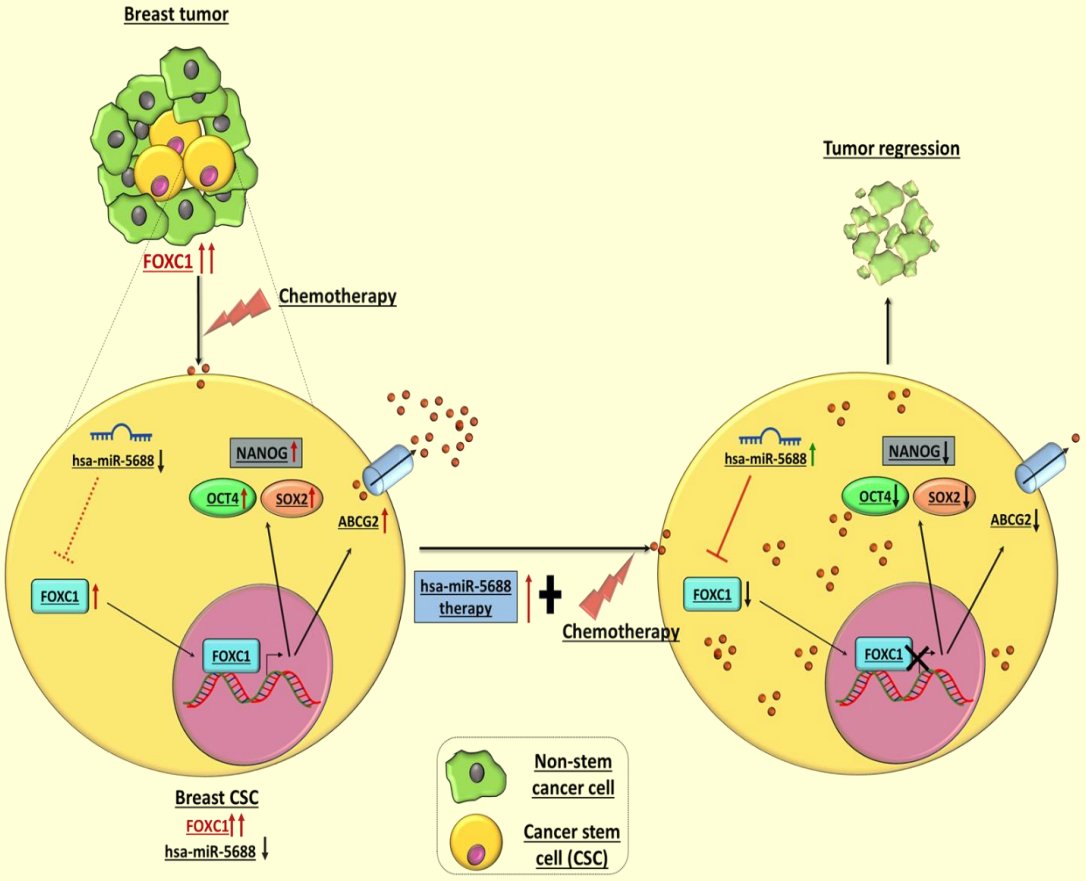
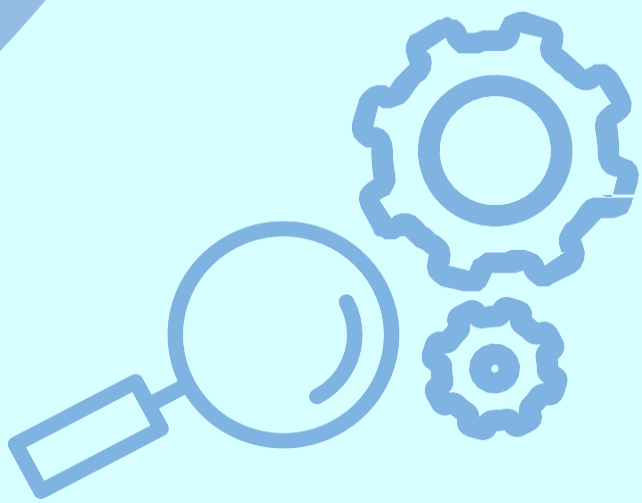


Figure 1. The hsa-miR-5688-induced sensitization of GOF p53 R273H CSCs towards chemotherapeutic agent Doxorubicin via FOXC1 knockdown. The conventional chemotherapeutic regimens fail to kill the resistant CSCs that ultimately reform the tumor leading to recurrence. In CSCs, FOXC1 expression is higher which in turn transactivates OCT4, SOX2, NANOG and ABCG2 thus making chemotherapeutic agent Doxorubicin unable to kill CSCs. However, upon down-regulation of FOXC1 expression by hsa-miR-5688, GOF p53R273H CSCs become sensitized due to down-regulation of OCT4, SOX2, NANOG and ABCG2. These sensitized CSCs are now able to be targeted and killed by Doxorubicin which ultimately leads to tumor regression.

SERVICE DEPARTMENTS/ SECTIONS



46th International Kolkata Book Fair

Bose Institute participated in the 46th International Kolkata Book Fair held in 31.01.23 to 12.02.23 at Central Park Maidan, Salt Lake City, Kolkata.

CENTRE FOR ASTROPARTICLE PHYSICS & SPACE SCIENCE

Overview

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.

- Commercially available polymer polyethylene terephthalate (PET) has been standardized and calibrated for use as Nuclear track detector. These have also been deployed at Darjeeling along with Ooty and Hanley for cosmic ray measurements.
- An Air Shower array using active detectors is being developed to study the energy spectrum and components of primary cosmic rays. Infra structural facilities like detector tanks and metal frames have been designed and fabricated in-house at the Bose Institute workshop.

- Vertical profile of rain rates, drop size distributions, radar reflectivity, fall velocity of hydro meteors and other rain parameters are being measured using Micro Rain radar (MRR).
- Vertical profile of water vapour mixing ratio and many other aerosol and cloud related quantities are being measured using Raman Lidar.
- Several automated online atmospheric trace gas analyzers e.g. SO , NO , CO, O etc have been running to study the gaseous pollutants in the atmosphere.
- Particulate matter present in the atmosphere are being studied using high volume sampler, online particulate matter monitor for number and mass concentrations and condensation particle counter to study the ultrafine particulate matter.

- Black carbon or soot particle in the atmosphere over Darjeeling is being studied using Aethelometer.
- Cloud Condensation Nuclie counter is being run for the study of finer aerosol particles which forms cloud.
- Sunphotometer is being run for the study of Aerosol Optical Depth i.e. the attenuation of incoming solar radiation due to loading of aerosol particles in the atmosphere.
- Automatic weather station is installed to collect meteorological data along with a sonic anemometer for different components of wind velocity
- Lightning detector and electric field monitor has been installed to study the variation of atmospheric electric field
- Organic and elemental carbon in the ambient atmosphere are being monitored continuosly.
- The size-segregated cloud condensation nuclei is being monitored under different ambient conditions in different seasons.
- The scattering coefficients of aerosols are being monitored under different humid conditions
- Atmospheric electricity is being studied under fair weather conditions covering all the seasons.
- Chemical characterization of wet precipitation is being studied during monsoon.

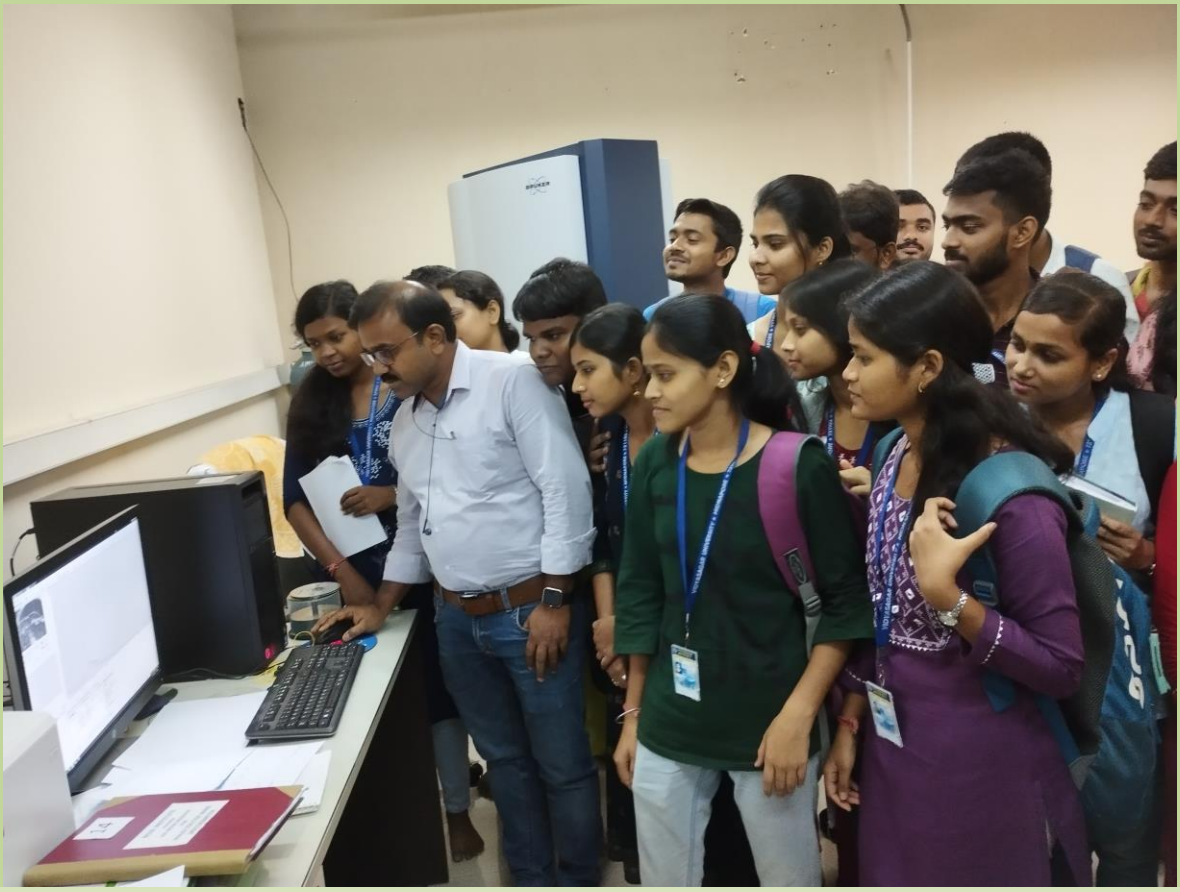
CENTRAL INSTRUMENT FACILITY (CIF)

Overview

The Central Instrument Facility (CIF) has played a pivotal role in supporting research activities at Bose Institute, mainly in biological and chemical sciences. Research in science and technology these days depend on sophisticated equipment which has to be operated collectively and not individually. The CIF at Bose Institute fosters an ideal ecosystem for scientists and students to develop skills and implement their ideas through cooperation and with a partnership spirit.

