JNCASR

Jawaharlal Nehru Centre for Advanced Scientific Research

ANNUAL REPORT

2023–24

ISSN.0973-9319

JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH
Jakkur Post, Bengaluru 560 064, Karnataka, India
Phone: +91 80 2208 2750
Email: admin@jncasr.ac.in
Website: www.jncasr.ac.in
@jncasr

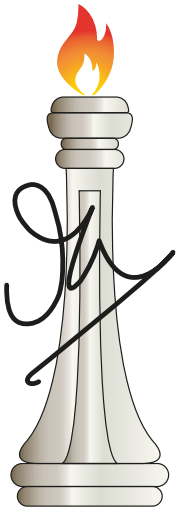
This report is published in September 2024

Content writing and copyediting by:
JNCASR and Editage Digital Media Solutions

Design by:
Editage Digital Media Solutions

ANNUAL REPORT

2023–24



JNCASR

An Autonomous Institution Under the Department of Science and Technology, Government of India; and an Institution Deemed-to-be-University

FOREWORD

PROF. G. U. KULKARNI
President
Jawaharlal Nehru Centre for
Advanced Scientific Research

This is the 35th edition of JNCASR's Annual Report and I am immensely proud to present all our achievements and progress during this financial year. The Centre was ranked 30th in National Institutional Ranking Framework (NIRF), which is incredible as we continue to be the only autonomous institute of DST to feature in the list!

Many of our members have won awards and received recognition on key global platforms. Bharat Ratna Prof. C. N. R. Rao was honoured with the prestigious M P Varghese Award 2023. I would also like to congratulate Prof. Rao on the release of his autobiography, *A Life in Science,* in Kannada as *Vijnanadolagondu Jeevana*. Prof. Kanishka Biswas was selected for the 2022–23 Pioneering Investigator Lectureship for Highly Commended Researchers of Chemical Society Reviews by the Royal Society of Chemistry. Prof. Govindaraju T., from the New Chemistry Unit won the National Technology Award from Technology Development Board, DST, for his outstanding contribution to commercialising innovative indigenous technologies. Prof. Sebastian C. Peter's startup Breathe Applied Sciences Pvt. Ltd. won the Sustainability Champion Award at the National Startup Awards 2023. Another very inspiring success story is that of Prof. Hemalatha Balaram, who has become the first woman President of the Society for Biological Chemists, India, which was founded 90 years ago! I congratulate all my colleagues as well as students who have received awards and accolades in this period.

Success stories are also evident through the large number of scientific publications and patents being granted to our researchers, which also reflect our scientific contributions. This year, there were 330 publications, several of which were in high impact-factor journals, and there were 7 granted patents. Additionally, we signed 17 agreements with various industries, which is a testament to our mission of advancing academia–industry collaborations, a necessity for innovation, fulfilling national goals of missions such as Make in India, Innovate India, Atmanirbhar Bharat and many more. I would also like to note that our research facilities have been consolidated as SAMat Research Facility and Biology Research Facility. The research facilities are easily accessible by in-house researchers and researchers from institutions across the country.

On the academic front, we have had a successful year, with 56 degrees and diplomas awarded. We have also grown as a community, with the addition of 121 new students, which brings our strength to 373. The Placement, Alumni, and International Relations (PAIRs) Office, which was established in 2021, has recently completed preparing a unique database of 868 alumni of the Centre and connected with each of them! This was a huge achievement,

FOREWORD

and we are very optimistic that PAIRs is going to be instrumental in creating employment opportunities and facilitating the academic and professional development of our students as well as faculty.

It gives me immense pleasure to share that we continue to be committed to connecting with and educating school/college and undergraduate students as well as the society through various outreach events and fellowships and extension programmes. We organised 32 outreach programmes this year, via our Educational Technology Unit, which cumulatively saw participation by more than 3,258 students and 536 teachers. I am also pleased that we could contribute to the educational practices in schools by conducting orientation programmes for teachers which focused on improved teaching methodologies.

This year we have organised several outstanding workshops and meetings. Notable among these were the Recent Advances in Materials (RAM-90) conference and the JNCASR-CECAM (European Centre for Atomic and Molecular Calculations) international conference, Molecular Dynamics (MD@60). We also celebrated 25 years of the establishment of the Evolutionary and Organismal Biology Unit and 10 years of the Neuroscience Unit with 2-day symposia.

On a more sombre note, the Centre deeply mourns the passing away of Prof. M. R. S. Rao, our former President, on 13th August 2023.

Yet, we have, indeed, had a productive and successful year. I would like to extend my heartfelt gratitude to each member of the Centre for putting in the hard work and staying committed to the vision of our Centre. I also thank DST, Government of India, for their continued support to the Centre.

IN MEMORIAM

Late Prof. M. R. S. Rao

Former President, JNCASR, and
SERB Year of Science Chair Professor

The Centre deeply mourns the passing away of **Prof. M. R. S. Rao**, our former President, and SERB Year of Science Chair Professor, on 13th August 2023. Prof. Rao steered the Centre's academic and research activities to greater heights as **President** for 10 years, along with carrying out his research in chromatin biology. He guided several students towards doctoral studies. Prof. Rao also served in several scientific bodies as Chair of Governing Councils, Research Councils, as well as many international bodies; and was the recipient of several honours and awards, including the **Padma Shri** conferred by the Government of India. The Centre held a condolence meeting to mourn his passing.

TABLE OF CONTENTS

01

INTRODUCTION

Born out of an idea to facilitate academic discourse and advancement through interdisciplinary collaborative research in advanced areas of science, the Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR) was established by the Department of Science and Technology of the Government of India in 1989. JNCASR has steadily grown to become a top national multidisciplinary research institute that has considerable global recognition. In 2002, the Centre was declared a Deemed-to-be-University by the University Grants Commission, allowing it to confer degrees to its students directly.

Today, the Centre has 373 students, several renowned faculty members, and 9 research units with top-class research infrastructure. Together, the JNCASR research community has made countless innovations and conducted ground-breaking research, which is reflected in the various awards, publications, and patent grants of these researchers on national and international platforms. This section gives an overview of the Centre, its missions, activities, and key accomplishments.

ABOUT JNCASR

The Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR) was founded in the year 1989 by the Department of Science and Technology, Government of India, to mark the birth centenary of Pandit Jawaharlal Nehru, India's first Prime Minister and a great advocate of science. The Indian Institute of Science (IISc), one of India's oldest and most esteemed research institutions, supported the founding of JNCASR, and a mutually beneficial partnership between the 2 institutes continues till date. Bharat Ratna Prof. C. N. R. Rao, JNCASR's Founding President, was instrumental in establishing the Centre and continues to play a prominent role in its journey, lending his valuable expertise and knowledge. Today, JNCASR's Governing Council is presided over by Prof. V. Ramgopal Rao, and its President is Prof. G. U. Kulkarni.

In 2002, JNCASR was designated as an Institution Deemed-to-be-University by the University Grants Commission (UGC), Government of India, and has been granted the privileges outlined in clause-4 (Dimensions of Autonomy for Category-I Universities) of the UGC Regulations based on its accomplishments and influence on the scientific community in India. In 2016, JNCASR obtained the NAAC accreditation status of A++ with a score of 3.76 out of 4 points.

The academic programmes provided by JNCASR include Ph.D., Integrated Ph.D., and Master's programmes in a variety of disciplines within the research units: Chemistry and Physics of Materials Unit (CPMU), Evolutionary and Organismal Biology Unit (EOBU), Engineering Mechanics Unit (EMU), International Centre for Materials Science (ICMS), Molecular Biology and Genetics Unit (MBGU), New Chemistry Unit (NCU), Neuroscience Unit (NSU), and Theoretical Sciences Unit (TSU). In 2023–24, JNCASR welcomed 121 new students, taking its total student strength to 373.

Equipped with the latest state-of-the-art experimental, computational, and infrastructural facilities, the Centre is also a significant contributor to India's scientific research capabilities. In 2023–24, JNCASR became the first autonomous institute to feature in the National Institutional Ranking Framework (NIRF), wherein it was ranked 30th. In addition, it is among the top 4.6% universities globally according to the 2022–23 Edition of World University Rankings. The significant contributions of JNCASR's researchers is also evident from the 330 publications in the past academic year and 7 granted patents out of 20 filed. JNCASR has also extensively collaborated with the government and industry on various projects, which has led to at least 17 agreements being signed in 2023–24. Furthermore, 55 new sponsored projects with a funding of over ₹7.9 crores have been added to the research repository of JNCASR in 2023–24. JNCASR's students and faculty members have also won various prestigious awards, pointing to the Centre's research excellence and impactful contribution this year. The Centre's commitment to scientific outreach was also demonstrated with 32 programmes that saw over 4,000 participants this year.

The Centre's vibrant academic atmosphere and world-class infrastructure makes it one of the most coveted places to be for budding scientists.

Read on to learn about all this and more in this year's annual report.

ABOUT JNCASR

Objectives

- Establish and conduct world-class research in Science and Engineering
- Foster interdisciplinary and collaborative research with institutions from India and abroad
- Establish state-of-the-art laboratories and computational and infrastructural facilities to facilitate scientific research
- Capacity building through high-quality M.S. and Ph.D.s in Science and Engineering
- Increase awareness about science and research among school and college students through extensive science outreach, novel fellowships, and extension programmes
- Take research from the laboratory to society by making a conscious effort towards the generation of intellectual property and establishment of start-ups from in-house inventions

Reservation, Official Language, and Implementation of the judgments/orders of the Central Administrative Tribunal (CAT)

The Centre follows the national policy on reservation and official language as per the rules and orders issued by the Government of India, with necessary guidelines from the Council of Management being implemented from time to time. During the year 2023–24, there were no cases pertaining to the Centre that appeared before the CAT.

YEAR AT A GLANCE

AWARDS AND ACHIEVEMENTS

83
Faculty Achievements

66
Students, Research Associates, and Alumni Achievements

EVENTS

147
Lectures, Seminars, and Conferences

SCIENCE OUTREACH PROGRAMMES ORGANISED BY EDUCATION TECHNOLOGY UNIT

32
Programmes

4,119
Participants

536+
Teachers

3,258+
Students

330
Publications

12
Faculty Fellowships

7
Patents Granted

121
New Admissions

56
Degrees and Diplomas

Total Publications
330

259	**24**	**18**
Research Articles and Early Access Articles	Book/Book Chapter	Review Articles
78.48%	7.27%	5.45%
14	**11**	**4**
Notes, Conference Papers, Meeting Abstracts and News Items	Biographical Items, Editorials and Editorial Material	Corrections and Erratums
4.24%	3.33%	1.21%

6.55 AVERAGE IMPACT FACTOR

YEAR AT A GLANCE

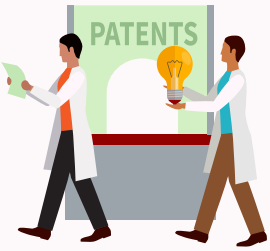
PROMOTIONS

PROFESSORS

- Prof. Ravi Manjithaya
- Prof. Sheeba Vasu

ASSOCIATE PROFESSORS

- Prof. Bivas Saha
- Prof. Bani Kanta Sarma



PATENT APPLICATIONS FILED

20

India:	8	PCT:	5
USA:	4	Europe:	3

PATENTS GRANTED

7 India: 7

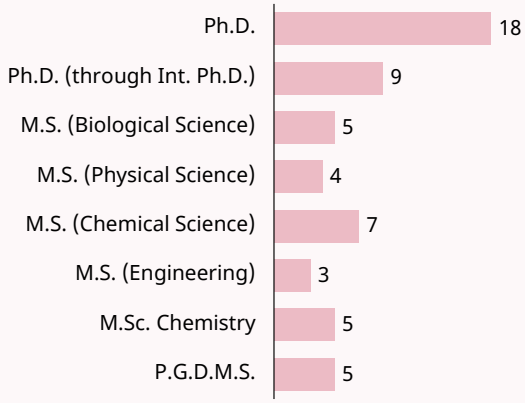
STUDENT STRENGTH

373 Total Students

121 New Admissions

DEGREES AND DIPLOMAS AWARDED

56



NEW SPONSORED PROJECTS

55

TOTAL GRANT RECEIVED FOR NEW PROJECTS

₹7.97 cr.

AWARDS AND ACHIEVEMENTS

NATIONAL INSTITUTIONAL RANKING FRAMEWORK (NIRF) RANKINGS

Secured
30th
position in the research institutions category in NIRF 2023

GENDER ADVANCEMENT FOR TRANSFORMING INSTITUTIONS (GATI) PILOT PROJECT, INITIATED BY THE WISE KIRAN DIVISION, DST, IN PARTNERSHIP WITH THE BRITISH COUNCIL IN 2020

JNCASR recognised as a GATI Achiever Institution

Scored
1st
rank among 30 research institutions in India

WORLD UNIVERSITY RANKINGS (2022–23 EDITION, GLOBAL 2000 LIST, CENTRE FOR WORLD UNIVERSITY RANKINGS)

JNCASR among the
top 4.6%
out of 19,788 universities globally

AWARDS AND ACHIEVEMENTS

FACULTY ACHIEVEMENTS

Awards

Prof. Sarit S. Agasti

- Awarded the National Prize for Research in Bio-Physical Chemistry (C. N. R. Rao Education Foundation) on 31st July 2023 (along with Prof. Pinaki Talukdar, IISER, Pune)

Prof. Kanishka Biswas

- Received the Chirantan Rasayan Sanstha (CRS) Award for Research and Innovation Excellence 2023
- Received the Khosla National Award (Sciences) 2022 by IIT Roorkee
- Selected amongst the 2022–23 Pioneering Investigator Lectureship—Highly Commended Researchers of Chemical Society Reviews by the Royal Society of Chemistry

Prof. K. N. Ganesh

- Honoured with the Chirantan Rasayan Sanstha (CRS) Life Science Achievement Award 2023

Prof. Subi Jacob George

- Received the Chirantan Rasayan Sanstha (CRS) Award for Research and Innovation Excellence 2023

Prof. Jayanta Haldar

- Awarded the MRSI Medal by the Materials Research Society of India (MRSI) 2023

Prof. Hiriyakkanavar Ila

- Invited for the Sri Krishna Endowment Lecture and Prize by the Department of Organic Chemistry, IISc, Bengaluru, in April 2023
- Invited for the Professor Deodhar Endowment Lecture and Prize by the Departmnet of Chemistry, IIT Bombay in January 2024

Prof. G. U. Kulkarni

- Received the Society for Materials Chemistry (SMC) Gold Medal from Bhabha Atomic Research Centre (BARC) in October 2023
- Conferred with Honorary Doctorate by K.L. University, Vijayawada
- Received a DST-Advanced Manufacturing Technologies project, *"Scalable coating of metal oxides on hybrid transparent electrodes and fabrication of smart window devices"* in collaboration with HHV Pvt. Ltd. Bengaluru, IIT Jodhpur, and CeNS, Bengaluru for a period of 3 years with a total budget of ₹4.45 crore

Prof. Tapas Kumar Maji

- Received the Society for Materials Chemistry (SMC) Silver Medal 2023 from Bhabha Atomic Research Centre (BARC) in October 2023
- Listed under The Asian Scientist 100 by *Asian Scientist Magazine*

Prof. Chandrabhas Narayana

- Received the Taranath Shetty Memorial Oration Popular Lecture Series Award 2023 from the Association of Clinical Biochemists of India
- Received the Sir C. V. Raman Memorial Science Day Lecture Award 2023 from the Indian Photobiology Society

AWARDS AND ACHIEVEMENTS

Prof. Sebastian C. Peter

- Received Rajiv Goyal Prize for Young Scientists (Chemical Sciences) from Kurukshetra University
- Received International Association for Advanced Materials (IAAM) Scientist Medal
- Received National StartUp Awards 2023 (Sustainability Champion) for Breathe Applied Sciences Pvt. Ltd., from the Department for Promotion of Industry and Internal Trade (DPIIT), Govt. of India
- Received Material Science Annual Prize 2023 by the Materials Research Society of India (MRSI)
- Received the Chirantan Rasayan Sanstha (CRS) Research Partnerships and Industry Translation Medal 2023

Prof. C. N. R. Rao

- Received the *'Chandan Ratna'* award from School Chandan, Laxmeshwar, Gadag, Karnataka on 3rd January 2024
- Received the *'Champions of Change Karnataka'* recognition in the field of Innovation and Science in the state of Karnataka by the Interactive Forum on Indian Economy (IFIE)
- Received M. P. Varghese Award (2023) instituted by Mar Athanasius College Association
- Conferred with an Honorary Doctorate from K. L. University, Vijayawada
- Received the Chemist of the Century Award in January 2024 from Indian Chemical Society

Dr. Achira Roy

- Selected as the runner-up of Ben Barres Spotlight Award 2023
- Received the SERB Grant for Symposia/Conferences, Science and Engineering Research Board (SERB), Department of Science and Technology (DST), Government of India

Prof. Balasubramanian S.

- Received Professor AK Chandra Memorial Award from Indian Chemical Society

Prof. Kaustuv Sanyal

- Awarded GN Ramachandran Gold Medal 2022 by CSIR

Prof. Govindaraju T.

- Received the Vividhlaxi Audyogik Samshodhan Vikas Kendra (VASVIK) Award 2022 for outstanding contributions in the chemical biology of 'functional & disease amyloids'
- Awarded the National Technology Award 2023 for "Outstanding Contribution of Scientists in Commercialising Innovative Indigenous Technologies" by Dr. Jitendra Singh, the Union Minister for Science and Technology, on 14th May 2023

Fellowships

Prof. Sundaresan A.

- Received JNCASR Silver Jubilee Professorship

Prof. Santosh Ansumali

- Received the INAE-SERB Abdul Kalam Technology Innovation National Fellowship

Prof. Rajesh Ganapathy

- Received Fellowship of the Indian Academy of Sciences

AWARDS AND ACHIEVEMENTS

Prof. Jayanta Haldar
- Received Fellowship of the Indian Academy of Sciences

Prof. G. U. Kulkarni
- Selected for SERB J. C. Bose Fellowship for the year 2022–23
- Received Fellowship of the Royal Society of Chemistry

Prof. Sebastian C. Peter
- Received Fellowship of the Indian Academy of Sciences

Prof. Srikanth Sastry
- Awarded Gauss-Professorship in 2024 by the Göttingen Academy of Sciences and Humanities, Germany

Dr. Shwetha Shivaprasad
- Received SERB Ramanujan Fellowship, Department of Science and Technology, India
- Received DBT-Ramalingaswami fellowship, Department of Biotechnology, India
- Received DBT-India Alliance Wellcome Trust Early Career Fellowship, Department of Biotechnology, India

Prof. Sheeba Vasu
- Received Fellowship of the Indian National Science Academy

Memberships

Prof. Anuranjan Anand
- Appointed as member of the Public Education and Awareness Committee, American Society of Human Genetics (ASHG), Rockville, USA

Prof. Meheboob Alam
- Appointed Member of IUTAM Symposia Panel for Fluid Dynamics (2022–26) by the International Union of Theoretical and Applied Mechanics (IUTAM)
- Appointed as the IUTAM Representative for IUTAM Symposium on *Rapid Granular Flows and Turbulent Particle Suspensions* at IIT Bombay

Prof. Hemalatha Balaram
- Appointed as Chair of Science Education Programmes, Indian Academy of Sciences
- First woman President in 90 years of the existence of Society for Biological Chemists, India (SBC(I))
- Elected as a committee member of DST-FIST Life Sciences

Prof. Subi Jacob George
- Appointed Fellow of the National Academy of Sciences, India (NASI), 2023
- Associate Editor of *Chemical Science*, a flagship journal of RSC
- Appointed Editorial Advisory board member, *Journal of the American Chemical Society* (JACS)
- Invited to become Editorial Advisory board member, *Physical Chemistry Chemical Physics*
- Appointed Editorial Advisory board member, *Chemistry-An Asian Journal*

AWARDS AND ACHIEVEMENTS

Prof. Jayanta Haldar
- Appointed as the Editor-in-Chief of *ACS Infectious Diseases*
- Invited to join as Member of American Society of Microbiology (ASM)
- Selected as Editorial board member of the journal *RSC Medicinal Chemistry*

Prof. Hiriyakkanavar Ila
- Received Indian National Science Academy Honorary Scientist position for a period of 3 years

Prof. Kavita Jain
- Selected as Member, Scientific Advisory Board of SFB on polygenic adaptation, Austrian Research Fund (FWF)

Prof. Amitabh Joshi
- Appointed as Chief Editor of *Dialogue: Science, Scientists, and Society,* Indian Academy of Sciences, Bengaluru

Prof. G. U. Kulkarni
- Appointed as Life Member, Society for Materials Chemistry
- Appointed as Member, Governing Board of INFLIBNET (UGC) for a period of 3 years
- Appointed as Member, DST Scientific Advisory Committee (SAC) for devising the technical details and scientific contents of the Indian Science Congress 2024
- Appointed as Additional Member, Indian National Science Academy Council for the year 2024 (as nominee of Secretary, DST)
- Appointed as Member, General Council of NAAC for a 3-year term
- Appointed as Member, UGC Consortium for Academic Research and Ethics Committee-Empowered Committee (CARE-EC)
- Appointed as Member, NAC-TRC of the Indian Association for Cultivation of Science (IACS), Kolkata
- Appointed Member of Senate of IISER Berhampur

Prof. Tapas Kumar Kundu
- Entrusted as the RC Chair of CSIR-IICB, by DG CSIR, for a period of 3 years w.e.f. September 2023
- Invited to join as Reviewing Editor of *eLife*

Prof. Tapas Kumar Maji
- Appointed as International Advisory Board Member for *Angewandte Chemie*

Prof. K. S. Narayan
- Appointed as Distinguished Visiting Professor, IIT Bombay, 2024–26
- Selected as Editorial Board Member for *Materials Horizon–RSC(UK), ACS Applied Electronic Materials, Elsevier–Synthetic Metals*
- Selected as Committee Member of Department of Science and Technology, Government of India, FIST and SAIF programme

Prof. Swapan K. Pati
- Appointed as Adjunct Research Professor at IISER, Kolkata for a period of 2 years

AWARDS AND ACHIEVEMENTS

Prof. Sebastian C. Peter
- Appointed as Editorial Advisory Member, RSC's *Chemical Science journal*
- Appointed as Editorial Advisory Board Member, *Journal of the American Chemical Society* (JACS)
- Invited to join as Editorial Advisory Board Member, *ChemSusChem* (Wiley-VCH)

Dr. Achira Roy
- Appointed as an Assistant Content Editor for *Bio-protocol Journal* since July 2023

Prof. Balasubramanian S.
- Appointed Expert Member of the University Research Council of SRM Institute of Science and Technology, Chennai for two years

Prof. Govindaraju T.
- Invited to join as Editorial Advisory Board Member of *ACS Medical Chemistry Letters*

Prof. Ranjani Viswanatha
- Appointed as Executive Editorial Board member, *Nano Futures*

STUDENT, RESEARCH ASSOCIATE, AND ALUMNUS ACHIEVEMENTS

CHEMISTRY AND PHYSICS OF MATERIALS UNIT (CPMU)

Dr. Sanchita Karmakar (Research Associate; research supervisor: Prof. Tapas Kumar Maji)
- Received Best Ph.D. Thesis Award 2023 at India's Carbon Capture and Utilization Network (CO_2 India)

Dr. Srimayee Mukherji (Research Associate; research supervisor: Prof. Balasubramanian S.)
- Received Best Poster Award from JNCASR and CECAM

Dr. Avula Nikhil (Research Associate; research supervisor: Prof. Balasubramanian S.)
- Received Best Poster Award at SoPhyC, IIT Kanpur

Dr. Debendra Prasad Panda (Research Associate; research supervisor: Prof. Sundaresan A.)
- Received Best Poster Award at the International Workshop on Energy and Sustainability (JIWES 2023)

Rohit Attri (Ph.D. Student; research supervisor: Prof. G. U. Kulkarni)
- Awarded Best Poster Prize at Materials, Methods and devices for futuristic Technologies (MDFT 2023), International Conference held at Dharwad, Karnataka

Disha Brahma (Ph.D. Student; research supervisor: Prof. Balasubramanian S.)
- Received Best Poster Award from JNCASR and CECAM
- Received Special Funding to Attend 28th Thermodynamics Conference from Delft University of Technology

Arghya Ghosh (Ph.D. Student; research supervisor: Prof. Tapas Kumar Maji)
- Received ACS Applied Materials and Interfaces Best Poster Prize at National Conference on Disorder and Soft Systems: Recent trends (DSSR)

AWARDS AND ACHIEVEMENTS

Anjana Joseph (Ph.D. Student, CPMU; Research Supervisor: Prof. Chandrabhas Narayana)
- Received Materials Research Society India Prize for the Best Poster at the 5th Indian Materials Conclave at the Indian Institute of Technology (BHU) Varanasi

Rahul Kumar (Ph.D. Student; research supervisor: Prof. Sundaresan A.)
- Received Best Poster Award at the International Workshop on Energy and Sustainability (JIWES 2023)
- Received Distinguished Student Award at the American Physical Society/International Centre for Diffraction Data

Kamlesh Mishra (Ph.D. Student; research supervisor: Prof. Rajesh Ganapathy)
- Awarded Poster Prize at Workshop *"Soft and Living Matter: From Fundamental Concepts to New Material Design"*, International Centre for Theoretical Studies, Bengaluru

Sneha Raj V. P. (Ph.D. Student; research supervisor: Prof. Tapas Kumar Maji)
- Received ACS Crystal Growth and Engineering Best Poster Prize at International Conference on Modern Trends in Inorganic Chemistry (MTIC-XX)

Tejaswini S. Rao (Ph.D. Student; research supervisor: Prof. G. U. Kulkarni)
- Awarded Best Flash Talk for poster at Materials, Methods and Devices For Futuristic Technologies (MDFT 2023), International Conference held at Dharwad, Karnataka

Sourav Rudra (Ph.D. Student; research supervisor: Prof. Bivas Saha)
- Received Best Poster Award from JNCASR

Uttam Tiwari (Int. Ph.D. Student; research supervisor: Prof. Rajesh Ganapathy)
- Awarded Poster Prize at Workshop *"Soft and Living Matter: From Fundamental Concepts to New Material Design"*, International Centre for Theoretical Studies, Bengaluru

Rahul Singh Rawat (M.S. through Int. Ph.D Student; research supervisor: Prof. Bivas Saha)
- Won the Best Poster Award from JNCASR and Rice University

ENGINEERING MECHANICS UNIT (EMU)

Ritwik Das (Alumnus, M.S. (Engineering); research supervisor: Dr. Diwakar Seyyanur Venkatesan)
- Received Prof. Roddam Narasimha and Family Award for the Best M.S. (Engineering) Thesis in Engineering Mechanics 2023

EVOLUTIONARY AND ORGANISMAL BIOLOGY UNIT (EOBU)

Dr. Hansraj Gautam (Alumnus, Ph.D.; research supervisor: Prof. T. N. C. Vidya)
- Received the Best Talk Prize at the Understanding Behaviour 2023 Conference

Athira T. K. (Ph.D. Student; research supervisor: Prof. T. N. C. Vidya)
- Received Travel Award, International Society for Behavioural Ecology (ISBE)

Ankana Sanyal (Ph.D. Student; research supervisor: Prof. T. N. C. Vidya)
- Received Poster Prize at the Understanding Behaviour 2023 Conference

AWARDS AND ACHIEVEMENTS

Chinmay Yadav Krishna Temura (Ph.D. Student; research supervisor: Prof. Amitabh Joshi)
- Received the Best Poster Award in JNCASR's In-House Symposium 2023, JNCASR

MOLECULAR BIOLOGY AND GENETICS UNIT (MBGU)

Dr. Md. Hashim Reza (DBT-Research Associate III; research supervisor: Prof. Kaustuv Sanyal)
- Received the EMBO Scientific Exchange Grant, EMBO
- Received the EMBL CPP Fellowship, EMBL Heidelberg

Dr. Banishree Sahoo (Research Associate; research supervisor: Prof. Kaustuv Sanyal)
- Received the WISE-PDF Fellowship, DST

Kajal Kamat (Ph.D. Student; research supervisor: Prof. Maneesha Inamdar)
- Selected for the ISSCR Travel Award by the International Society for Stem Cell Research (ISSCR) to attend its 2023 Annual Meeting

Amit Kumar (Ph.D. Student; research supervisor: Dr. Kushagra Bansal)
- Awarded the Best Poster and Travel Award in Global Immunology Summit 2024 (GIS-2024), THSTI, Faridabad

Prerana Muralidhara (Ph.D. Student, MBGU; Research Supervisor: Dr. Kushagra Bansal)
- Received a Travel Grant from SERB to present the research work at the meeting *"Gene Expression & Signalling in the Immune System"* held at Cold Spring Harbor Laboratory, New York from 16th–20th April 2024

Pallawi Choubey (Int. Ph.D. Student; research supervisor: Dr. Kushagra Bansal)
- Awarded the Best Poster in JNCASR's In-House Symposium 2023, JNCASR
- Awarded the Best Poster Award in Global Immunology Summit 2024 (GIS-2024), THSTI, Faridabad

Kuladeep Das (Int. Ph.D. Student; research supervisor: Prof. Kaustuv Sanyal)
- Received the EMBO Scientific Exchange Grant, EMBO

Harshdeep Kaur (Int. Ph.D. Student; research supervisor: Dr. Kushagra Bansal)
- Awarded the Best Talk in JNCASR's In-House Symposium 2023, JNCASR

Priyesh Singh Parihar (Int. Ph.D. Student; research supervisor: Prof. Kaustuv Sanyal)
- Awarded the Best Participant Award at School in Chronobiology 2023 held at NEHU and organised by the Indian Society for Chronobiology

NEW CHEMISTRY UNIT (NCU)

Dr. Debattam Sarkar (Alumnus, Ph.D.; research supervisor: Prof. Kanishka Biswas)
- Received KPIT Shodh Best Research Award (For Best Ph.D. Thesis) (2024), KPIT Technologies
- Received Goldsmid Award, International Thermoelectric Society (ITS)

Dr. Prasenjit Mandal (Research Associate; research supervisor: Prof. Ranjani Viswanatha)
- Received International Travel Grant from Science and Engineering Research Board (SERB) International Travel Support

AWARDS AND ACHIEVEMENTS

Dr. Angshuman Das (Research Associate; research supervisor: Prof. Subi Jacob George)
- Winner of the Sarangh's: Thesis Presentation Competition 2023 for Ph.D. students 2023, Indian National Young Academy of Sciences (INYAS)

Dr. Kalpita Baruah (Research Associate; research supervisor: Prof. Bani Kanta Sarma)
- Received Best Poster Award at the 4th Student Indian Peptide Symposium 2024

Anju A. K. (Ph.D. Student; research supervisor: Prof. Subi Jacob George)
- Received Best Poster Award at the in Thieme Organic Chemistry Symposium 2023, Thieme Group

Anshulata (Ph.D. Student; research supervisor: Prof. Bani Kanta Sarma)
- Received Best Oral Award at the 4th Student Indian Peptide Symposium 2024

Yash Sanjay Acharya (Ph.D. Student; research supervisor: Prof. Jayanta Haldar)
- Selected for Oral Presentation, GRS on New Antibacterial Drug Discovery 2024, Ventura, California, USA
- Selected for Poster Presentation, GRC on New Antibacterial Drug Discovery 2024, Ventura, California, USA

Samprete Bhattacharyya (Ph.D. Student; research supervisor: Prof. Bani Kanta Sarma)
- Received Best Poster Award at the Annual Faculty Meeting and In-House Symposium 2023, JNCASR

Paramesh Das (Ph.D. Student; research supervisor: Prof. Bani Kanta Sarma)
- Received Travel Award, International Peptide Symposium, 2023 Brisbane, Australia. Sponsor: International Peptide Symposium organising committee

Debajit Kalita (Ph.D. Student; research supervisor: Prof. Bani Kanta Sarma)
- Received Travel Award, International Peptide Symposium, 2023, Brisbane, Australia. Sponsor: Ambiopharm

Soumi Mondal (Ph.D. Student; research supervisor: Prof. Sebastian C. Peter)
- Received Best Poster Award from the Materials Research Society of India

Riddhimoy Pathak (Ph.D. Student; research supervisor: Prof. Kanishka Biswas)
- Received Young Researcher Award from the European Materials Research Society, Strasbourg, France
- Received Materials Next 5.0 Award at Tata Steel's Advanced Materials Research Centre

Satyajit Patra (Ph.D. Student; research supervisor: Prof. Subi Jacob George)
- Received Best Poster Award in SPSI Macro 2023 from the The Society for Polymer Science (SPSI)

Nandini Saha (Ph.D. Student; research supervisor: Prof. Jayanta Haldar)
- Selected for Poster Presentation at the Annual Faculty Meeting and In-House Symposium 2023, JNCASR

Vaishali Taneja (Ph.D. Student; research supervisor: Prof. Kanishka Biswas)
- Received Materials Next 5.0 Award at the Tata Steel's Advanced Materials Research Centre

Shuva Biswas (Int. Ph.D. Student; research supervisor: Prof. Kanishka Biswas)
- Received Student Chanakya Fellowship for Quantum Technology Research, I-Hub Quantum Technology Foundation

AWARDS AND ACHIEVEMENTS

Sayan Chakravarty (Int. Ph.D. Student; research supervisor: Prof. Jayanta Haldar)
- Selected Participant for "C-CAMP AMR Innovator School-2024", Bengaluru

Sudip Mukherjee (Int. Ph.D. Student; research supervisor: Prof. Jayanta Haldar)
- Selected for Poster Presentation at the Nature Conference "Nanomaterials in biomedical applications" 2024, Nature Conferences, Manipal
- Selected for Oral Presentation at the 17th International Conference on Polymer Science and Technology ("SPSI-MACRO-2023") 2023, IIT Guwahati

Dipanjana Patra (Int. Ph.D. Student; research supervisor: Prof. Jayanta Haldar)
- Selected for Poster Presentation at the Nature Conference "Nanomaterials in biomedical applications" 2024, Nature Conferences, Manipal
- Received Best Poster Award at the Annual Faculty Meeting and In-House Symposium 2023 at JNCASR
- Selected for Oral Presentation at the 17th International Conference on Polymer Science and Technology ("SPSI-MACRO-2023") 2023, IIT Guwahati
- Selected for Poster Presentation at the International Conference on Recent Advances in Materials (RAM-90), JNCASR

NEUROSCIENCE UNIT (NSU)

Vishal R. Lolam (Int. Ph.D. Student; research supervisor: Dr. Achira Roy),
- Received First Prize in Oral Presentation at the Manipal Genetics Update VII international event on *"Cellular and Animal Models for Rare Genetic Diseases"*, Manipal Academy of Higher Education (MAHE), Manipal
- Received Best Poster Award in Annual Faculty Meeting and In-house Symposium 2023, JNCASR
- Received Best Paper Award from the Organisers of the Indian Academy of Neurosciences (IAN) and Jiwaji University, Gwalior
- Received Ravindra and Lalita Nath Travel Fellowship from the Indian Academy of Neurosciences (IAN)
- Ranked 25th in CSIR-NET for Lectureship/Assistant Professor (LS)

Pragya Sharma (Int. Ph.D. Student; research supervisor: Prof. Sheeba Vasu)
- Received the DBT-CTEP Travel grant to attend the Gordon Research Conference in Chronobiology, DBT-CTEP

THEORETICAL SCIENCES UNIT (TSU)

Sujan Kashivasi Krishna Prasad, Ph.D. Student; research supervisor: Prof. N.S. Vidhyadhiraja)
- Received International Travel Support from Science and Engineering Research Board, DST

MAJOR EVENTS AND CELEBRATIONS

Total Events
147

02 Special Celebrations by Research Units	**25** Lectures, Seminars, Workshops, and Conferences
01 Endowment Lecture	**13** Celebrations
03 Events organised by Hindi Cell	**05** Key Events
01 Participation in Science Exhibition	**97** Other Unit Events

Major events included in this chapter

Unit events which have not been elaborated upon in this chapter

SPECIAL CELEBRATIONS BY RESEARCH UNITS

EOBU@25

A 2-day symposium was organised to commemorate the 25th year of establishment of the Evolutionary and Organismal Biology Unit. The symposium was held on 16th and 17th February 2024 at JNCASR in hybrid mode and comprised a series of scientific talks presented by the unit faculty members and their research collaborators, alumni, and students. The major achievements of the Unit over the last 25 years were also discussed on this occasion.

On 16th February 2024, the Darwin Lecture (8th in the series) was delivered by Prof. Erik Svensson, Professor, Lund University, Sweden on the topic *"Reflections upon latitudinal diversity gradients and how to link micro-and macroevolution: Insights from an old insect order"*.

MAJOR EVENTS AND CELEBRATIONS

"Nerve-storming: from molecules to behaviour" Symposium

To celebrate the 10th year of establishment of the Neuroscience Unit, a symposium on *"Nerve-storming: from molecules to behaviour"* was hosted at JNCASR on the 8th and 9th March 2024, co-organised by Dr. Achira Roy and Prof. Sheeba Vasu. This event covered sessions on diverse themes in the field of neurobiology: neurodevelopment, signalling and circuitry, physiology and behaviour, and a spectrum of neurological disorders. The symposium dwelt on diverse model systems (worm, insect, fish, bird, rodent, marsupial, monkey, cells, and organoid models) and discussed the challenges and technical advancements in studying the nervous system in health and disease. In addition, the symposium included a panel discussion on potential avenues towards strengthening neuroscience research in India and an interactive session with the editor of *eLife*, where Prof. Vidita Vaidya, from Tata Institute of Fundamental Research (TIFR), Mumbai, ruminated on the nuances of peer review and publication.

This 2-day event saw a total of 33 invited speakers (national and global) and 22 posters from the JNCASR neuroscience community and external submissions; 32 external delegates from across India attended the meeting. The nerve-storming between eminent scientists and clinicians from different fields encompassed basic, translational, and clinical neurobiology. Notably, this event is also part of the 35th anniversary celebration of JNCASR.

Speakers and participants of the "Nerve-storming: from molecules to behaviour" Symposium.

MAJOR EVENTS AND CELEBRATIONS

ENDOWMENT LECTURE

Prof. C. N. R. Rao Oration Award Lecture 2023 & Welcome to New Students

The Prof. C. N. R. Rao Oration Award Lecture 2023 was presented by Prof. Balasubramanian S. from Chemistry and Physics of Materials Unit, JNCASR, on the topic *"Chemical Complexity and Molecular Simulations"* on 11th August 2023. On this occasion, newly joined students were welcomed, and an orientation programme was organised for them.

Prof. Balasubramanian S., recipient of Prof. C. N. R. Rao Oration Award Lecture 2023, presenting his talk during the award ceremony on 11th August 2023.

Welcome to New Students & Student Orientation Programme.

CELEBRATIONS

Khel Utsav 2023

Khel Utsav 2023, the month-long sports celebration, began at JNCASR on 17th April 2023 with great enthusiasm and cheers by the JNCASR community. The event, which saw exciting sports activities, including football, volleyball, and cricket, was inaugurated by Prof. G. U. Kulkarni, President, JNCASR.

International Yoga Day

The International Day of Yoga 2023 was celebrated at JNCASR on 21st June 2023 under the theme of *"Yoga for Vasudhaiva Kutumbakam"* and *"Har Aangan Yog"*. Yoga Guru Shri Prasanna V. Raju delivered a lecture on *"Introduction to Yoga and benefits and importance of Yoga for leading a healthy life"*. The lecture was followed by a demonstration of yoga asanas by students and staff members of the Centre under the supervision of the Yoga

MAJOR EVENTS AND CELEBRATIONS

Guru Shri Prasanna and his student Bramarambha Patil, the Yoga teacher at JNCASR. Students, faculty members, and staff of the Centre enthusiastically participated in the event.

Photographs of International Yoga Day programme on 21st June 2023 at JNCASR.

Independence Day Celebration

On the occasion of our 77th Independence Day on 15th August 2023, Prof. G. U. Kulkarni, President, JNCASR unfurled the national flag at the Jakkur campus. This was followed by singing of the national anthem by the students of the cultural group. Bharat Ratna Prof. C. N. R. Rao, along with Dr. Indumati Rao, and a large number of faculty, students, and staff members participated in the celebration.

Meri Maati Mera Desh Campaign

"Meri Maati Mera Desh" envisions a unified celebration of India's soil and valour, commemorating the nation's journey of freedom and progress by connecting with the land and honouring our heroes. As part of the Azadi Ka Amrit Mahotsav initiative, *"Meri Maati Mera Desh"* campaign was organised at JNCASR on 16th August 2023. Saplings were planted by Prof. G.U. Kulkarni, President, JNCASR and various other officials of the Centre, to encourage the initiative of *"Keep the Earth Clean and Green"* and inculcate an environmental consciousness in our community. Prof. N. S. Vidhyadhiraja, Dean, Fellowship and Extension Programmes, administered the *"Panch Pran Pledge"* in Hindi and English to contribute positively to society. The students of the cultural group presented the Mitti Anthem to infuse a sense of unity, pride, and patriotism. A large number of faculty, students, staff, and children participated in the campaign.

Prof. G. U. Kulkarni, President, JNCASR, and other faculty, staff, and students planting saplings as part of the "Meri Maati Mera Desh" campaign on 16th August 2023.

Teachers' Day

Teachers' Day was celebrated at JNCASR on 5th September 2023 by hosting a screening of the National Teachers' Awards 2023.

MAJOR EVENTS AND CELEBRATIONS

Rashtriya Ekta Diwas

Rashtriya Ekta Diwas was observed at JNCASR on 31st October 2023 to commemorate the birth anniversary of Sardar Vallabhbhai Patel. Homage was paid to the Iron Man of India and the Rashtriya Ekta Diwas Pledge was taken at the Kannada Auditorium.

The JNCASR community takes a pledge on Rashtriya Ekta Diwas, 31st October 2023.

Vigilance Awareness Week

The Vigilance Awareness Week 2023 was observed at JNCASR from 30th October to 5th November 2023. The Integrity pledge was administered on 30th October 2023 by Vigilance Officer Prof. Kaustuv Sanyal and Vigilance Awareness posters were displayed digitally throughout the campus during Vigilance Awareness Week. A talk on accountability and transparency was given by M. R. Chandrashekhar (Security, Legal, and Campus Management) on 2nd November 2023. A marathon run was organised on 4th November 2023 to create awareness on "Say No to Corruption".

JNCASR community members at the marathon organised as part of Vigilance Awareness Week on 4th November 2023.

Khadi Mahotsav

The Khadi Mahotsav campaign 2023 was organised under the theme *"Vocal for Local"* by taking an oath that encouraged people to buy Khadi and local products and attempted to inculcate pride in use of local products. Members of the JNCASR community wore dresses made from khadi/handloom fabric on 31st October 2023.

Officials of JNCASR administering the Khadi Day pledge at JNCASR on 31st October 2023.

Karnataka Rajyotsava

On the occasion of Karnataka Rajyotsava, Prof. G. U. Kulkarni, President, JNCASR unfurled the Karnataka flag on 1st November 2023.

MAJOR EVENTS AND CELEBRATIONS

Ayurveda Day

On account of the 8th Ayurveda Day celebration, a health awareness talk and a medical camp held at JNCASR followed by the distribution of medicinal plants by the Central Council for Research in Ayurvedic Sciences–Central Ayurveda Research Institute, Bengaluru research team on 3rd November 2023.

Snapshots of the medical camp at JNCASR on the 8th Ayurveda Day on 3rd November 2023.

Republic Day

The 75th Republic Day was celebrated at the Centre on 26th January 2024 with patriotism and great reverence. The national flag was unfurled by Prof. G. U. Kulkarni, President, JNCASR. Bharat Ratna Prof. C. N. R. Rao and Dr. Indumati Rao participated in the Republic Day celebrations along with the faculty members, students, and staff of the Centre.

National Science Day 2024

JNCASR celebrated National Science Day as Open Day on 28th February 2024 and saw participation of about 500 students/teachers from different schools and colleges in Bengaluru. The Units organised various scientific experiments, demonstrations and hands-on learning experiences to promote scientific curiosity among the participants. The event provided an opportunity for the students and teachers to engage with the faculty and students through live scientific experiments/demonstrations/poster presentations.

Snippets from National Science Day at JNCASR on 28th February 2024.

Inter-institute Volleyball Tournament

On the occasion of International Women's Day, JNCASR organised an Inter-institute Volleyball Tournament, wherein students and faculty members of the Centre, Indian Institute of Science (IISc), Raman Research Institute (RRI), Indian Institute of Astrophysics (IIA), National Centre for Biological Sciences (NCBS), and International Centre for Theoretical Sciences (ICTS) participated. The sports event began on 8th March 2024 and concluded on 10th March 2024, with an exciting final match in which IISc men's and women's teams lifted the cup, and teams from JNCASR in both the categories became runners-up. This unique event also saw participation by women's teams from the participating institutes.

MAJOR EVENTS AND CELEBRATIONS

Prof. G. U. Kulkarni, President, JNCASR, along with students at the Inter-institute Volleyball Tournament held from 8th to 10th March 2024.

EVENTS ORGANISED BY THE HINDI CELL

Hindi Diwas/Pakhwada (Hindi Fortnight) Programmes

Hindi Day/Hindi Fortnight 2023 celebration was organised from 14th to 29th September 2023 in JNCASR. The programme was inaugurated with the circulation of Hon'ble Home Minister's Hindi Fortnight Message. This 2-week event comprised various events aimed at popularising the use of Hindi in our official work. These events included Hindi essay writing competition, Hindi noting and drafting competition, Hindi written quiz competition, Hindi antakshari, singing in Indian languages on the occasion of Indian Languages Harmony Day, and a special Hindi workshop. The celebration concluded with a valedictory function and distribution of prizes to the winners. All prize winners were given 75% cash and 25% of the amount in the form of Hindi books to encourage reading of the language. All other participants were given participation prizes. Members of the JNCASR community enthusiastically participated in these competitions and programmes.

Various competitions and events organised during the Hindi Pakhwada from 14th to 29th September 2023.

Special Two-day Hindi Computer Training

A special Two-Day Hindi Computer Training programme was organised for the benefit of the employees of JNCASR on 15th and 16th November 2023. Employees enthusiastically participated in the Training Programme to learn Indian Inscript Keyboard. The training was very successful. All the trained employees got confidence to work in Hindi in their routine Office work.

MAJOR EVENTS AND CELEBRATIONS

Official Language Conference

A 2-day Official Language Sammelan (Joint Official Language Conference) was organised by Official Language Implementation Committee (OLIC) at JNCASR on 22nd and 23rd February 2024 in association with DST, IIA and RRI. Dignitaries present in the conference were A. Dhanalakshmi, Joint Secretary, Department of Science and Technology (DST); Prof. G. U. Kulkarni, Chairperson, OLIC and President, JNCASR; Shri Anirban Kumar Viswas, Deputy Director (Implementation), Min. of Home Affairs, Kendriya Sadan, Bengaluru; and Dr. Kamakhya N. Singh, Deputy Director (Official Language), DST, New Delhi. Invited speakers were Dr. S. Mahesh, Assistant Director (Official Language), Centre for Artificial Intelligence and Robotics Defence Research and Development Organisation, Bengaluru, and Smt. Nandita Nidhi, Sr. Translation Officer, DST. A total of 80 officers and staff from RRI, NCBS, IISc, Indian Institute of Astrophysics, Institute for Stem Cell Science and Regenerative Medicine (inStem), and Centre for Nano and Soft Matter Sciences participated in the Sammelan.

Smt. A. Dhanalakshmi, Joint Secretary, DST, (bottom right) inaugurating the event and (left) visiting the exhibition during the Official Language Conference on 22nd and 23rd February .
(Top right) Group photograph of all participants of the conference.

A. Dhanalakshmi, along with Prof. G. U. Kulkarni, Dr. Kamakhya N. Singh, and Shri Anirban Biswas, inaugurated the event with the lighting of a lamp. The programmes composed of lectures on topics such as *"Rajbhasha and government policy", "Responsibility of implementation of the Official Language", "Hands-on training for usage of the latest Hindi software in PCs", and "Other inspection authorities of Official Language and our responsibilities". The* speakers shared valuable insights during their lectures and clarified participants' doubts. Participants also visited the Chemical Heritage Exposition and "A Glorious Journey" Galleries of the Centre. On 23rd February 2024 (day 2 of the conference), a Science Outreach lecture programme in Hindi was organised and was attended by 80+ students (class 11) from Jawahar Navodaya Vidyalaya of Bengaluru rural and urban districts. Prof. Amitabh Joshi, Evolutionary and Organismal Biology Unit, and Dr. Jaishri Sanwal presented scientific talks to the students in Hindi.

KEY EVENTS

Raktdaan Amrit Mahotsav

A blood donation camp was organised by JNCASR at its Jakkur campus on 14th June 2023, on the occasion of World Blood Donor Day to create awareness among the community under "Raktdaan Amrit Mahotsav" campaign: "Give blood, give plasma, share life, share often". This camp was organised in collaboration with the Sankalp India Foundation. Around 70 members of the JNCASR community, including students, professors, and staff members, voluntarily came forward to participate in the drive. A pledge in English and Hindi for blood donation was administered at the camp.

JNCASR community members participating in a pledge organised during the Raktdaan Amrit Mahotsav on 14th June 2023.

MAJOR EVENTS AND CELEBRATIONS

Review Meeting of Parliamentary Committee on Official Language

Under the chairmanship of Prof. Rita Bahuguna Joshi, the Parliamentary Committee on Official Language organised a review meeting with JNCASR at Bengaluru on 14th July 2023. During this meeting, the Committee reviewed the implementation of the Official Language in the Centre in the presence of senior officials from the ministry and department.

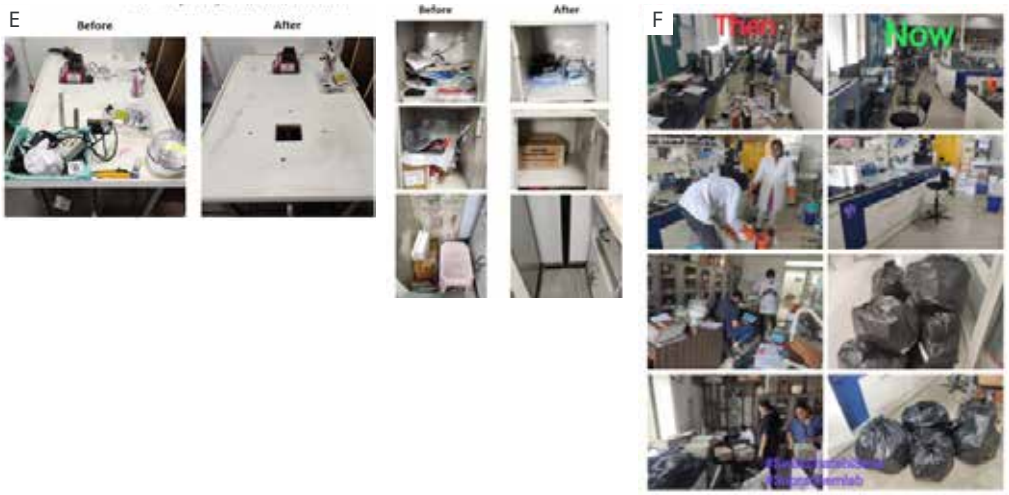
Prof. G. U. Kulkarni, President, JNCASR, along with Administrative Officer and other officials from the Centre and DST at the Review Meeting of Parliamentary Committee on Official Language on 14th July 2023 at Bengaluru.

Swacchhata Pakhwada – Special Campaign 3.0

JNCASR started the preparatory phase of the Special Campaign 3.0 as Swacchhata Pakhwada from 15th September to 2nd October 2023. An officers' meeting was organised to prepare the action plan and discuss the guidelines released for this campaign. On 1st October 2023, as part of "Ek Tareekh Ek Ghanta Ek Saath", JNCASR organised Swachhata Pakhwada, Swachhata Hi Seva, a massive cleanliness drive to clean public roads around its Jakkur campus. A large number of students, faculty members, and staff enthusiastically participated in the drive. On 2nd October 2023, as a tribute to Mahatma Gandhi on his birth anniversary and as part of Swachhata Pakhwada, cleaning of the pond and storm water drain passing across JNCASR's Jakkur campus was taken up. Cleaning and beautification of laboratories were also taken up by faculty members and students.

Images A–D: A comprehensive cleanliness drive, disposal of scrap and record management have been taken up by all sections of JNCASR Administration under the Implementation Phase of Special Campaign 3.0. Over 15000 sqft area was cleaned and debris were removed from over 30 locations across the campuses.

MAJOR EVENTS AND CELEBRATIONS



Images E–F: Cleaning and beautification of laboratories

Book Launch of Bharat Ratna Prof. C. N. R. Rao's Autobiography

A book launch function of Bharat Ratna Prof. C. N. R. Rao's autobiography in Kannada *Vijnanadolagondu Jeevana*, translated from *A Life in Science,* was organised jointly by JNCASR and Navakarnataka Publications on 19th October 2023 at its Jakkur campus. The function was presided by Prof. G. U. Kulkarni, President, JNCASR. The book was unveiled by Dr. Chandrashekhara Kambara (a Jnanapeeta, Padma Shri, and Padma Vibhushan Awardee) during the event. This event was graced by several dignitaries including, Bharat Ratna Prof. C. N. R. Rao, Dr. Indumati Rao, Dr. M. S. S. Murthy (translator), and Shri A. Ramesha Udupa (publisher). The event was also live-streamed on YouTube: https://www.youtube.com/watch?v=cf80SzWxixw

(From left to right) Dr. M. S. S. Murthy (translator of the book), Bharat Ratna Prof. C. N. R. Rao, Linus Pauling Research Professor and Honorary President, JNCASR, Dr. Chandrashekhara Kambara (a Jnanapeeta, Padma Shri, and Padma Vibhushan Awardee), Prof. G. U. Kulkarni, President, JNCASR, and Shri A. Ramesha Udupa (publisher).

Interactive Meeting With DST Officials

A 12-member team of officers from DST, Government of India, visited JNCASR on 11th March 2024. The team was on a guided tour to Bengaluru. An interactive meeting between senior officers of the Centre and the DST team was organised, wherein Prof N. S. Vidhyadhiraja, Dean, Fellowships and Extension Programmes, gave a brief presentation on the research and academic activities of the Centre, followed by a short introduction by each officer of the Centre. Prof G. U. Kulkarni, President, JNCASR, also interacted with the DST officers. The visiting

MAJOR EVENTS AND CELEBRATIONS

team interacted with a group of research students, who highlighted the advanced research being carried out at the Centre. The team was also taken on a short campus tour, including the Chemistry Heritage Exposition, C. N. R. Rao Hall of Science, and a few key research laboratories in the Centre.

Scenes from the Interactive Meeting with DST Officials on 11th March 2024.

PARTICIPATION IN SCIENCE EXHIBITION

India International Science Festival 2023

At the India International Science Festival 2023, held from 17th to 20th January 2024, at the DBT THSTI-RCB Campus in Faridabad, Haryana, our students and faculty proudly presented the Centre's cutting-edge research and innovations at our exhibition stall within the DST Pavilion of the Science, Technology, and Innovation Exhibition. Our stall garnered an enthusiastic response from visitors, who displayed keen interest in our work. Notable guests at our stall included the Chief Minister of Haryana, the Secretary of DST, and the Chairman of ISRO, alongside numerous students and researchers.

Collages showcasing JNCASR's participation in the India International Science Festival from 17th to 20th January 2024.

LECTURES AND WORKSHOPS

Workshop on RNA-seq and Data Analysis

A 4-day workshop on RNA-seq and Data Analysis was organised from 8th to 11th May 2023 in collaboration with Clevergene Biocorp Pvt. Ltd.

Mass Spectrometer Data Analysis Workshop

A 3-day Mass Spectrometer Data Analysis Workshop on the basics of proteomics and metabolomics data analysis using mass spectrometry (MS) and MS/MS spectra was organised in collaboration with Thermo Fisher Scientific from 16th to 18th May 2023.

MAJOR EVENTS AND CELEBRATIONS

SAMat Talk

The talk was organised on 12th June 2023 at JNCASR. The speaker, Prof. Anthony K. Cheetam, Materials Research Laboratory, University of California, Santa Barbara, USA, presented a lecture on *"Recent development in perovskite halides".*

EOBU Special Seminar

The seminar was organised on 23rd June 2023 at JNCASR. The speaker, Prof. Mewa Singh, Life-long Distinguished Professor, University of Mysore, presented a lecture on *"Half a century with monkeys in jungles and towns: Notes on their behaviours and conservation"*. This seminar was organised in association with NCBS, Bengaluru, Centre for Ecological Sciences, IISc, and Indian Society of Evolutionary Biologists.

Bio-imaging Workshop

The workshop was organised from 3rd to 5th July 2023 at the Molecular Biology and Genetics Unit, JNCASR in association with Zeiss, Evident Olympus, and Biotron Healthcare. During the workshop, researchers were trained on confocal and super-resolution microscopy and its applications and several other bio-imaging areas.

Yoga Classes at JNCASR

The JNCASR Sports Committee initiated yoga classes for students and employees from 11th July 2023 onwards, Monday to Friday from 7:15 to 8:15 a.m. Professional yoga trainers guided these classes.

NAMMA Psi-k Workshop

The workshop was held at JNCASR and IISc campuses from 24th to 26th July 2023 and focused on new approaches and machine learning methods for *ab initio* calculations. The workshop included pedagogical lectures by renowned scientists from India and abroad and provided hands-on training to students on *ab initio* calculations and AI/ML techniques.

CPMU Day

Annual Alumni Materials Lecture on *"Mechanistic Approach to Investigate the Structure of Interfacial Water Molecules at Air/Aqueous Interface Using Nonlinear Vibrational Spectroscopy"* was delivered by Dr. Kailash Chandra Jena, IIT Ropar, Punjab, on 9th September 2023.

Prof. K. S. Valdiya Memorial Lecture

Prof. K. S. Valdiya Memorial Lecture on *"Unearthing Earth's Past: How Geology Reveals the Story of Our Planet"* was delivered by Dr. R. Sajeev, Director, Geological Survey of India, Karnataka and Goa, Ministry of Mines, Government of India, on 6th October 2023.

MAJOR EVENTS AND CELEBRATIONS

Young Scientists' Online Meeting on Climatic Change and Earth Systems

The Young Scientists' Online Meeting on Climatic Change and Earth Systems was organised by Nepal Academy of Science & Technology, Nepal, in association with TWAS Central & South Asia Regional Partner (TWAS-CASAREP) at JNCASR between 1st and 3rd November 2023.

8th Meeting of the Asian Forum for Chromosome and Chromatin Biology

Research on chromosome-chromatin biology has gained tremendous impetus in recent years. For more than a decade, this forum has been instrumental in developing excellent collaborative research activities across the continents. Following on from the success of the past seven meetings, this year's meeting was held at the AMRL Hall at JNCASR from 4th to 6th November 2023. The event emphasised on the research areas of *"Epigenetic basis of modulation of transcription and chromatin organization"* and *"implication of chromatin biology in differentiation and disease"*. Apart from several active scientists from India, eminent international scientists also participated in this meeting. It provided an apt platform to research scholars and budding scientists to present their work, get the appropriate feedback and network with researchers and experts.

Photographs of Asian Forum for Chromosome and Chromatin Biology held at AMRL Hall at JNCASR from 4th to 6th November 2023.

JNCASR-Rice University Workshop

Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR) and Rice University, Houston, partnered to host our first international conference: the Joint International Workshop on Energy and Sustainability (JIWES2023) on materials chemistry together, on 8th and 9th November 2023, to jointly achieve the Net Zero 2050 decarbonization goals. The conference aimed to provide a comprehensive overview of the groundbreaking research in energy transition technologies and their potential environmental impact. The partnership stemmed from a desire to bridge the gap between research and translation, demonstrating how innovations are making a tangible impact on real-world industrial applications. JIWES2023 addressed the world's most pressing environmental concerns, through the lens of materials science.

Annual Faculty Meeting and In-House Symposium 2023

The Annual Faculty Meeting (AFM) and In-house Symposium (IHS) 2023 at JNCASR was held on 16th and 17th November 2023, and began with an opening address delivered by Prof. G. U. Kulkarni, President, JNCASR. His talk was accompanied by remarks from Prof. Umesh V. Waghmare, Dean, Faculty Affairs, JNCASR, highlighting the progress made by the Centre since the previous meeting in 2022.

MAJOR EVENTS AND CELEBRATIONS

This 2-day event featured scientific presentations by the faculty members and students of JNCASR, along with talks by 2 special guests invited for the occasion. Additionally, a cultural programme was also organised.

Photographs from the Annual Faculty Meeting (AFM), In-House Symposium (IHS), and the Degree Award Ceremony held during these events at JNCASR on 16th and 17th November 2023.

International Winter School "Frontiers in Materials Science"

The annual International Winter School *"Frontiers in Materials Science"* was held from 4th to 6th December 2023 at JNCASR. The event featured poster presentations and speakers from eminent institutes in India and abroad, and participants delved into the frontier areas of materials science.

Photographs from the International Winter School "Frontiers in Materials Science" held from 4th to 6th December at JNCASR.

Recent Advances in Materials (RAM-90) Conference

The Recent Advances in Materials (RAM-90) Conference was organised at JNCASR from 6th to 9th December 2023. Several eminent scientists, JNCASR faculty members, and alumni discussed their latest research in the area of materials science—from quantum entanglement to oxides, semiconductors, and many others.

MAJOR EVENTS AND CELEBRATIONS

Various speakers and participants at the international RAM-90 Conference held at JNCASR from 6th to 9th December 2023.

Sheikh Saqr Materials Lecture

The 13th Sheikh Saqr Materials Lecture was presented by Prof. Ram Seshadri on *"Seeking new low-k dielectrics and topological superconductors"* on 6th December 2023.

NCU Scientific Lecture

Prof. Sebastien Lecommandoux, Professor, Bordeaux-INP, ENSCBP, Universite de Bordeaux, presented the lecture on *"Harnessing biomimicry with self-assembled bioconjugates: from therapeutics to protocells"* on 31st January 2024.

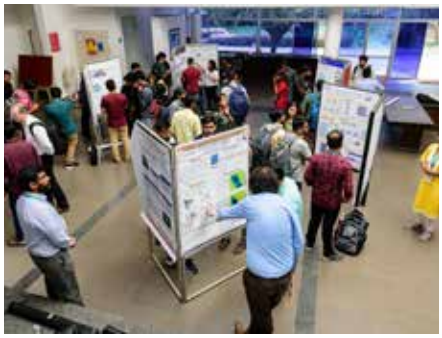
NCU Seminar

Prof. Jyotirmayee Dash, Indian Association for the Cultivation of Science, Kolkata, presented a lecture on *"Bioorthogonal synthesis of anticancer agents"* on 16th February 2024.

JNCASR-CECAM International Conference MD@60

The conference was held from 26th to 29th February 2024 at JNCASR in celebration of Dr. Anees Rahman's pioneering contribution to Molecular Dynamics (MD) simulation 60 years ago. The conference brought together leading experts, along with the new generation of practitioners in the field, to showcase and explore the history and latest methodological developments in the field. The conference was co-organised with European Centre for Atomic and Molecular Calculations (CECAM) and convened by Prof. Balasubramanian S., Chemistry and Physics of Materials Unit, and Prof. Umesh V. Waghmare, Theoretical Sciences Unit, JNCASR.

MAJOR EVENTS AND CELEBRATIONS


Snapshots of all the participants, poster sessions, and presentations at the JNCASR-CECAM Conference from 26th to 29th February 2024.

NCU Special Lecture

A special lecture was presented by Prof. Sara E. Skrabalak, Professor, Indiana University, USA, on the topic *"Nanoparticle conversion pathway to high entropy alloy electrocatalysts"* on 29th February 2024.

ACS On Campus

The American Chemical Society (ACS) in association with JNCASR, organised an interactive lecture programme *"ACS on Campus"* on 1st March 2024 at JNCASR where more than 180 students and faculty members participated from the Centre. Faculty members from JNCASR and other scientific institutions from India and abroad who are also serving as the Editors of ACS journals addressed the students on best practices of publishing scientific articles and science communication.

India@DESY Users Workshop

JNCASR organised the India@DESY Users Workshop from 12th to 14th March 2024 with over 100 participants from India and abroad. Representatives from DST also participated in this meeting. The India@DESY project is an international collaboration between JNCASR and DESY Germany, sponsored under the Nano Mission scheme of the Department of Science and Technology, Government of India. A visit to Galleries and ChemExpo at JNCASR was organised by the Education Outreach Unit as a part of this event on 14th March 2024.


India@DESY Workshop organised by JNCASR from 12th to 14th March 2024, where representatives from DST and scientists from Germany participated.

MAJOR EVENTS AND CELEBRATIONS

Dhwani Talk

The talk, titled *"The Monsoon Melodies: Nature's Symphony of Wind and Rain"*, was delivered on 15th March 2024 at JNCASR by Dr. Indumati Rao, Education Technology Unit, and Dr. Jaishri Sanwal Bhatt, Geosciences Unit. The talk delved into the enchanting intricacies of the monsoon season.

Dr. Jaishri Sanwal Bhatt presenting her talk during the event on 15th March 2024.

Geosciences Unit Lecture

The Geosciences Unit organised a lecture by Prof. Mary Hubbard, Geology Department of Montana State University, Bozeman, USA, on 18th March 2024 on the topic *"Whispers of the Himalayan Peaker: Collaborative Research to Track Orogenic Origins"*.

Prof. Mary Hubbard, Geology Department, Montana State University, USA, giving a talk to JNCASR students and faculty members.

MAJOR EVENTS AND CELEBRATIONS

Fourth C. N. R. Rao Annual Materials Lecture

The School of Advanced Materials (SAMat) organised the Fourth C. N. R. Rao Annual Materials Lecture by Prof. Arindam Ghosh, Department of Physics, Indian Institute of Science, Bengaluru, on 20th March 2024 at ICMS, JNCASR.

Prof. Arindam Ghosh, Department of Physics, IISc, Bengaluru, giving a lecture to a captivated audience.

In the year 2023–24, the various units at JNCASR also organised 97 other events which are not presented here but are listed across the report.

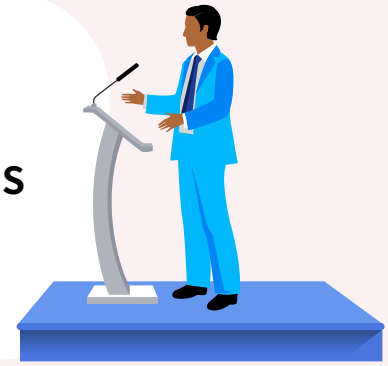
ACTIVITIES CHART

EDUCATION

Academic programmes

- Ph.D.
- Int. Ph.D.
- M.S.-Ph.D.
- M.S. (Research)
- M.S. (Engineering)
- M.Sc. Chemistry
- P.G.D.M.S.