Beginning with a small facility to train postdoctoral fellows in the late '80s, the CIF has grown in size and complexity. The facility provides an opportunity for researchers from this Institute but also from neighboring ones to use not just high-end equipment such as a confocal microscope, NMR and mass spectrometers, but also basic ones such as documentation systems, PCR, and UV-VIS spectrophotometers.

One of the more recent additions in the CIF is the LC/MS/MS system. This system has generated a significant amount of interest among internal as well as external users for proteomic and metabolomic studies. In recent times, Ayush, the Govt of India's organization that deals with Ayurvedic and traditional medicine research, has shown keen interest in using the LC/MS/MS and has started analyzing their samples here.

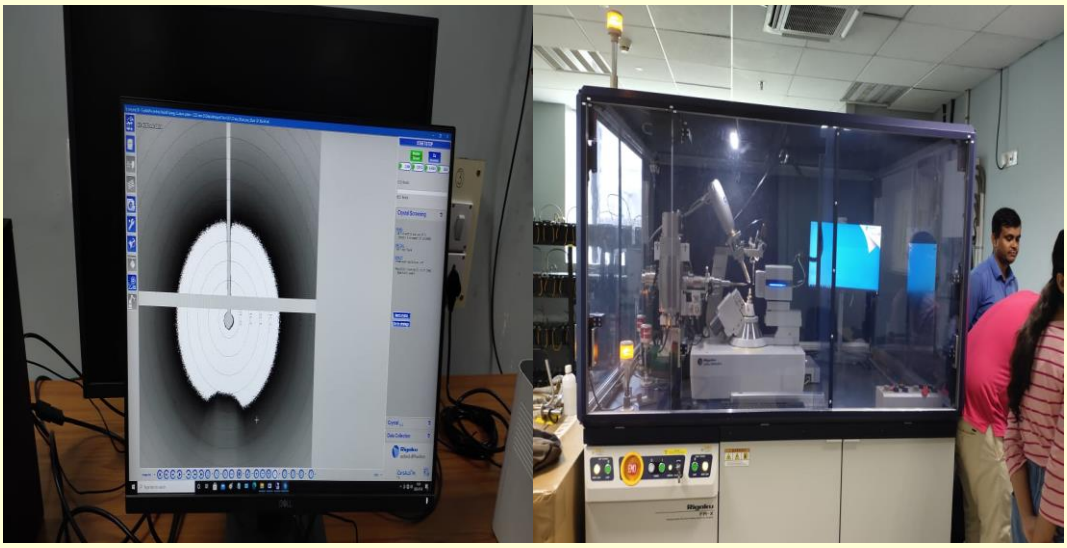


The CIF has also been successful in functionalizing its first NGS platform. A series of novel bacteria and bacterial metagenomes have been sequenced, leading to several important publications in microbiology and geomicrobiology. Apart from this two equipment, the NMR facility has contributed immensely towards the Institute's scientific output. It has been used extensively to design novel peptides with biological activity and understand the structure-function relationship of peptides and proteins.

The herculean task of moving the entire CIF to the new campus has been initiated. We expect to procure more sophisticated equipment to be placed in the CIF labs in the new campus. The list includes an advanced confocal microscope, an X-Ray generator for studying proteins' structure. In the future, CIF in the new campus will also house equipment related to research in physical and environmental sciences. One such example is the state of the art tip-enhanced Raman Spectrometer which is in the process of procurement.

The following instruments were available at CIF:

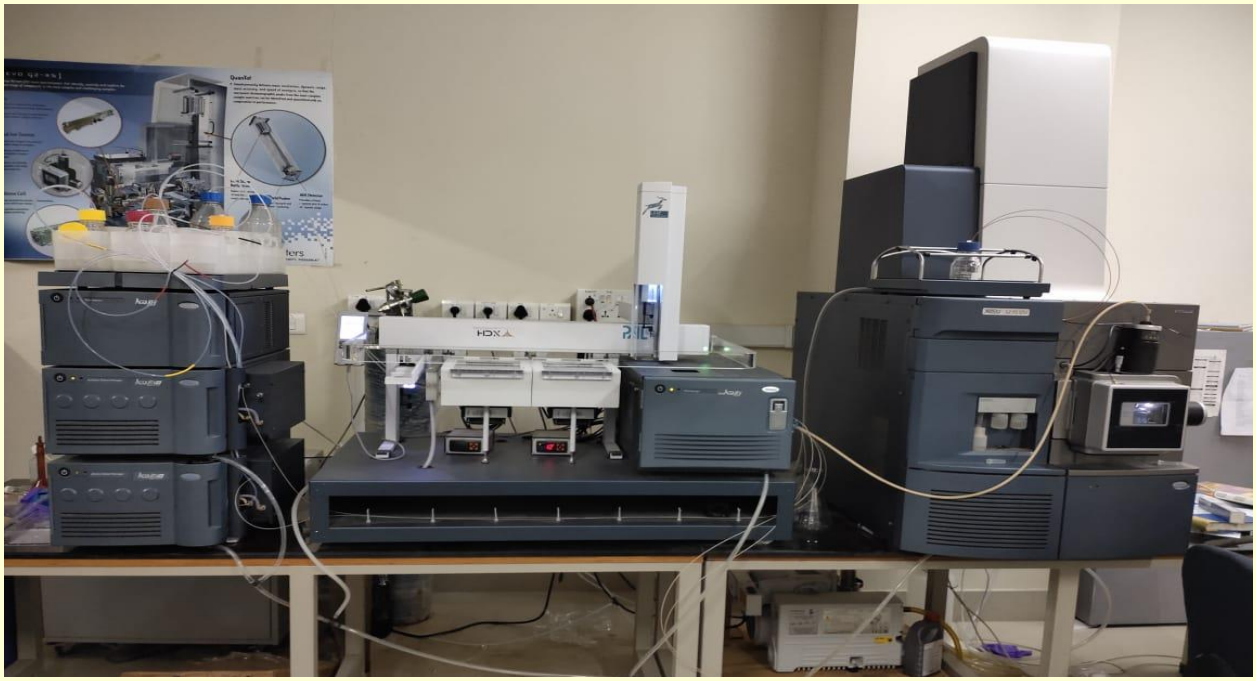
- FACS
- Confocal Microscope
- DNA Sequencer
- GC-MS
- HPLC



XRD Spectra

- NMR 500Mhz & 700Mhz
- Maldi TOF/TOF
- RT-PCR
- Circular Dichroism spectrophotometer
- Gel Doc, XR+
- Fluorescence spectrophotometer
- SEM
- Liquid Scintillation counter (PerkinElmer)
- FPLC
- Peptide Synthesizer
- AAS
- Single Protein Crystal Diffractometer(XRD)
- SPR

NGS & ACCESSORIES (THERMO FISCHER)



LC-ESI-MS/MS Q-TOF (WATERS)

Management Committee: Prof. Jayanta Mukhopadhyay, In-charge CIF, Dr. Abhijit Chatterjee, Dr. Abhrajyoti Ghosh, Prof. Achintya Singha, Prof. Ajit Bikram Datta, Prof. Anirban Bhunia, Prof. Atin Kumar Mandal, Prof. Kaushik Biswas, Prof. Pallob Kundu, Prof. Shubho Chaudhuri, Prof. Srimonti Sarkar, Prof. Tapan Kumar Dutta, Dr. Zhumur Ghosh, Mrinal Das, Ranjan K. Dutta, Dr. Wriddhiman Ghosh (Convener).

Staff Members : Ranjan Kumar Dutta, Smriti Ranjan Maji, Mrinal Das, Swaroop Biswas, Sheolee Ghosh Chakraborty, Amarandra Nath Biswas, Pallab Chakraborty, Souvik Roy, Alpana Chattopadhaya.

CENTRE FOR TRANSLATIONAL ANIMAL RESEARCH (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 using 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.**

LIST OF PERSONNEL

Scientist-in-Charge: Prof. Kaushik Biswas.

FALTA EXPERIMENTAL FARM

In Charge: Prof. Pallob Kundu

Bose Institute Falta Experimental Farm (FEF) is located at Falta Village of South 24 Parganas, which is about 80 km away from Bose Institute Unified Academic Campus. The farm is utilized as one of the nodal point for Bose Institute outreach activities, and we conduct rural biotechnology-related research and training programmes on this farm. In addition, we cultivate several crops throughout the year on this farm. Our proper planning, wholesome efforts, and scientific approaches enabled the production of multiple excellent quality and hygienic crops every year. Student groups from several schools and colleges visited the farm to learn about activities at the farm. We also use the farm for in-house meetings, brainstorming, and scientific retreat.

This year, we have cultivated rice, cucumber, broccoli, cauliflower, bean, okra, knolkhol, Bokchoy, ridge gourd, radish, green pea, kakri, and snake gourd. Additionally, coconut, green coconut, and different mango varieties were harvested from trees around the campus. We have also produced oyster and milky mushrooms and spawns of mushrooms for in-house cultivation and supply to enthusiastic farmers. We collected honey from multiple apiculture units installed throughout the farm, processed it, and bottled it.

In our effort to encourage organic farming, we are continuing vermicompost production. This product is used in our field and distributed to all members of Bose Institute. All products obtained

from the farm are sold at a reasonable cost to members of Bose Institute and the excess to the local market. All these activities led to a significant amount of revenue generation.

The fishery training programme at the Falta Experimental Farm:

We organized a one-day training camp to celebrate Azadi Ka Amrit Mahotsav on the topic "Emerging Techniques For Fish Cultivation" at the Falta Experimental Farm on 16th November 2022. A total of 23 people participated. Among them, 13 were OBC, and 3 participants were SC category. Seven female participants also showed their enthusiasm. We invited scientists from ICAR-CIFRI to act as resource persons and progressive fish farmers to share their experiences. Dr. Sanat K Das, Associate Professor from the Environmental Science Section of Bose Institute, delivered a lecture on environmental factors for nutritious fish cultivation.

All attendees of the fishery training programme at the Falta Experimental Farm.

Inauguration event of the fishery training programme.

Fishing for the demonstration purpose in the training programme at Falta Experimental Farm

Mr. Shuvankar Roy, Mr. Tanmay Samanta, Mr. Subhamoy Chakraborty, and all other casual staff members of the farm actively helped organize the event and demonstrated various techniques to improve fish pond health, fish breeding, and cultivation. The programme was highly successful, and all participants expressed gratitude for such an event at the farm.

Rural Biotechnology programme:

The project entitled "Improvement and broad-scale implementation of different biotechnology-oriented programmes for the socio-economic upliftment of Scheduled Tribes community of West

Bengal", PI: Dr. Pallob Kundu; Co-PI: Dr. Gaurab Gangopadhyay; Co-PI: Dr. Shubho Chaudhuri, Division of Plant Biology, funded by the Tribal Sub Plan of DST SEED programme is being implemented. This project will allow us to continue our biotechnology-based outreach activities and bring knowledge of modern agricultural practices to the marginal people of West Bengal.

We have recruited one Project Associate and two Project Assistants through nationwide advertisement and selection. We have also shortlisted candidates for the post of four master trainers for interviewing.