DISCUSSION MEETINGS, LECTURES & CONFERENCES



PUBLICATION OF MONOGRAPHS AND PROCEEDINGS

RESEARCH

- Faculty members
- Units and laboratories

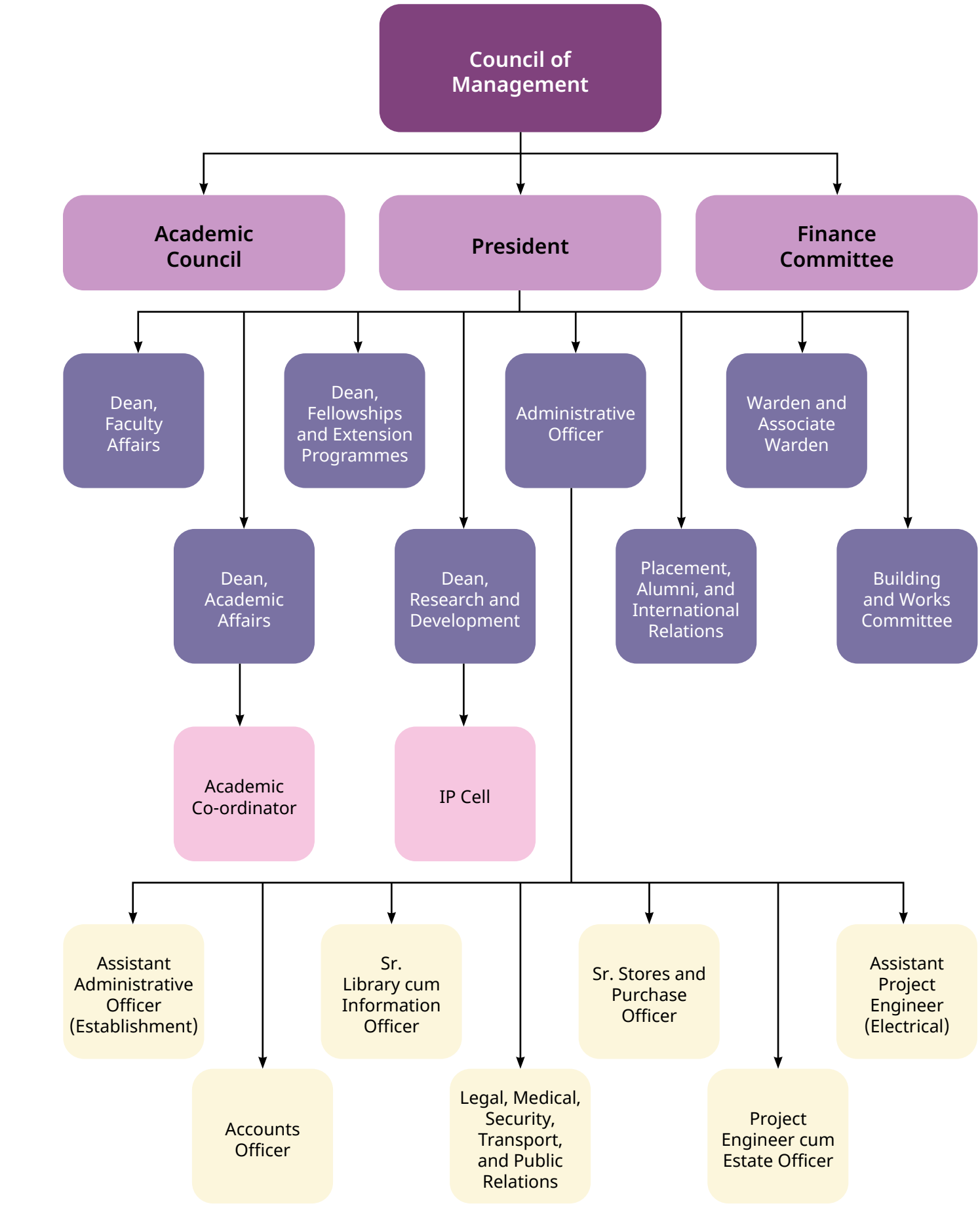
EXTENSION PROGRAMMES & SCIENCE OUTREACH

Fellowships and Extension Programmes

- Summer Research Fellowship Programme (SRFP)
- Visiting Fellowship Programme
- Project-oriented Chemistry Education (POCE)
- Project-oriented Biology Programmes (POBE)
- Student Buddy Programme
- Graduate Research Internship Programme (GRIP)

Science Education & Education Technology

ORGANIZATIONAL CHART



COUNCIL OF MANAGEMENT

List of Committees (Council of Management, Finance Committee, Academic Advisory Committee), Endowed Chair, and Honorary Faculty Members

The members of Council of Management (2022–26) are:

Prof. V. Ramgopal Rao
Chairperson (nominated by DST)
Group Vice Chancellor, BITS Pilani, Rajasthan

Prof. G. U. Kulkarni
Member (ex-officio)
President, JNCASR

Prof. Govindan Rangarajan
Member (ex-officio)
Director, IISc, Bengaluru

Prof. Abhay Karandikar
Member (ex-officio)
Secretary, DST

Shri Vishvajit Sahay
Member (ex-officio)
AS and FA, DST

Prof. M. Jagadesh Kumar
Member (DST nominee)
Chairman, UGC

Prof. Vinod K. Singh
Member (DST nominee)
IIT Kanpur

Prof. K. N. Ganesh
Member (DST nominee)
SERB National Science Chair and Former Director, IISER, Tirupathi

Prof. R. Murugavel
Member (DST nominee in consultation with UGC)
IIT Mumbai

Prof. Raghavan Varadarajan
Member (IISc nominee)
IISc, Bengaluru

Prof. H. P. Khincha
Member (Society nominee)
Former Advisor, IISc, Bengaluru

Prof. Umesh V. Waghmare
Member (Centre nominee)
JNCASR

Prof. Eswaramoorthy M.
Member (Centre nominee)
JNCASR

Prof. Shobhana Narasimhan
(Centre nominee; nominated by Chairperson)
JNCASR

Joydeep Deb
Non-member Secretary (ex-officio)
Administrative Officer, JNCASR

COMMITTEES

Finance Committee (2022–26)

NAME AND DESIGNATION	POSITION
Prof. G. U. Kulkarni, President, JNCASR	Chairperson (ex-officio)
Prof. K. N. Ganesh, SERB National Science Chair and Former Director, IISER, Tirupati	Member
Vishvajit Sahay, AS and FA, DST	Member (ex-officio)
R. Mohan Das, Former Registrar, IISc	Member
Prof. Umesh V. Waghmare, Dean, Faculty Affairs, JNCASR	Member
Sampad Patra, Accounts Officer, JNCASR	Member (ex-officio)
Joydeep Deb, Administrative Officer, JNCASR	Non-member Secretary (ex-officio)

Academic Council (2023–25)

NAME AND DESIGNATION	POSITION
Prof. G. U. Kulkarni, President, JNCASR	Member (ex-officio)
Prof. N. Ravishankar, Professor, IISc	Member
Prof. Ashok K. Ganguli, Director and Professor of Chemical Sciences, IISER-Berhampur	Member
Prof. Anand K. Bachhawat, IISER, Mohali	Member
Prof. Vijay Chandru, Distinguished Technologist, IIACD, Bengaluru	Member
Prof. P. Seshu, IIT Bombay	Member
Prof. Leena Chandran Wadia, Professor and Head, VEC, TDU Vocational Education Programmes, Bengaluru	Member
Prof. Umesh V. Waghmare, Dean, Faculty Affairs, JNCASR	Member (ex-officio)
Prof. Eswaramoorthy M., Dean, Academic Affairs, JNCASR	Member (ex-officio)
Prof. K. R. Sreenivas, Dean, R&D, JNCASR	Member (ex-officio)
Prof. N. S. Vidhyadhiraja, Dean, F&E, JNCASR	Member (ex-officio)
Prof. Tapas Kumar Kundu, Programme Coordinator, M.Sc. in Inter-Disciplinary Biosciences Programme, JNCASR	Member (ex-officio)
Prof. Kanishka Biswas, Faculty In-charge: Placement, Alumni and International Relations, JNCASR	Member (ex-officio)
Prof. Ranjan Datta, Coordinator, Int. Ph.D.—Materials Science Programme, JNCASR	Member (ex-officio)
Prof. Sheeba Vasu, Chair-ETU and Coordinator, Int. Ph.D.—Biology Programme, JNCASR	Member (ex-officio)

COMMITTEES

NAME AND DESIGNATION	POSITION
Prof. Sebastian C. Peter, Coordinator, Int. Ph.D.—Chemical Sciences, JNCASR	Member (ex-officio)
Prof. Jayanta Haldar, Coordinator, M.Sc.—Chemical Sciences, JNCASR	Member (ex-officio)
Joydeep Deb, Administrative Officer, JNCASR	Member-Secretary (ex-officio)
Dr. Princy J. Pereira, Academic Coordinator, JNCASR	Controller of Examination (ex-officio)

Members of the General Body (Society) (2022–26)

NAME AND DESIGNATION	POSITION
Prof. V. Ramgopal Rao, Group Vice Chancellor, BITS Pilani, Rajasthan	Chairperson
Prof. M. Jagadesh Kumar, Chairman, UGC	Member
Prof. Vinod K. Singh, IIT Kanpur	Member
Prof. K. N. Ganesh, SERB National Science Chair and Former Director, IISER, Tirupathi	Member
Prof. Govindan Rangarajan, Director, IISc	Member
Prof. R. Murugavel, IIT Mumbai	Member
Prof. H. P. Khincha, Former Advisor, IISc	Member
Prof. V. Chandrasekhar, Centre Director, TIFR, Hyderabad	Member
Prof. S. K. Saidapur, Dharwad	Member
Prof. Abhay Karandikar, Secretary, DST	Member
Vishvajit Sahay, AS and FA, DST	Member
Prof. G. U. Kulkarni, President, JNCASR	Member
Prof. Raghavan Varadarajan, Professor, IISc	Member
Prof. Umesh V. Waghmare, Dean, Faculty Affairs, JNCASR	Member
Prof. Eswaramoorthy M., Dean, Academic Affairs, JNCASR	Member
Prof. Shobhana Narasimhan, Professor, JNCASR	Member
Joydeep Deb, Administrative Officer, JNCASR	Non-member Secretary

Endowed Professor

NAME AND DESIGNATION	POSITION
Bharat Ratna Prof. C. N. R. Rao	Linus Pauling Research Professor
Prof. H. Ila	Hindustan Lever Research Professor (up to 31st Dec 2023)

COMMITTEES

Honorary Professors (Tenure: October 2022–September 2025)

Prof. Milan K. Sanyal, Kolkata
Prof. P. Balaram, IISc
Prof. S. Sampath, IISc
Prof. Raghavendra Gadagkar, IISc
Prof. Shubha Tole, TIFR, Mumbai
Prof. Umesh Varshney, IISc

Prof. Russel Foster, FRS, United Kingdom
Prof. A. K. Tyagi, BARC, Mumbai
Prof. V. Kumaran, IISc
Prof. Jaywant Arakeri, IISc

Honorary Professors (Tenure: November 2021–October 2024)

Prof. T. V. Ramakrishnan
Prof. D. D. Sarma

Prof. A. K. Sood
Prof. Gagandeep Kang

ADMINISTRATION

NAME AND DESIGNATION	POSITION
Prof. G. U. Kulkarni, Ph.D., F.A.Sc., F.N.A.Sc., F.N.A.E., F.N.A.	President
Prof. Umesh V. Waghmare, Ph.D., F.A.Sc., F.N.A.Sc., F.N.A.E., F.N.A.	Dean, Faculty Affairs
Prof. Eswaramoorthy M., Ph.D.	Dean, Academic Affairs
Prof. N. S. Vidhyadhiraja, Ph.D.	Dean, Fellowships and Extension Programmes
Prof. K. R. Sreenivas, Ph.D.	Dean, R&D
Prof. Bivas Saha, Ph.D.	Warden and Student Counsellor
Prof. Sarit S. Agasti, Ph.D.	Faculty In-charge, Sports Facility
Dr. Achira Roy, Ph.D.	Associate Warden
Prof. Premkumar Senguttuvan, Ph.D.	Head, CompLab
Joydeep Deb, M.Sc. (Electronics), M.Sc. (Telecommunication), M.B.A. (HRM)	Administrative Officer and Public Information Officer
C. S. Chitra, B.Com.	Assistant Administrative Officer (SG)
Dr. Princy Jaison Pereira, Ph.D.	Academic Coordinator
Dr. Panneer K. Selvam, M.A., M.B.A., L.L.B., Ph.D.	Coordinator (F&E and R&D) (On Contract)
Sampad Patra, B.Com., P.G.D.C.A., M.B.A. (Finance)	Accounts Officer
K. Bhaskara Rao, M.Sc.	Senior Stores and Purchase Officer
Nabonita Guha, M.L.I.S.	Senior Library cum Information Officer
A. Srinivasan, B.A.	Senior Secretary to President
B. Venkatesulu, B.Sc.	Junior Accounts Officer
Susheela G., B.Sc.	Assistant Public Information Officer
Mahadevan N., B.E., M.I.E.	Project Engineer (On Contract)
Nadiger Nagaraj, D.C.E.	Project Engineer Gr. II
Sujeeth Kumar S., D.E.E.	Assistant Project Engineer (Elec.)
Veeresha N. R., D.C.E.	Junior Project Engineer (Civil)
A. N. Jayachandra, B.Com., P.G. Diploma (Finance)	Coordinator (Special Projects) (On Contract)
M. R. Chandrasekhar, B.Sc., L.L.B.	Coordinator (Security, Legal, and Campus Management) (On Contract)

ADMINISTRATION

NAME AND DESIGNATION	POSITION
M. G. Narayana, B.A.	Coordinator (PR) (On Contract)
Ananda, M.A., M.B.A.	Coordinator (Hindi) (On Contract)
Dr. G. R. Naghabhushana, M.B.B.S., F.C.C.P., F.C.G.P., P.G. Diploma in M&CHL	Chief Medical Officer (On Contract)
Dr. Kavitha Sridhar, M.B.B.S.	Medical Officers (On Contract)
Dr. Senthamarai S. Manoharan, M.B.B.S., P.G.D.M.L.S., Diploma in Preventive and Promotive Health Care, Diploma in Counseling Skills, P.G.D.H.H.M., M.B.A. (HA)	
Dr. Chandralekha H. V., M.B.B.S.	
Shridhar B. G., M.Sc. (Clinical Psychology)	Clinical Psychologist (On Contract)
Savitha M. S., M.Sc. (Clinical Psychology), Diploma in Clinical Psychology	
Y. Yogesh, Bachelor's Degree in Physical Therapy	Physiotherapist (On Contract)
Balraj A., M.B.A. (Finance)	Section Officer (On Contract)
Nagaraja B. S.	Advisor (Establishment Matters) (On Contract)

APPOINTMENTS AND PROMOTIONS

PROMOTIONS	
Prof. Ravi Manjithaya	Promoted as Professor, NSU
Prof. Sheeba Vasu	Promoted as Professor, NSU
Prof. Bivas Saha	Promoted as Associate Professor, CPMU and ICMS
Prof. Bani Kanta Sarma	Promoted as Associate Professor, NCU

ADDITIONAL RESPONSIBILITIES	
Prof. Subi J. George	Chairperson, NCU
Prof. Sheeba Vasu	Chairperson, ETU
Prof. Jayanta Haldar	Associate Chairperson, NCU
Prof. Premkumar Senguttuvan	Head, CompLab
Prof. Bivas Saha	Warden
Dr. Achira Roy	Associate Warden
Dr. Princy J. Pereira, Academic Coordinator	Nodal Officer, National Education Policy (NEP) Compliance Officer, Study in India (SII)
Chitra C. S., AAO (SG)	To oversee the maintenance of the Women's Lounge
M. G. Narayana, Coordinator (PR)	To oversee the maintenance of the Faculty Lounge
Dr. Jay Ghatak, Senior Research Officer	Nodal Officer, Lok Sabha Election 2024
Dr. Nanda Kumari E., Senior Library Cum Information Assistant Grade I	Nodal Contact Point, DST/Mission Karmayogi office

NEW APPOINTMENTS	
Dr. Pratap Vishnoi	Assistant Professor
Dr. Achira Roy	Assistant Professor
Dr. Anand Krishnan	Assistant Professor
Dr. Abhishek Kumar	Assistant Professor
Dr. Varun Bhaskar	Assistant Professor
Manasa M.	Junior Admin Assistant

NEW APPOINTMENTS	
Srinivasa M.	Junior Admin Assistant
Amruth A. Gowda	Junior Admin Assistant
Dushyant Chaudhary	Junior Admin Assistant
Ande Akhil	Junior Admin Assistant
Yadunath K.	Junior Admin Assistant
Arun Radhakrishnan	Technical Assistant

02

ACADEMICS

Students are at the very core of what JNCASR strives to achieve as an institute. Through a range of postgraduate programmes, offered across the 8 research units, our students contribute significantly to cutting-edge research at the Centre. Admission to these programmes is strictly based on merit and performance in a highly competitive selection process.

This section provides an overview of the various academic programmes offered at the Centre, the requirements for admission, and the degrees conferred.

ACADEMIC PROGRAMMES

JNCASR is a vibrant Deemed-to-be-University that offers Ph.D., Integrated (Int.) Ph.D., M.S. (Research), M.S. (Engineering), M.Sc. and P.G.D.M.S. degree and diploma programmes in the areas of Science and Engineering.

Candidates with an M.Sc. or equivalent, B.E., B.Tech., B.S. (4 year) or equivalent, or M.E., M.Tech. or equivalent or B.V.Sc./M.V.Sc., or M.B.B.S./M.D., as applicable, to individual Units are eligible to apply for the Ph.D./M.S. (Engineering)/M.S. (Research) programmes. In addition, candidates with an M.Sc. or equivalent and M.E./M. Tech. or equivalent should have at least 55% marks in aggregate or its equivalent grade, and candidates seeking admission after a 4-year/8-semester Bachelor's degree programme should have a minimum of 75% marks in aggregate or its equivalent grade on a point scale where the grading system is followed. The eligible candidates should also have qualified in any one of the national exams: GATE/JEST/GPAT/UGC-JRF/CSIR-NET-JRF/ICMR-JRF/DBT-JRF/INSPIRE-JRF. The final selection of candidates is based on their academic record, performance in national-level qualifying exams, recommendations from referees, and performance in an interview.

Int. Ph.D. programmes are offered in the areas of Physical Science, Chemical Science, and Biological Science, whereas M.Sc. is offered in the areas of Chemistry and Inter-disciplinary Biosciences. The Post Graduate Diploma in Materials Science (P.G.D.M.S.) is a one-year program and is meant for students who have completed their M.Sc. The Int. Ph.D., M.Sc., and P.G.D.M.S. programmes are offered only during the August session of admissions.

Enrolled students are expected to take courses and actively participate in research. Students registered to all degree programmes except the M.Sc. programmes receive monthly fellowship as per the Govt./Centre's norms. On successful completion of their coursework and thesis, students are awarded relevant degrees and diplomas. The students get ample opportunity to interact with renowned scientists and other fellow students via national and international conferences and workshops. Every Unit also conducts its own seminars where faculty and students get opportunities to discuss their research. Students have access to world-class infrastructure and cutting-edge facilities.

Research Admissions

In the academic year 2023–24, 121 students were enrolled in various degree programmes at the Centre:

Ph.D.	49
Int. Ph.D. in Biological Science	8
Int. Ph.D. in Physical Science	18
Int. Ph.D. in Chemical Science	5
M.S. (Engineering)	2
M.Sc. Chemistry	14
M.Sc. Inter-disciplinary Biosciences	20
P.G.D.M.S.	5

The student strength at JNCASR as of 31st March 2024: **373**

Degrees and Diplomas Awarded

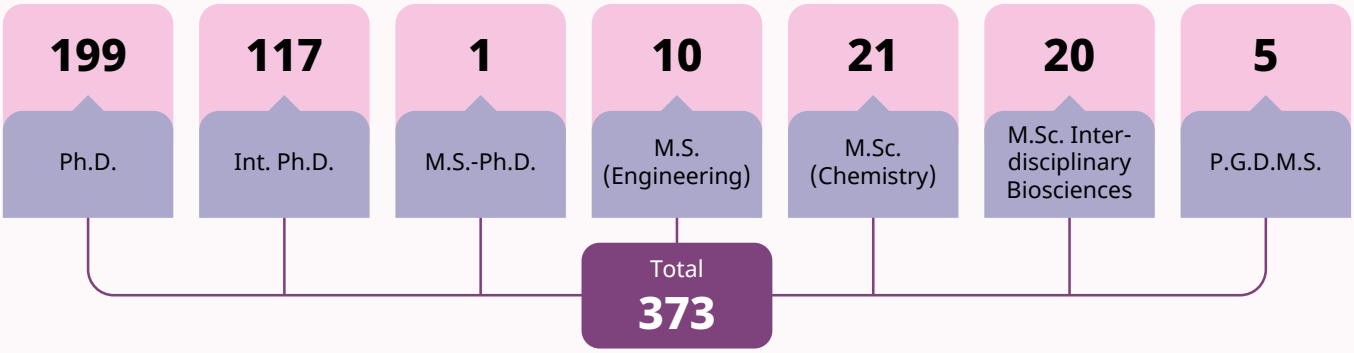
In the past year, the following number of degrees were awarded:

Ph.D.	18
Ph.D. (through Int. Ph.D.)	9
M.S. in Biological Science	5
M.S. in Physical Science	4
M.S. in Chemical Science	7
M.S. (Engineering)	3
M.Sc. Chemistry	5
P.G.D.M.S.	5

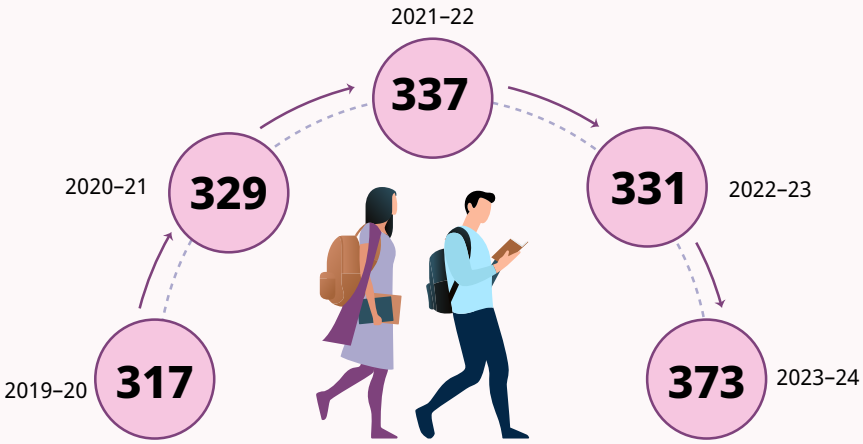
Total degrees and diplomas awarded as of 31st March 2024: **56**

ACADEMIC PROGRAMMES

TOTAL STUDENT STRENGTH ACROSS DEGREE AND DIPLOMA PROGRAMMES 2023–24



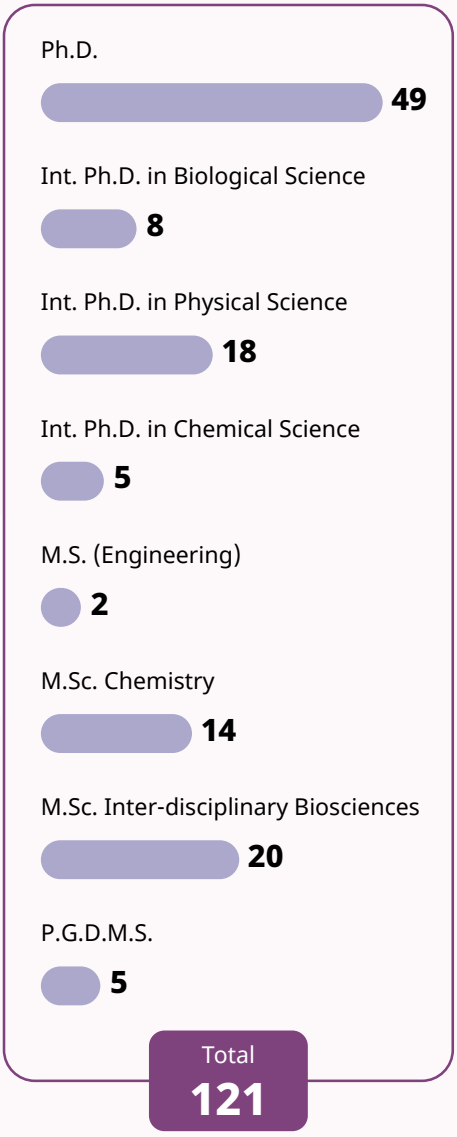
TOTAL STUDENT STRENGTH (PAST 5 YEARS)



NEW ADMISSIONS (PAST 5 YEARS)

	2019–20	2020–21	2021–22	2022–23	2023–24
	55	69	67	83	121
Ph.D.	29	38	36	52	49
M.S. (Int. Ph.D.)	14	16	19	17	31
M.S. (Engineering)	4	8	5	1	2
M.Sc. Chemistry	5	5	5	8	14
M.Sc. Inter-disciplinary Biosciences	0	0	0	0	20
P.G.D.M.S.	3	2	2	5	5

NEW ADMISSIONS IN 2023–24



ACADEMIC PROGRAMMES

DEGREES AND DIPLOMAS AWARDED (2023–24)

TOTAL **56**

Ph.D.	18
Ph.D. (through Int. Ph.D.)	9
M.S. in Biological Science	5
M.S. in Physical Science	4
M.S. in Chemical Science	7
M.S. (Engineering)	3
M.Sc. Chemistry	5
P.G.D.M.S.	5

DEGREES AND DIPLOMAS AWARDED (PAST 5 YEARS)

	2019–20	2020–21	2021–22	2022–23	2023–24
	55	**78**	**55**	**77**	**56**
Ph.D.	28	50	29	56	27
M.S. through Int. Ph.D.	21	12	18	13	16
M.S. of M.S.-Ph.D.	0	0	0	1	0
M.S. (Engineering)	3	8	4	0	3
M.Sc. Chemistry	0	5	4	5	5
P.G.D.M.S.	3	3	0	2	5

UNIT-WISE CURRENT STUDENT STRENGTH AND DEGREES/DIPLOMAS AWARDED IN 2023–24

Unit	Total Students	*New Students	*Degrees/Diplomas Awarded
CPMU	**51**	**11**	**12**
	Ph.D.: 40	Ph.D.: 9	Ph.D.: 8
	Ph.D. through Int. Ph.D.: 9	M.S. (Engineering): 2	M.S. (Int. Ph.D.): 4
	M.S. (Engineering): 2		
EMU	**13**	**3**	**5**
	Ph.D.: 11	Ph.D.: 3	Ph.D.: 2
	M.S. (Engineering): 2		M.S. (Engineering): 3
EOBU	**15**	**4**	**0**
	Ph.D.: 14	Ph.D.: 4	
	M.S.-Ph.D.: 1		
ICMS	**5**	**5**	**5**
	P.G.D.M.S.: 5	P.G.D.M.S.: 5	P.G.D.M.S.: 5
MBGU	**47**	**7**	**10**
	Ph.D.: 28	Ph.D.: 7	Ph.D.: 5
	Ph.D. through Int. Ph.D.: 19		M.S. (Int. Ph.D.): 5

ACADEMIC PROGRAMMES

Unit	Total Students	New Students	Degrees/Diplomas Awarded
NCU	**111**	**32**	**19**
	Ph.D.: 57	Ph.D.: 13	Ph.D.: 7
	Ph.D. through Int. Ph.D.: 22	M.S. in Chemical Science (through Int. Ph.D.): 5	M.S. (Int. Ph.D.): 7
	M.S. in Chemical Science (through Int. Ph.D.): 11	M.Sc. Chemistry: 14	M.Sc. Chemistry: 5
	M.Sc. Chemistry: 21		
NSU	**19**	**8**	**0**
	Ph.D.: 14	Ph.D.: 8	
	Ph.D. through Int.PhD.: 5		
TSU	**33**	**5**	**5**
	Ph.D.: 23	Ph.D.: 5	Ph.D.: 5
	Ph.D. through Int. Ph.D.: 10		
CPMU + TSU	**22**	**18**	**0**
	M.S. in Physical Science (through Int. Ph.D.): 22	M.S. in Physical Science (through Int. Ph.D.): 18	
MBGU + NSU	**18**	**8**	**0**
	M.S. in Biological Science (through Int. Ph.D.): 18	M.S. in Biological Science (through Int. Ph.D.): 8	
MBGU + NSU + NCU	**20**	**20**	**0**
	M.Sc. Inter-disciplinary Biosciences: 20	M.Sc. Inter-disciplinary Biosciences: 20	

A detailed list of students admitted and students who received degrees during 2023-24 is given in page no. 48

WHO CAN APPLY

M.S. (Engineering/Research)/Ph.D.

- Candidates with an M.Sc. or equivalent, B.E./B.Tech./B.S. (4 year) or equivalent or M.E./M.Tech. or equivalent or B.VSc./M.VSc. or M.B.B.S./M.D. as applicable to individual units are eligible to apply.
- Candidates with an M.Sc. or equivalent, M.E./M.Tech. or equivalent should have at least 55% marks in aggregate or its equivalent grade on a point scale wherever the grading system is followed.
- Candidates seeking admission after a 4-year/8-semester Bachelor's degree programme should have a minimum of 75% marks in aggregate or its equivalent grade on a point scale where the grading system is followed.
- The candidates should also have qualified in any one of the national exams: GATE/JEST/GPAT/UGC-JRF/CSIR-NET-JRF/ICMR-JRF /DBT-JRF/INSPIRE-JRF. The award certificate of such tests should have the validity period for seeking admission to a research programme as on 1st August 2024.
- Qualifying in the national exam is desirable for M.E./M.Tech. or equivalent degree holders.

P.G.D.M.S. Candidates who have completed their M.Sc. in any branch of Science are eligible to apply.

Int. Ph.D. Programme

Candidates with at least 55% marks in their Bachelor's degree in any area of Science/ Engineering or B.E./B.Tech. degree or equivalent degree and will be evaluated on past academic records and/or scores in qualified any relevant national level exams.

M.Sc. Chemistry

Applicants possessing a minimum of 55% marks at the Bachelor's degree in any branch of Science with Chemistry as one of the major subject.

M.Sc. Inter-disciplinary Biosciences

Applicants possessing a minimum of 55% marks at the Bachelor's degree in any branch of Biological Science with Chemistry as a significant subject and who have qualified for the Joint Admissions Test for Masters (JAM) 2024 and/or equivalent examination are eligible to apply.

ACADEMIC PROGRAMMES

WHEN TO APPLY

For August session

All programmes

Advertisement for admissions is released in the month of March.

For January session

Ph.D. and M.S. only

Advertisement for admissions is released in the month of November.

STIPEND/MONTH

Ph.D. (Science and Engineering)

Year 1	₹37,000/-
Year 2	₹37,000/-
Year 3	₹42,000/-
Year 4	₹42,000/-
Year 5	₹42,000/-
Year 6	₹18,000/-

M.S.

M.S. (Engineering)/Research:

Year 1	₹37,000/-
Year 2	₹37,000/-

First 6 months in 3rd year: ₹15,000/-

Int. Ph.D.

Year 1	₹19,000/-
Year 2	₹19,000/-
Year 3	₹37,000/-
Year 4	₹37,000/-
Year 5	₹37,000/-
Year 6	₹42,000/-
Year 7	₹42,000/-
Year 8	₹18,000/-

Any Other Programme

P.G.D.M.S. ₹25,000/-

ANNEXURES

Detailed List of New Students (Academic Session: Regular)

August 2023

Degree Programme: **Ph.D.**

CPMU

Student name	Research supervisor
Debendra Meher	Prof. Balasubramanian S.
Aritra Dey	Prof. Bivas Saha
Alok Raj	Prof. K. S. Narayan
Shoubhik Deb	Prof. A. Sundaresan
Patel Nishit Ranjitbhai	Prof. A. Sundaresan
Devika S.	Prof. Tapas Kumar Maji
Avinash Kumar Yadav	Prof. M. Eswaramoorthy

ACADEMIC PROGRAMMES

Degree Programme:

Ph.D.

Student name | Research supervisor

EMU

Student name	Research supervisor
Raghu	Prof. Ganesh Subramanian
Saumyakanta Mishra	Prof. Ganesh Subramanian

EOBU

Student name	Research supervisor
Abhijith A. V.	Dr. Anand Krishnan
Saravanan B.	Dr. Anand Krishnan
Sattaru Krishna Chaitanya	Prof. T. N. C. Vidya
Katta Abhishek Goud	Prof. Amitabh Joshi

MBGU

Student name	Research supervisor
Pavithra Umashankar	Shwetha Shivaprasad and Chair MBGU
Manisha Sharma	Prof. Ranga Udaykumar
Simran Shabir	Prof. Anuranjan Anand
Sukanya Sahoo	Prof. Kaustuv Sanyal

NCU

Student name	Research supervisor
Aagustya Gupta	Prof. T. Govindaraju
Neeraj Chauhan	Prof. Ranjani Viswanatha
Deepsikha Debnath	Prof. Jayanta Haldar
Jagmeet Kaur	Prof. Sebastian C. Peter
Nisha	Prof. Sarit S. Agasti
Navami V. V.	Prof. Ranjani Viswanatha
Kishmita Kalita	Dr. Bani Kanta Sarma
Ayan Ganguly	Prof. Kanishka Biswas
Alapan Samanta	Prof. Premkumar Senguttuvan
Priyanka Kanaujiya	Dr. Pratap Vishnoi

NSU

Student name	Research supervisor
Badigannavar Neeti Anand Geeta	Prof. Sheeba Vasu
Geetha V. C.	Prof. Anuranjan Anand
Rupareliya Vimal Pravinbhai	Prof. Sheeba Vasu
Yashasvi Sharma	Dr. Achira Roy
Shubham Singhal	Prof. K.S. Narayan
Smruti Rekha Sahoo	Prof. Anuranjan Anand

TSU

Student name	Research supervisor
Kaushik Dey	Prof. Subir K. Das
Tanuja Shridhar Joshi	Prof. Shobhana Narasimhan
Shiv Praksh Mishra	Prof. Srikanth Sastry
Venu Goswami	Prof. Kavita Jain

ACADEMIC PROGRAMMES

Student name | Research supervisor

Degree Programme: Int. Ph.D.

NCU

Int Ph.D. Coordinator				
Bastab Panja	Kavitha N.	Tambavekar Akshay Popat	Ayan Chowdhury	Yashas V. Bharadwaj

MBGU + NSU

Int Ph.D. Coordinator				
Venkateswaran M.	Kukreja Kanishka	Adithi Rao	Nivedita Sivakumar	Savyasachi Banerji
	Kriti Tyagi	Spandana J.	Aparna	

CPMU + TSU

Int Ph.D. Coordinator				
Sutopa Modak	Subhajit Manna	Vanshita Ramsinghani	Krishna Das Nair	Jyotirmoy Sarkar
Tanmay Pal	Souritra Shee	Devale Vaishnavi Umesh	Asif Iqbal M.	Prashant Singh
Sejal Uday Lotliker	Nijo Johnson Olakkengil	Suman Maji	Diksha Dadhich	Anwesha Das
	Suhas Adiga	Gunjan Mishra	Archita Barman	

Degree Programme: M.S. (Engineering)

CPMU

Soumyadeep Das	Prof Rajesh Ganapathy	Aditya Ghosh	Prof. Sarit S. Agasti

Degree Programme: M.Sc. Chemistry

NCU

M.Sc. Coordinator				
Kausik Kundu	Soumyadip Maiti	Abhirup Guha	Sharanava Dasgupta	Chandrayee Mitra
Arpitha R.	Sumedha Ganguly	Pratyush Pandit	Soumitri Chatterjee	Tanu Sharma
Dexi Polachan	Anindita Phukan	Afrin Ahamed	Nikita Tuwani	

ACADEMIC PROGRAMMES

Student name | Research supervisor

Degree Programme: **M.Sc. Inter-disciplinary Biosciences**

MBGU + NSU + NCU

M.Sc. Coordinator				
Bhavya Gupta	S. Srivarshini	Anushka Sarkar	Aishik Sinha	Anjalika Das
Vidhi Wadhawan	Anwesha Pal	Mehta Aditi Kuldeep Rekha	Shreya Bera	Nilanjana Baishya
Kanish Kumar R.	Hrishee Ray	Swarnava Majumdar	Aishani Sengupta	Srashti Birla
Charandeep Singh	Koushiki Saha	Sneha Das	Saumya Pandey	Sangari S.

Degree Programme: **P.G.D.M.S.**

ICMS

Swathy N.	Prof. Premkumar Senguttuvan
K. Palani Ganesh	Prof. Subi Jacob George
Swagata Patra	Prof. Kanishka Biswas
Ann Mary Antony	Prof. G.U. Kulkarni
Elizabeth Paul	Prof. M. Eswaramoorthy

Detailed List of New Students (Academic Session: Mid-Year)

January 2024

Degree Programme: **Ph.D.**

CPMU

Renuka Manish Karanje	Prof. Bivas Saha
Sukanya Baruah	Prof. G. U. Kulkarni

EMU

Pingali Niharika Shankar	Prof. Santhosh Ansumali

TSU

Rubee Swarnkar	Prof. Shobhana Narasimhan

MBGU

Sohini Bhattacharyya	Prof. Tapas Kumar Kundu
Palash Sen	Dr. Varun Bhaskar
Parna Chakraborty	Prof. Tapas Kumar Kundu

NCU

Samina Dastagir Mulla	Dr. Abhishek Kumar
Rahul Kumar	Prof. Subi Jacob George
Jikesh Bhoi	Prof. T. Govindaraju

NSU

Mahalakshmi N.	Prof. Anuranjan Anand
Pritiben Pankajbhai Prajapati	Prof. Sheeba Vasu

ACADEMIC PROGRAMMES

Detailed List of Degrees and Diplomas Awarded

Award Date: 25th May 2023

Degree Awarded: Ph.D.

CPMU

Soumita Chakraborty (Research Supervisor: Prof. M. Eswaramoorthy)
Investigation of Electrocatalytic Water Splitting and Carbon Dioxide Reduction by Nanostructured Materials

Krishan Chand Maurty (Research Supervisor: Prof. Bivas Saha)
Light-Matter Interactions: Plasmon & Phonon Polaritons in Refractory Nitrides for Nanophotonics

Srimayee Mukherjee (Research Supervisor: Prof S. Balasubramanian)
Ion Transport and Solvation in Next Generation Battery Electrolytes: Molecular Simulation Studies

Anaranya Ghorai (Research Supervisor: Prof K. S. Narayan)
Studies on the Photophysics and Charge Carrier Dynamics in Solution-Processed Semiconductors using Time and Frequency Domain Measurements

Ashutosh Kumar Singh (Research Supervisor: Prof. Sebastian C. Peter)
Investigations on the Structure - Property Relationship in 3d Transition Metal - Based Intermetallics

EMU

Prateek Anand (Research Supervisor: Prof. Ganesh Subramanian)
Motion of Anisotropic Particles In: Sedimentation, Uni - Directional Shear Flows and Turbulence

MBGU

Sreshtha Pal (Research Supervisor: Prof. Ranga Uday Kumar)
An Association Between Transcription Strength of HIV - 1 LTR and the Gene Expression Noise: Implications for HIV-1 latency

Priya Brahma (Research Supervisor: Prof. Kaustuv Sanyal)
Factors Determining Morphological Transitions in the Human Fungal Pathogen Candida albicans

ACADEMIC PROGRAMMES

NCU

Arka Som (Research Supervisor: Prof. Sarit S. Agasti)
Engineering Dynamic and Stimuli - Responsive Supramolecular Host - Guest Systems for Biological Applications

Sapatarshi Chakraborty (Research Supervisor: Prof. Ranjani Viswanatha)
Understanding Competing Photophysical Processes in Quantum Dots Using Advanced Spectroscopic and Structural Tools

Rajib Dey (Research Supervisor: Prof. Jayanta Haldar)
Engineering Small Molecular Therapeutics and Multifunctional Biomaterials to Mitigate Topical Infections

Sreyan Ghosh (Research Supervisor: Prof. Jayanta Haldar)
Development of Antimicrobial Biomaterials to Tackle Healthcare-Associated Infections

TSU

Abhishek Kumar Adak (Research Supervisor: Prof. Shobhana Narasimhan)
Engineering Inorganic and Organic Nanostructures on Metal Surfaces Using Insights from Density Functional Theory

Koyendrilla Debnath (Research Supervisor: Prof. Shobhana Narasimhan)
Theory of Electronic and Structural Transitions in Layered Materials and 2D Heterostructures: Properties Tunable with Pressure, Electric Field and Twist

Degree Awarded: M.S. (Engineering)

EMU

Saumyakanta Mishra (Research Supervisor: Dr. Diwakar S. Venkatesan)
A Diffuse - Interface Analysis of Two - Phase Thermo - Convective Instabilities

Ritwik Das (Research Supervisor: Dr. Diwakar S. Venkatesan)
A novel mini pressure swing adsorption plant for oxygen concentration

ACADEMIC PROGRAMMES

Degree Awarded: M.S. through Int. Ph.D.

MBGU

Aman Sharma (Research Supervisor: Prof. Maneesha S. Inamdar)
Understanding the role of mitochondrial proteases AFG3L2 and YME1L in Drosophila blood cell function

Award Date: 22nd September 2023

Degree Awarded: Ph.D.

CPMU

Kompella V. K. Srinath (Research Supervisor: Prof. S. Balasubramanian)
Computational Investigations to Unravel the Origins of Lag Phase, Chirality Transfer, and Diastereoselectivity in Supramolecular Self-Assemblies

Navneet Singh (Research Supervisor: Prof. Rajesh Ganapathy)
Uncovering Hidden Structural Order in Dense Colloidal Liquids in Flat-Space and Glass Transition, Melting, and Shear-Melting of Wigner Colloidal Phases on Curved Manifolds

Janaky S. (Research Supervisor: Prof Chandrabhas Narayana)
Raman Investigations on Pressure and Temperature Induced Topological, Electronic, Magnetic, and Structural Phase Transitions

EMU

Mohammad Rafiuddin (Research Supervisor: Prof. K. R. Sreenivas)
Study of Thermal Structure and Fog Episodes in the Nocturnal Boundary Layer: Numerical Simulations and Satellite Observations

ACADEMIC PROGRAMMES

MBGU

Smitha A. S. (Research Supervisor: Prof. Tapas Kumar Kundu)
Histone acetylation and Heterochromatinization in Neurogenesis: Role of Non-histone proteins HP1α, PC4 and Lysine acetyltransferase KAT3B/p300

Siddharth Singh (Research Supervisor: Prof. Tapas Kumar Kundu)
Oral Cancer-Associated Somatic Mutations in TP53 and their Pathophysiological Relevance

Akash Kumar Singh (Research Supervisor: Prof. Tapas Kumar Kundu)
Exploring the Therapeutic Potential of a Specific Small Molecule Activator of Lysine Acetyltransferases P300/CBP for Neurological Disorders

TSU

Supriti Dutta (Research Supervisor: Prof. Swapan K. Pati)
Computational Studies on the Photo-Electrocatalytic Activity and Selectivity in Renewable Energy Conversion Processes

Bidhan Chandra Garain (Research Supervisor: Prof. Swapan K. Pati)
Computational Perspectives on Triplet Exciton Harvesting: A Combined Ab Initio and Machine Learning Investigation

Varghese Babu (Research Supervisor: Prof. Srikanth Sastry)
A Numerical Study of Shear Jamming

NCU

Madhu R. (Research Supervisor: Prof. T. Govindaraju)
Molecular Tools and Methods to Understand and Modulate Alzheimer's Disease Pathology

Reetendra Singh (Research Supervisor: Prof. C. N. R. Rao)
Investigations of the Properties of Covalently Linked 2D Nano-Sheets, ALD/CVD Grown Thin Films of Metal Chalcogenides, and C-Doped Gallium Nitride

Suchi Smita Biswas (Research Supervisor: Prof. M. Eswaramoorthy)
Investigation of Nanomaterials for Ammonia Synthesis and Hydrogen Production and Storage

ACADEMIC PROGRAMMES

Degree Awarded: M.S. (Engineering)

EMU

Shashank R. (Research Supervisor: Prof. Meheboob Alam)
DSMC and Fast Spectral Solutions of Poiseuille Flows: Rarefied Molecular and Granular Gases

Degree Awarded: M.S. through Int. Ph.D.

CPMU

Sarbajit Dutta (Research Supervisor: Prof. Umesh V. Waghmare)
First-Principles and Theoretical Analysis of Electronic, Optical and Vibrational Properties in Layered Materials

Deeksha Sharma (Research Supervisor: Prof. Bivas Saha)
Emergence of Exotic Physical Phenomena from Light-Matter Interaction in Novel Materials

Sneha Raj V. P. (Research Supervisor: Prof. Tapas Kumar Maji)
Post-Synthetically Modified Metal-Organic Frameworks (MOFs) for Visible-Light-Driven Photocatalytic CO_2 Reduction

Shubhanshi Mishra (Research Supervisor: Prof. G. U. Kulkarni)
Optimizing Design Parameters for Smart Window Applications

MBGU

Souradip Mukherjee (Research Supervisor: Prof. Hemalatha Balaram)
Studies on E. coli L-Tartrate Dehydratase and M. Jannaschii Inosine 5'-Monophosphate Dehydrogenase

Ritoprova Sen (Research Supervisor: Prof. Ravi Manjithaya)
Elucidating the Role of Mitophagy in Mitochondrial Diseases

Deepam Bhattacharya (Research Supervisor: Prof. Ravi Manjithaya)
Mutating Bacterial Short Linear Motifs (SLiMs) to Investigate their Role in Interaction with Host Autophagy Machinery

Vishal Rajesh Lolam (Research Supervisor: Dr. Achira Roy and Chair, NSU (Co-guide))
Investigating Mechanisms Underlying Cortical Malformations Using Mouse Models

ACADEMIC PROGRAMMES

NCU

Ritika Raghuvanshi (Research Supervisor: Prof. Sarit S. Agasti)
Multivalent Transient Binding Probe for Extended Single Molecule Tracking

Vandana Kushwaha (Research Supervisor: Prof. Subi Jacob George)
Stimuli Responsive Supramolecular Polymers

Ivy Maria (Research Supervisor: Prof. Kanishka Biswas)
Unusual Chemical Bonding and Intrinsic Correlated Disorder-Tailored Electronic and Thermal Transport in Crystalline Solids

Sayan Chakravarty (Research Supervisor: Prof. Jayanta Haldar)
Development of Synthetic Small Molecules and Polymeric Delivery Platforms to Tackle Drug Resistant Infections

Arghya Ghosh (Research Supervisor: Prof. Tapas Kumar Maji)
Investigation on 'Soft' Hybrid Functional Materials towards Catalytic and Ferroelectric Properties

Surya Pravo Mookerjee (Research Supervisor: Dr. Bani Kanta Sarma)
Studies on Collagen Mimetic Peptides with Azapeptidomimetic Modifications

Prabhat Thapliyal (Research Supervisor: Prof. Premkumar Senguttuvan)
Soft-Chemical Synthesis of Metal Fluorides for Oxygen Evolution Catalysis

Degree Awarded: M.Sc. Chemistry

NCU

Research Supervisor: M.Sc. Coordinator

- K. Palani Ganesh
- Arpita Panda
- Jatin Chauhan
- Ramjayakumar V.
- Kashish Kumar Taneja

ACADEMIC PROGRAMMES

Diploma Awarded: P.G.D.M.S.

ICMS

Poornima Baburaj (Research Supervisor: Prof. Premkumar Senguttuvan)
Synthesis and Formation Mechanism of Spherical-Shaped $Na_{0.71}Li_{0.14}(Mn_{0.57}Co_{0.29})O_2$ Particles and their Application in a Sodim-Ion Battery

Parisha (Research Supervisor: Prof. Rajesh Ganapathy)
Rheology of Vertically Vibrated Monolayers of Active Granules-Design and Construction of the Apparatus and Some Preliminary Results

Ananya A. (Research Supervisor: Prof. Subi Jacob George)
Ambient Triplet Harvesting from Thio-Core Substituted Pyromellitic Diimides

Ankit Kumar (Research Supervisor: Prof. Bivas Saha)
The Proximity Effect of Superconductor-Ferromagnet Heterostructures

Sakil Mallick (Research Supervisor: Prof. C. N. R. Rao)
Synthesis and Characterisation of Metal Chalcogenides for Efficient Electrocatalytic HER Activity

MEMBERS OF THE ACADEMIC PROGRAMMES OFFICE

Dean, Academic Affairs	Prof. M. Eswaramoorthy
Academic Coordinator	Dr. Princy J. Pereira
Junior Admin Assistant	Vinutha S., Dushyant Chaudhary
Office Executives (On Contract)	Chaitra P., Gowri Mohan

03

RESEARCH AND DEVELOPMENT

The main objective of the Centre has been to promote and facilitate high-quality research while maintaining high standards of research integrity. Staying true to these principles, the research students and faculty at the Centre have always strived to advance science in their respective fields, leading to various discoveries and innovations that have propelled the Centre to the forefront of scientific research, both nationally and globally.

JNCASR has 9 research units, with significant industry engagement. These 9 units are the Chemistry and Physics of Materials Unit, Evolutionary and Organismal Biology, Engineering Mechanics Unit, Geosciences Unit, International Centre for Materials Science, Molecular Biology and Genetics Unit, New Chemistry Unit, Neuroscience Unit, Theoretical Sciences Unit, and School of Advanced Materials.

In the year 2023–24, the Centre has made significant contributions in various fields and obtained 7 patent grants. This section provides an overview of the scientific achievements of all research units.

CHEMISTRY AND PHYSICS OF MATERIALS UNIT

The Chemistry and Physics of Materials Unit (CPMU) was established at JNCASR as a seat of world-class research and higher education in materials science and technology. It was the first research unit to be established at JNCASR and has been operational for over 25 years. The Unit strives to be a centre for the confluence of talents drawn from both the titular and traditional disciplines. It is equipped with state-of-the-art facilities.

Due to the interdisciplinary nature of materials research, the Unit amalgamates researchers from chemistry, physics, and biology backgrounds. Since its inception, CPMU has made many groundbreaking discoveries and advances in the field of Materials Science and has collaborated with several national and international laboratories.

Research Areas

- Two-dimensional materials
- Neuromorphic devices
- Molecular systems and properties
- Heterogeneous catalysis
- Room temperature ionic liquids (RTIL)
- Brillouin spectroscopy of carbon nanotube and other novel systems
- Atomic layer deposition and pulsed laser deposition
- Membranes
- Magnetoelectrics and multiferroics
- Functional processable “soft” organic/hybrid gel materials
- Biological systems (essentially proteins)
- High-energy resolution electron energy loss spectroscopy (HREELS)
- Electrocatalysis
- Electrochemical energy storage
- Superconductivity
- Nanoscale MOFs and composites
- Supramolecular self-assembly
- Photoluminescence properties
- Nanomaterials
- Solid state chemistry
- Porous materials (MOFs and organic porous polymers)
- Metal-metal and metal-semiconductor interfaces
- Organic-inorganic hybrid halides
- Framework solids
- Nanolithography and fabrication
- Aberration corrected high resolution transmission electron microscopy
- Molecular beam epaxial growth of III-nitrides
- Quantum materials
- Epitaxial growth of semiconductors
- Catalysis

Research Highlights

- A simple approach to enhancing photoluminescence quantum yield in 2D Heisenberg antiferromagnets by increasing alkylene chain length of $[H_3N–(CH_2)m–NH_3]MnCl_4$ compounds was proposed.

CPMU

- Novel neuromorphic devices consisting of self-forming hierarchical Al and Ag nanostructures were fabricated.
- Structurally induced chirality of an achiral chromophore on self-assembled nanofibers was investigated using positively charged cyanine dyes.
- Confining charge-transfer complex in a metal-organic framework for photocatalytic CO_2 reduction to CH_4 in water under visible light irradiation was performed.
- Well-anchored, low platinum-containing Vulcan carbon catalyst with zinc oxide sacrificial template for acidic hydrogen evolution reaction was synthesised.
- Enhancement of dual near-infrared zero phonon line (ZPL) emission from silicon–boron (SiB) and silicon-vacancy (SiV^-) centres in nanodiamonds was investigated.
- A consolidated review of the current research on catalytic activity, structural analysis, and reaction mechanisms involving metal-organic frameworks (MOF) was conducted.
- 2D nanosheets of layered double perovskites were synthesised and their photostable bright orange emission and photoluminescence blinking phenomenon were investigated.
- A novel driving force towards magnetic stress-driven metal-insulator transition in strongly correlated antiferromagnetic CrN was discovered.

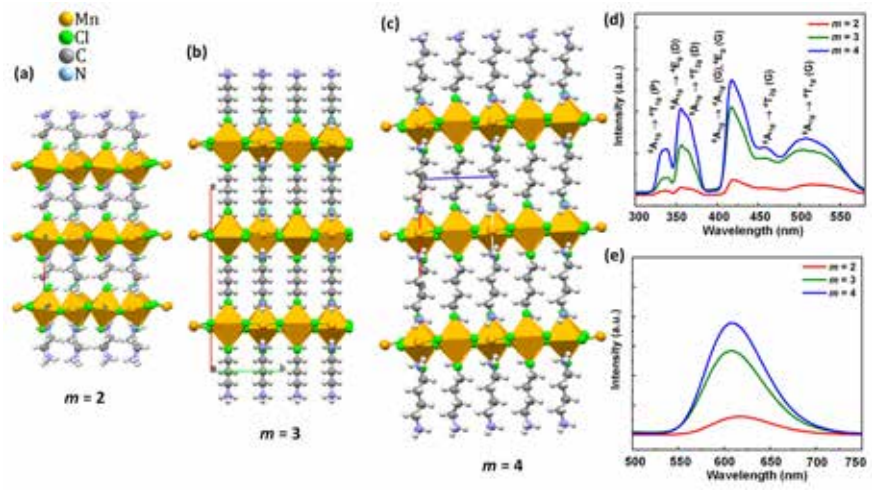
RESEARCH ACTIVITIES AND ACHIEVEMENTS OF 2023–24

Prof. Sundaresan A. *F.A.Sc.*

Professor and Chairperson, CPMU

Designing organic-inorganic (OIH) halides that exhibit both long-range magnetic ordering and high photoluminescence quantum yield (PLQY) is a challenging task owing to the contrasting effect arising from the dimensionality of the compounds.

Our team reported a facile approach for enhancing PLQY in 2-dimensional (2D) Heisenberg antiferromagnets by increasing the alkylene chain length of $[H_3N–(CH_2)m–NH_3]MnCl_4$ (m = 2, 3, and 4) compounds. The designed compounds had 2D layers of corner-sharing $MnCl_6$ octahedra with intercalated organic cations. They exhibited long-range antiferromagnetic ordering, which was confirmed by magnetic susceptibility and heat capacity measurements. We also observed that the Néel temperature (TN) decreased with an increase in the length of spacer cations due to a reduction in interlayer exchange interactions. However, it enhanced the lifetime of photoexcited electrons from 24 to 56 µs and PLQY from 8% to 23%. The findings of this study can provide useful information when designing new OIH halides with long-range magnetic ordering and high PLQY.



2-dimensional structure of $[H_3N-(CH_2)m-NH_3]MnCl_4$ (m = 2, 3, and 4) compounds and their excitation and emission spectra.

Reference: *APL Mater*. 11 (3): 031114, 2023. doi: 10.1063/5.0140821

CPMU

Events Organised:

- 12th–16th June 2023: *Workshop on Data Analysis of Neutron and Users Meeting*, JNCASR
- 22nd–29th August 2023: *Micro symposium on Crystal and Magnetic Structures of Novel Perovskites,* co-chaired by Prof. Frbio-Denis Romero, CNRS, Grenoble, Melbourne, Australia
- 16th–17th February 2024: Workshop on *Neutron Scattering (Elastic and inelastic) and Muon Spectroscopy,* co-organised with Prof. Subhash Thota, IIT Guwahati

Major Talk During 2023–24:

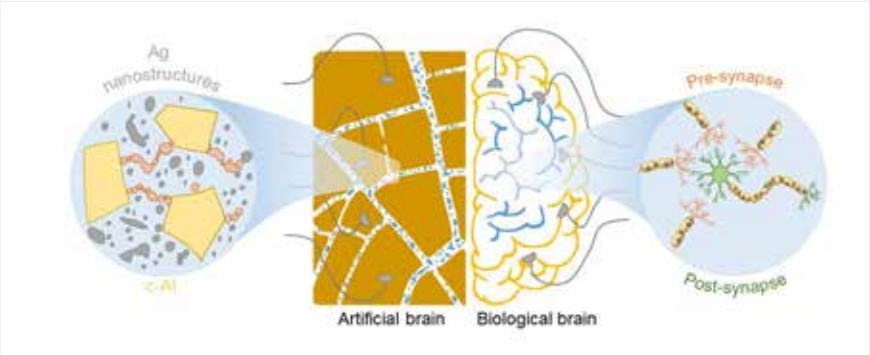
- 3rd–8th September 2023: Talk on *"Structure and Properties of A-site Ordered Spinels"* at the 10th International Workshop on Spinel Nitrides and Related Materials, organised by Leonore Wiehl, Germany

Prof. G. U. Kulkarni *F.A.Sc., F.N.A.Sc., F.N.A.E., F.N.A., F.R.S.C., J.C. Bose Fellow*

Professor, CPMU and President, JNCASR

Creating neuromorphic devices that can closely imitate the structure and behaviour of biological neural networks could open up new avenues for energy-efficient smart systems. Our team developed an artificial synaptic network (ASN) with hierarchical structures made up of isolated Al and Ag micro–nanostructures that were fabricated via desiccated crack pattern, anisotropic dewetting, and self-formation.

The ASN exhibited a threshold switching (Vth ~ 1–2 V) with an ultra-low energy requirement of ~1.3 fJ per synaptic event despite having multiple synaptic junctions between electrodes. To identify the importance of the individual metallic components in contributing to threshold switching and energy minimisation, we analysed several configurations of device architecture. We realised the emerging potentiation behaviour of the conductance (G) profile under electrical stimulation and its permanence over a wide current compliance range of 0.25 to 300 μA. The insights provided by this study could help us improve our understanding of the complex behaviour of the brain for neuromorphic computing.



The image depicts an artificial synaptic network (ASN) comprising hierarchical structures of isolated Al and Ag micro–nanostructures.

Reference: *Mater. Horiz.* (11): 737–746, 2024. doi: 10.1039/D3MH01367G

Major Talks During 2023–24:

- 12th October 2023: SMC Gold Medal Lecture on *"Stabilising Gold in non-cubic crystal structure"*, organised by Society for Materials Chemistry, Mumbai
- 13th October 2023: Dr. Rajendra Rathore Colloquium of Chemistry on *"Stabilising Gold in Non-cubic Crystal Structure"* at IIT Kanpur
- 16th–18th December 2023: Talk on *"Stabilising Gold in non-cubic Crystal Structure"* at the international conference Molecular Matter–Emerging Directions for Sustainability, organised at IIT Madras, Chennai
- 19th–21st December 2023: Talk on *"Stabilising Gold in non-cubic Crystal Structure"* at the international conference EFCS-2023, organised at Farook College, Kozhikode

CPMU

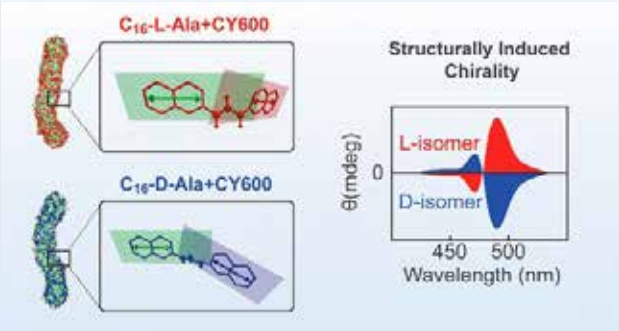
- 3rd February 2024: Talk on *"Neuromorphic Devices for AI"* at the Global Science Festival, IISER, Thiruvananthapuram, Kerala
- 28th February 2024: Science Day Talk on *"Functional Glass and Smart Windows"* organised by Ramaiah University of Applied Sciences, Bengaluru
- 6th March 2024: Talk on *"Neuromorphic Devices for AI"* at the International Conference Recent Trends in Materials Science (ICRTMS-24), sponsored by DST-SERB and organised by Kristu Jayanti College, Bengaluru
- 15th March 2024: Talk on *"Smart window technology: Concept to realization"* at the Advanced Materials Technologies workshop, organised by Vellore Institute of Technology, Chennai

Prof. Balasubramanian S. *F.A.Sc.*

Professor, CPMU

In a recent study, our team explored the significance of chiral surface domains of self-assembled amphiphiles in transferring chirality to achiral chromophores. To investigate this, we used l- and d-isomers of alkyl alanine amphiphiles that self-assemble in water as nanofibers and possess a negative surface charge. When positively charged cyanine dyes (CY524 and CY600) are bound to these nanofibers, they show contrasting chiroptical features.

We discovered that CY600 displayed a bisignated circular dichroic (CD) signal with mirror-image symmetry, while the CD for CY524 was silent. Furthermore, we carried out molecular dynamics simulations, which revealed that the model cylindrical micelles (CM) derived from the 2 isomers exhibited surface chirality and CY524 displayed 2 equally populated conformers with opposite sense. In contrast, CY600 presented as 2 pairs of twisted conformers due to differences in weak dye caused by amphiphile hydrogen bonding interactions. These findings shed light on the elusive structurally induced chirality of achiral chromophores through the transfer of chiral surface information.



Structurally induced chirality of 2 positively charged cyanine dyes CY524 and CY600, each having 2 quinoline rings bridged by conjugated double bonds.

Reference: *ACS Nano.* 17 (11): 11054–11069, 2023. doi: 10.1021/acsnano.3c03892

Event Organised:

- 26th–29th February 2024: *JNCASR-CECAM Conference on MD@60,* International Conference, co-organised with Prof. U.V. Waghmare, JNCASR

Major Talk During 2023–24:

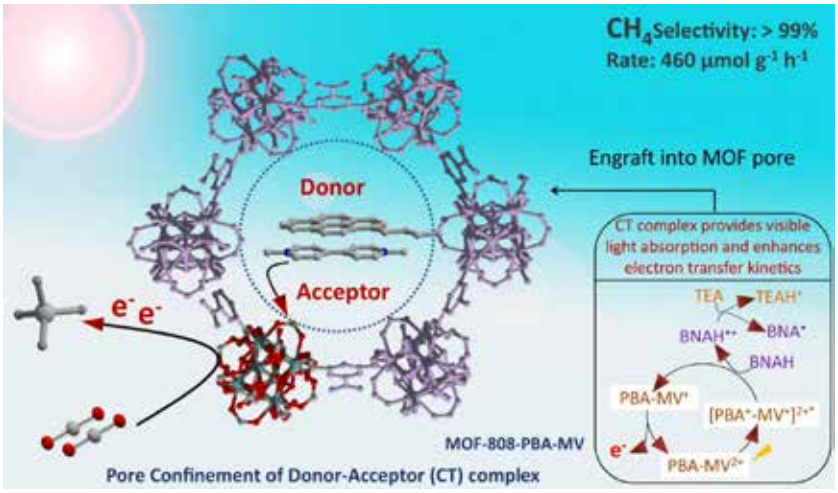
- 29th–31st October 2023: Talk on *"Structurally Induced Chirality of an Achiral Chromophore on Self-Assembled Nanofibers"* at the SoPhyC Conference, organised by IIT, Kanpur

CPMU

Prof. Tapas Kumar Maji *F.A.Sc., F.R.S.C.*

Professor, CPMU

In the quest for renewable fuel production, the selective conversion of CO_2 to CH_4 under visible light in water is a leading-edge challenge, considering the involvement of kinetically sluggish, multiple elementary steps. In this context, we designed mesoporous MOF-808 (Zr) as a suitable platform for post-synthetic modification (PSM) for its well-accessible formate to exchange with 1-pyrenebutyric acid (PBA) produce a luminescent MOF (MOF808-PBA) with a high excited-state lifetime. We noted that the prudent choice of defect-regulated mesoporous MOF-808 (Zr) can be justified by its large pore size, presence of hierarchical meso and microporosity, and very high water/chemical stability when combined with available unsaturated Zr^{IV} metal site. We introduced a supramolecular D–A assembly using noncovalent grafting of methyl viologen (an electron acceptor). Integrating the D–A module inside the pore surface can create an artificial "special pair" like the system to facilitate fast charge transfer kinetics by driving the charge-separation process to reduce CO_2 beyond the 2-electron reduction process. Hence, rapid electron transfer process from PBA → MV → catalytic site (Zr-oxo cluster) and suitable band position overcome the required electron injection for CO_2RR to produce a highly reduced product in aqueous medium. The proximal presence of the charge transfer complex enhances charge transfer kinetics as realised from transient absorption spectroscopy, and the facile electron transfer helps to produce CH_4 from CO_2. Furthermore, the reaction mechanism was established by *in situ* diffuse reflectance FT-IR (DRIFT), and electron paramagnetic resonance (EPR) studies, which were well supported by density functional theory (DFT) calculation.



Schematic illustrating engrafting of a donor–acceptor (PBA-MV) complex into MOF-808 (Zr) pore for visible-light-driven CO_2 reduction to selective CH_4 production. Here, the D–A complex acts as a light harvester to boost the electron flow near the catalytic site in the presence of light.