The project review meeting was held on 28th February 2023 at Bose Institute. Several officials from the DST SEED division and external experts were present in this review meeting. The committee assessed the status of the projects being implemented at Bose Institute (BI), the Indian Association for Cultivation of Science (IACS), Ramakrishna Mission Vivekananda Educational and Research Institute (RKMVERI), and interacted with the Central Leather Research Institute (CLRI). In this meeting, Prof. Pallob Kundu presented the progress made in the project work. Prof. Gaurab Gangopadhyay presented his research observations on the sesame crop and explained his plan to encourage sesame cultivation in farmers' fields. Our collaborator Prof. Somnath Bhattacharyya from Bidhan Chandra Krishi Viswavidyaylaya (BCKV), also presented his observations on cultivating multiple lentil varieties. He has also insisted on popularizing lentil cultivation in Scheduled Tribe farmers' fields. The review committee took cognizance of the activities and recommended implementing the proposed studies through NGOs.

Selection of facilitating NGOs: We have screened and shortlisted 110 NGOs from 192 applications. We invited all 110 NGOs to present their proposal and interact with the selection committee. The selection committee meeting in the presence of external experts and DST SEED officials was held from 1st March to 2nd March 2023 at Bose Institute, Unified Academic Campus. Finally, the committee selected 35 NGOs to participate in this project and facilitate the implementation of the project in different villages of West Bengal.

DST officials and external experts attended the rural biotechnology project review meeting.

Cultivation of cruciferous vegetables in this year in the farm.

J. C. BOSE CENTRE
(PUBLICATION AND MUSEUM)

J C Bose Centre comprises the Museum dedicated to J.C. Bose and the Publication unit. The museum is a special attraction in the Main Campus. It nestles a permanent exhibition on the life, research contributions and works of Acharya Jagadis Chandra Bose. Presently the Museum is a repository of the significant scientific instruments designed by J.C. Bose, commemorative items, and rare and significant archival documents. Guided tours are conducted on special occasions for group visits of school/college/university students. New acquisitions from various Libraries, Institutes and other Museums from both India and abroad are undertaken every year. The Museum takes part in different National-level Science Fairs and Exhibitions. 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.

Paticipation in Science Exhibition/ Fairs:

1. Bose Institute participated in the **25th National Science Exhibition, Kolkata 2022, organised by Central Calcutta Science & Culture Organiztion for Youth,** from 25.08.2022 to 28.08.2022 at Central Park Maidan, Salt Lake City, Kolkata.

2. Bose Institute participated in the **Mega Science Technology and Industry Expo of 8th IISF 2022** held from January 21-24 2023 at MANIT, Bhopal. Faculty members and staff of BI actively attended the Science Festival.

3. Bose Institute participated in the **46th International Kolkata Book Fair 2023** held in 31.01.23 to 12.02.23 at Central Park, Salt Lake City, Kolkata.

Since its inception in 1980, the Publication Section has been entrusted with the responsibilty of bringing out publications of Bose Institute on a regular basis. The Annual Report (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 publications are presently available for sale : J. C. Bose and Microwaves – A Collection Rs.200.00; Science and Society – Reflections Rs.1050.00; Acharya J.C. Bose -A Scientist and A Dreamer – Vol. 1 Rs.1250.00; Vol. II Rs.1250.00; Vol. III Rs.600.00; Vol. IV 1500.00 ; Vol. V Rs.550.00; Patrabali (Bengali) Rs.350.00; Acharya Jagadis Chandra Bose (Bengali) Rs.12.00; Abyakta (Bengali book written by Sir J.C. Bose) Rs.80.00; Acharya Jagadis Chandra Bose (Bengali Combined) Rs.325.00; BoseInstitute-Myself & Ribosome Rs. 200.00; In the Realm of Bose (the diary of a teenager's brief sojourn at Bose Institute) Rs. 180.00; An Appraisal of J. C. Bose – In the context of Sociology of Science Rs. 350.00; Nivedita Commemoration Volume Rs. 500.00; D.M. Bose-A Scientist Incognito Rs. 350.00; Basu Vigyan Mandir –O-Amar Karmojibon Rs. 200.00.

LIST OF MEMBERS

Prof. Gaurab Gangopadhyay (Chairman), Prof. Gautam Basu, Prof. Somshubhro Bandyopadhyay, Prof. Achintya Singha, Shri Tarun Kumar Maji, Dr. Ishani Chatterjee.

BOSE INSTITUTE LIBRARY

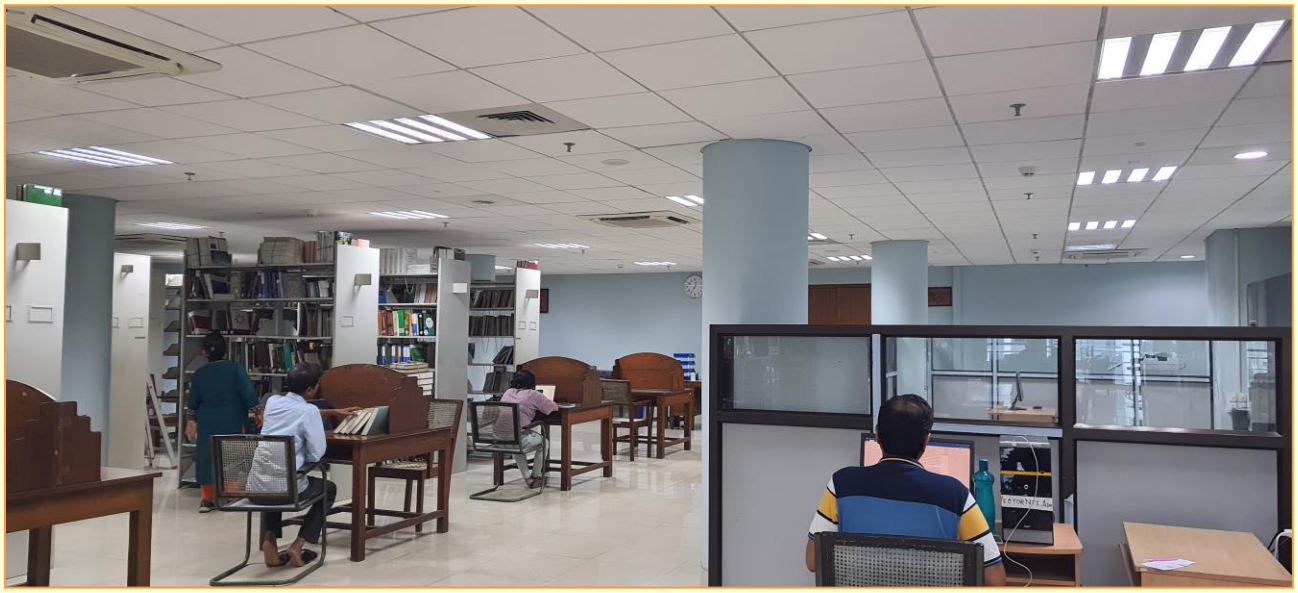
The Institute Library system is one of the best 'Science Reference Libraries in Eastern India, set up on the main campus in 1917 by Acharya Jagadish Chandra Bose, and a wing at the 'Centenary Building' was opened in 1983. In the year 2007, a small library was set up in the Salt Lake Campus of the Institute. 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, staff members, and students of the Integrated M.Sc.-Ph.D. program. The library extends its physical Library facilities as well as online resources access to other Institutions /Universities /R&D organizations in and around Kolkata. 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 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. At present the library's total collection of reading materials is 45140 as of 31.03.2023. Total 41nos. of thesis added during the year.

Library has joined with the National Knowledge Resource Consortia (NKRC) since 2008 which is joint consortia of CSIR and DST Institutes for accessing more than 5000+ online journal packages from more than 50 Publishers. Through this consortium faculty members/scholars of this institute can access more than 5000+ online resources, SCIFINDER of ACS, Web of Science, Patent databases, etc.

Library Collection:

- Books
- Bound Volumes of Journals
- Theses
- Online journals through National Knowledge Resource Consortia (NKRC)
- Sir J.C. Bose Collection
- Scientific Software(s) and Database(s)
- Reports, Newsletters, Annual Reports of other Institute(s),
- Publication of Bose Institute etc.
- Hindi books
- Books on Bengali literature.



Library Services

I. Bibliographic services.

II. Reprography Services.

III. Lending Services

IV. Inter-Library Loan.

V. Document Delivery Services.

VI. Web OPAC in network

VII. Plagiarism checking software

VIII. Tool for Grammar Checking.

IX. E-resources

X. Institutional Repository

XI. Technical Query Service

XII. Bibliographic & Full-text Search Services

XIII. Software & Database:

Sl. No.	Software(s)	Database(s)
1.	ENDNOTE X8 Multi-User Download-Research Software	SCOPUS the largest abstract and citation database
2.	Upgradation of Sigmaplot 11 Software to Sigmaplot version 14	Web of Science Core Collection
3.	iThenticate-anti-plagiarism software	SciFinder®
4.	Grammarly: Free Writing AI Assistance	SCOPUS, abstract and citation database

LIST OF MEMBERS

Staff members: Ms. Ananya Raha, Ms. Sumita Dey.

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.

The on-going research programmes of the plant scientists of DPB at MEF are as follows:

Prof. Shubho Chaudhuri: Growing of transgenic lines of rice at dedicated green-house (28°C-30°C) in connection to the research programme on “Understanding the regulatory role of rice epigenome during abiotic stress (salinity and cold)”.

Prof. Gaurab Gangopadhyay: Prof Gaurab Gangopadhyay has grown different improved sesame genotypes over the last few years in Madhyamgram Experimental Farm. The germplasm of Sesame (INGR22090) has been registered by the Plant Germplasm Registration Committee (PGRC) of the Indian Council of Agricultural Research (ICAR) on 08.07.2022. Presently his group is working on developing sesame with synchrony in pod maturation.

Prof. Pallob Kundu: 'Development of CRISPR/Cas9-based optimized toolkit for gene regulation in tomato' and 'Significance of specific miRNA-mRNA interactions in tomato stress-biology.' We had raised tomato Microtom transgenic plants with altered expression of some of the purported disease tolerance genes using the CRISPR/Cas9 technology. We utilized the Madhyamgram glasshouse for the growth and maintenance of these tomato transgenics till seed setting. Additionally, this multifunctional glasshouse has also helped us effectively grow other varieties of tomatoes, such as Pusa Ruby, and tobacco plants all year round.

Tomato Pusa Ruby plants in Madhyamgram glasshouse

Transgenic tomato Microtom

Dr. Anupama Ghosh: Deciphering host-defence responses against specific pathogen effectors proteins – *Zea mays* against *Ustilago maydis* causing corn smut disease, and *Oryza sativa* against *Rhizoctoniasolani* causing sheath blight disease of rice.

List of personnel:

In Charge: Prof. Shubho Chaudhuri (present Scientist-in-charge)

Staff members: Pulak Kr Roy, Asis Kumar Dalal, Sk Inal Ali (Superannuated on 31.03.2023), Mahesh Dasgupta, Laxmi Kanta Pradhan, Bhanu Kisku

Research personnel (project): Dr. Sambit Datta, RA.

Notable event

The Botany undergraduate students and their teachers of Shri Shikshayatan College Kolkata made a field trip to the Madhyamgram Experimental Farm of Bose Institute on 01.06.2023. It was in connection with the study of the cultivation processes of cereal, oilseed, and other food crops, along with the related laboratory demonstration under the CBCS syllabus of the University of Calcutta. After attending brief lectures, the students went to the field and observed sesame breeding and selection processes in field conditions. They visited the laboratories and greenhouses of Acharya JC Bose Transgenic Plant Research Laboratory. They also visited the Central Animal House and Research Facility. The students returned with high spirits and ambition for higher studies and research.

SHYAMNAGAR EXPERIMENTAL FARM

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.

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 2022-23:-

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.

LIST OF PERSONNEL

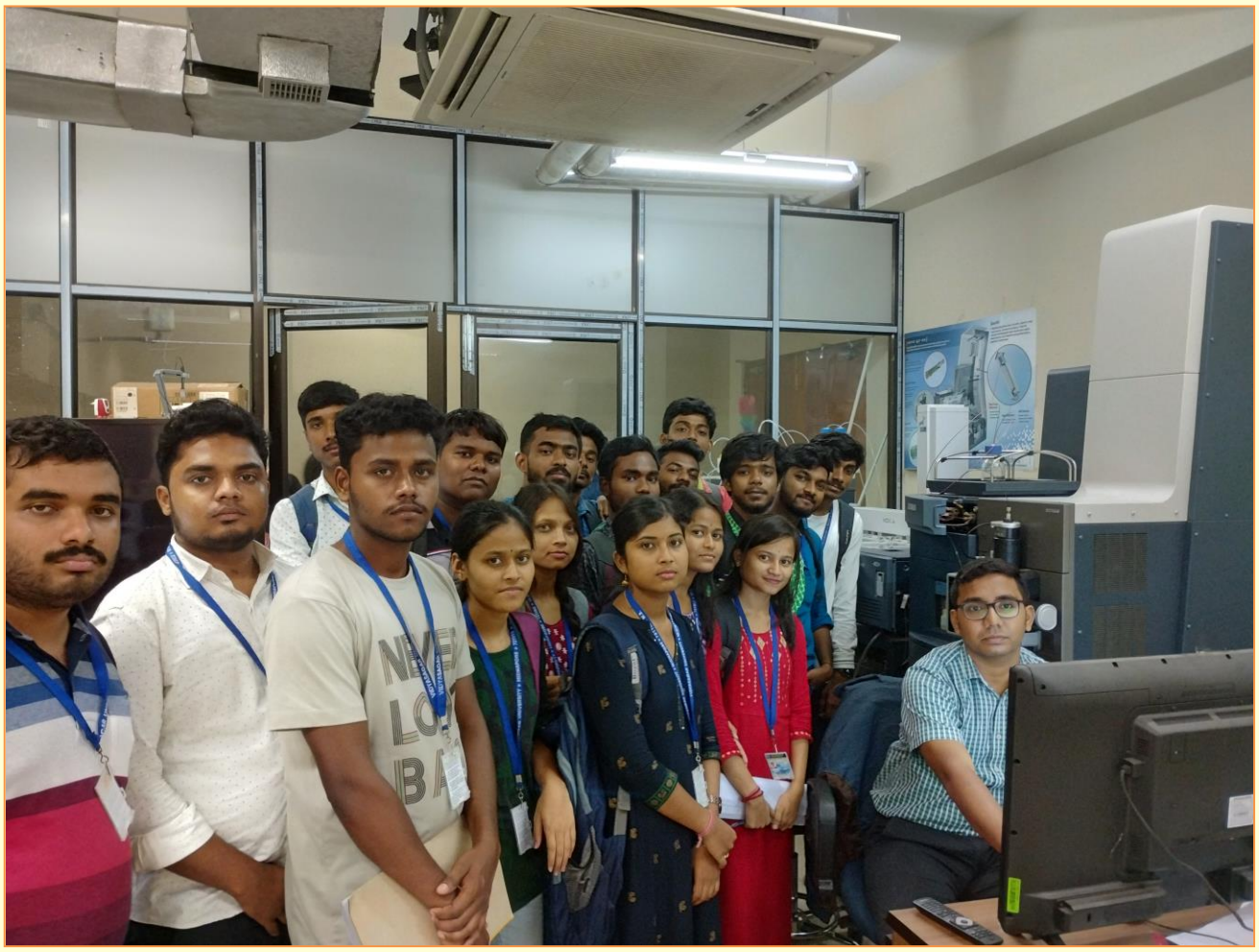
Staff Members : Raju Chandra Paul ,Workshop Superintendent, Prabir Halder, Pranab Banerjee, Sanjoy Santra, Baidya Nath Murm.

OUTREACH AND MAN POWER DEVELOPMENT

Bose Institute has been actively involved in promoting the well being of SC/ST/weaker sections, through the Rural Biotechnology / scheduled tribe specific rural biotechnology programs. Using the Falta Experimental Farm as the hub the actual outreach programme was started in 2008. Later a core grant was obtained from the DST for expanding our activities. In this programme Bose Institute has adopted a holistic approach to train tribal people in generating their livelihood. Among several programmes undertaken, notable are, trainings and distribution of units of pisciculture, apiary, mushroom cultivation, vermicompost production, rain water harvesting, kitchen gardening, duck rearing, goat rearing, sericulture. The rural biotechnology program of Bose Institute covered 140 villages spread over 6 districts of West Bengal involving 35 NGOs, 105 trainers. In total as many as 7000 tribal families benefitted from the program, many of them continued developing the unit they had received till 2019, or cessation of the project due to the alteration of DST funding head. The success of the project, as seen by income augmentation, women empowerment and enthusiasm among beneficiaries, prompted us to develop another project for continuation of the outreach activities.

Objectives:

(i) Utilization and further extension of existing network of NGOs for mapping of current livelihoods, natural resources endowment based on secondary data, current needs of target beneficiaries, mapping of technological gaps and needed S&T Interventions.



(ii) Improvement of existing technologies of rain water harvesting, organic farming, kitchen gardening, conservation agriculture etc. and implementation in SC/ST villages for poverty alleviation and better natural resource management.

(iii) Women empowerment and further skill development in plant tissue culture.

(iv) Research targeting encouragement of cultivation of marginal crops for nutritional and livelihood security of the SC/ST community of West Bengal.

Rural Biotechnology programme:

The project entitled "Improvement and broad-scale implementation of different biotechnology-oriented programmes for the socio-economic upliftment of Scheduled Tribes community of West Bengal", PI: Dr. Pallob Kundu; Co-PI: Dr. Gaurab Gangopadhyay; Co-PI: Dr. Shubho Chaudhuri, Division of Plant Biology, funded by the Tribal Sub Plan of DST SEED programme is being implemented. This project will allow us to continue our biotechnology-based outreach activities and bring knowledge of modern agricultural practices to the marginal people of West Bengal.

We have recruited one Project Associate and two Project Assistants through nationwide advertisement and selection. We have also shortlisted candidates for the post of four master trainers for interviewing.

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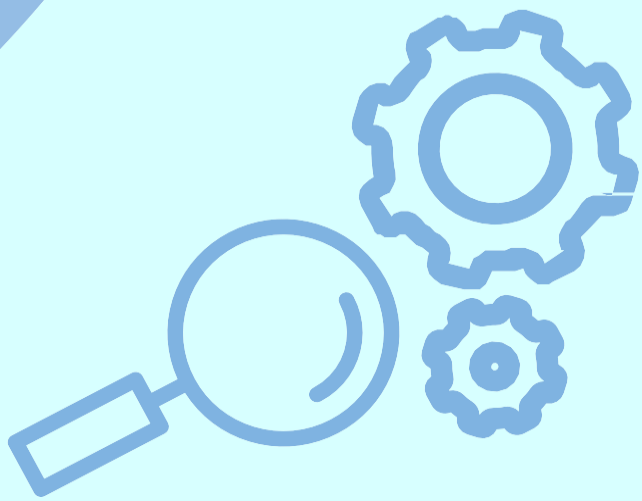
Selection of facilitating NGOs: We have screened and shortlisted 110 NGOs from 192 applications. We invited all 110 NGOs to present their proposal and interact with the selection committee. The selection committee meeting in the presence of external experts and DST SEED officials was held from 1st March to 2nd March 2023 at Bose Institute, Unified Academic Campus. Finally, the committee selected 35 NGOs to participate in this project and facilitate the implementation of the project in different villages of West Bengal.

Plan of outreach activities in the near future:

We will continue the proposed works and studies in the new project. Our plan is to involve upto 34 NGOs in the programme, and in collaboration with NATMO, DST and Bidhan Chandra Krishi Viswavidyalaya we will perform an initial survey to understand the current conditions, available resources, current needs of target beneficiaries, technological gaps and needed S&T Interventions. We wish to bring as many as 1000 beneficiaries under the programme and organize 15 training camps on site. Two camps at the Falta Experimental farm to provide training to at least 50 people will also be organized.

STATEMENT OF ACCOUNTS FOR THE YEAR 2022-23



Visit of the IAS Trainees

IAS trainees visited Bose Institute Main Campus and Unified Campus on 24.01.2023

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, 2023, and the Income & Expenditure account, Receipts & Payment Account for the year then ended, 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, 2023, and of its financial performance for the year then ended.

Basis for Qualified Opinion

1. The Institute has accounted for expenses on cash basis in the financial statements in few cases which are contradictory to the Schedule 24 clause 4.2 of the "Significant Accounting Policies and Notes to Accounts" as well as the fundamental accounting assumptions as per AS 1, notified by the Institute of Chartered Accountants of India. There are 46 instances where Expenditure relating to the FY 2021-22 has been accounted for in F.Y. 2022-23, thereby an excess booking of Expenditure has been found amounting to Rs. 21302559.00. The same should have been booked as Prior Period Expenses.

2. Interest earned on Bank deposit, in some cases, are accounted for on cash basis in contravention of accounting policy as referred to in clause 4 of Schedule 24 in Notes to Accounts. The Bank confirmation received on Accrued Interest has not been considered. The total impact is not ascertainable.

3. Salt Lake City Land valued Rs. 1446213.80/- has been acquired under 999 year Lease and the same has not been properly accounted as leasehold land. Lease amount is not amortised over the years contrary to requirements of AS-19 notified by the Institute of Chartered Accountants of India. The impact on current year Financial Statement is not ascertained.

4. Refer to in clause 2 of Schedule 24 in Notes to Accounts, Falta land is being inserted in the books of account from this year (2022-23) at a nominal value of Rs. 1/- since the value of the land is not ascertainable. The impact of taking nominal value on future period is not ascertainable at this stage.

5. Fixed Assets have not been periodically verified. In respect of Equipment under schemes, no register is available. The same is recorded under respective Scheme sub ledger. Periodic physical verification has not also been undertaken. 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.