Reference: *Nat. Commun.* 14: 4508, 2023. doi: 10.1038/s41467-023-40117-z

Events Organised:

- 23rd June 2023: Recent Advances in Solid State Chemistry and Physics symposium, co-organised with Prof. S. Agasti and Prof. Eswaramoorthy M., JNCASR, Bengaluru
- 14th–17th December 2023: Modern Trends in Inorganic Chemistry (MTIC-XX), Conference, co-organised with MTIC-XX Team, IISc, Bengaluru

Major Talks During 2023–24:

- 24th–27th September 2023: Talk on *"Post-modified MOFs as Catalyst towards Solar Fuel Production"* at the EuroMOF2023 Artificial Photosynthesis conference, co-organised by Prof. Daniel Maspoch Comamala and Prof. Jorge A. Rodríguez Navarro and held at Granada, Spain
- 4th–6th December 2024: Talk on *"Developing Photocatalyst by Post-Synthetic Modification of Metal-Organic Frameworks"* at the International Winter School on Frontiers in Materials Science, co-organised with Prof. Eswaramoorthy M., Prof. Subi J. George, Prof. Sundaresan A., and Prof. Umesh V. Waghmare (JNCASR) and Prof. Ram Seshadri (University of California, Santa Barbara)

CPMU

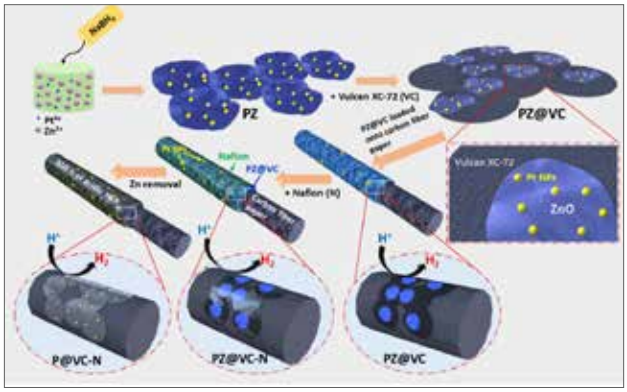
- 19th–21st February 2024: Talk on *"Metal-Organic Self-assembled 'Soft' Nanomaterial for Solar Fuel Production"* at the Fifteenth Annual International Workshop on Advanced Materials (IWAM 2024), co-organised with Ras Al Khamiah Centre for Advanced Materials (RAK CAM), United Arab Emirates (UAE)
- 11th–13th March 2024: Talk on *"Developing Photocatalyst by Post-Synthetic Modification of Metal-Organic Frameworks"* at the International Conference on Catalysis (IC²), co-organised with Prof. P. Ghosh, Prof. T. K. Paine, Prof. J. Guin, and Prof. A. Datta (IACS, Kolkata)

Prof. Eswaramoorthy Muthusamy

Associate Director, ICMS; and Dean, Academic Affairs

To commercialise proton exchange membrane electrolysers, a robust electrocatalyst with low platinum concentration to carry out an acidic hydrogen evolution reaction is essential. Our team reported the simple synthesis of a well-anchored, low Pt-containing Vulcan carbon catalyst with ZnO acting as a sacrificial template. The very low Pt content electrocatalyst, the PZ@VC material, was prepared via simultaneous borohydride reduction followed by loading of Vulcan carbon.

Electrochemical analysis of the materials revealed that PZ@VC with 2 wt.% Pt showed excellent performance for acidic HER. We found that PZ@VC with low Pt loading showed significantly low η_{10} (15 mV) and η_{100} (46 mV) values but coating it with Nafion (PZ@VC-N) significantly improved its performance with η_{10} and η_{100} being 7 mV and 28 mV, respectively. It also increased the stability to ≈300 h. PZ@VC-N also showed a record high mass activity of 71 A mg_{Pt}^{-1} at 50 mV of overpotential. Post-reaction characterisations revealed that strong metal-support interaction led to such high stability at low Pt loading.



Schematic representation of Pt nanoparticle-loaded carbon paper that exhibits enhanced hydrogen evolution reaction in acidic medium

Reference: *Small*. 19 (45): e2303495, 2023. doi: 10.1002/smll.202303495

Events Organised:

- 4th–6th December 2023: *International Winter School on Frontiers in Materials Science,* Winter School, co-organised with Prof. Umesh V. Waghmare
- 7th–9th December 2023: *International conference on Recent Advances in Materials (RAM-90),* Conference, co-organised with Prof. Sundaresan A., Prof. Subi J. George, Prof. Umesh V. Waghmare, and Prof. Ram Seshadri

Major Talks During 2023–24:

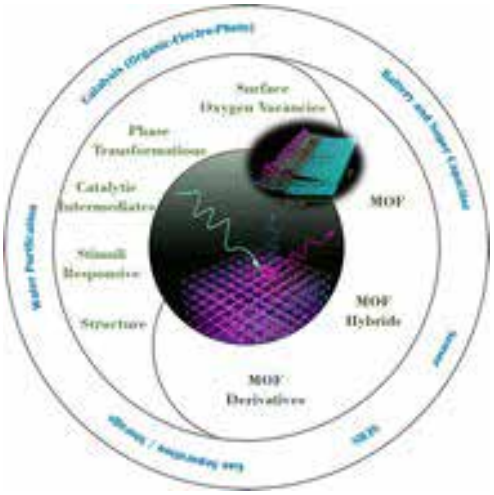
- 18th–21st February 2024: Talk on *"Electrochemical Synthesis of Ammonia: Stakes and Challenges"* at the IWAM Conference, organised by IWAM, UAE
- 26th March 2024: Talk on *"Electrochemical Synthesis of Ammonia: Stakes and Challenges"* at the Dr. Paarivendhar Research Colloquium (DPRC-2024), organised by SRMIST, Kattankulathur, Chennai

CPMU

Prof. Chandrabhas Narayana *F.A.Sc., F.N.A.Sc., F.R.S.C.*

Professor (On Deputation), CPMU

Metal–organic frameworks (MOFs) are made up of coordinating metal ions or clusters that are connected to bridging organic ligands. Their unique structures impart them with exceptional physiochemical properties. Gaining real-time information about the different processes and associated structural changes in MOFs using in situ and in operandi Raman spectroscopic studies recently gained a lot of momentum.



Graphical summary of the insights from our review paper.

Reference: *Chem. Soc. Rev.* 52: 3397–3437, 2023. doi: 10.1039/D2CS01004F

We published a review, wherein we explored the current research status of Raman spectroscopy in probing the structure, guest adsorption, catalytic activity, and reaction mechanisms of MOFs. We provided a brief overview of the potential application of MOFs in energy storage and enhanced Raman spectroscopy (SERS) based detection and diagnostics. The review also highlighted the advancements in the Raman spectroscopy technique that have facilitated *in situ* studies in the atmosphere as well as various chemical environments and the use of infrared tools for analysing MOFs. With this review, we aimed to encourage further development of newer analysis techniques or enhancement of current Raman spectroscopy research methods.

Prof. K. S. Narayan *F.A.Sc., F.N.A.Sc., F.N.A.*

Professor, CPMU

Colour centres in nanodiamonds (NDs) have been largely explored by coupling to a photonic structured matrix (PSM) to amplify visible range emission features, enhancing their use in quantum technologies. We studied the emission enhancement of dual near-infrared zero phonon line (ZPL) emission from silicon-boron (SiB) and silicon-vacancy (SiV^-) centers in NDs using a spontaneously emerged low index-contrast quasi-periodic PSM, having micron-scale air pores. An intensity enhancement factor of 6.15 for SiV^- and 7.8 for SiB ZPLs were attained for the PSM sample compared to a control sample. We found Purcell enhancement of 2.77-fold for PSM sample using the spatial-dependent decay rate measurements, supported by localised field intensity confinement in the sample. Such cavity-like emission enhancement and lifetime reduction were enabled by an in-plane order-disorder scattering in the PSM sample substantiated by the pump-dependent emission measurements. The results put forward a facile approach to tailor the near-infrared dual ZPL emission from NDs using nanophotonic structures.

Reference: *Opt. Lett.* 49(3): 510–513, 2024. doi: 10.1364/OL.507207

Event Organised:

- 17th July 2023: *Exploring innovative solutions for vision restoration,* 1-day workshop, co-organised with Vini Gautam, CENSE IISc, Bengaluru

CPMU

Major Talks During 2023–24:

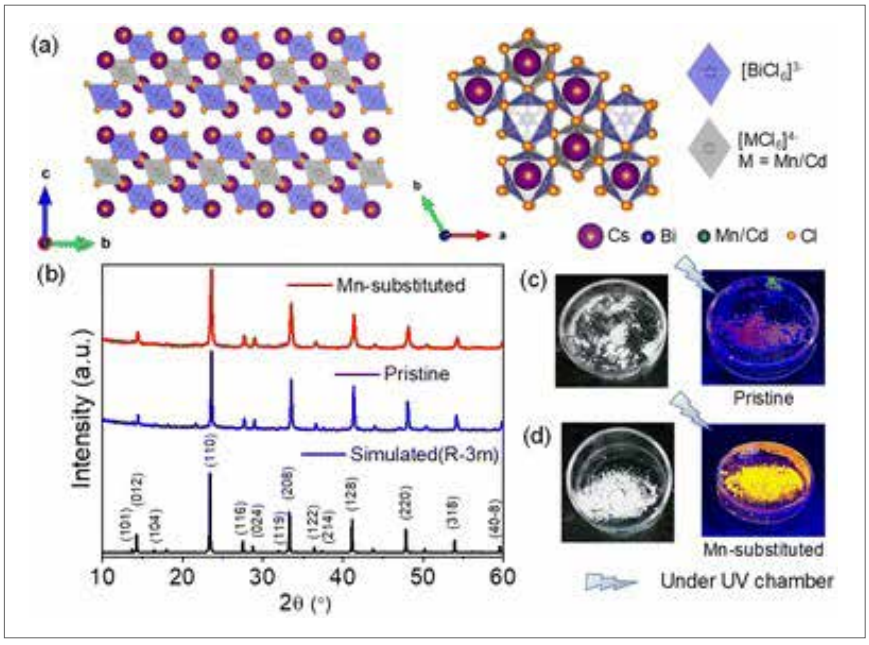
- 10th–15th October 2023: Talk on *"Organic semiconductors for retinal prosthetics"* at the international conference OP2023 Optical Probes, organised by University of Genoa, Milan Poly, Lake Como, Italy
- 6th February 2024: Talk on *"Active role of confinement on Quantum Characteristics of Molecular Systems"* at the NPC2024 Physics Conference, organised by SRM Chennai
- 15th March 2024: Talk on *"Biophysics of Avian Retina and Light-Induced Actuation of Liquid Metal Films"* as part of the Applied Sciences Department Annual Symposium organised by SAIS, IACS Kolkata

Prof. Sarit S. Agasti

Associate Professor, CPMU and NCU; Faculty In-charge, Sports Facility

Lead (Pb)-free layered double perovskites (LDPs) have recently garnered a lot of attention due to their exquisite optical properties and environmental stability. However, not much is known about their high photoluminescence (PL) quantum yield at the single particle level. Our team reported a hot-injection route for the synthesis of 2 dimensional (2D) ~2–3 layer thick nanosheets (NSs) of LDP, $Cs_4CdBi_2Cl_{12}$ in its pristine form and its partially Mn-substituted analog $Cs_4Cd_{0.6}Mn_{0.4}Bi_2Cl_{12}$. We also presented a solvent-free mechanochemical synthesis method for obtaining bulk powders of these samples. The Mn-substituted NS emitted intense orange PL with a relatively high PL quantum yield of ~21%.

We carried out super-resolved fluorescence microscopy and time-resolved single particle tracking, which revealed the occurrence of metastable non-radiative recombination channels in a single NS. Further experiments showed that the pristine NSs exhibited blinking-like nature, which could be attributed to dynamic equilibrium flanked by the active and inactive states of metastable non-radiative channels. The unique optical properties of the synthesised material and insights into their mechanisms can prove helpful for the development of optoelectronic applications in the future.



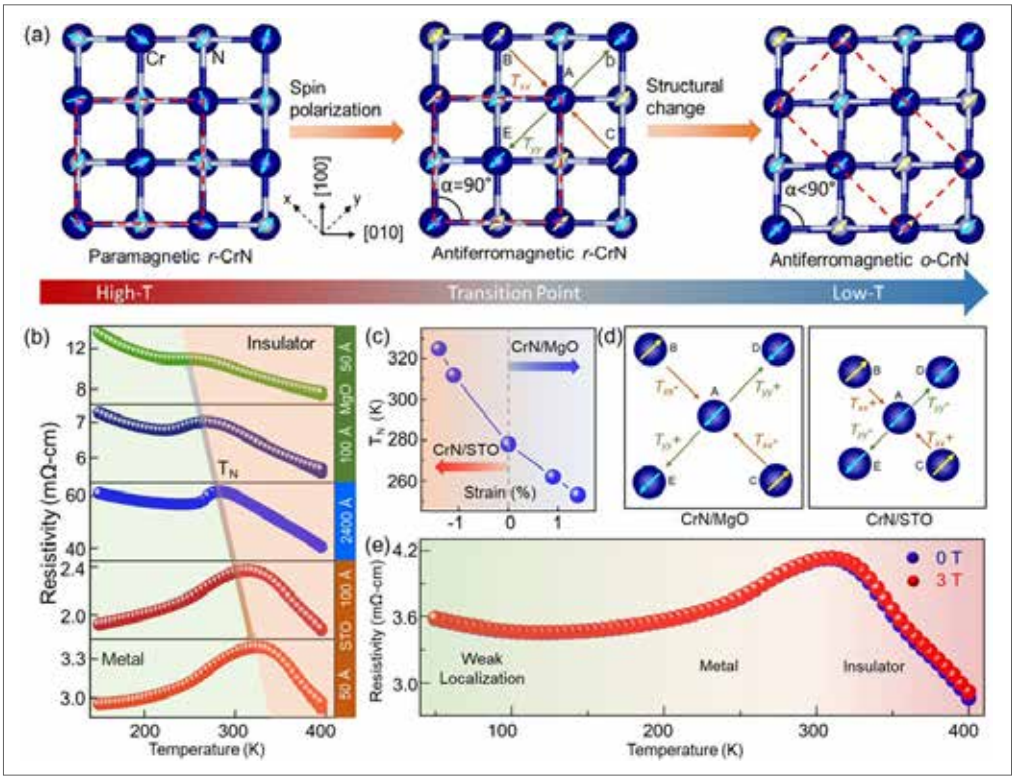
a) Crystal structure of layered double perovskite. (b) Powder X-ray diffraction pattern of mechanochemically synthesised $Cs_4CdBi_2Cl_{12}$ and Mn-substituted $Cs_4Cd_{0.6}Mn_{0.4}Bi_2Cl_{12}$. (c) and (d) are the physical appearances of the samples under day light and UV light, respectively.

Reference: *Chem. Sci.* 14 (26): 7161–7169, 2023. doi: 10.1039/D3SC02506C

CPMU

Prof. Bivas Saha

Associate Professor, ICMS and CPMU; and Warden and Student Counsellor



(a) Schematic showing a non-spin polarised to AFM non-spin polarised transition accompanied with the structural transition in CrN. After the initial spin polarization, a compressive magnetic-stress T_{xx} and tensile magnetic-stress T_{yy} distort the cubic structural symmetry and transform it into an orthorhombic structure. (b) Temperature-dependent resistivity of relaxed (blue) and strained films shows that compressive stress increases the TN, while tensile stress decreases TN in CrN. (c) The evolution of transition temperature with in-plane strain shows a linear behaviour. (d) Schematic description of the changes in magnetic stress in CrN with epitaxial strain. The T_{yy} behaves conversely to T_{xx}. (e) Temperature-dependent electrical resistivity of 10 nm CrN on STO substrate at 2 different out-of-plane magnetic fields of 0 and 3 T.

Reference: *Phys. Rev. Lett.* 131: 126302, 2023.
doi: 10.1103/PhysRevLett.131.126302

We have experimentally demonstrated that magnetic stress that stems from the peculiar arrangement of atomic spin drives the simultaneous structural, magnetic, and metal-insulator transition. Moreover, the presence of magnetic stress is a driving force behind the metal-insulator transition in CrN and our study revealed pathways for its manipulation. The magnetic stress within CrN emerges from the interplay between 2 distinct magnetic orderings along mutually perpendicular directions directly tied to the magnetic exchange interaction between 2 neighbouring Cr atoms. We employed a technique that involves altering the equilibrium atomic spacing within CrN ultrathin films to fine-tune the magnetic exchange interactions (epitaxial strain engineering). When subjected to compressive strain, the magnetic stress increases, resulting in metal-insulator transition at elevated temperatures compared to bulk values. Conversely, when the film is under tensile stress, the magnetic stress diminishes, prompting a metal-insulator transition at a significantly lower temperature than the bulk value. The structural symmetry also changes from rock salt at high temperatures to orthorhombic at low temperatures simultaneously. The new mechanism of metal-insulator phase transition can lead to a better understanding of how spin, charge, and lattice degrees of freedom are coupled in materials, paving the way for new classes of materials that exhibit metal-insulator phase transition.

Major Talks During 2023–24:

- 12th May 2023: Talk on *"Rare-earth Nitrides for 4th Industrial Revolution"* at the Victoria University of Wellington, New Zealand
- 2nd December 2023: Talk on *"Magnetic Stress-driven metal-insulator phase transition in Strongly Correlated Quantum Materials"* at the 14th APCTP-IACS-Academy-JNCASR Meeting, jointly organised by APCTP (Asia Pacific Center for Theoretical Physics), IACS (Indian Association for the Cultivation of Science), Indian Academy of Sciences (Bengaluru), and JNCASR
- 10th January 2024: Talk on *"Magnetic Stress as a New Chauffeur of Metal-Insulator Transition"* at the International

CPMU

Conference on Functional Materials, organised by IIT Kharagpur, India

- 19th January 2024: Seminar on *"Magnetic Stress-driven Metal-insulator Phase Transition in Strongly Correlated Quantum Materials"* at the Department of Physics, IISER Pune, India
- 26th February 2024: Talk on *"Functional nitride thin films and superlattices for thermoelectric applications"* at the Indo-German Workshop on Thermoelectric Devices for Emerging Applications, organised by IISER, Thiruvananthapuram, India

Unit Members

Faculty	
Professor and Chairperson	**Prof. Sundaresan A.**
Professor, CPMU and President, JNCASR	**Prof. G. U. Kulkarni**
Linus Pauling Research Professor; Honorary President, JNCASR; and Director, ICMS	**Bharat Ratna Prof. C. N. R. Rao**
Professors	**Prof. Balasubramanian S.** **Prof. Tapas Kumar Maji** **Prof. Eswaramoorthy Muthusamy** (Associate Director, ICMS; and Dean, Academic Affairs) **Prof. Chandrabhas Narayana** (on deputation) **Prof. K. S. Narayan**
Associate Professors	**Prof. Sarit S. Agasti** (jointly with NCU; Faculty In-Charge, Sports Facility) **Prof. Bivas Saha** (jointly with ICMS; Warden and Student Counsellor)

Associate Faculty

- **Prof. Ranjan Datta** (Professor, ICMS)
- **Prof. Rajesh Ganapathy** (Professor, ICMS)
- **Prof. Shobhana Narasimhan** (Professor, TSU)
- **Prof. Swapan K. Pati** (Professor, TSU)
- **Prof. Sridhar Rajaram** (Professor, ICMS)
- **Prof. Srikant Sastry** (Professor, TSU)
- **Prof. N. S. Vidhyadhiraja** (Professor, TSU; and Dean, Fellowships and Extension Programmes)
- **Prof. Umesh V. Waghmare** (Professor, TSU; and Dean, Faculty Affairs)

CPMU

Research Students	
Ph.D. through Int. Ph.D.: 9	**Anjali Gaur, Nijita Mathew, Abhishek Kumar, Niloyendu Roy, Uttam Tiwari, Shubhanshi Mishra, Sneha Raj V. P., Swaraj Servottam, Dipanjana Patra**
M.S. (Engineering): 2	**Soumyadeep Das, Aditya Ghosh**
Ph.D.: 40	**Rahul Kumar, Souvik Banerjee, Abhijith Krishnan, Bhupesh Yadav, Tejaswini S. Rao, Oishika Jash, Megha, Rohan Jena, Anupam Dey, Prasanna Das, Anjana Joseph, Suhas K. T., Simanta Kalita, Disha Brahma, Sourav Rudra, Athira M. P., Sayantan Maity, Souvik Mondal, Sudip Ghosh, Kamlesh Mishra, Chandan Pramanik, Debmalya Mukhopadhyay, Mousona Pal, Shubham Kumar Mehta, Pritam Kumar, Soumya Kanti Mondal, Dipayan Mandal, Ujjwal Vidyarthi, Sudip Mahato, Monika Yadav, Rishika Konar, Debendra Meher, Aritra Dey, Alok Raj, Shoubhik Deb, Patel Nishit Ranjitbhai, Devika S., Avinash Kumar Yadav, Renuka Manish Karanje, Sukanya Baruah**

Technical Staff	
Sr. Technical Officers	**Sreenath V., Srinivas S.**
Sr. Lab Assistants	**Anilkumar J., Vasudeva B. S., Alla Srinivasa Rao**

Technical Staff (On Contract)	
Technical Support	**Reetu**
Technical Assistant Trainees	**Krithi M. G., Arun Aravindakshan K. V.**

Temporary Staff	
Workshop Assistant	**Raja Kumar D.**
Glass Blower	**Nandha Kishore**

Research Staff (On Contract)

DST-INSPIRE Faculty Fellow
Dr. Soumitra Barman

Research Associates- II
Dr. Pratibha Kumari

Junior Research Fellows
Rishab Singh
Divya Bhutani
Md Fahim Hossain

Project Associates-I
Kanishka Toshniwal
Ronit Jain

CPMU

Project Assistants
Parvathy S.
Seema Sahu
C. S. Deepak
Sukanya Baruah
Anaranya Ghorai

R&D Assistants
Gulshan Khurana
Samiran Chakaborty
Daizy Kalita
Nagalambika G. Biradar
Jatin Chauhan
Chirag Sarthi J.

Research Associates
Dr. Meenakshi Pahwa
Dr. K. Sriram
Dr. Resmi V. Nair
Dr. Sumukh Anil Purohit
Dr. Dipanjan Maity
Dr. Smhrutisikha Biswal

SERB National PDF
Dr. Deepa Bhatt

SERB-TARE
Dr. Priyanka K. P.

Senior Research Fellows
Ankit Kumar
Oishika Jash
Suchithra P.

Research Associates (P)
Shadab Saifi
Arti Bisht
Avula Venkata Siva Nikhil
Dheemahi
Sinay Simanta Behera
Soumen Pradhan

Research Associates
Dr. Sandip Biswas
Dr. Pavitra V.
Dr. Srimayee Mukherji
Dr. Momin Ahamed
Dr. Manzoor Ahmad
Dr. Tanmay Rom
Dr. Ganesha Krishna V. S.
Dr. Sudhakar Chennu
Dr. Debendra Prasad Panda
Dr. Kompella V. K. Srinath
Dr. Sanchita Karmakar
Dr. Pavitra Nityanand Shanbhag
Dr. Prashant Kumar
Dr. Nimish Dwarkanath
Dr. Bidesh Biswas
Dr. Anshu Kataria
Dr. Faruk Ahamed Rahimi
Dr. Tuhina Mondal
Dr. Manpreet Kaur
Dr. Varchaswal Kashyap

CPMU

Unit at a Glance

Honours/Fellowships/Memberships Received

7 Faculty Members **15** Students

Faculty Achievements

Prof. Sundaresan A.

- Received JNCASR Silver Jubilee Professorship

Prof. G. U. Kulkarni

- Received the Society for Materials Chemistry (SMC) Gold Medal 2023 from Bhabha Atomic Research Centre (BARC) in October 2023
- Conferred with Honorary Doctorate by K.L. University, Vijayawada
- Appointed Member of Senate of IISER Berhampur
- Received Sir J. C. Bose Fellowship by SERB
- Received Fellowship of the Royal Society of Chemistry
- Received a DST-Advanced Manufacturing Technologies project, *"Scalable coating of metal oxides on hybrid transparent electrodes and fabrication of smart window devices"* in collaboration with HHV Pvt. Ltd. Bengaluru, IIT Jodhpur, and CeNS, Bengaluru for a period of 3 years with a total budget of ₹4.45 crore
- Appointed as Life Member, Society for Materials Chemistry
- Appointed as Member, Governing Board of INFLIBNET (UGC) for a period of 3 years
- Appointed as Member, DST Scientific Advisory Committee (SAC) for devising the technical details and scientific contents of the Indian Science Congress 2024
- Appointed as Additional Member, Indian National Science Academy Council for the year 2024 (as nominee of Secretary, DST)
- Appointed as Member, General Council of NAAC for a 3-year term
- Appointed as Member, UGC Consortium for Academic Research and Ethics Committee-Empowered Committee (CARE-EC)
- Appointed as Member, NAC-TRC of the Indian Association for Cultivation of Science (IACS), Kolkata

Prof. Balasubramanian S.

- Received Professor AK Chandra Memorial Award from Indian Chemical Society
- Appointed Expert Member of the University Research Council of SRM Institute of Science and Technology, Chennai for two years

Prof. Tapas Kumar Maji

- Appointed as International Advisory Board Member for *Angewandte Chemie*
- Listed under The Asian Scientist 100 by *Asian Scientist Magazine*
- Received the Society for Materials Chemistry (SMC) Silver Medal 2023 from Bhabha Atomic Research Centre (BARC) in October 2023

Prof. Chandrabhas Narayana

- Received the Taranath Shetty Memorial Oration Popular Lecture Series Award 2023 from the Association of

Clinical Biochemists of India
- Received the Sir C. V. Raman Memorial Science Day Lecture Award 2023 from the Indian Photobiology Society

Prof. K. S. Narayan
- Appointed as Distinguished Visiting Professor, Indian Institute of Technology Bombay, 2024–26
- Selected as Editorial Board Member for Materials Horizon–RSC(UK), ACS Applied Electronic Materials, Elsevier–Synthetic Metals
- Selected as Committee Member of Department of Science and Technology, Government of India, FIST and SAIF programme

Prof. Sarit S. Agasti
- Awarded the National Prize for Research in Bio-Physical Chemistry (CNR Education Foundation) on 31st July 2023 (along with Prof. Pinaki Talukdar, IISER, Pune)

Student Achievements

Dr. Sanchita Karmakar (Research Associate; research supervisor: Prof. Tapas Kumar Maji)
- Best Ph.D. Thesis Award 2023 at India's Carbon Capture and Utilization Network (CO_2 India)

Dr. Srimayee Mukherji (Research Associate; research supervisor: Prof. Balasubramanian S.)
- Received Best Poster Award from JNCASR and CECAM

Dr. Avula Nikhil (Research Associate; research supervisor: Prof. Balasubramanian S.)
- Received Best Poster Award at SoPhyC, IIT Kanpur

Dr. Debendra Prasad Panda (Research Associate; research supervisor: Prof. Sundaresan A.)
- Received Best Poster Award at the International Workshop on Energy and Sustainability (JIWES 2023)

Rohit Attri (Ph.D. Student; research supervisor: Prof. G. U. Kulkarni)
- Awarded Best Poster Prize at Materials, Methods and Devices for Futuristic Technologies (MDFT 2023), International Conference held at Dharwad, Karnataka

Disha Brahma (Ph.D. Student; research supervisor: Prof. Balasubramanian S.)
- Received Best Poster Award from JNCASR and CECAM
- Received Special Funding to Attend 28th Thermodynamics Conference from Delft University of Technology

Arghya Ghosh (Ph.D. Student; research supervisor: Prof. Tapas Kumar Maji)
- ACS Applied Materials and Interfaces Best Poster Prize at National Conference on Disorder and Soft Systems: Recent trends (DSSR)

Anjana Joseph (Ph.D. Student, CPMU; Research Supervisor: Prof. Chandrabhas Narayana)
- Received Materials Research Society India Prize for the Best Poster at the 5th Indian Materials Conclave at the Indian Institute of Technology (BHU) Varanasi

CPMU

Rahul Kumar (Ph.D. Student; research supervisor: Prof. Sundaresan A.)
- Received Best Poster Award at the International Workshop on Energy and Sustainability (JIWES 2023)
- Received Distinguished Student Award at the American Physical Society/International Centre for Diffraction Data

Kamlesh Mishra (Ph.D. Student; research supervisor: Prof. Rajesh Ganapathy)
- Awarded Poster Prize at Workshop *"Soft and Living Matter: From Fundamental Concepts to New Material Design"*, International Centre for Theoretical Studies, Bengaluru

Sneha Raj V. P. (Ph.D. Student; research supervisor: Prof. Tapas Kumar Maji)
- Won the ACS Crystal Growth and Engineering Best Poster Prize at International Conference on Modern Trends in Inorganic Chemistry (MTIC-XX)

Tejaswini S. Rao (Ph.D. Student; research supervisor: Prof. G. U. Kulkarni)
- Awarded Best Flash Talk for poster at Materials, Methods and Devices for Futuristic Technologies (MDFT 2023), International Conference held at Dharwad, Karnataka

Sourav Rudra (Ph.D. Student; research supervisor: Prof. Bivas Saha)
- Received Best Poster Award from JNCASR

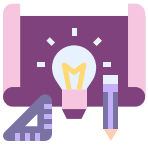
Uttam Tiwari (Int. Ph.D. Student; research supervisor: Prof. Rajesh Ganapathy)
- Awarded Poster Prize at Workshop *"Soft and Living Matter: From Fundamental Concepts to New Material Design"*, International Centre for Theoretical Studies, Bengaluru

Rahul Singh Rawat (M.S. through Int. Ph.D Student; research supervisor: Prof. Bivas Saha)
- Won the Best Poster Award from JNCASR and Rice University

Total Publications

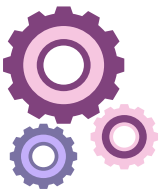
102 Peer-reviewed articles indexed in Web of Science/Scopus

Sponsored Projects



15 New Projects

₹1.95 cr. Grant Amount Received During 2023–24



29 Ongoing Projects

₹87.39 cr. Grant Amount Received During 2023–24

CPMU

Students Graduated During 2023–24

Ph.D.: 8
Soumita Chakraborty, Krishan Chand Maurty, Srimayee Mukherjee, Anaranya Ghorai, Ashutosh Kumar Singh, Kompella V. K. Srinath, Navneet Singh, Janaky S.

M.S. (Int. Ph.D.): 4
Sarbajit Dutta, Deeksha Sharma, Sneha Raj V. P., Shubhanshi Mishra

Students Admitted During 2023–24

Ph.D.: 9
Debendra Meher, Aritra Dey, Alok Raj, Shoubhik Deb, Patel Nishit Ranjitbhai, Devika S., Avinash Kumar Yadav, Renuka Manish Karanje, Sukanya Baruah

M.S. (Engineering): 2
Soumyadeep Das, Aditya Ghosh

Current Student Strength

51

ENGINEERING MECHANICS UNIT

The Engineering Mechanics Unit (EMU) pursues research on a range of problems where momentum, heat, and mass transport processes play a critical role. Research done in the Unit has fundamental scientific relevance in attempting to explain the underlying physical origin of phenomena observed in both nature and the laboratory, and in addition, is relevant to a host of technological applications. Research areas currently underway concern the study of both complex micro-structured fluids (granular materials, suspensions and emulsions, polymer solutions and melts, and active matter) and complex flows (linear and nonlinear evolution of hydrodynamic instabilities, mechanisms of pattern formation, turbulence, and dynamical systems theory), spanning an enormous range of length and time scales from the microscopic to the geological/astrophysical, via a combination of experiments, parallel computations, and theoretical analyses. Apart from above topics that are of interest to Engineering graduates, a subset of research topics that would be of interest to Applied Mathematicians and Soft-matter Physicists are:

i. The kinetic-theory-based continuum models and
ii. Nonlinear stability analyses and bifurcation phenomena

Research conducted in the EMU, despite encompassing almost the entire gamut of fluid mechanics and transport phenomena, can nevertheless be organised under a few underlying themes. Research endeavours under each of these themes are described in more detail below. The research efforts of the EMU faculty have led to connections, both research-based and funding-based, with leading institutions within India and around the world.

Research Areas

- Complex Fluids and Multiphase Flows
- Experimental Fluid Dynamics, Heat Transfer and Atmospheric Flows
- Mechanics of Granular Suspensions and Active Matter: From Kinetic Theory to Nonlinear Hydrodynamic Equations
- Thermo-hydrodynamics of Rarefied Gases (as encountered in "nano-scale'' gaseous flows as well as in "thin'' atmospheres such as on Mars and Moon)
- Roads to Turbulence in Inertial Suspensions: Taylor-Couette Flow as a Prototype
- Dynamical Systems Theory and Bifurcation Phenomena
- Computational Fluid Dynamics

Research Highlights

- Inertial migration of spheres was revisited to demonstrate, for the first time, the existence of equilibrium locations outside of the classical ones discovered by Segre and Silberberg.
- Unified scaling for torque response in suspension Taylor-Couette flow [*Philosophical Transactions of the Royal Society A*, https://doi.org/10.1098/rsta.2022.0266]

EMU

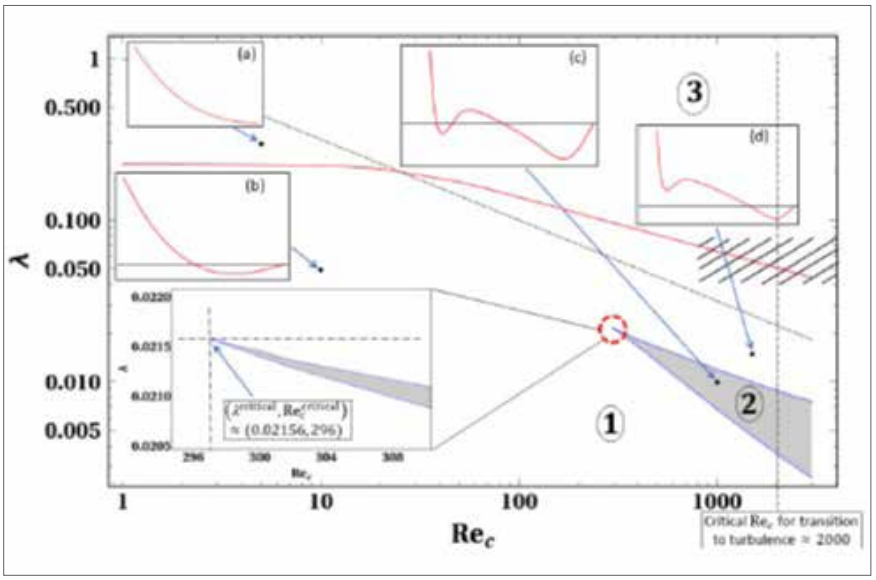
- Unveiled the role of dilatation on thermo-hydrodynamics of rarefied molecular gases [*Journal of Fluid Mechanics* (2024), in press]
- Fog occurrence was predicted through the study of thermal structures in the atmospheric boundary layer during evening transition and the impact of aerosols on radiative cooling was determined using a machine learning algorithm.
- Electrochemical factors affecting dendrite formation during microscale electrodeposition of copper from copper sulphate was analysed.