6. (Refer Schedule 3 of Balance sheet Liability under "Earmarked /endowment Fund-Development Fund (Planning commission) closing balance as on 31.03.2023 Rs. 85605296.00 and corresponding Assets Schedule 10 "Investment from Earmarked/ Endowment Fund Asset

acquired under for development and modernisation fund amounting to Rs. 66657578.15 have been held under "investment and under earmarked fund" and has not been capitalised thereby understating the fixed assets to that extent. Consequent impact on depreciation and current year's profit is not ascertainable.

7. Capital WIP to the tune of Rs. 2211659.00 has no movement since long. Current status of work and consequential impact on the books of accounts is not ascertainable. (Refer Schedule 8A of Financial Statements – Capital W.I.P)

8. The unidentified receipt under the head 'Grant in aid unallocated' amounting to Rs. 518404.00 (Cr.) Bank suspense amounting to Rs. 17085.22 (Cr.) and Stale Cheque amounting Rs. 324268.43 (Cr.) have been appearing since long and the consequential impact on the books of account is not ascertainable. Refer clause 19 of Schedule – 24 – Notes on Accounts.

9. 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.

10. Current liability of Payable to Pensioner of Rs.312088.00, appearing in Pension Fund Accounts for FY 2022-23, is a long outstanding amount, the details of which were not made available to us. Hence the effect of the same on books of account cannot be determined.

11. Asset includes Rs. 16000.00 receivable as TDS Pension is lying unadjusted for long details of which were not made available to us. Hence the effect of the same on books of account cannot be determined.

12. With respect to Contributory Provident Fund Account for FY 2022-23, details in relation to Payable to staff Rs. 202160.00 (Cr.), Receivable from Bose Institute Rs. 707074.00 (Dr.) and Loan liability Rs. 109482.00 are long outstanding amount, the details of which were not made available to us. Consequential impact on the books of account is not ascertainable at this stage.

13. In Books of Account, we have found debit balance in Payable accounts and vice versa credit balance in Receivable accounts. Instead of segregating the same to show in proper head, these have been wrongly clubbed in the payable and receivable account respectively. As a result, both the receivable and payable are understated. The net impact is not ascertainable.

14. Non realisation of refund of Service Tax amounting to Rs. 202.83 Lakh has been appearing since long.

15. Details of number of terminated projects and unspent balance not surrendered to competent authority was produced for verification.

16. Matters related to Terminated Projects during 2022-23 :

    a. Expenditure and Closing Balance between books of accounts (Tally) vis-a-vis Reports like Utilisation Certificate (UC) is subject to reconciliation.

    b. Latest Audited UC/(SOE) as per terms of sanction order have not been submitted for all 18 projects . In earlier period, we observed SOE and UC prepared without separate audit so stipulated in respective sanction order.

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:

17. As per Schedule 24 Clause 18 under para 4 of 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:

SI 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.

18. Refer Schedule 24 Clause 16 of Notes on Accounts on Capitalisation of Assets of Unified Academic Campus of Bose Institute, The institute has capitalised the asset on the basis of the completion costs given by M/s. RITES limited (the Project Management Consultant), 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.

19. Refer Schedule 24 clause 2.4 of Notes on Accounts on Fixed Assets. The Institute has taken up initiatives to prepare a comprehensive Fixed Asset Register. Up to 2019-20 is prepared and work for preparation of Fixed Asset Register for 2020-21, 2021-22 & 2022-23 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). 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.

20. Refer Schedule 24 clause 14 of Notes on Accounts on Long Un-Reconciled Balance. There are unreconciled balances appearing in books of account. The total impact is not ascertainable.

21. Refer Schedule 24 clause 11 of Notes on Accounts on Contingent Liability, no contingent liability has been ascertained. Though, there are several pending cases against the Institute.

22. Refer Schedule 24 clause 3.2 of Notes on Accounts, the Institute has charged full depreciation on Written down Value Method as per given rates, irrespective of dates of putting the same to use.

23. Attention is drawn to clause 20 of Schedule 24 – notes on Accounts. An amount of Rs. 12785075.00 has been accounted for. Sufficient supporting documents and work completion certificate was not produced for our verification.

24. We observed that in some funds 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	8748487824.57	70111949.00
Employees Welfare Fund	3446675.63	372066.00
Development Fund – Planning Commission	85605296.00	66657578.17

25 Attention is drawn to clause 6 of Schedule 24 – notes on Accounts. No separate trust has been created in respect of Contributory Provident Fund, General Provident Fund and Employees Pension Fund.

26. No details were produced in respect of Advance outstanding from Members amounting to Rs. 614918.00.

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: 29.09.2023

For A.N.Chatterjee & Co.
Chartered Accountants
F.R.N. 302143E
Anindra Nath Chatterjee
(Partner)
M.No. 055985
UDIN: 23055985BGVWEQ3363

BOSE INSTITUTE
BALANCE SHEET AS ON 31ST MARCH 2023

Corpus /Capital fund and liabilities	Schedule	2022-23 (₹)	2021-22 (₹)
Corpus /Capital fund	**1**	3,20,17,89,731.28	3,16,85,61,205.28
Reserves and surplus	**2**		
Earmarked/Endowment funds	**3**	1,18,,23,86,757.99	97,58,34,814.99
Secured loans and borrowings	**4**		
Unsecured loans and borrowings	**5**		
Deferred credit liabilities	**6**		
Current liabilities and provisions	**7**	33,39,85,203.08	1,02,49,04,266.12
Total		**4,71,81,61,692.35**	**5,16,93,00,286.39**
Assets			
Fixed Assets	**8,8B,8C,8D**	2,31,07,04,239.44	2,33,21,70,887.61
Capital Work in Progress	**8A**	11,59,13,025.20	11,59,13,025.20
Investments-others	**9**	41,73,24,200.72	37,35,00,135.72
Investments -from earmarked/endowment Funds	**10**	14,47,66,303.18	14,17,55,495.18
Current assets, loans, advances etc.	**11**	1,72, 94,53,923.81	2,20,59,60,742.68
Miscellaneous expenditure (to the extent not written off or adjusted)			
Total		**4,71,81,61,692.35**	**5,16,93,00,286.39**
Significant accounting policies and notes on accounts	**24**		

Place : Kolkata
Date : 29.09.2023

Signed in terms of our separate Report of even date.
For A.N. Chatterjee & Co.
Chartered Accountants
Firm Registration No. 302143E
Anindra Nath Chatterjee
Partner
Membership No. 055985

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

Sd/-	Sd/-
Prof. Rajarshi Ray	Prof. (Dr.) Uday Bandyopadyay
Registrar(O)	Director

BOSE INSTITUTE
INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31.03.2023

	Schedule	2022-23	2021-22
		Rs.	Rs.
INCOME	**12**	39,50,344.00	41,85,431.00
Income from Sales and Services			
Grants/Subsidies	**13**	55,29,48,166.54	97,81,00,000.00
Fees/Subscriptions	**15**	-	-
Income from Investments (Income on Investment, from earmarked /endowment Funds transferred to Funds)	**14**	-	6,88,85,980.00
Income from royalty, publication etc .	**16**	-	-
Interest Earned	**17**	-	-
Other Income	**18**	31,79,435.26	20,27,119.00
Increase/ (decrease) in stock of Finished goods and work-in-progress	**19**	-	-
Total (A)		**56,00,77,945.80**	**1,05,31,98,530.00**
EXPENDITURE			
Establishment Expenses	**20**	46,80,93,970.88	51,71,61,010.06
Other Administrative Expenses	**21**	27,26,88,304.09	21,03,54,473.88
Expenditure on Grant, Subsidies etc.	**22**	-	-
Interest	**23**	-	75,16,198.00
Fund for capital Expenditure	**23A**	3,28,04,158.00	11,12,59,846.58
Depreciation (Net Total at the year end corresponding to Schedule 8)		6,52,87,466.79	6,89,61,552.59
Depreciation for UAC	**8B**	14,88,02,660.47	16,56,76,890.69
Total (B)		**98,74,76,560.13**	**1,08,09,29,971.80**
Balance being excess of Income over Expenditure (A-B)		-42,73,98,614.33	-2,77,31,441.80
Transfer to Special Reserve (Specify each)			
Prior Period Items	**23B**	-12,26,124.00	48,21,999.00
		-42,86,24,738.33	
Last Year Unspent Balance /overspent balance		**5,01,16,558.13**	**7,30,26,000.93**
Balance of Unspent Balance After Adjustment		-85,79,814.87	7,30,26,000.93
Balance being Surplus/(deficit) carried to corpus/capital fund		**-43,72,04,553.21**	**5,01,16,558.13**
Significant accounting policies and notes on accounts	24		

Place : Kolkata
Date : 29.09.2023

Signed in terms of our separate Report of even date.
For A.N. Chatterjee & Co.
Chartered Accountants
Firm Registration No. 302143E
Anindra Nath Chatterjee
Partner
Membership No. 055985

Sd/-
Shaubhik Ghosh
UDC

Sd/-
Kamal Sing
Accountant (Cash)

Sd/-
Vikash Kumar
Audit & Finance Officer

Sd/-
Achintya Mukherjee
Accounts Officer

Sd/-
Prof. Rajarshi Ray
Registrar(O)

Sd/-
Prof. (Dr.) Uday Bandyopadyay
Director

BOSE INSTITUTE
RECEIPTS & PAYMENT ACCOUNTS FOR YEAR ENDED 31ST MARCH 2023 (COUNCIL A/C)

Receipts	Sch. No.	Amount (Rs.)	Payments	Sch. No.	Amount (Rs.)
Opening Balance	1	98,52,32, 693.75	Overtime		7,655.00
Receipt against Establishment Expenses	2	3,96,040.84	Establishment Expenses	2	46,98,13,457.72
Receipt against Laboratory Expenses	3	2,91,430.00	Laboratory Expenses	3	9,30,45,091.79
			Other Administrative Expenses	4	17,06,30,707.63
Receipt Against Other Administrative Expenses	4	2,36,050.39			
Receipt from Indirect Income	9	3,85,23,980.00	Payments for the current assets	8	2,26,68,346.00
Receipt from Grant in Aids form Scheme	7	81,86,00,000.00	Payments for the Fixed Assets	6	3,24,12,309.00
Receipt from other Assets		-			
Receipts from Current Assets	8	2,33,31,522.00			
Receipts from Statutory Liabilities	5	9,23,13,736.00	Payment for Current Liabilities & Statutory Liabilities	5	8,90,27,701.00
Receipts from Current Liabilities & Other Liabilities (except Statutory Liabilities)	6A & 7A	2,02,41,431.71	Payment for Other Liabilities under Current Liabilities	6A & 7A	2,36,33,679.00
			Intellectual Property Development Fund		1,55,520.00
Employees General Provident Fund		-	Grant-in-Aid	7	26,56,51,833.46
			Payment for other income	9	28,200.00
Inter Unit Account			**Inter Unit Account**		
			FAIR		
			Scheme/Project Grant-in-aid		
Scheme/Project		14,46,57,074.00	Scheme/Project		2,48,01,608.00
Scheme/Project Grant-in-aid		11,31,00,000.00	ST-Rural		3,71,700.00
ST-Rural		7,59,527.00	Governing Body		-
FAIR		2,98,710.00	Closing Balance	1	1,04,57,34,387.09
		2,23,79,82,195.69			**2,23,79,82,195.69**