RESEARCH ACTIVITIES AND ACHIEVEMENTS OF 2023–24

Prof. Ganesh Subramanian

Professor and Chairperson, EMU

We have examined theoretically the inertial migration of a neutrally buoyant rigid sphere in pressure-driven channel flow, accounting for its finite size relative to the channel width (the confinement ratio). A small but finite confinement ratio qualitatively alters the inertial lift velocity profiles obtained using a point-particle formulation for sufficiently large channel Reynolds numbers. Finite size effects lead to new equilibria, in addition to the well-known Segre-Silberberg pinch locations. Consequently, a sphere can migrate to either the near-wall Segre-Silberberg equilibria or the new stable equilibria located closer to the channel centreline, depending on the channel Reynolds number and its initial position. Our findings are in accord with recent experiments and simulations and have implications for passive sorting of particles based on size, shape, and other physical characteristics, in microfluidic applications.



Inertial migration diagram for neutrally buoyant spheres on the aspect-ratio-Reynolds-number plane.

Reference: *Phys. Rev. Lett.* 132: 054002, 2024. doi: 10.1103/PhysRevLett.132.054002

Major Talks During 2023–24:

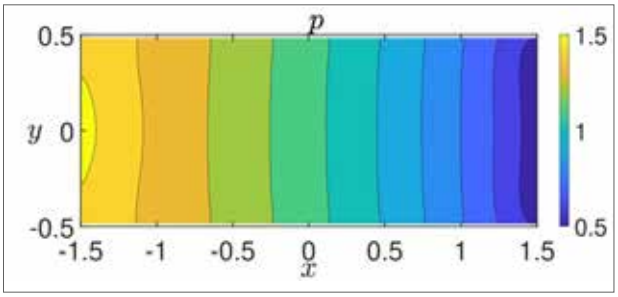
- 26th–30th June 2023: Talk on *"Rheology and dynamics of inertial suspensions"* at the Euromech Colloquium 622: Suspension flows and rheology: inertia, shape and roughness matter, organised by Universite Cote d'Azur, Nice, France
- 18th–20th December 2023: Talk on *"An altered streamline topology allows deformed drops to transport mass faster than spherical ones"* at the Compflu conference, organised by IIT Madras
- 26th–28th February 2024: Talk on *"Active Taylor Dispersion"* at the Perspectives in Hydrodynamics symposium, organised by Chemical Engineering Department, IIT Bombay

EMU

Prof. Meheboob Alam

Professor, EMU

The plane Poiseuille flow of rarefied gas in a finite length channel, driven by an axial pressure gradient, was analysed to probe (i) the role of "dilatation" on its thermo-hydrodynamics and to clarify (ii) the possible equivalence with its well-studied "dilatation-free" or "isochoric" counterpart driven by a constant acceleration. It was shown that while the mass flow rate increases logarithmically at Kn >> 1 in the acceleration-driven case, it saturates to a constant value at Kn >> 1 in the pressure-driven case due to the finite length of the channel, in agreement with prior theory and recent experiments. The pressure-dilatation cooling was responsible for the absence of the bimodal shape of the temperature profile in the pressure-driven Poiseuille flow. The dilatation-driven reduction of the shear viscosity and the odd signs of 2 normal stress differences (N_1 and N_2) in the pressure-driven flow in comparison to those in its acceleration-driven counterpart may be explained from the constitutive relations for the stress tensor of rarefied gas. While both N_1 and N_2 appear at the Burnett-order $O(Kn^2)$ in the acceleration-driven flow, they appear at O(Kn) due to the non-zero dilatation in the pressure-driven Poiseuille flow, confirming that the 2 flows are not equivalent even at the Navier-Stokes-Fourier order O(Kn). The heat-flow rate of the tangential heat flux is found to be negative (i.e., directed against the axial pressure gradient), in contrast to its positive asymptotic value (at Kn >> 1) in the acceleration-driven flow. The double-well shape of the tangential heat-flux profile in the near-continuum limit agrees well with predictions from a generalised Fourier law. The dilatation-driven signatures (such as the pressure-dilatation work and the "normal" shear-rate differences) are shown to be the progenitor for the observed differences between the pressure-driven and acceleration-driven flows with regard to (i) the hydrodynamic fields, (ii) the rheology and (iii) the flow-induced heat transfer.



Pressure distributions in the channel flow of a rarefied gas at a Knudsen number of Kn = 0.05; the flow is directed from left to right.

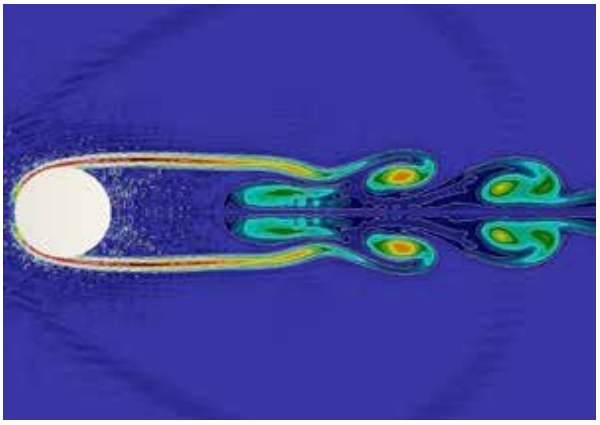
Reference: *J. Fluid.* Mech. 2024. In Press.

Prof. Santosh Ansumali

Professor, EMU

Kinetic models account for the internal degrees of freedom of a polyatomic gas at the level of the 2-particle distribution function. When closer to the hydrodynamic limit, the situation changes and the internal (rotational) degrees of freedom tend to become well represented just by rotational kinetic energy density.

Our team examined the kinetic model of a polyatomic gas and accounted for the rotational energy by augmenting the ellipsoidal statistical Bhatnagar–Gross–Krook (ES–BGK) model. We found that this reduced model aligned with the H theorem and recovered the compressible hydrodynamics for polyatomic gases as its macroscopic limit. Our findings indicated that for a polyatomic gas model, the extended ES–BGK model not only



Kinetic models of a polyatomic gas.

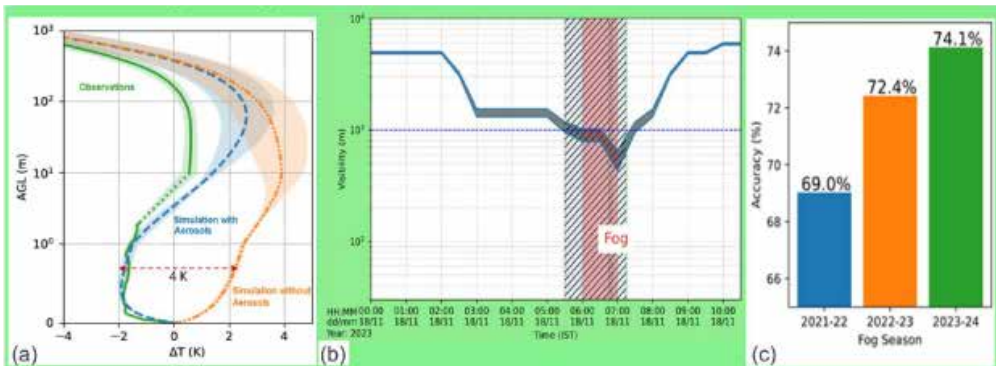
Reference: *J. Fluid Mech.* 963: A7, 2023.
doi: 10.1017/jfm.2023.323

provided the correct specific heat ratio but also allowed tuning of thermal conductivity, shear viscosity, and bulk viscosity. Furthermore, our study demonstrated the model's effectiveness via a lattice Boltzmann method implementation.

Prof. K. R. Sreenivas

Professor, EMU and Dean, Research and Development

Our field studies on evening transitions and fog occurrence in Bengaluru International Airport (BIA) regions have demonstrated the requirement to include aerosols in the modelling of transport and thermal structure of the nocturnal boundary layer. Our approach to identify a set of critical factors impacting fog occurrence and our development of a machine learning algorithm that utilizes output from WRF simulations along with satellite observations, has resulted in a 75% success rate in predicting fog occurrence over the BIA region. Our predictions on fog occurrence and visibility variation are shared with the Airport for their daily operations.



(a) Field observation of temperature profile compared with simulations with and without aerosols. (b) Predicted visibility variation on 18th November 2023. (c) Success in predicting fog over the BIA region.

Reference: *Q. J. R. Meteorol. Soc.* 2024. In Press.

Dr. Diwakar Seyyanur Venkatesan

Faculty Fellow, EMU

Dendritic formations are a morphological change in electrodes which have detrimental effects on the performance and lifetime of batteries. Our team used *in situ* infrared thermometry and microscopy to study the evolution of temperature profiles during the microscale electrodeposition of copper from copper sulphate. Here, the objective was to understand the morphological changes that occur during electrochemical processes.

We found that under certain conditions, the growth front of the deposit receded, and the fastest-growing dendrites suddenly stopped growing. We observed and analysed the physicochemical, temperature, and current changes and discovered that many dynamic phenomena can be correlated and associated with the localised pH. It became evident that changes in the pH altered the chemistry of electrodeposition and led to a potential drop across the electrodes, which changed the transport around dendrites. The insights from our study can be used to develop strategies to mitigate dendrite formation in electrodes.

EMU

Dendrite formation during electrodeposition of copper from copper sulphate.

Reference: *Electrochim. Acta.* 462: 142616, 2023. doi: 10.1016/j.electacta.2023.142616

Major Talk During 2023–24:

- 14th–16th June 2023: Talk on *"A second-order coupling of Carman-Koseny expression with Navier-Stokes equations for modelling fluid-structure interactions"*, at the Hydrodbio 2023 Conference, organised by University of Bordeaux, France

Unit Members

Faculty	
Professor and Chairperson	**Prof. Ganesh Subramanian**
Professor	**Prof. Meheboob Alam** **Prof. Santosh Ansumali** **Prof. K. R. Sreenivas** (Dean, Research and Development)
Faculty Fellow	**Dr. Diwakar Seyyanur Venkatesan**

Research Students	
M.S. (Engineering): 8*	**Akhilesh Srivastava, Anomitra Saha, Ganesh Kumar B., Jishnu Goswami, Guruprasad S., Manoj Tanaji Tanagawade, Akash Bansal, Shounak Dey**
Ph.D.: 15*	**Piyush Garg, Sangamesh Gudda, K. Siddharth, Vybhav G. R., Suryadev Pratap Singh, Subham Banerjee, Raksha Mahalinkam, Praveen Kumar K., Shaurya Kaushal, Akshaysingh Bhawarsingh Shekhawat, Abhisek Ganguly, Uttara S., Raghu, Saumyakanta Mishra, Pingali Niharika Shankar**

*Students including those whose registrations were cancelled during 2023-24.

EMU

Research Staff (On Contract)

R&D Assistant
S. V. Siva Krishna

Junior Research Fellows
Piyush Garg

Research Associates
Dr. Manojit Ghosh
Dr. Harish N. Mirajkar
Dr. Sazid Zamal Hoque

Research Associates-III
Dr. Abhijit Dhamanekar
Dr. Pavan Kumar Singeetham

Senior Research Fellow
Shaurya Kaushal

Unit at a Glance

Honours/Fellowships/Memberships Received

2 Faculty Members **1** Alumnus

Faculty Achievements

Prof. Meheboob Alam

- Appointed Member of IUTAM Symposia Panel for Fluid Dynamics (2022–26) by the International Union of Theoretical and Applied Mechanics (IUTAM)
- Appointed as the IUTAM Representative for IUTAM Symposium on *Rapid Granular Flows and Turbulent Particle Suspensions* at IIT Bombay

Prof. Santosh Ansumali

- Received the INAE-SERB Abdul Kalam Technology Innovation National Fellowship

Alumnus Achievement

Ritwik Das (Alumnus, M.S. (Engineering); research supervisor: Dr. Diwakar Seyyanur Venkatesan)

- Received Prof. Roddam Narasimha and Family Award for the Best M.S.(Engineering) Thesis in Engineering Mechanics 2023

EMU

Total Publications

10 Peer reviewed articles indexed in Web of Science/Scopus

Sponsored Projects

2 New Projects

₹19 lac Grant Amount Received During 2023–24

4 Ongoing Projects

₹2.43 cr. Grant Amount Received During 2023–24

Students Graduated During 2023–24

Ph.D.: 2
Prateek Anand, Mohammad Rafiuddin

M.S. (Engineering): 3
Saumyakanta Mishra, Ritwik Das, Shashank R.

Students Admitted During 2023–24

Ph.D.: 3
Raghu, Saumyakanta Mishra, Pingali Niharika Shankar

Current Student Strength

13*

*Students with valid registration as on 31st March 2024.

EVOLUTIONARY AND ORGANISMAL BIOLOGY UNIT

Biological systems are organised hierarchically in terms of structure, but functionality is much more integrated across structural levels. Decades of narrowly focused studies at one or the other level of structural complexity have greatly enhanced the body of information we possess about these biological systems. However, this information needs to be interpreted and understood in a meaningful natural context of whole organisms, and their behaviour, ecology, and evolution.

Therefore, in our unit, we address questions regarding the functional biology of organisms and attempt to synthesise information from different structural levels of complexity into a holistic understanding of how organisms function and evolve. Our unit is one of the principal centres in the country for research and training in evolutionary dynamics, population ecology, and behavioural and socio-ecology. In our quest to understand the functionality of living systems, we use tools from a wide range of disciplines including molecular and evolutionary genetics, biochemistry, physiology, morphology, functional anatomy, bioacoustics, behaviour, ecology, computation, physics, statistics, and mathematics.

We mostly do empirical research, both in the laboratory and in the field, using a combination of diverse and interdisciplinary approaches spanning from observational and experimental studies to theoretical research, both analytical and computational. Some of our research also addresses issues in the history and philosophy of biology. Our unit is well-equipped for field studies and studies using a range of experimental and computational tools.

Research Areas

- Life-history evolution, using lab populations of *Drosophila*
- Evolution of competitive ability and population dynamics, using *Drosophila*
- Foundational conceptual issues in evolutionary theory
- Asian elephant socioecology and behaviour
- Modelling in ecology and evolution
- Comparative functional anatomy and bioacoustics

Research Highlights

- The detrimental effects of larval crowding on pre-adult survivorship and development time in *Drosophila melanogaster* were explored.
- Our first tests of the Ecological Model of Female Social Relationships (EMFSR) in the Asian elephant lend support to the EMFSR at the habitat scale but not at a finer spatial scale.
- The ways geographic barriers influence syntax and the arrangement of notes in bird songs were examined.

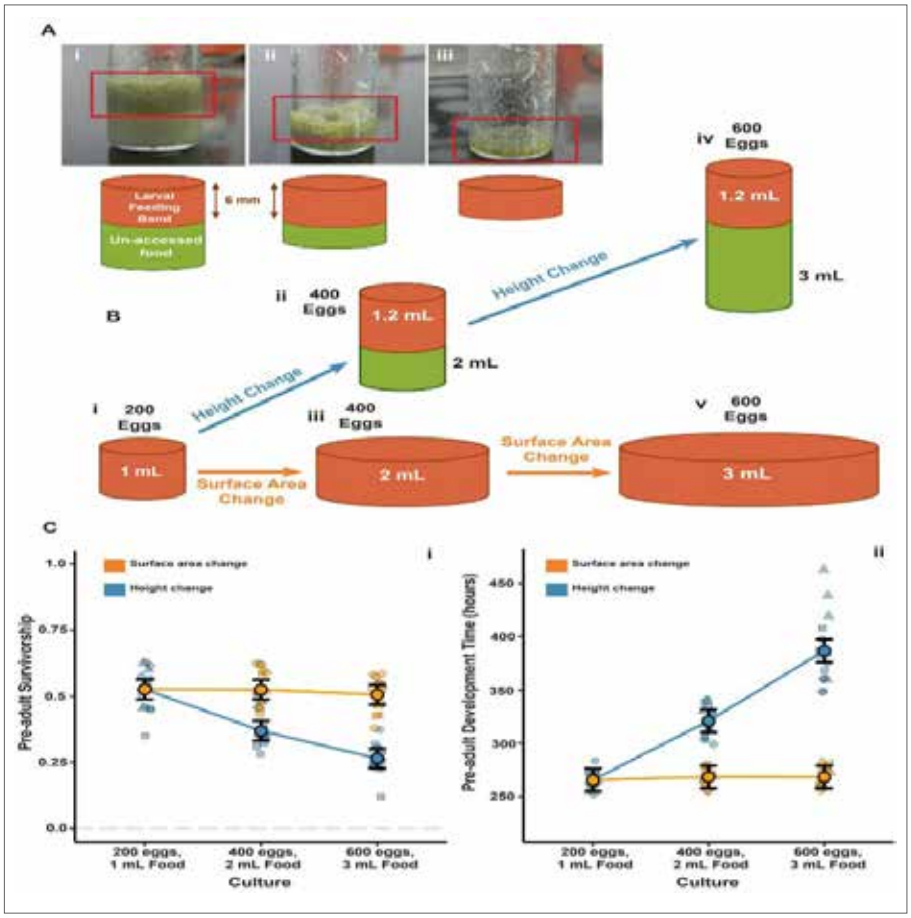
EOBU

RESEARCH ACTIVITIES AND ACHIEVEMENTS OF 2023–24

Prof. Amitabh Joshi *F.A.Sc., F.N.A.Sc., F.N.A., F.I.S.E.B*

Professor and Chairperson, EOBU

For many decades, in studies of ecology and evolution using laboratory populations of *Drosophila*, it was believed that larval density (number of eggs per unit volume of food medium in a rearing container) was a good index of the strength of crowding (competition) being experienced by the population. We conducted an experiment examining pre-adult survivorship and development time in *D. melanogaster* populations subjected to rearing in vials of differing diameter, food volume, and number of eggs per vial, for a total of 27 treatments, several of which had the exact same larval density, but achieved through different combinations of egg number, food volume, and vial diameter. The results clearly showed that larval density was not a good index of the deleterious effects of larval crowding on the 2 fitness components assayed. In fact, it was the precise combination of egg number, food volume, and vial diameter that principally affected the 2 fitness components. These observations represent a paradigm shift in our understanding of the effects of larval crowding.



Larval crowding effects on fitness components in D. melanogaster involve more than just number of larvae per unit volume of food medium: (A) Differing ecologies of crowded cultures with similar larval densities; (B) Schematic of experimental design; (C) Data from the experiment showing that when food column height is changed while keeping larval density the same, both pre-adult survivorship and development time are affected (blue data points/lines), whereas a similar effect is not seen when surface area is changed while holding larval density constant (orange data points/lines).

Reference: *bioRxiv.* 2023. doi: 10.1101/2023.07.26.550621

Events Organised:

- 23rd June 2023: EOBU Special Seminar on *Half a century with monkeys in jungles and towns: Notes on their behaviour and conservation* and felicitation of the speaker Prof. Mewa Singh was organised in collaboration with the Centre for Ecological Sciences, IISc and NCBS, Bengaluru
- 15th December 2023: EOBU Seminar on *Neurobiology of Vocal Communication: Insights from the Singing Mice*— with Dr. Arkarup Bannerjee, Cold Spring Harbor Laboratory, USA as the speaker

EOBU

- 9th January 2024: EOBU Seminar on *Mangrove forest dynamics in response to climatic and sea level changes along the Indian coastline* with Dr. Jyoti Srivastava, Birbal Sahni Institute of Palaeosciences, Lucknow as the speaker
- 16th January 2024: Organised EOBU Special Seminar on *Explaining species wide variation: What shapes phenotypic and genotypic diversity?* by speaker Prof. Dr. Dieter Ebert, University of Basel, Switzerland; seminar was co-organised with Prof. Raghavendra Gadagkar, IISc. and Hon. Prof. JNCASR
- 29th January 2024: EOBU Special Seminar on *Paradox of predictability* with Prof. David Houle, Florida State University, USA as the key speaker
- 16th–17th February 2024: EOBU@25: *Symposium of Evolutionary and Organismal Biology,* co-organised with Prof. T. N. C. Vidya, EOBU, JNCASR

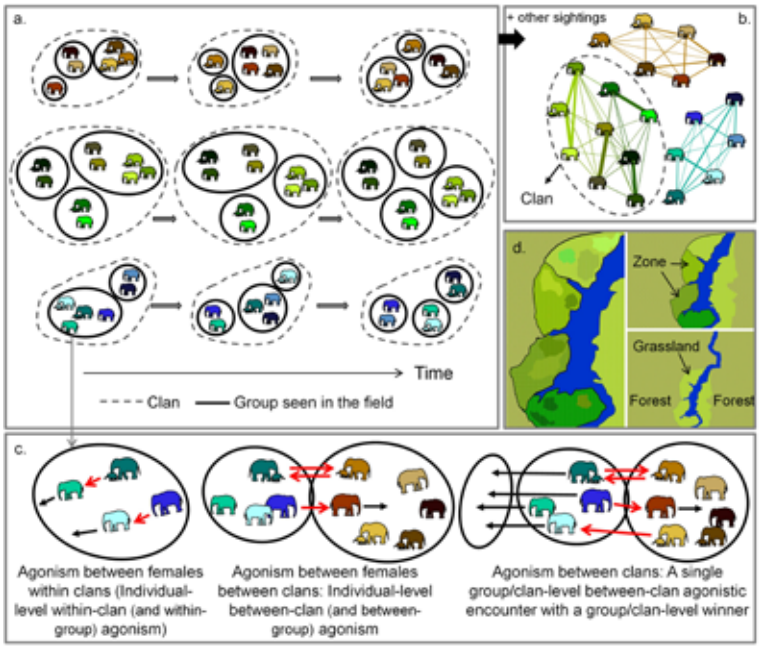
Major Talks During 2023–24:

- 4th April 2023: Online talk on *"The importance of evolutionary biology"* at the EvoBio 2023 Workshop for teachers, IISER Kolkata
- 21st April 2023: Talk on *"The Art of Science and the Science of Art, and why the twain do meet"* at Dhwani seminar, JNCASR
- 29th June 2023: Plenary Talk on *"What is heritability in the light of a phenotypical theory of natural selection?"* at the Understanding Behaviour 2023 conference at IISER Kolkata
- 11th October 2023: Talk on *"What is natural selection?"* at an outreach programme organised by Resonance: Journal of Science Education, IASc., Bengaluru and Kashmir University, Srinagar
- 12th October 2023: Talk on *"Why understanding evolution is so important?"* as part of the Special Lecture Series organised by Anhad Foundation and Government Degree College, Sogam, Kupwara
- 7th December 2023: Plenary Talk on *"Biology is rarely simple: the curious case(s) of crowding in Drosophila cultures"* at the Indian Drosophila Research Conference 2023 held at IISER Pune and IISER Thiruvananthapuram

Prof. T. N. C. Vidya *F.I.S.E.B.*

Associate Professor, EOBU

According to the ecological model of female social relationships (EMFSR), food resource abundance and distribution shape competition within and between female social groups. While this has been tested largely in primates, we tested aspects of the EMFSR in the Asian elephant for the first time. We collected behavioural data on a large number of individually-identified elephants and data on resources from vegetation plots in Nagarahole and Bandipur National Parks, in southern India. Although female Asian elephants show high fission-fusion dynamics, overlapping home ranges, and graminivory, which are all associated with infrequent contests, we found high frequency of between-clan contests. We attribute this to the resource-rich habitat patch and high population density, which seem to increase agonism despite high fission-



Schematic showing a) elephant fission-fusion dynamics with individuals, groups, and clans, b) example social network with clans, c) agonistic interactions, and d) resource distributions.

Reference: *R. Soc. Open Sci.* 10: 230990, 2023. doi: 10.1098/rsos.230990

fusion dynamics and graminivory. While results were consistent with predictions at the level of the habitat patch, agonism was not related to food abundance or heterogeneity at smaller scales, contradicting the EMFSR.

Events Organised:

- 10th–14th October 2023: Resonance Science Outreach Programme for college students, co-organised with Prof. Sury B., Prof. Jasjeet Singh Bagla, Prof. Vijaya Anand, Resonance Journal, Indian Academy of Sciences, and Prof. Manzoor Ahmad Malik, Kashmir University, Srinagar
- 16th–17th February 2024: EOBU@25: *Symposium of Evolutionary and Organismal Biology,* co-organised with Prof. Amitabh Joshi, EOBU, JNCASR

Major Talks During 2023–24:

- 15th July 2023: Public lecture on *"Understanding Elephants"* at Science Sanje organised by Kalasuruchi and Kutuhalli, Mysuru
- 12th August 2023: Public lecture on *"Asian Elephant Demography and Behavioural Ecology: Study and Experience from the Bandipur Landscape"* at the World Elephant Day Programme organised by the Bandipur Tiger Reserve, Karnataka Forest Department, Mysuru
- 12th October 2023: Seminar on *"Understanding Animal Social Organisation"* as part of the Science Lecture Series organised by Anhad and Government Degree College, Sogam, Kupwara, Kashmir

Dr. Anand Krishnan

Assistant Professor, EOBU

We demonstrated that geographic barriers in Northeast India and Southeast Asia shape how mountain-dwelling birds sequence their songs. We found that different species use the same basic building blocks (or notes) of vocal sequences, but arrange them according to different rules depending on which region they dwell in. We focused on a group of birds called wren-babblers (*Spelaeornis*), which occupy very restricted areas in different hill ranges of Northeast India and Southeast Asia. We classified songs using several different mathematical approaches, and found that although all species used broadly similar notes, they arranged them according to region-specific rules. Species in the Eastern Himalayas alternated between 2 and 3 notes, those south of the Brahmaputra (the South Assam Hills) used complex note arrangements, and species from Southeast Asia tended to repeat the same note many times. In areas between major geographic regions, species exhibited signs of an intermediate syntax. We suggested that these demonstrate how geographic barriers can influence vocal syntax.

Two species of montane wren-babbler. (Left) The Spelaeornis caudatus species, which is found in the Eastern Himalayas. (Right) The Spelaeornis longicaudatus species, which is found in the hills of Meghalaya.

Reference: *Behav. Ecol. Sociobiol.* 77 (109), 2023. doi: 10.1007/s00265-023-03385-9

Event Organised:

- 9th–12th October 2023: *Workshop: Bioacoustics in Conservation,* co-organised with Taksh Sangwan, Divya Panicker, and Viral Joshi as part of the Student Conference in Conservation Science

Major Talk During 2023–24:

- 23rd–25th February 2024: Talk on *"Form-function biomechanics in cavity excavating barbets"* at the National Symposium in Avian Biology organised by the Association of Avian Biologists in India

EOBU

Unit Members

Faculty	
Professor and Chairperson	**Prof. Amitabh Joshi**
Associate Professor	**Prof. T. N. C. Vidya**
Assistant Professor	**Dr. Anand Krishnan**

Research Students	
Ph.D.: 16*	**Athira T. K., Ankana Sanyal, Satyabrata Nayak, Medha Rao, Chinmay Krishna Yadav Temura, Anuj Menon, Singh Viveka Jagdish, Mohnish Singh, Bhawna, Jabili Chowdari, Divya Choudhary, Bindya R. S., Abhijith A. V., Saravanan B., Sattaru Krishna Chaitanya, Katta Abhishek Goud**
M.S.-Ph.D.: 1	**Anvitha S.**

*Students including those whose registrations were cancelled during 2023-24.

Administrative Staff
Rajanna N. (Helper)

Research Staff (On Contract)

Field Assistant
Siddharth Biniwale

Project Associate-II
Thanikodi M.

Junior Research Fellows
Niranjana C.
Padmanav Baruah

R&D Assistant
Subham Mohanty

Research Associate
Dr. Alakananda Maitra

Unit at a Glance

Honours/Memberships Received

1 Faculty Member **4** Students

Faculty Achievements

Prof. Amitabh Joshi

- Appointed as Chief Editor of *Dialogue: Science, Scientists, and Society* (January 2024–December 2026), Indian Academy of Sciences, Bengaluru

EOBU

Student Achievements

Dr. Hansraj Gautam (Postdoctoral Researcher, research supervisor: Prof. T. N. C. Vidya)

- Received the Speed Talk first prize for work carried out in the Animal Behaviour Lab, EOBU, at the Understanding Behaviour 2023 Conference

Athira T. K. (Ph.D. Student; research supervisor: Prof. T. N. C. Vidya)

- Received Travel Award, International Society for Behavioural Ecology (ISBE)

Ankana Sanyal (Ph.D. Student; research supervisor: Prof. T. N. C. Vidya)

- Received poster prize for work carried out in the Animal Behaviour Lab, EOBU, at the Understanding Behaviour 2023 Conference

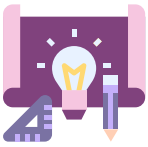
Chinmay Yadav Krishna Temura (Ph.D. Student; research supervisor: Prof. Amitabh Joshi)

- Received Best Poster Award at JNCASR's In-House Symposium 2023, JNCASR

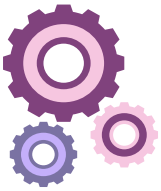
Total Publications

14

Sponsored Projects



2 New Projects **₹42.11 lac** Grant Amount Received During 2023–24



2 Ongoing Projects **₹42.12 lac** Grant Amount Received During 2023–24

Students Admitted During 2023–24

Ph.D.: 4

Abhijith A. V., Saravanan B., Sattaru Krishna Chaitanya, Katta Abhishek Goud

Current Student Strength

15*

*Students with valid registration as on 31st March 2024.

GEOSCIENCES UNIT

Research at the Geosciences Unit (GSU) encompasses the reconstruction of paleo-monsoon dynamics and the in-depth analysis of inter-tropical climatic behaviour, specifically focusing on extreme climatic events in the Himalayas and the Indian Peninsula. Comprehensive investigations are also conducted into natural hazards, including surface faulting, earthquakes, tsunamis, and landslides. To enhance understanding of the complex relationship between global and regional climates and monsoon rainfall patterns, the researchers employ advanced modelling techniques that leverage extensive geological proxy databases. The frontiers of research in the Cuddapah Basin of Andhra Pradesh have recently expanded to include paleobiological studies of its Precambrian rocks. This new area of research investigates the ancient past of the Cuddaph Basin, aiming to illustrate the paleoenvironmental dynamics that shaped this enigmatic geological formation.

Additionally, in collaboration with the Geological Survey of India in Bengaluru, researchers at GSU studied selected urban lakes using environmental geochemistry to discern climatic variations and anthropogenic influences. Expanding their scientific endeavours, natural analogue studies have been initiated by GSU in collaboration with the Theoretical Science Unit of JNCASR and the Bhabha Atomic Research Centre in Mumbai. The primary focus of this project is to delve into the multidisciplinary structure, vibrational, and elastic properties of natural hydroxyapatites that contain carbonate and actinide substitutions. This unique combination of experimental and simulation-based investigations provides valuable insights into the stability of carbonate in apatite-type matrices. The outcomes of the research have significant potential applications across various domains. They contribute to our understanding of the dynamic properties exhibited by apatites and their implications for the development of innovative materials. These materials find applications in diverse fields such as groundwater purification, nuclear waste management, and advancements in dental and orthopaedic treatments.

Research Areas

- Comprehensive study of geological proxies such as limestone caves (speleothems) and both paleo and urban lakes
- Reconstruction of past climatic variations in the Himalayas and the Indian Peninsula
- Petrography and mineralogy and stable isotopes of speleothems
- Investigations into potential hazards in the tectonically active Himalayas and mountains in the Western Ghats
- Establish the relationship between global and regional climates by utilising regional atmospheric circulation models
- Study of structural, vibrational, and elastic properties of natural hydroxyapatites with carbonate and actinide substitutions
- Paleobiological studies of Precambrian rocks in the Cuddapah Basin, Andhra Pradesh, to understand the paleoenvironmental dynamics of the basin

GSU

Research Highlights

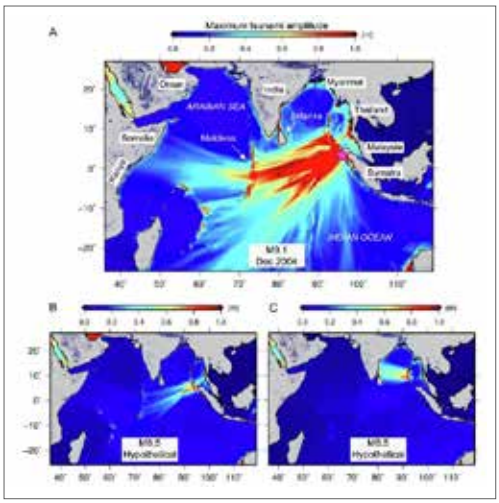
- Nine tsunami events in the Sumatra-Andaman subduction zone were analysed that revealed variable inter-event periods ranging from 220 ± 185 to 1605 ± 245 years.

RESEARCH ACTIVITIES OF 2023–24

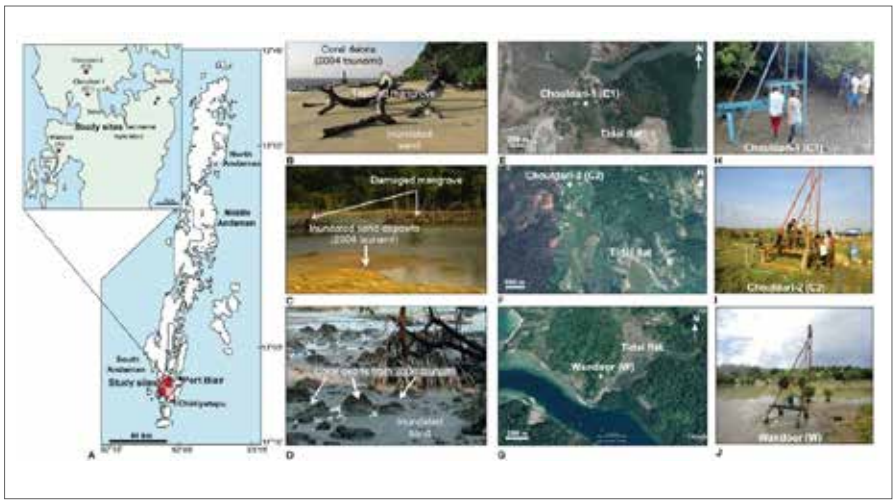
Dr. Jaishri Sanwal Bhatt

Research Associate III

Our research unveils a captivating ~6,500-year record of tsunamis in the Indian Ocean, challenging previous assumptions about their frequency. Multiple analyses of sediment cores near Port Blair, Andaman Islands, revealed out-of-sequence deposits with unique sediment characteristics and microfossil content. These deposits, dated from 601 to 6357 cal yr BP, are interpreted as past tsunami events based on their similarity to the well-documented 2004 tsunami deposit. Notably, these events show chronological equivalence with far-field locations, suggesting a widespread impact. Interestingly, the recurrence pattern appears non-linear. An initial quasi-periodic phase with an average interval of 980 years (mid-Holocene) is followed by a prolonged quiescent period (1605 years) before transitioning to a regime of clustered events. This variability aligns with existing theoretical models for subduction zone dynamics, emphasising the importance of long-term stress recycling processes. Overall, this study unveils a ~6500-year record of Indian Ocean tsunamis, highlighting their complex recurrence pattern and providing valuable insights for future earthquake and tsunami prediction in the region.

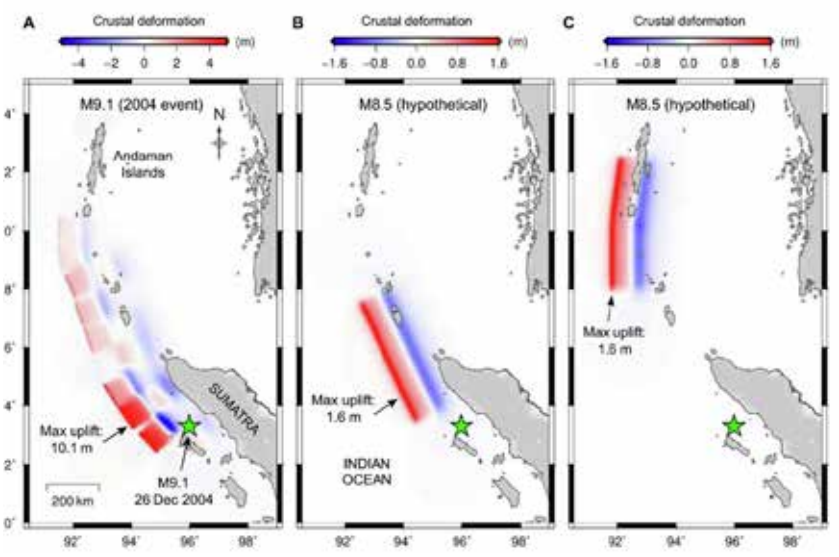


Tsunami modelling. A. The Mw 9.1 December 2004 earthquake; B and C. Two hypothetical Mw 8.5 events sourced from 2 hypothetical source regions within the Sumatra-Andaman subduction zone.

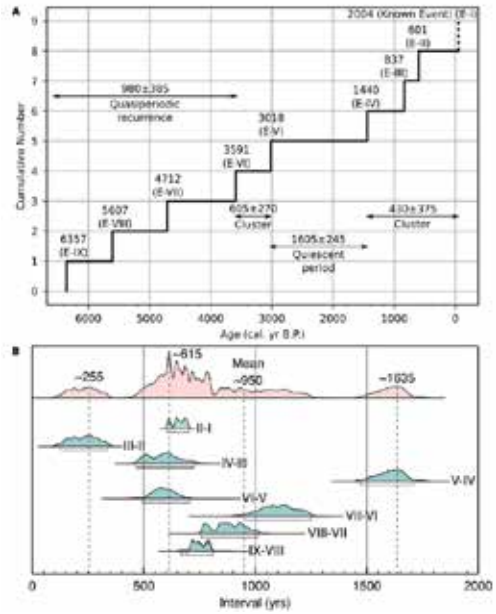


A. Map of Andaman Islands and study area in south Andaman. B–C. Photographs of 2004 tsunami deposits near study sites. D. Close-up views of coral boulders and sand that were deposited during the 2004 tsunami near Wandoor site. E–G. Close-up views of the coring sites near Port Blair. H–J. Field photographs of coring sites.

GSU



Crustal deformation associated with earthquakes of differing magnitudes. A. The Mw 9.1 December 2004 earthquake. B–C. Two hypothetical Mw 8.5 events sourced from different regions of the study area. A, B, and C here correspond to tsunami modelling results shown in Figs. 2A, B, and C, respectively.



A. The temporal pattern of the nine tsunami events from this study. The temporal pattern follows a Devil's Staircase-like trend. B. The modelled recurrence pattern of tsunami deposits from this study.

Reference: *Mar. Geol.* 460: 107051, 2023. doi: 10.1016/j.margeo.2023.107051

Events Organised:

- 6th October 2023: Prof. K. S. Valdiya Memorial Lecture, Symposium, co-organised with Education Technology Unit, and Geosciences Unit, JNCASR
- 1st–3rd November 2023: *Climatic Change and Earth Systems,* International conference, Nepal Academy of Science and Technology, Nepal, in association with TWAS Central and South Asia Regional Partner and JNCASR
- 22nd December 2023: Science Outreach Programme, Lecture on *"Origin of life on Earth"*, presented by Prof. V. C. Tewari, Formerly, Geology Department, Central University, Gangtok, Sikkim, Education Technology Unit and Geosciences Unit, JNCASR
- 18th March 2024: *Whispers of the Himalayan Peaks: Collaborative Research to Track Orogenic Origins*, Lecture, Presented by Prof. Mary Hubbard, Geology Department at Montana State University, Bozeman, USA, held at Geosciences Unit, JNCASR

Major Talks During 2023–24:

- 13th–20th June 2023: Talk on *"Evidence and Chronology of Active Tectonics and Earthquake Destructions Using Speleothems in Central Himalayan Cave"* at the INQUA Roma 2023 Conference (online), organised by the National Research Council and the Italian Association for Quaternary Research, Sapienza University of Rome, Italy
- 1st July 2023: Talk on *"Evolution of Earth, Climate, and Life"* at the Interactive Science Outreach Programme for Graduate and Post Graduate Students, organised by Vigyan Shaala International, Delhi, India
- 10th–14th October 2023: Talk on *"Unveiling Earth's History: A Journey Through Rocks"* at the Science Outreach Programme and Outdoor Exploration of Flora, Fauna and Geology, organised by Kashmir University, Srinagar and Resonance, the Indian Academy of Science, Bengaluru
- 10th–12th December 2023: Talk on *"Geo-Detectives: Solving Earth's Mysteries"* at the Science Outreach Programme, organised by School Chandan, Laxmeshwar, Karnataka
- 23rd February 2024: Talk on *"Geosciences: Exploring Entangled Mysteries of the Earth"* at the Hindi Rajbhasha Celebration event, organised by JNCASR

GSU

- 9th March 2024: Guest Talk on *"Understanding Region, Climate and Culture: A Geological Point of View of the Indian Subcontinent"* at Christ University, Delhi–NCR
- 18th March 2024: Talk on *"The Monsoon Melodies: Nature's Symphony of Wind and Rain"* at the Dhwani Talk Symposium, organised by JNCASR

Unit Members

Research Associate III	**Dr. Jaishri Sanwal Bhatt**

Unit at a Glance

Total Publications

2 Peer reviewed articles indexed in Web of Science/Scopus.

INTERNATIONAL CENTRE FOR MATERIALS SCIENCE

The International Centre for Materials Science (ICMS) is the first international Centre devoted to high-impact and interdisciplinary scientific research, education, and extension activities in Materials Science. Established in the confines of a scientific cum educational institution, the Centre was envisaged by the Department of Science and Technology (DST), Government of India. The plans to establish the Centre materialised in 2007, with JNCASR taking the lead and necessary steps for its establishment. The Centre was inaugurated and dedicated to the nation on 3rd December 2008 by the then Hon'ble Prime Minister of India, Dr. Manmohan Singh. An important and unique activity of ICMS is supporting research and international exchange programmes. ICMS is a constituent of the School of Advanced Materials (SAMat), JNCASR.

Research Areas

- Integrated terahertz photonics
- Terahertz-induced phase transition
- Topological light–matter interactions
- Epitaxial growth of semiconductors
- Solid state chemistry
- Experimental soft condensed matter physics
- Meta-photonics
- High-energy resolution electron energy loss spectroscopy (HREELS)
- Ultrafast terahertz spectroscopy and photonics (UTSP)
- Aberration-corrected high-resolution transmission electron microscopy
- Ultrafast photonics
- Sensing and communication

Research Highlights

- Potential of NbO_2 as a highly stable ultrafast anode material for Li- and Na-ion batteries was explored.
- Well-anchored, low platinum-containing Vulcan carbon catalyst with zinc oxide sacrificial template for acidic hydrogen evolution reaction was synthesised.
- Image simulations were conducted through atomic resolution transmission electron microscopy by considering the atom as an electrostatic interferometer and developing direct methods for phase retrieval in HRTEM imaging
- Hidden order in dense liquids and glasses using multi-point correlation functions was uncovered.
- A new class of non-cytotoxic and robust aliphatic polycarbonate was developed.
- Non-resonant exciton–plasmon interaction in metal–chalcogenide (Cu_xS)/perovskite ($CsPbBr_3$)-based colloidal heterostructure was demonstrated.
- A novel driving force towards magnetic stress-driven metal-insulator transition in strongly correlated antiferromagnetic CrN was discovered.
- A new high-capacity multi-redox NASICON- $Na_{1.5}V_{0.5}Nb_{1.5}(PO_4)_3$ anode Na-ion battery was reported.
- Three new molybdenum chloride double perovskites were structurally characterised, with dimensionality controlled for optical and magnetic properties

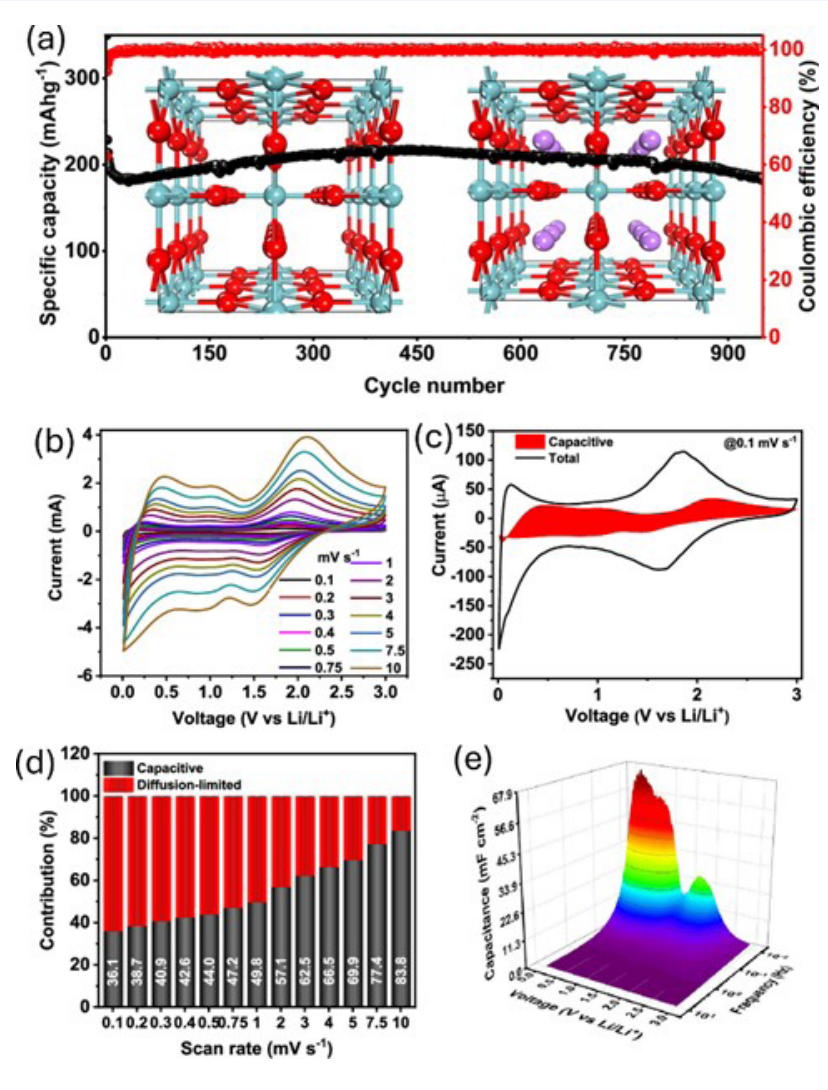
ICMS

RESEARCH ACTIVITIES AND ACHIEVEMENTS OF 2023–24

Bharat Ratna Prof. C. N. R. Rao *D.Sc., F.R.S., Hon. F.R.S.C.*

Linus Pauling Research Professor; Honorary President, JNCASR; and Director, ICMS

Li-ion batteries (LIBs) and Na-ion batteries (SIBs) are at the forefront of research and have significantly contributed to various applications ranging from portable electronics to automobiles. The electrochemical energy storage devices demand active anode materials with high energy density, fast-charging capabilities, and long cycling stability for realising next-generation LIBs and SIBs. We reported a simple synthetic strategy to obtain NbO_2 and its studied applications in LIBs and SIBs. For lithium batteries, NbO_2 exhibited a specific capacity of 344 mAh g^{-1} at 100 mA g^{-1} and remarkable stability over 1,000 cycles, with 92.0% capacity retention. Additionally, it showed a unique fast charging capability, with 30 seconds to reach a specific capacity of 83 mAh g^{-1}. For sodium batteries NbO_2 exhibited a specific capacity of 244 mAh g^{-1} at 50 mA g^{-1} with 70% capacity retention up to 500 cycles. Furthermore, detailed density functional theory reveals that various factors like bulk and surface charging processes, lower ion diffusion energy barriers, and superior electronic conductivity of NbO_2 are responsible for the observed battery performances.



(a) Crystal structures of delithiated NbO_2 and lithiated NbO_2. (b) CV curves at various scan rates (c) Capacitive contribution to total current at 0.1 mV s^{-1} scan rate, (d) Variation of capacitive and diffusion-limited contribution with respect to scan rate, and (e) 3D Bode plot of C' vs. frequency vs. voltage of the NbO_2 anode for LIB.

Reference: *ACS Appl. Mater. Interfaces.* 15: 45868–45875, 2023.
doi: 10.1021/acsami.3c08694

Prof. Eswaramoorthy Muthusamy

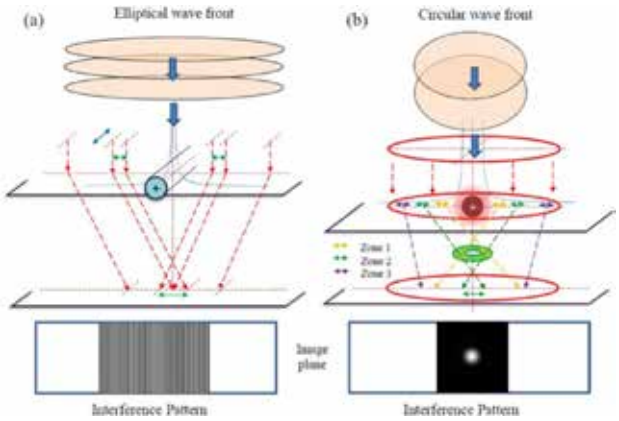
Associate Director, ICMS; and Dean, Academic Affairs

Please refer to pg. 65 for research activities

ICMS

Prof. Ranjan Datta
Professor, ICMS

We introduced an alternative approach to image simulation in high-resolution transmission electron microscopy (HRTEM) after a comparative analysis of the existing image simulation methods. Based on considering the atom center as an electrostatic interferometer, this method is similar to the conventional off-axis electron bi-prism within a few nanometers of focus variation. Our method was able to predict the absolute intensity of atoms with atomic numbers in the correct order, unlike the other methods where only relative intensity between atoms could be compared. We also found that the image intensity of the simulated observations was in close agreement with the experimental images of Mo and B atoms recorded under the optimum combination of third-order spherical aberration C_s = -35 µm and defocus Δf = 1, 4, and 8 nm.



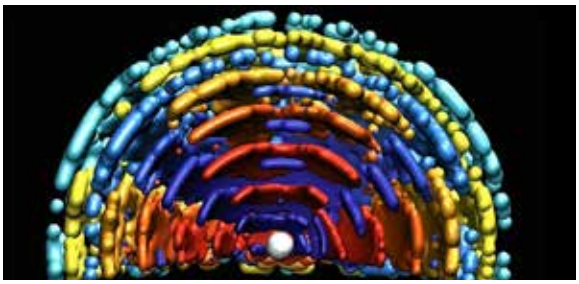
The interference pattern due to (a) unidirectional bi-prism and (b) atom as charge center

Reference: *J. Phys. Commun.* 5(8): 085004. 2021.
doi: 10.1088/2399-6528/ac1839

Prof. Rajesh Ganapathy *F.A.Sc.*
Professor, ICMS

Our group has been involved in multiple research themes in the past year. These include uncovering the hidden structural order in dense liquids and glasses, developing ways to tune single-particle heat engines' performance, and elucidating their operation in viscoelastic baths.

The conventional wisdom is that liquids are completely disordered and lack nontrivial structure beyond nearest-neighbour distances. Recent observations have upended this view and demonstrated that the microstructure in liquids is surprisingly rich and plays a critical role in numerous physical, biological, and industrial processes. However, approaches to uncover this structure are either system-specific or yield results that are not physically intuitive. Through single-particle resolved 3-dimensional confocal microscope imaging and the use of a recently introduced 4-point correlation function, we showed that bidisperse colloidal liquids have a highly nontrivial structure comprising alternating layers with icosahedral and dodecahedral order, which extends well beyond nearest-neighbour distances and grows with supercooling. By quantifying the system's dynamics at the particle level, we established that it is this intermediate range order, and not the short-range order, which has a one-to-one correlation with dynamical heterogeneities, a property directly related to the relaxation dynamics of glassy liquids. Our experimental findings provide a direct and much sought-after link between the structure and dynamics of liquids and pave the way for probing the consequences of this intermediate-range order in other liquid state processes.



Alternating icosahedral and dodecahedral order extending to the intermediate range in a binary colloidal liquid.

Reference: *Proc. Natl. Acad. Sci. U.S.A.* 120: e2300923120, 2023.
doi: 10.1073/pnas.2300923120

ICMS

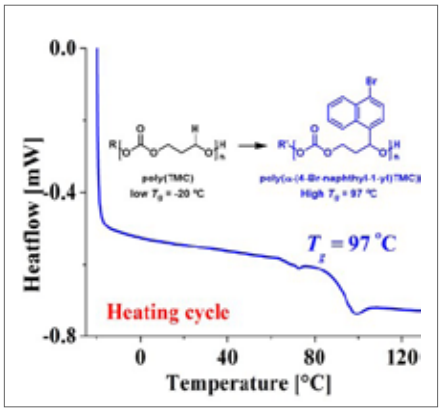
Major Talks During 2023–24:

- April 2023: Physics colloquium talk on *"Uncovering the hidden order in dense liquids and glasses"* at the Harish-Chandra Research Institute, Allahabad
- August 2023: Talk on *"Cell shape governs dynamics in confluent monolayers of synthetic cell mimics"* at the Soft and Living Matter: From Fundamental Concepts to New Material Design workshop, organised by the International Centre for Theoretical Studies, Bengaluru
- August 2023: Talk on *"Intermediate-range order governs dynamics in dense colloidal liquids"* at the 9th IDMRCS Meeting, held at Chiba, Japan
- August 2023: Talk on *"Cell shape governs dynamics in confluent monolayers of synthetic cell mimics"*, at the Statphys28 conference, held at Tokyo, Japan
- September 2023: Talk on *"Geometric constraints structure and glassy dynamics"* at the Frontiers in the Physics of Soft and Biological Matter conference, organised by the Raman Research Institute, Bengaluru
- September 2023: Keynote talk on *"Melting and shear-melting on curved surfaces"* at the International Soft Matter Conference, held at Osaka, Japan
- October 2023: Talk on *"Cell Shape Governs Dynamics in Confluent Monolayers of Synthetic Cell Mimics"* at the Active Matter in Complex Environments conference, organised by the International Centre for Theoretical Studies, Bengaluru
- December 2023: Talk on *"Putting a spin on active matter"* at the CompFlu conference, organised by IIT Madras, Chennai

Prof. Sridhar Rajaram

Professor, ICMS

Aromatic polycarbonates are a class of widely used plastics. Upon degradation in the environment, they release bisphenol A, an endocrine disruptor. Due to this reason, there has been a push to replace aromatic polycarbonates with more benign alternatives. In this context, we have been working on developing aliphatic polycarbonates as robust alternatives. Aliphatic polycarbonates can be prepared with good control over molar mass and dispersity by ring opening polymerisation of cyclic carbonates. Despite this advantage, aliphatic polycarbonates have not found widespread application because of their poor thermal and mechanical properties. We have developed a new class of aliphatic polycarbonates with a pendant aromatic group. By varying the pendant group, we have shown that the thermal properties can be easily tuned. Based on this approach, we developed polycarbonates with glass temperatures of around 100°C. We have shown that these polymers degrade into non-cytotoxic products.



Attaching a pendant aromatic group to poly (TMC) can enhance the glass transition temperature (T_g)

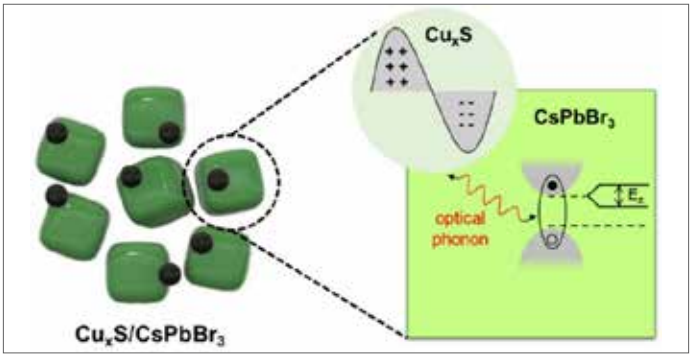
Reference: *J. Polym. Sci.* 1, 2024. doi:10.1002/pol.20230829

Prof. Ranjani Viswanatha *SERB-POWER Fellow*

Professor, ICMS

Heterostructures often leverage exciton–plasmon coupling between 2 materials to enhance various optical properties, with resonant energy coupling being a key requirement. However, recent studies have demonstrated that non-resonant exciton–plasmon interaction can occur within a single semiconductor plasmonic nanomaterial, even when there is no energy overlap between plasmonic and excitonic absorptions. We designed a colloidal heterostructure consisting of plasmonic Cu_xS and excitonic $CsPbBr_3$, with no spectral overlap, to investigate

non-resonant interaction between the 2 distinct materials. This heterostructure exhibits unique structural and optical characteristics, including a strained interface between its components, higher Urbach energy compared to perovskite, and photoluminescence quenching, indicating potential interaction. Additionally, its magnetic circular dichroism properties reveal clear evidence of strong nonresonant exciton–plasmon interaction. This is the first demonstration of such interaction, potentially opening new avenues in plasmontronics.



Colloidal heterostructure composed of plasmonic Cu_xS and excitonic $CsPbBr_3$ without any spectral overlap.
Reference: *J. Phys. Chem. C.* 127: 15353–15362, 2023.
doi: 10.1021/acs.jpcc.3c03331

Major Talks During 2023–24:

- 27th April 2023: Invited talk on *"Understanding mechanism of Mn emission in perovskite halides using Raman spectroscopy and magnetic circular dichroism"*, organised by Dr. Ajay Soni, IIT Mandi
- 5th–8th July 2023: Invited talk on *"Study of Magneto-optical Effects for Nanophotonic Applications"* at the Biennial International Conference on Photonics organised in 2023 by IISc, Bengaluru. Was also a panel member for the *"Discussion on Women in Optics"* at the conference
- 4th November 2023: Lecture on *"Size: A Strategic Asset in the Pursuit of Revolutionizing the World of Materials"*, as part of the Dasara Lecture Series, organised by Jawaharlal Nehru Planetarium, Bengaluru
- 8th November 2023: Talk on *"The Discovery and Synthesis of Quantum Dots"* as part of the Nobel Lecture Series Webinars, organised by the Karnataka Science and Technology Academy
- 21st November 2023: Talk on *"Mn-doping in Quantum Dots, Symposium"* at the Colloidal Quantum Dots: Celebration of Nobel Prize Chemistry 2023 event organised by the Institute of Chemical Technology-Mumbai-IOC Bhubaneswar
- 29th November–2nd December 2023: Talk on *"Exploring Spin-Valley Physics in Two-Dimensional Ruddlesden-Popper Phase Perovskites"* at the Indo-Korea Meeting on Quantum Materials conference, jointly organised by Academy-APCTP-IACS-JNCASR
- 4th–6th December 2023: Talk on *"Quantum Dots: Revolutionizing the World of Materials"* at the International Winter School, held at JNCASR
- 11th December 2023: Talk on *"Quantum Dots: Revolutionizing the World of Materials"* as part of the Nobel Lecture Series, organised by the Visvesvaraya Industrial and Technological Museum
- 15th–17th December 2023: Talk on *"Mechanism of Mn Emission in Perovskite Halides"* at the ATOS Materials in Focus conference, organised by IISER Mohali
- 22nd–23rd December 2023: Talk on *"Spin Physics in Metal Halide Perovskites"* at the HyPe-2023 conference, organised by IACS Kolkata
- 19th–21st January 2024: Invited talk on *"Study of Magneto-optical Effects for Nanophotonic Applications"* at the Frontiers Symposium in Chemistry (FS-CHM), organised by IISER TVM
- 15th February 2024: Invited talk on *"Discovery and Synthesis of Quantum Dots"* at the Nobel Prize in Chemistry 2023 Seminar, organised by Sarvajanik Education Society (SES), Surat
- 12th–14th March 2024: Talk on *"XAFS spectroscopy as a tool to study the electronic structure of nanomaterials"* at the India@DESY Users Workshop, organised by JNCASR
- 14th March 2024: Panel Discussion on *"Quantum Materials revolutionizing the world of materials"* as part of Topics of Interest in Quantum Materials, IOP Webinar
- 26th–28th March 2024: Invited talk on *"Quantum Dots: Revolutionizing the World of Materials"* at the 2-Day Hands-on Workshop on Photoluminescence and its Application, organised by Ramaiah University

ICMS

Prof. Bivas Saha

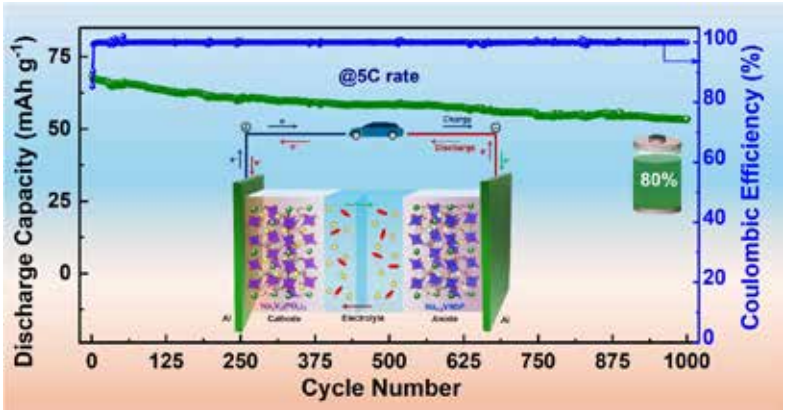
Associate Professor, ICMS and CPMU; and Warden and Student Counsellor

Please refer to pg. 68 for research activities

Prof. Premkumar Senguttuvan

Associate Professor, ICMS and NCU; and Head, CompLab

Sodium superionic conductor or NASICON-type materials have gained momentum as Li- and Na-ion cathodes and solid-state electrolytes. However, their ability as anodes has not been explored due to their lower capacities and higher intercalation voltages responsible for reducing their overall energy densities as Li- and Na-ion batteries (LIBs and SIBs).



Cycling stability of NASICON-$Na_3V_2(PO_4)_3$||NASICON-$Na_{1.5}V_{0.5}Nb_{1.5}(PO_4)_3$ Na-ion battery.

Reference: *Adv. Energy Mater.* 14: 2304091, 2024.
doi: 10.1002/aenm.202304091

Our team developed a new multi-redox NASICON-$Na_{1.5}V_{0.5}Nb_{1.5}(PO_4)_3$ anode, which exhibits lower insertion voltage (1.4 V vs. Na^+/Na^0) through $Nb^{5+}/Nb^{4+}/Nb^{3+}$ and V^{3+}/V^{2+} redox activities with reversible capacities of ≈140 mAh g^{-1}. The multi-redox anode displays stellar cycling (89% capacity retention at 5C after 500 cycles) and rate performances (105 mAh g^{-1} at 5C). A complete Na-ion cell based on NASICON-$Na_3V_2(PO_4)_3$ cathode and NASICON-$Na_{1.5}V_{0.5}Nb_{1.5}(PO_4)_3$ anode has been built, which renders remarkable energy density of 98 Wh kg^{-1} and retains 80% of its capacity at 5C rate over 1,000 cycles. Our research highlighted the importance of chemical tuning to enhance the performance of NASICON materials.

Major Talks During 2023–24:

- 17th February 2024: Talk on *"Tailoring, High-Capacity Phosphate Cathodes"* at the One Day Energy Discussion event organised by Prof. Satish Ogale, RISE, TCG-CREST, Kolkata
- 22nd March 2024: Talk on *"(Local)structure-Na-ion (de)intercalation correlation in NASICON Frameworks using Synchrotron XRD and XAS studies"* at the Development on Battery Materials Characterization Seminar, organised by Prof. Sagar Mitra, IIT-Bombay

Dr. Abhishek Kumar

Assistant Professor, ICMS and NCU

Major Talks During 2023–24:

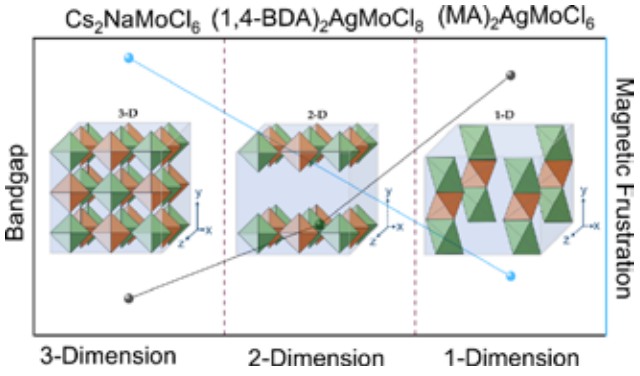
- 6th November 2023: Talk on *"Quantum properties of light and matter for 6G communication"* at the 4-day FDP on Nano Composites for Naval Engineering Symposium, organised by Cambridge Institute of Technology, Bengaluru
- 7th January 2024: Talk on *"Unravelling topological phase of light and matter"* as part of the IISER Kolkata Optica student chapter seminar, organised by IISER Kolkata

- 19th April 2024: Talk on *"Photonic Integrated Circuits: Platform for high-speed on-chip and quantum communication"* at the Future of Quantum Computing and Communication in-line with National Quantum Mission India seminar organised by GIER Odisha
- 20th April 2024: Talk on *"Topological phase of light and matter from physics to application"* as part of Department of Physics Colloquium, at IIT Bhubaneswar

Dr. Pratap Vishnoi

Assistant Professor, ICMS and NCU

Halide double perovskites are a promising class of semiconducting materials complete applications in solar cells and other optoelectronic devices. Recently, there has been a surge of interest in these materials to study phenomena beyond optoelectronics, especially magnetism. We reported 3 new Mo^{3+} ($4d^3$) based chloride double perovskites: a 3D rock-salt ordered $Cs_2NaMoCl_6$, a 1D chain $(MA)_2AgMoCl_6$ and a Dion–Jacobson type 2D layered $(1,4\text{-BDA})_2AgMoCl_8$ (MA = methylammonium; 1,4-BDA = 1,4-butanediammonium). Their structures and dimensionalities can be tuned by means of the A-cation. The measured bandgaps are relatively narrow (2.0–2.1 eV), which show a blueshift on reducing the dimensionality. At low temperatures, we observe antiferromagnetic coupling between the nearest-neighbour Mo^{3+} ions in all these systems. $Cs_2NaMoCl_6$ shows stronger coupling with a frustration index f of 5, which we attribute to the geometrically frustrating fcc lattice of Mo^{3+} ions. This work expands the scope of halide double perovskites beyond main group metals and optoelectronics, and we hope that it will lead to future developments in magnetic halide perovskites.