Place : Kolkata
Date : 29.09.2023

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For A.N. Chatterjee & Co.
Chartered Accountants
Firm Registration No. 302143E
Anindra Nath Chatterjee
Partner
Membership No. 055985

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 2023 (Project)

RECEIPTS	Sch. No.	Amount Rs	PAYMENTS	Sch. No.	Amount Rs
OPENING BALANCE	1	**55,36,86,053.24**			
Receipt from projects	2	1,67,47,305.43	Payment from Projects	2	3,25,49,513.82
Receipt from projects from Adhoc /RA / PDF	3	1,60,71,151.00	Payment from Adhoc/RA/PDF	3	1,85,80,115.00
Receipts from Other Than Scheme / Projects	4	14,30,074.00	Payment for other than Project	4	1,28,87,895.00
Receipts from IFCC		28,92,17,756.00			
			Payment of IFCC		17,39,55,860.00
Receipts from St Rural		9,46,93,965.70	Payment of ST-Rural		9,47,00,070.80
Receivable From Scholars'		67,464.00	Receivable From Scholars'		67,464.00
Branch /Inter Unit					
Bose Institute		5,60,06,461.00	**Branch /Inter Unit**		
			Bose Institute		39,70,23,065.98
Margin cum FD		8,51,85,359.00			
			Margin cum FD		10,32,06,187.00
			CLOSING BALANCE	1	28,01,35,417.00
		1,11,31,05,589.37			**1,11,31,05,589.37**

Place : Kolkata
Date : 29.09.2023

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For A.N. Chatterjee & Co.
Chartered Accountants
Firm Registration No. 302143E
Anindra Nath Chatterjee
Partner
Membership No. 055985

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

Bose Institute Employees' Pension Fund
BALANCE SHEET
For the year ended 31ST March 2023

As at 31st March 2022 (Rs.)	Liabilities	As at 31st March 2023 (Rs.)	As at 31st March 2022 (Rs.)	Assets	As at 31st March 2023 (Rs.)
15,49,80,164.05	Balance As per last Account	14,62,86,426.05			
-86,93,738.00	Add: Excess of Income over Expenditure	1,45,64,673.00	13,89,97,853.00	Fixed Deposit	16,97,26,864.19
			9,01,946.00	Accrued Interest on FD	36,98,022.00
2,61,407.00	Payable to Pensioner	2,61,407.00	2,15,56,908.19	Bank Balance With S.B.I Savings bank Account	1,92,003.00
			1,95,89,521.86	Receivable from Bose Institute Council	3,36,44,015.86
-	tds pension	-	1,88,709.00	RECEIVABLE FROM EMPLOYEES	(47,360.00)
			16,000.00	TDS PENSION	16,000.00
31,16,103.00	Payable to BOSE INSTITUTE	-			
50,26,372.00	Provision for Deduction of Excess Payment	1,10,55,711.00			
3,12,088.00	Payable to Staff	3,12,088.00			
2,62,48,542.00	Liability towards 30% 7CPC	3,47,49,240.00			
18,12,50,938.05		**20,72,29,545.05**	**18,12,50,938.05**		**20,72,29,545.05**

Place : Kolkata
Date : 29.09.2023

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For A.N. Chatterjee & Co.
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Anindra Nath Chatterjee
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Membership No. 055985

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Accounts Officer

Sd/-
Prof. Rajarshi Ray
Registrar(O)

Sd/-
Prof. (Dr.) Uday Bandyopadyay
Director

Bose Institute Employees' Pension Fund
Income & Expenditure Account
For the year ended 31ST March 2023

For the year ended 31st March 2022 (Rs.)	Expenditure	For the year ended 31st March 2023 (Rs.)	For the year ended 31st March 2022 (Rs.)	Income	For the year ended 31st March 2023 (Rs.)
17,73,70,455.00	To Pension Account	8,09,04,451.00		By Contribution from Bose Institute	
57,18,642.00	To Gratuity Account	2,62,250.00			
1,76,27,468.00	To Pension Commutation	15,16,219.00	18,38,46,415.00	For Pension & Gratuity	8,75,44,727.00
2,12,366.00	TO ARREAR PENSION	-		By Contribution from Other	
-	To Bank Charges	-	10,59,480.00	Leave Salary Retirement	
	To Leave Salary Retirement	33,095.00			
-	To Loss on Fixed deposit	-	69,45,646.00	By Interest Fixed Deposit with Bank	92,83,608.00
(86,93,738.00)	To Excess of Income over Expenditure	**1,45,64,673.00**			
			3,83,652.00	Savings Bank Account	4,52,353.00
19,22,35,193.00		**9,72,80,688.00**	**19,22,35,193.00**		**9,72,80,688.00**

Place : Kolkata
Date : 29.09.2023

Signed in terms of our separate Report of even date.
For A.N. Chatterjee & Co.
Chartered Accountants
Firm Registration No. 302143E
Anindra Nath Chatterjee
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Prof. Rajarshi Ray
Registrar(O)

Sd/-
Prof. (Dr.) Uday Bandyopadyay
Director

Bose Institute Employees' General Provident Fund
BALANCE SHEET
For the year ended 31ST March 2023

31-03-2022 Amount in Rs.	Liabilities	31-03-2023 Amount in Rs.	31-03-2022 Amount in Rs.	Assets	31-03-2023 Amount in Rs.
14,83,19,957.31	GPF Accumulation Capital Fund Balance Brought Forward	15,46,89,592.31	17,10,26,942.00	Fixed Deposit with State Bank of India	19,40,88,667.00
			-	Investment	-
	Add: Refund of Advance Adjusted with Accumulated profit		6,50,718.00	Advance Outstanding from Members	6,14,918.00
-		-	-	Add: Refund of Advance Adjusted with Accumulated profit	-
2,44,89,507.00	Add: Subscription by members during the year	1,53,81,351.00	6,50,718.00		6,14,918.00
1,06,13,272.00	Add: Interest Paid to members	1,10,71,086.00	11,87,348.00	Interest Accrued but not received from on Fixed Deposit	16,01,189.00
18,34,22,736.31		18,11,42,029.31			
			79,41,698.25	Bank Balance with SBI	9,86,130.25
2,87,33,144.00	Less: Withdrawal	88,38,043.00			
15,46,89,592.31		17,23,03,986.31	96,72,069.00	Receivable from Bose Institute	1,09,07,290.00
2,06,09,038.94	Add: Excess of Income over Expenditure transferred from Income Expenditure Account	2,09,78,363.94	-	Receivable from Staff	-
1,49,15,844.00	Payable to Bose Institute	1,49,15,844.00			
2,64,300.00	Payable to CPF	-			
19,04,78,775.25		**20,81,98,194.25**	**19,04,78,775.25**		**20,81,98,194.25**

Place : Kolkata
Date : 29.09.2023

Signed in terms of our separate Report of even date.
For A.N. Chatterjee & Co.
Chartered Accountants
Firm Registration No. 302143E
Anindra Nath Chatterjee
Partner
Membership No. 055985

Sd/-
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Prof. Rajarshi Ray
Registrar(O)

Sd/-
Prof. (Dr.) Uday Bandyopadyay
Director

Bose Institute Employees' General Provident Fund
INCOME AND EXPENDITURE
For the year ended 31ST March 2023

31-03-2022 Amount in Rs.	Expenditure	31-03-2023 Amount in Rs.	31-03-2022 Amount in Rs.	Income	31-03-2023 Amount in Rs.
1,06,13,272.00	Interest Paid to Members	1,10,71,086.00	1,08,40,520.00	Interest on Fixed Deposit	1,13,16,791.00
-	Loss on Fixed Deposit	-			
-	Bank Charges	-	2,65,679.00	Interest on savings Bank Accounts	1,23,620.00
4,92,927.00	Excess of Income Over Expenditure	3,69,325.00			
1,11,06,199.00		**1,41,40,411.00**	**1,11,06,199.00**		**1,14,40,411.00**
				Excess of Income over Expenditure	
			2,01,16,111.94	Brought forward from previous year	2,06,09,038.94
2,06,09,038.94	Excess of Income over Expenditure transferred to Balance Sheet	2,09,78,363.94			
				Excess of Income over Expenditure	
			4,92,927.00	Brought forward from current year	3,69,325.00
2,06,09,038.94		**2,09,78,363.94**	**2,06,09,038.94**		**2,09,78,363.94**

Place : Kolkata
Date : 29.09.2023

Signed in terms of our separate Report of even date.
For A.N. Chatterjee & Co.
Chartered Accountants
Firm Registration No. 302143E
Anindra Nath Chatterjee
Partner
Membership No. 055985

Sd/-
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Accounts Officer

Sd/-
Prof. Rajarshi Ray
Registrar(O)

Sd/-
Prof. (Dr.) Uday Bandyopadyay
Director

Bose Institute Employees' Contributory Pension Fund
BALANCE SHEET
For the year ended 31ST March 2023

Previous Year Amount in Rs.	Liability	Current Year Amount in Rs.	Previous Year Amount in Rs.	Assets	Current Year Amount in Rs.
30,17,337.75	Capital Fund	6,60,624.75	2,62,420.00	Fixed Deposit	2,75,789.00
-	Add: Interest to members	-			
23,56,713.00	Less : Final Withdrawal	6,006.00			
6,60,624.75		6,54,618.75			
8,92,114.00	Profit & Loss as per Income & Expenditure	9,24,159.00	6,22,511.75	Bank Balance at SBI	8,98,616.75
2,02,160.00	Payable to staff	2,02,160.00	8,075.00	Accrued Interest	8,940.00
			7,07,074.00	Receivable from Bose Institute	7,07,074.00
1,09,482.00	Loans	1,09,482.00			
			2,64,300.00	Receivable from GPF	-
18,64,380.75		**18,90,419.75**	**18,64,380.75**		**18,90,419.75**

Place : Kolkata
Date : 29.09.2023

Signed in terms of our separate Report of even date.
For A.N. Chatterjee & Co.
Chartered Accountants
Firm Registration No. 302143E
Anindra Nath Chatterjee
Partner
Membership No. 055985

Sd/-
Vikash Kumar
Audit & Finance Officer

Sd/-
Achintya Mukherjee
Accounts Officer

Sd/-
Prof. Rajarshi Ray
Registrar(O)

Sd/-
Prof. (Dr.) Uday Bandyopadyay
Director

Bose Institute Employees' Contributory Pension Fund
INCOME AND EXPENDITURE
For the year ended 31st March 2023

31-3-2022 Amount in Rs.	Expenditure	31-3-2023 Amount in Rs.	31-3-2022 Amount in Rs.	Income	31-3-2023 Amount in Rs.
1,05,742.00	Bank Charges	-	29,745.00	Interest earned on Investment CPF	32,045.00
-75,997.00	Balance	32,045.00			
29,745.00		32,045.00	29,745.00		32,045.00
			-75,997.00	Balance c/f	32,045.00
8,92,114.00	Profit & Loss	9,24,159.00	9,68,111.00	Excess of Income over Expenditure	8,92,114.00
8,92,114.00		**9,24,159.00**	**8,92,114.00**		**9,24,159.00**

Place : Kolkata
Date : 29.09.2023

Signed in terms of our separate Report of even date.
For A.N. Chatterjee & Co.
Chartered Accountants
Firm Registration No. 302143E
Anindra Nath Chatterjee
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Registrar(O)

Sd/-
Prof. (Dr.) Uday Bandyopadyay
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. To adopt the changes some account heads are clubbed or splitted and represented differently to suit the requirements of new format. The Balance Sheet has been drawn by consolidating statement of accounts of Council and the Governing Body with schedules thereon without incorporating the consolidated transactions in the Income and Expenditure Account. Further, the transactions of the Governing Body have not been incorporated in the books of Council. This principle of accounting has been consistently followed from year to year. In case of Governing Body, Pension Fund and Indo FAIR Coordination Centre, since no format was prescribed for Annual Accounts, they are maintained in the same format as before. The accompanying financial statements have been prepared on historical cost convention and conform to the fundamental accounting assumptions.

2.0 Fixed Assets:

2. 1 Land at Madhyamgram

The Institute got possession of 18.73 acres out of 40.99 acres land allotted for Experimental Farm by Govt. of West Bengal. The Governing Body of the Institute decided on 31.07.1989 not to claim the balance land in dispute from the Government considering other related factors.

2.2 Value of Land at Falta Experimental Firm

The Value of land of Falta Experimental Firm has been shown in books of accounts for the financial year 2022-23 at Re.1.00. Since the value of the land is readily not ascertainable, value has been considered at nominal value as per the Para 8.2 of Guidance Note on accounting for Fixed Assets as approved by C&AG and recommendation of Ministry of Finance, Department of Economic Affairs (Budget Division) vide O.M. F.No1(2)-B(AC)/2017 dated 19th July 2018.

2. 3 Nomenclature of Land at Salt lake

The nature of land at Salt lake has been categorised as Lease hold land in the Balance Sheet for the financial year 2022-23 as per the land deed and rules and regulation of Department of Urban Development & Municipal Affairs Government of West Bengal.

2.4 Fixed Asset Register

The Institute has taken up initiatives to prepare a comprehensive Fixed Asset Register. Up to 2019-20 is prepared and work for preparation of Fixed Asset Register for 2020-21 & 2021-22 and 2022-23 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). 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.

2.5 Work-in-Progress

The particulars of fixed assets, under construction/installation are given in Schedule 8A.

2.6 Import in Progress

Import in Progress has been amounted for on the basis of bank advice on the date of actual payment.

2. 7 Valuation of assets

a. The valuation of Fixed Assets has been made at cost less depreciation for the years 1990-91 till date.

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 2022-23 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.

3.0 Depreciation:

3.1 As per the requirement of new format depreciation for the year 2022-23 and is charged to Income & Expenditure Account.

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

1. Building – 10%
2. Equipment – 15%
3. Books & Journals – 10%
4. Furniture – 10%
5. Vehicles – 15%
6. Air Conditioner – 10%
7. Electric Installation – 10%
8. Computer & Internet Peripherals – 60%

3.3 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 2022-23, Grant-in-Aid for Council has been received under the head General, Salaries and Capital. Grant-in-Aid under General and Salaries have been treated as revenue grant. All incomes other than Government Grant and Bank Interest are accounted for on cash basis. Govt. Grants are accounted for on accrual basis provided the order sanctioning the Grant is received before the end of the financial year. As per Rule Rule 230 (8) of General Financial Rule all the interest earned out the Grant in Aid needs to be refunded to the Consolidated fund of India, therefore all the interest earned during the financial year 2022-23 has been transferred to the account “Provision for Interest (Bharatkosh)” and the same will be deposited to Bharatkosh immediately after finalisation of annual accounts for the financial year 2022-23.

4.2 The Institute has a system of accounting in respect of expenses for items like Salary, Stipend payable to Research Scholars under Sponsored Project Account, Gratuity, Leave Salary, Rates & Taxes etc. on cash basis. Liabilities for amount payable to suppliers for materials, services and other expenses are accounted for on accrual basis.

4.3 Consumable Stores are charged to expenditure after purchases.

4.4 Revenue expenditure on Scheme/Project and on specific grant are recognised in the accounting period in which the corresponding expenditure and grant arise. Net excess of receipts over expenditure of grants-in-aid schemes, sponsored by various agencies are represented in bank balances.

4.5 Government Grants received during the financial year are shown in the Income & Expenditure Account and surplus/deficit during the current financial year is reflected in the Balance Sheet.

4.6 In the Financial Year 2022-23 (w.e.f 30/08/2022) all payment has been made through PFMS platform using Treasury Single Accounts (TSA). Before Implementation of TSA based payment system all committed expenditures were paid from unspent balances of last financial year 2021-22 with intimation to Department of Science and Technology Ministry of Science and Technology, Government of India. During Financial year 2022-23 the overall allocation (assignment limit) was Rs. 81,86,00,000.00 segregated into GIA-salary Rs. 48,11,00,000.00, GIA–General Rs. 23,20,00,000.00 & GIA-Capital Rs. 10,55,00,000.00. Out of the total assignment, an amount of Rs. 55,29,48,166.54 (Rs. 21,01,01,762.00 from GIA-General, Rs. 30,73,67,007.54 from GIA Salary and Rs. 3,54,79,397.00 from GIA Capital), were spent leaving a balance of Rs. 26,56,51,833.46 as on 31st March 2023 which was automatically surrendered as per the PFMS-TSA system. Accounting entries were made accordingly in annual accounts for the financial year 2022-23.

4.7 The minus balance of Rs. 43,72,04,553.30 crore in the income & expenditure account for the financial year 2022-23 is a result of charging non-cash expenditure i.e. depreciation since financial year 2012-13 to 2022-23 which shall be adjusted with the capital fund after detailed reconciliation and adopting the policy of changing depreciation as per applicable Act.

5.0 Retirement/Post Retirement and Staff Benefits:

5.1 The interest on loans, being recoverable after realisation of principal amount is accounted for as and when it becomes receivable and the said interest is credited to the House Building Advance Fund. This is done as per Central Govt. Guidelines.

5.2 The Institute has General Provident Fund, Contributory Provident Fund and Pension Schemes.

5.3 Leave encashment, Gratuity, Provident Fund Contribution and Pension are accounted for on cash basis.

6.0 System of Fund Accounts

6.1 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.

6.2 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 and CPF are maintained in New prescribed format.

7.0 Earmarked Funds:

Earmarked Funds shall be treated as a liability on their creation.

Income on investments out of Earmarked Fund is recognised and credited to Earmarked Fund wherever accrued. Any expenditure of a revenue nature which is incurred specifically on selected Scheme/Project it charged to the relevant Earmarked Fund.

8.0 Foreign Currency Transactions:

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

9.0 Research and Development Costs:

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

10.0 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.

11.0 Contingent Liability:

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

12.0 Previous year's Figures:

The previous year's figures have been re-grouped and re-arranged in conformity with the figures of current year.

13.0 General Provident Fund:

GPF figures have been reconciled and properly incorporated in accounts.

14.0 Long Un-Reconciled Balance:

This is well known that Bose Institute is a century old organisation so as its accounts. After a long and good deal of deliberation manual accounts were replaced by computerised accounting system in 2010-11, but still there are some unreconciled balances appearing in the accounts. All-out efforts are given to reconcile them and make the Balance Sheet more lucid and presentable. Some of the balances has been reconciled and reconciliation processes for the other balances are going on. It is expected to be completed that during 2023-24 financial year.

15.0 Interest on unspent balance of EMR projects:

The interest on unspent balance held with Bose Institute for some EMR projects are shown on 31st March 2023. Total amount of such interest is Rs. 96,70,241.51. Out of which some amounts are refunded to the funding authorities through Bharatkosh.

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

Bose Institute has constructed its Unified Academic campus (UAC) at Plot No. 80, Block EN, Sector V, Salt Lake City, 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 arrived at are as follows as per the certification of M/s. RITES Limited:

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

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.

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

A DO letter was issued by Head AI division, DST, GoI, vide No. AI/5/1/2019, dated 07.02.2019 mentioning that as per Department of Expenditure OM No. 1/1/2016-E-III(A), dated: 13.01.2017 "where the categories of employees whose pattern of emoluments structure i.e. pay scales and allowances and conditions of service are not similar to that of the Central

Government employees, a separate "Group of Officers" (GoO) in respect of each Autonomous Bodies may be constituted in the respective Ministry/Department." Accordingly the "Group of Officers" were constituted for Bose Institute and informed through the OM No. AI/5/1/2019, dated: 5th March 2019 to ensure that the final package of benefits extended to the employees of BI is not more beneficial than that admissible to the corresponding categories of the Central Government employees. The final package recommended by the "Group of Officers" will be submitted to AS&FA for further concurrence of the Ministry of Finance."

After several meetings of GoO with Bose Institute authorities and officers and exchange of several documents and correspondences it was concluded 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 compared to the corresponding categories of the Central Government employees. In its report No. AI/1/40/BI/2019, dated: 16th Oct 2019 the GoO 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 revised and given effect in the monthly pay bill preparation. 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.

18.0 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, 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 to properly account for in the financial statements of Bose Institute. Since, all the assets created under FAIR project will be transferred to FAIR Germany as per the convention of FAIR, therefore the assets created under FAIR should be capitalised first and reflected in Institutes financial Statement and also transfer the assets to FAIR project. Accordingly now from this financial 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 of FAIR Books' & 'Schedule – 08 B of Bose Institute Council Books'. The balance which is under progress and yet to be shipped to FAIR and is shown as CWIP (Capital Work In Progress).

19.0 Unidentified receipts and accrued Interest of Project Account

There are some unidentified receipts with Union Bank of India account No. 3355 amounting to Rs. 5.18 lakhs during financial year 2022-23, which has been shown in "Grant-in-Aid Unallocated". Initiative has been taken to identify the same. Institute is in the process of reconciliation of some accrued interest pertaining to the financial year 2012-13.

20.0 Booking of deposit works by CPWD

During the financial year 2022-23 an amount of Rs. 2,34,88,742.00 were paid to CPWD against nine numbers of deposit works, out of which four works has been completed as per Form-65 submitted by the Assistant Engineer CPWD and accounted accordingly up to 31st March 2023 for an amount of Rs. 1,27,85,075.00. The balance amount of Rs. 1,07,03,667.00 will be accounted for after the completion of works by CPWD.

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 2023 & 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, 2023 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. The FAIR PROJECT has accounted for expenses on cash basis in the financial statements in few cases which are contradictory to the Schedule 24 clause 4.2 of the "Significant Accounting Policies and Notes to Accounts" as well as the fundamental accounting assumptions as per AS 1, notified by the Institute of Chartered Accountants of India. There are many instances where Expenditure related to the FY 2022-23 has not been accounted for, thereby a short booking of Expenditure has been found. Similarly, Expenditure of earlier period was booked in the FY 2022-23. The Prior period Expenditure so booked is found in 12 instances amounting to Rs. 43493722.80.
2. In respect of Advances we observed that Rs. 250000/- paid to Finance Officer NISER on 24.01.2023 for organizing CBM Meeting which held on February 3rd and 4th 2023. But till to the end of the year as on 31.03.2023 the same has not been adjusted in the accounts and shown under the head ‘Advance’.
3. 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.
4. Depreciation is not charged on Office Equipment’s valued Rs. 98530/- & Rs. 298685/- 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: 29.09.2023

For A.N.Chatterjee & Co.
Chartered Accountants
F.R.N. 302143E
Anindra Nath Chatterjee
(Partner)
M.No. 055985
UDIN: 23055985BGVWES1633

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 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).

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 (IFCC)
BALANCE SHEET
For the year ended 31ST March 2023

As at 31st March 2022 (₹)	Liabilities	As at 31st March 2023 (₹)	As at 31st March 2022 (₹)	Assets	As at 31st March 2023 (₹)
40,13,80,801.00	Fund for Creation of Asset	56,07,13,865.00	54,732.00	Shares in FAIR GmbH	54,732.00
				Office Equipment Furniture : ₹ 98,530.00	
			2,86,256.00	Equipment : ₹2,98,685.00	3,97,215.00
	Unspent Grant				
7,02,70,770.77	Grant from Department of Science and Technology (**Schedule-1**)	48,01,340.77	21,36,04,744.59	Assets Transferred to FAIR **(Schedule-4)**	25,35,96,171.59
			18,74,35,068.41	Assets Under CWIP **(Schedule-4)**	30,66,65,746.41
21,33,58,415.47	Grant from Department of Atomic Energy (**Schedule-2**)	13,13,00,597.47	-	Advance	2,50,000.00
			-	Receivable From Bose Institute	-
1,31,38,899.00	Interest Earned (**Schedule-3**)	-	-	**Cash Balance** Cash in Hand	-
				Bank Balances	
59,000.00	Audit Fees Payable	17,700.00	2,16,39,297.24	Union Bank of India S.B. A/c -	13,69,03,543.24
2,37,360.00	Payable to Bose Institute	10,33,905.00	27,54,25,148.00	Fixed Deposits	-
69,84,45,246.24		**69,78,67,408.24**	**69,84,45,246.24**		**69,78,67,408.24**

Place : Kolkata
Date : 29.09.2023

Signed in terms of our separate Report of even date.
For A.N. Chatterjee & Co.
Chartered Accountants
Firm Registration No. 302143E
A N Chatterjee
Partner
Membership No. 055985

Sd/-
Shaubhik Ghosh
UDC

Sd/-
Achintya Mukherjee
Accounts Officer

Sd/-
Prof. Rajarshi Ray
Registrar(O)

Sd/-
In-charge Fair Project

Sd/-
Prof. (Dr.) Uday Bandyopadyay
Director

BOSE INSTITUTE (IFCC)
STATEMENT OF EXPENDITURE
For the year ended 31ST March 2023

For the year ended on 31st March, 2022 (₹)	Particulars	For the year ended on 31st March, 2023 (₹)
-	Advertisement Expenses	-
59,000.00	Audit Fees	17,700.00
-	Bank Charges	-
1,000.00	Contingency Expenses	38,268.00
3,46,025.00	Meeting Expenses - IFCC	1,24,865.00
-	Fellowship (JRF)	-
1,12,050.00	Salary(Human Resources)	13,96,624.00
-	Student Support	-
-	Travelling Expenses	9,65,997.00
-	Overhead Charges	-
-	Workshop	-
5,18,075.00		**25,43,454.00**

Place : Kolkata
Date : 29.09.2023

Signed in terms of our separate Report of even date.
For A.N. Chatterjee & Co.
Chartered Accountants
Firm Registration No. 302143E
A N Chatterjee
Partner
Membership No. 055985

Sd/-
Shaubhik Ghosh
UDC

Sd/-
Achintya Mukherjee
Accounts Officer

Sd/-
Prof. Rajarshi Ray
Registrar(O)

Sd/-
In-charge Fair Project

Sd/-
Prof. (Dr.) Uday Bandyopadyay
Director

BOSE INSTITUTE (IFCC)
RECEIPT & PAYMENT
For the year ended 31ST March 2023

Particulars	Amount (₹)	Particulars	Amount (₹)
Opening Balance			
Cash in Hand	-		
SB A/c Union Bank of India	2,16,39,297.24		
Fixed Deposits	27,54,25,148.00		
GRANT FROM DST	-		
GRANT FROM DAE	-		
GRANT FROM DST (IFCC Exp.)	-		
Interest on SB A/c	18,02,990.00		
Interest on FD (Term Deposits)	40,48,293.00		
Advance	42,000.00		
Income Tax (TDS-194C)	20,97,931.00	Advance	2,92,000.00
Income Tax (TDS-194J)	900.00	Income Tax (TDS-194C)	20,97,931.00
Income Tax (TDS-194Q)	1.33.196.00	Income Tax (TDS-194J)	900.00
		Income Tax (TDS-194Q)	1,33,196.00
TDS on GST (IGST)	6,66,017.00	TDS on GST (IGST)	6,66,017.00
		Workshop	-
		Travelling Expenses	9,65,997.00
		Bank Charges	-
		Meeting Expenses - IFCC	1,24,865.00
		Audit Fees	59,000.00
		Contingency Expenses	38,268.00
		Overhead Charges	-
		Salary (Human Resources)	13,96,624.00
		Student Support	-
		Advertisement Expenses	-
		Office Equipment	1,10,959.00
		Power Converter (In-Kind)	12,14,62,349.00
		Detector (FAIR Experiment)	-
		Vacuum Chamber (In-Kind)	3,77,32,756.00
		Beam Stopper (In-Kind)	27,000.00
		GRANT FROM DST (IFCC Exp.) (Return of Bank Interest for the Year 2020-21)	2,80,529.00
		GRANT FROM DST (IFor FAIR) (Return of Bank Interest for the Year 2021-22)	33,26,478.00
Inter Unit Account		**Inter Unit Account**	
Bose Institute (Council)	61,350.00	Bose Institute (Council)	2,98,710.00
Scheme/Project	50,01,281.00	Scheme/Project	50,01,281.00
		Closing Balance	
		Cash in Hand	-
		SB A/c : Union Bank of India	13,69,03,543.24
		Fixed Deposits	-
	31,09,18,403.24		**31,09,18,403.24**

Sd/-
Achintya Mukherjee
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, 2023, and the Income & Expenditure account 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, 2023, 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 31.03.2023 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/-

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/-

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 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: 29.09.2023

For A.N.Chatterjee & Co.
Chartered Accountants
F.R.N. 302143E
Anindra Nath Chatterjee
(Partner)
M.No. 055985
UDIN: 23055985BGVWER4773

BOSE INSTITUTE (GOVERNING BODY)
BALANCE SHEET AS AT 31ST MARCH 2023

	Schedule No.	As on 31/03/2023 Rs.	As on 31/03/2022 Rs.
FUNDS & LIABLITIES			
CAPITAL FUND			
AS PER LAST ACCOUNT		23,17,833.36	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	1	29,62,629.96	29,62,629.96
DEPOSITS & OTHER LIABILITIES	2	10,98,200.66	11,34,260.66
TOTAL		**79,78,432.38**	**80,14,492.38**
PROPERTIES & ASSETS			
FIXED ASSETS			
AS PER LAST ACCOUNT	3	23,74,712.85	23,74,712.85
INVESTMENTS			
AS PER LAST ACCOUNT	4	75,48,484.67	75,48,484.67
RECEIVABLE & DEPOSITS			
AS PER LAST ACCOUNT	5	7,70,488.00	3,92,870.00
CASH & BANK BALANCES	6	12,53,169.34	12,42,480.34
INCOME & EXPENDITURE A/C			
EXCESS OF INCOME OVER EXPENDITURE		(39,68,422.48)	(35,44,055.48)
TOTAL		**79,78,432.38**	**80,14,492.38**

INCOME & EXPENDITURE STATEMENT FOR THE YEAR ENDED 31ST MARCH 2023

Particulars	2022-23 Rs.	2021-22 Rs.
INCOME		
INTEREST ON TERM DEPOSIT	4,30,916.00	1,25,756.00
INTEREST ON SAVINGS BANK	-	-
TOTAL	**4,30,916.00**	**1,25,756.00**
EXPENDITURE		
SALARY & WAGES	-	-
ACCOUNTING CHARGES	-	-
AUDIT FEES	5,900.00	5,900.00
BANK CHARGES	649.00	649.00
EXCESS OF INCOME OVER EXPENDITURE FOR THE YEAR	4,24,367.00	1,19,207.00
TOTAL	**4,30,916.00**	**1,25,756.00**
INCOME BROUGHT DOWN AND ADJUSTED WITH LAST YEAR	4,24,367.00	1,19,207.00
BALANCE BROUGHT DOWN FROM LAST A/C	35,44,055.48	34,24,848.48
BALANCE TAKEN TO BALANCE SHEET	**39,68,422.48**	**35,44,055.48**

Place : Kolkata
Date : 29.09.2023

Signed in terms of our separate Report of even date.
For A.N. Chatterjee & Co.
Chartered Accountants
Firm Registration No. 302143E
A N Chatterjee
Partner
Membership No. 055985

Sd/-
Kamal Sing
Accountant (Cash)

Sd/-
Vikash Kumar
Audit & Finance Officer

Sd/-
Achintya Mukherjee
Accounts Officer

Sd/-
Prof. Rajarshi Ray
Registrar(O)

Sd/-
Prof. (Dr.) Uday Bandyopadyay
Director

138TH BIRTHDAY OF PROF. DEBENDRA MOHAN BOSE

As a part of Azadi Ka Amrit Mahotsav, Bose Institute observed 138th Birthday of Prof. Debendra Mohan Bose on November 26, 2022. Dr. Satinath Mukhopadhyay, MD DM FRCP (London), Fellow, National Academy of Medical Sciences (India), Professor, Department of Endocrinology & Metabolism, IPGMER & SSKM Hospital, Calcutta, graced the occasion as Guest of Honour and delivered the D. M. Bose Memorial Lecture 2022 on the topic “Impact of Vitamin D Deficiency on Skeletal and Non-skeletal Health”. Prof. Syamal Roy, ICMR Emeritus Scientist, CSIR-Indian Institute of Chemical Biology, Kolkata & Former Vice Chancellor, Cooch Behar Panchanan Barma University, presided over the programme.

BOSE INSTITUTE

(AN AUTONOMOUS INSTITUTE UNDER
DEPARTMENT OF SCIENCE & TECHNOLOGY, GOVT. OF INDIA)

Main Campus
93/1 APC Road
Kolkata-700 009, West Bengal

Unified Academic Campus
EN-80, Sector-V, Salt Lake
Kolkata-700091, West Bengal

Centenary Campus
P-1/12, CIT Scheme VII (M)
Kolkata-700054, West Bengal