Three-dimensional, 2-dimensional, and 1-dimensional molybdenum chloride double perovskites.
Reference: *Chem. Sci.* 14: 3982–3989, 2023. doi: 10.1039/D3SC00132F

Major Talks During 2023–24:

- 6th–9th July 2023: Talk on *"Transition Metal Halide Perovskites: Halide Perovskites Beyond Optoelectronics"* at Kaleidoscope 2023, A Discussion Meeting in Chemistry, organised by IIT Bombay and TIFR Mumbai
- 30th–31st October 2023: Talk on *"Hybrid Halide Perovskites for Applications in Optoelectronics and Beyond"* at the Global trends in sustainable technology and its applications in applied sciences conference, organised by the Department of Applied Science, REVA University, Bengaluru
- 9th–11th December 2023: Talk on *"Hybrid Halide Perovskites of Main Group Metals and Beyond"* at the 3rd International Conference on Main-group Molecules to Materials (MMM III), organised by the Department of Chemistry, IIT Hyderabad and School of Chemical Sciences, University of Hyderabad
- 19th–21st February 2024: Talk on *"Recent Developments in Magnetic Halide Perovskites of Heavy Transition Metals"* at the 15th International Workshop on Advanced Materials (IWAM), organised by Ras Al Khamiah Centre for Advanced Materials (RAK CAM), UAE
- 7th–8th March 2024: Talk on *"A Molecular Approach to Halide Double Perovskite Materials"* at the Frontiers in Materials Sciences: Challenges and Opportunities workshop, organised by Department of Chemical Sciences, Tezpur University, Assam
- 29th–30th March 2024: Talk on *"Recent Developments in Magnetic Halide Perovskites of Heavy Transition Metals"* at the Advances in Chemical and Applied Sciences for Sustainable Development (ACASSD-2024) conference, organised by the Department of Chemistry, School of Sciences, JECRC University, Jaipur, Rajasthan

ICMS

Unit Members

Faculty	
Linus Pauling Research Professor; Honorary President, JNCASR; and Director, ICMS	**Bharat Ratna Prof. C. N. R. Rao**
Associate Director, ICMS	**Prof. Eswaramoorthy Muthusamy** (Professor, CPMU; and Dean, Academic Affairs)
Professor	**Prof. Ranjan Datta** **Prof. Rajesh Ganapathy** **Prof. Sridhar Rajaram** **Prof. Ranjani Viswanatha**
Associate Professors	**Prof. Bivas Saha** (jointly with CPMU; and Warden and Student Counsellor) **Prof. Premkumar Senguttuvan** (jointly with NCU; and Head, CompLab)
Assistant Professors	**Dr. Abhishek Kumar** (jointly with NCU) **Dr. Pratap Vishnoi** (jointly with NCU)

Associate Faculty

- **Prof. Sundaresan A.** (Professor and Chairperson, CPMU)
- **Prof. Kanishka Biswas** (Professor, NCU)
- **Prof. G. U. Kulkarni** (Professor, CPMU; and President, JNCASR)
- **Prof. Tapas Kumar Maji** (Professor, CPMU)
- **Prof. Shobhana Narasimhan** (Professor, TSU)
- **Prof. Chandrabhas Narayana** (Professor, CPMU; on deputation with RGCB)
- **Prof. K. S. Narayan** (Professor, CPMU)
- **Prof. Swapan K. Pati** (Professor, TSU)
- **Prof. Srikant Sastry** (Professor, TSU)
- **Prof. Balasubramanian S.** (Professor, CPMU)
- **Prof. Umesh V. Waghmare** (Professor, TSU; and Dean, Faculty Affairs)

Research Students	
P.G.D.M.S.: 5	**Swathy N., Ann Mary Antony, K. Palani Ganesh, Elizabeth Paul, Swagata Patra**

Administrative Staff	
Laboratory Assistant	**Mune Gowda H.**
Jr. Admin Assistant	**Ramya C.**

ICMS

Technical Staff	
Sr. Research Officer	**Dr. Jay Ghatak**
Technical Assistant (Inst)	**Mahesh J. I.**
Technical Assistant Trainees	**Ruther Tyson Lewis, Remya Radhakrishnan**

Research Staff (On Contract)

Project Associates-I
Khushi Chanllawala
Anushka Chakravorty
Souren Mondal

Project Scientist II
Sanjit Kumar Parida

R&D Assistants
Sakil Mallick
Alfred Rosario A.
Sneha Kobri
Dheeshna N. P.

Research Associates
Dr. M. S. Ramesh
Dr. Abhijit Chatterjee

Research Associate III
Dr. K. Manjunath

Senior Research Associate
Dr. Chithaiah P.

SERB-National Post-Doctoral Fellow
Dr. Nidhi Pandey

Unit at a Glance

Honours/Fellowships/Memberships Received

3 Faculty Members

Faculty Achievements

Bharat Ratna Prof. C. N. R. Rao

- Received the *'Chandan Ratna'* award from School Chandan, Laxmeshwar, Gadag, Karnataka on 3rd January 2024
- Received the *'Champions of Change Karnataka'* recognition in the field of Innovation and Science in the state of Karnataka by the Interactive Forum on Indian Economy (IFIE)
- Received M. P. Varghese Award (2023) instituted by Mar Athanasius College Association
- Conferred with an Honorary Doctorate from K. L. University, Vijayawada
- Received the Chemist of the Century Award in January 2024 from Indian Chemical Society

ICMS

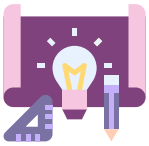
Prof. Rajesh Ganapathy
- Received Fellowship of the Indian Academy of Sciences

Prof. Ranjani Viswanatha
- Appointed as Executive Editorial Board member, *Nano Futures*

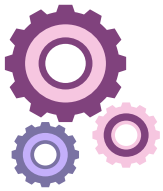
Total Publications

52 Peer-reviewed articles indexed in Web of Science/Scopus

Sponsored Projects



3 New Projects



7 Ongoing Projects

₹24.42 cr. Grant Amount Received During 2023–24

Students Graduated During 2023–24

P.G.D.M.S.: 5
Poornima Baburaj, Parisha, Ananya A., Ankit Kumar, Sakil Mallick

Students Admitted During 2023–24

P.G.D.M.S.: 5
Swathy N., Ann Mary Antony, K. Palani Ganesh, Elizabeth Paul, Swagata Patra

Current Student Strength

5

MOLECULAR BIOLOGY AND GENETICS UNIT

Research at the Molecular Biology and Genetics Unit (MBGU) leverages fundamental principles and advanced methodologies to deepen the understanding of biological processes and facilitate knowledge-based healthcare solutions. Focused initially on communicable and non-communicable diseases, the unit has expanded over the past 25 years into diverse fields, including cell biology, molecular biology, developmental genetics, and biochemistry. Further, it integrates insights from chemistry, physics, materials science, medical sciences, and engineering disciplines.

Due to JNCASR's expertise across various research areas, biologists can seamlessly traverse multiple scientific disciplines and establish a global network of world-class collaborations. Our work enhances biomedical research themes and has substantial translational emphasis. We explore several biochemical, molecular, and cell biology questions in viruses, protozoans, fungi, flies, and mice, alongside studies on human biology. The gamut of our research spans from understanding biomolecules to examining human development and disease. Our facilities, funding, and training programmes are designed to foster cross-disciplinary interactions.

With decades of experience, our faculty members hold advisory and leadership positions nationally and internationally. The unit's contributions to science are reflected in its members' numerous awards and honors, playing a role in JNCASR's impressive ranking in the Nature Index (normalised, 2019).

Research Areas

- RNA metabolism and homeostasis
- Mosquito-borne RNA viruses
- Stem cells and vascular biology
- Molecular, genetic, and developmental analysis of cardiovascular development
- Epigenetic regulation of gene expression, in the context of disease biology, diagnostics, and therapy
- Cell cycle regulation, genome evolution, and histone variants in fungal pathogens
- Cellular and molecular genetic basis of human neurological disorders
- HIV-1C transcriptional silencing
- Molecular mechanisms underlying malaria infection severity and drug resistance
- Regulation of immune cell differentiation and function
- Molecular mechanism of T cell tolerance in the thymus
- Chromatin dynamics and transcription regulation
- Metabolism in Plasmodium
- Molecular enzymology and protein structure-function analysis
- Autophagy and related pathways
- Neurodegeneration
- Unconventional protein secretion

MBGU

Research Highlights

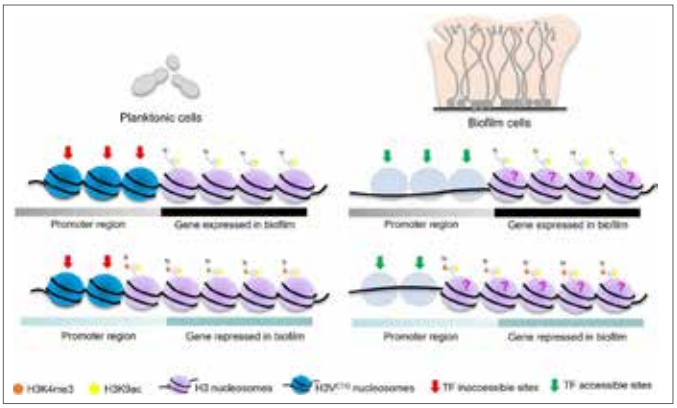
- Biased eviction of variant histone H3 nucleosomes trigger biofilm growth in *Candida albicans* was investigated.
- Enantioselectivity in the enzymatic dehydration of malate and tartrate was analysed using the enantiomer superposition model.
- An overview of molecular, transcriptional, and metabolic pathways associated with artemisinin resistance was provided.
- Microtubule-associated abnormalities due to *EFHC2* mutations were implicated in human generalised epilepsy syndrome.
- A set of recommendations for scientists working with human stem cells in basic research laboratories was presented by the International Society for Stem Cell Research.
- Oral administration of a specific p300/CBP lysine acetyltransferase activator (CSP-TTK21) that induces synaptic plasticity and repairs spinal cord injury was explored.
- It was demonstrated that ataxin-3-associated synaptic dysfunction in motor neurons of flies could be rescued by genetic intervention of the autophagy pathway.
- The emerging promoter-variant HIV-1 strains with latent viral reservoirs of higher stability and the significant challenges for HIV cure were explored.
- AIRE reliance on Z-DNA to flag gene targets for thymic T cell tolerisation was investigated.
- Host regulators of flavivirus replication in human and mosquito cells were studied using novel RNA-centric and protein-centric methods.

RESEARCH ACTIVITIES AND ACHIEVEMENTS OF 2023–24

Prof. Kaustuv Sanyal *F.A.A.M., F.N.A., F.A.Sc., F.N.A.Sc., J. C. Bose National Fellow*

Professor and Chairperson, MBGU

Candida albicans, an opportunistic pathogen can switch between yeast and hyphal forms. While alterations in gene expression patterns during planktonic to biofilm growth transitions in *C. albicans* have been studied, the underlying molecular mechanisms largely remain unexplored. We performed genome-wide profiling of $H3V^{CTG}$ nucleosomes in *C. albicans* planktonic cells and found them to be enriched at promoter regions. In planktonic cells, $H3V^{CTG}$-enriched regions are mostly devoid of the histone H3 post-translational modifications that allow active transcription, thus strengthening the role of $H3V^{CTG}$ as a negative regulator of biofilm formation. By combining genome-wide transcriptional alterations, nucleosome positioning (MNase-seq), and DNA accessibility (ATAC-seq) assays, we show a significant reduction in the total number of nucleosomes in biofilm cells as compared to planktonic cells, indicating a more open chromatin state during biofilm growth.



Schematic model illustrating biased eviction of $H3V^{CTG}$ nucleosomes leads to differential gene expression in biofilm cells.

Reference: *mBio.* 14: e02063–23, 2023.
doi: 10.1128/mbio.02063-23

MBGU

Events Organised:

- 14th October 2023: Seminar at the 2nd edition of Bengaluru Yeast Biology Club, co-organised with Dr. Sunil Laxman (inStem) and Dr. Saravanan Palani
- 2nd March 2024: Seminar at the 3rd edition of Bengaluru Yeast Biology Club, co-organised with Dr. Sunil Laxman (inStem) and Dr. Saravanan Palani

Major Talks During 2023–24:

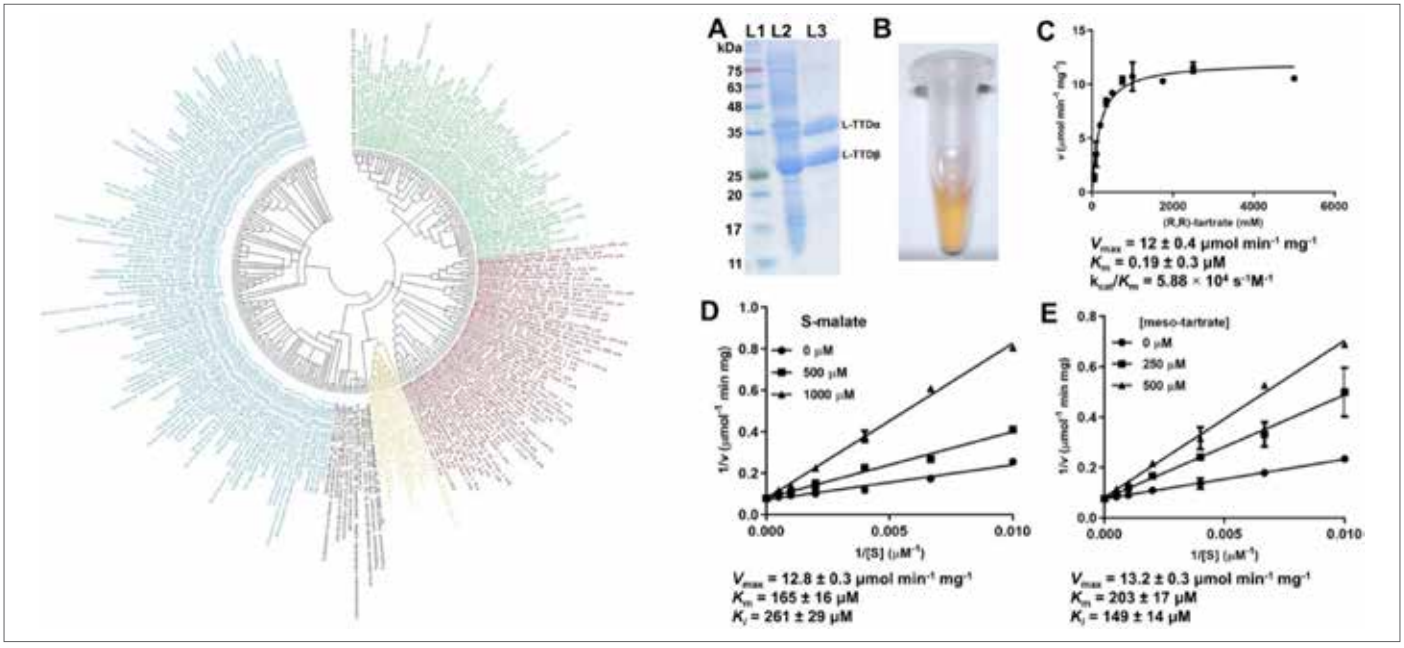
- 5th April 2023: Talk on *"Discovery of a novel mitotic progression factor in Candida albicans- a potential target to develop antifungals"* at the Cell Cycle and Cilia Meeting, organised by IISc, Bengaluru
- 18th April 2023: Seminar on *"Making CENs: The Centromere Code Hypothesis"* organised by Dr. Gunjan Mehta at the Department of Biological Sciences, IIT-Hyderabad
- 19th April 2023: Seminar on *"Making CENs: The Centromere Code Hypothesis"* organised by Dr. Rashna Bhandari at the Centre for DNA Fingerprinting and Diagnostics, Hyderabad
- 28th April 2023: Colloquium talk on *"The Centromere Code Hypothesis"* organised by the Department of Life Science and Biotechnology, Jadavpur University, Kolkata
- 11th July 2023: Seminar on *"The Centromere Code Hypothesis: Lessons Learned from Fungi"*, organised by Prof. Tatsuo Fukagawa, Osaka University, Japan
- 24th–26th July 2023: Talk on *"Understanding nonconventional heterochromatin"* at the 21st Transcription Assembly Meeting, held at IISER Bhopal, BITS-Pilani, Hyderabad
- 20th July 2023: Invited seminar on *"The Centromere Code Hypothesis: Lessons learned from fungi"*, organised by Dr. Mridula Nambiar at the Department of Biological Sciences, IISER-Pune
- 17th August 2023: Seminar on *"The Centromere Code Hypothesis"*, organised by Prof. Naweed Naqvi, Temasek Lifesciences Laboratory, Singapore
- 8th September 2023: Invited seminar on *"The Centromere Code Hypothesis"*, organised by Prof. Jeyaprakash Arunanandan, University of Edinburgh, UK
- 2nd January 2024: Invited Seminar on *"Aneuploidy and Drug Resistance in Candida auris"*, organised by Dr. Rupinder Kaur, Centre for DNA Fingerprinting and Diagnostics, Hyderabad
- 13th–15th January 2024: Talk on *"Heterochromatin ensures kinetochore integrity and 3D genome assembly in the fungal pathogen Cryptococcus neoformans"* as part of the 3rd Subhash Mukhopadhyay Symposium 2024, IISc, Bengaluru
- 29th January 2024: Invited seminar on *"The Centromere Code Hypothesis"*, organised by Prof. Rahul Siddharthan at the Institute of Mathematical Sciences
- 19th–23rd February 2024: Talk on *"Centromere-mediated genome innovations"* as part of the EMBO: Evolution and Diversity of the DNA damage response workshop organised at Lonavla, India
- 7th–9th March 2024: Talk on *"The centromere code hypothesis"* at the 2nd International Conference on Physiology to Pathology: Finding the Therapeutic Roadmap, held at Amity University, Kolkata

Prof. Hemalatha Balaram *F.A.Sc., F.N.A.*

Resident Honorary Professor, MBGU

Escherichia coli L-tartrate dehydratase (EcL-TTD) and *Methanocaldococcus jannaschii* fumarate hydratase (MjFH) share a high degree of sequence conservation and consequently adopt almost identical folds, with very similar disposition of active site functionalities. Yet their favoured substrates have opposite chiralities. MjFH shows activity on S-malate and (S, S)-tartrate while EcL-TTD is active on (R, R)-tartrate and R-malate. Classical models of enzyme-substrate binding do not explain this unique behaviour, but the enantiomer superposition model provides a possible explanation. Conformational plasticity in both the enzyme and the substrate tartrate merit

serious consideration. The puzzle of stereospecificity in these two well-conserved enzymes highlights the complexity of enzyme-substrate interactions and the enigmatic nature of chiral compounds even after 170 years since their discovery.



Phylogenetic tree (cladogram) of Class-I FH and L-TTD protein sequences (left panel). Purified subunits of L-TTD, colouration due to Fe-S cluster, and kinetic characterisation of EcL-TTD (panels A–E on the right)

Reference: *Protein Science.* 32 (10): e4779, 2023.
doi: 10.1002/pro.4779

Events Organised:

- 16th–17th October 2023: National Symposium on *"Molecular Diagnostics in the Era of Genomics and Proteomics"*, organised as a member of the Sun Pharma Science Foundation, University of Kashmir, Srinagar
- 20th–22nd February 2024: Workshop on *Basics of Biological Mass Spectrometry 2024* at the Banaras Hindu University, Varanasi
- 19th–22nd March 2024: Workshop on *Application of Mass Spectrometry in Biomedical Research,* organised in coordination with Dr. Rajdeep Das, GITAM University, Visakhapatnam, Andhra Pradesh

Major Talks During 2023–24:

- 1st June 2023: Invited lecture on *"Structure-function studies on the enzyme guanosine monophosphate (GMP) synthetase"* at the University of Jammu
- 23rd June 2023: Invited lecture on *"Dynamics and stability in guanosine monophosphate synthetase"* at the Institute of Life Sciences, Bhubhaneshwar
- 29th July 2023: Webinar on *"An unusually stable succinimide in a hyperthermostable GATase: investigations on formation, stability and function"*, as part of the Chemistry and Bio-chemistry around the Proteins event organised by the Mumbai-Pune Chapter of the Society of Biological Chemists, India
- 2nd–4th February 2024: Talk on *"An unusually stable succinimide in a hyperthermostable GATase: investigations on formation, stability and function"* at the Frontier Symposium in Biology, held at IISER-TVM, Thiruvananthapuram
- 20th–22nd February 2024: Six lectures on basics and applications of mass spectrometry in life sciences, as part of the *Basics of Biological Mass Spectrometry 2024* workshop held at Banaras Hindu University, Varanasi
- 9th March 2024: Invited lecture on *"Molecular basis of enzyme function" as part of the "STEM Powered by Women"* event organised by NASI, Bengaluru

MBGU

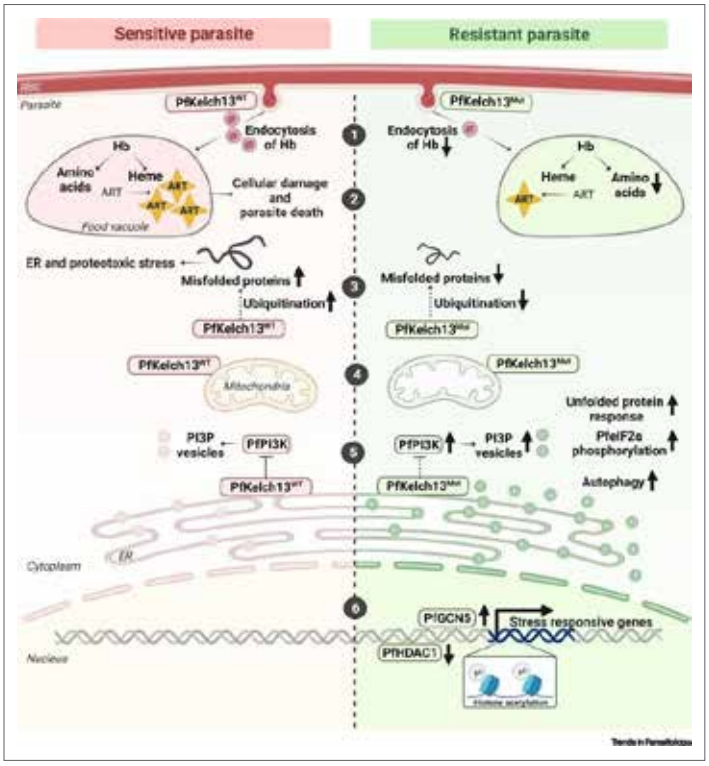
- 19th–22nd March 2024: Talk on *"Use of mass spectrometry for structural examination of a hyperthermostable GATase"* as part of the *"Application of Mass Spectrometry in Biomedical Research"* workshop, organised by GITAM University, Visakhapatnam, Andhra Pradesh

Prof. Namita Surolia *F.A.Sc., F.N.A.Sc.*

DBT Distinguished Biotechnology Research Professor, MBGU

Resistance of *Plasmodium falciparum* against artemisinin (ART) poses a major challenge when it comes to controlling malaria. Studies have shown that parasites with mutations in *PfKelch13*, the major marker for ART resistance, reduce haemoglobin endocytosis. They do so by inducing the unfolded protein response (UPR), elevating phosphatidylinositol-3-phosphate (PI3P) levels and stimulating autophagy. Diverse mechanisms, including reduced haemoglobin endocytosis and involvement of the ubiquitin-proteasome system, have also been suggested as plausible reasons for explaining *PfKelch13*-mediated ART resistance. Furthermore, there have also been reports of *PfKelch13*-independent resistance, which is an indicator of extensive complementation by reconfiguration in the parasite metabolome and transcriptome.

These findings suggest that there may not be a single "universal identifier" of ART resistance. Our review sheds light on the molecular, transcriptional, and metabolic pathways associated with ART resistance. It also encompasses the interplay between cellular heterogeneity, environmental stress, and ART sensitivity.



Schematic representation of the different molecular mechanisms proposed for artemisinin (ART) resistance in Plasmodium falciparum.

Reference: *Trends Parasitol.* 39 (12): P1060–1073, 2023. doi: 10.1016/j.pt.2023.09.011

Prof. Anuranjan Anand *F.A.Sc., F.N.A.Sc., F.N.A., J. C. Bose National Fellow*

Professor, MBGU

We have identified and characterised rare *EFHC2* gene variants identified among patients with genetic generalised epilepsy (GGE). We examined the *EFHC2* sequence among 550 families with GGE and found potentially pathogenic variants, p.Arg135Gln, p.Asn176Lys, p.Tyr196Phe, p.Arg246His, p.Lys386Glu, p.Arg486Cys, and p.Pro610Ser. All the identified variants were unique, except p.Arg135Gln, a recurrent allele among the patients examined. *EFHC2* is expressed in adult human brain regions. *EFHC2* localises to the nucleus and cytoplasm; it is present at the spindle poles and mid-body during cell division. *EFHC2* variants lead to microtubule-based cell division abnormalities in cultured mammalian cells. Interestingly, these abnormalities are rescued by *EFHC1*, a juvenile myoclonic epilepsy (JME) protein highly homologous to EFHC2; likewise, *EFHC2* rescues *EFHC1* mutations. Our experiments suggest

the role of *EFHC2* in JME and functional redundancy between EFHC1 and EFHC2, which may imply the clinical manifestation of the disorder.

Major Talks During 2023–24:

- 4th–6th December 2023: Talk on *"A mitotic perspective on a genetic generalised epilepsy syndrome"* at the Vienna International Symposium, organised by International Society of Stem Cell Research (ISSCR)
- 8th–9th March 2024: Talk on *"Centromeres, Cilia, and Epilepsy: Connecting the Threads"* as part of the Nerve-storming: From Molecules to Behaviours symposium organised by the Neuroscience Unit, JNCASR

Prof. Maneesha S. Inamdar *J. C. Bose National Fellow, F.A.Sc., F.N.A.*

Director (On Deputation) at DBT-inStem and Professor, MBGU

Our laboratory is unravelling the basic biology of stem cells with the goal of contributing to strategies to control and manipulate them effectively for applications in cell therapy and regenerative medicine. Our primary focus is on understanding conserved mechanisms of hematopoiesis and cardiovascular development. Specifically, we decipher fundamental principles of stem cell biology and understand their role in development and aging.

The laboratory culture of human stem cells aims to replicate a cellular condition as an *in vitro* substitute for a biological system. For the results and outputs from research to be accurate, meaningful, and durable, there are standards that ensure the reproducibility and reliability of the data produced. On that front, the multinational conglomerate of researchers have come together to discuss the International Society for Stem Cell Research or ISSCR standards for the use of human stem cells in basic research. Although such standards have been previously proposed for repositories and distribution centres, there is a lack of widely accepted best practices for laboratory research with human pluripotent and tissue stem cells. To fill that void, the ISSCR developed a set of recommendations, including reporting criteria, for scientists in basic research laboratories. These criteria were designed to be technically and financially feasible and, when implemented, enhance the reproducibility and rigor of stem cell research.

However, such standards are developed based on studies done with select stem cell lines, which do not represent the rich diversity of genomes across world populations. This limits the applicability of disease models to represented populations. Further, implications for studies on drug safety and efficacy are serious as they may have limited benefits or adverse effects on populations that are not tested. Hence, we also published a WorldViews commentary in *Nature* calling for equity and diversity in stem cell research standards, which was widely appreciated.

Reference: *Stem Cell Rep.* 9 (18): P1744–1752, 2023.
doi: 10.1038/d41586-023-03508-2

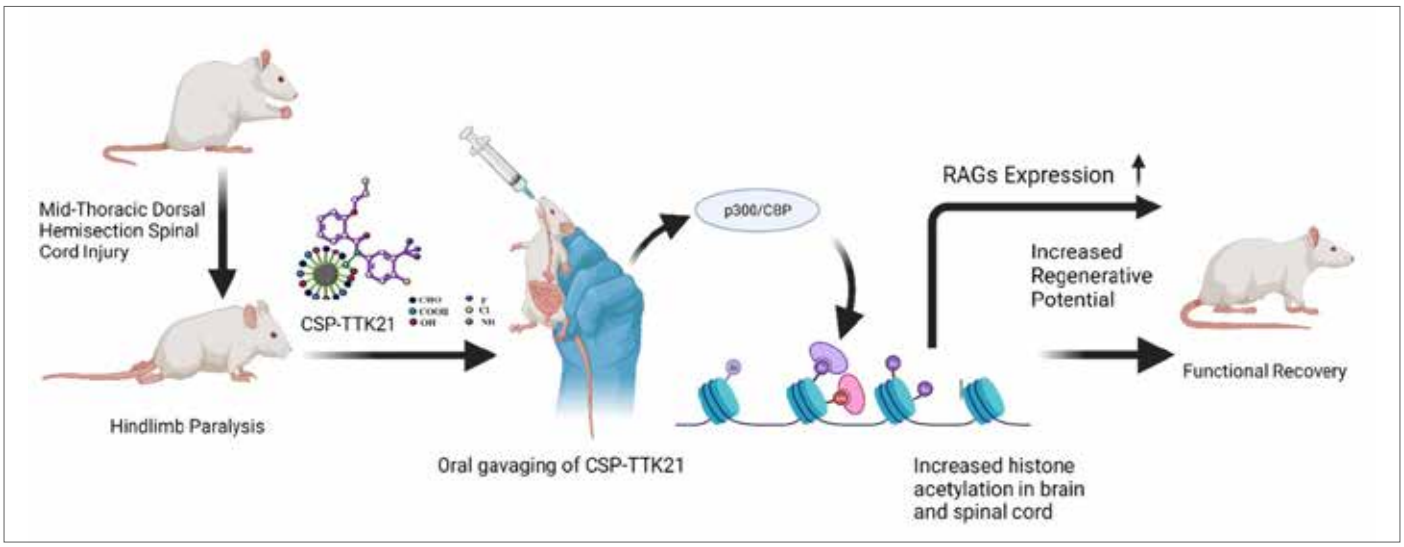
Prof. Tapas Kumar Kundu *F.N.A.Sc., F.A.Sc., F.N.A., F.A.M.S., and J. C. Bose National Fellow*

Professor, MBGU

When conjugated with a glucose-derived carbon nanosphere (CSP), the small-molecule activator TTK21 forms CSP-TTK21, which can efficiently cross the blood-brain barrier, promoting adult neurogenesis and supporting long-term spatial memory retention following intraperitoneal (IP) administration. We evaluated the efficacy of CSP-TTK21 when administered via oral gavage and compared the effects of oral administration of CSP and CSP-TTK21 to those of IP administration in wild-type mice. Oral administration of CSP-TTK21 effectively induced long-

term potentiation in the hippocampus, a response comparable to IP injection. CSP-TTK21 administered orally showed efficacy equivalent to IP administration in improving motor function and promoting histone acetylation dynamics.

Increased expression of regeneration-associated genes (RAGs) was noted, highlighting its potential for neural regeneration. No toxic or mutagenic effects were observed at a maximum tolerated dose of 1 g/kg in Sprague–Dawley (SD) rats via the oral route. Our findings demonstrated that CSP-TTK21 can be effectively administered orally, maintaining its efficacy in promoting neurogenesis and aiding recovery in spinal cord injury models. The oral route of CSP-TTK21 administration provides a non-invasive alternative to IP injection, with no observed toxicity at the tested dosage. Future research will focus on optimising dosage and administration protocols to further enhance the therapeutic benefits of CSP-TTK21 in various neurological conditions.



The proposed model for CSP-TTK21-mediated improvement in motor functions after spinal cord injury.

Reference: *ACS Chem. Neurosci.* 2024 (Online ahead of print).
doi: 10.1021/acschemneuro.4c00124

Events Organised:

- 9th June 2023: Seminar on *"Dysregulation of histone & noncoding RNA-mediated epigenetic regulatory mechanisms in etiology of neuropsychiatric disorders"* by speaker Dr. Aravind Kumar, Professor, Centre for Cellular and Molecular Biology (CCMB), Hyderabad
- 8th August 2023: Seminar on *"Epigenome alterations associated with aging: Implications for breast cancer susceptibility"* by speaker Dr. Parijat Senapati, Rajiv Gandhi Centre for Biotechnology, Thiruvananthapuram, India
- 14th–15th September 2023: Malda Workshop 2023 on *Homo Sapiens: Owner of the Best Brain*, held at Malda, India
- 16th–17th September 2023: Hands-on science workshop with 20 selected students from different schools participating in the Malda workshop, at the Children Science Innovation and Technology Centre, Malda, India
- 4th–6th November 2023: 8th meeting of the Asian Forum for Chromosome and Chromatin Biology

Major Talks During 2023–24:

- 22nd–24th April 2023: Talk on *"Rare epigenetic modification meets adipogenesis: Implication in anti-obesity therapy"* at the 16th Asian Epigenomics Meeting (AEM), Conference, organised by Ewha Womans University, POSCO International Center, POSTECH, Pohang, South Korea

MBGU

- 27th–30th June 2023: Talk on *"Chromatin meets autophagy: A tale of nonhistone chromatin protein mediated genome organization and transcription regulation"* at the Current trends in Molecular Biology conference organised by Adichunchanagiri University in Mandya
- 25th–27th July 2023: Talk on *"Regulation of RNA polymerase II-driven transcription by the human histone chaperone NPM1: Implications in diseases"* at the Transcription and Assembly meeting organised at IISER Bhopal
- 23rd–26th September 2023: Talk on *"Regulation of RNA polymerase II-driven transcription by the human histone chaperone NPM1: Implications in oral cancer"* at the 17th Asian Transcription Conference, held at Jiangwan Campus of Fudan University, China
- 27th September 2023: Invited Talk on *"Role of Lysine acetyltransferases p300/CBP in memory and neuro disorders: Implications in Therapy"* at Wuhan University, China
- 29th September 2023: Invited Talk on *"Chromatin meets autophagy: A tale of nonhistone chromatin protein mediated genome organization and transcription regulation"* at East China Normal University, China
- 7th–10th December 2023: Talk on *"Targeting lysine acetyltransferases p300/CBP for neuro disorders: Implications in therapeutics"* at the Asilomar Chromatin, Chromosomes and Epigenetics Conference, held at Asilomar in Pacific Grove, California, USA
- 12th December 2023: Invited talk on *"Chromatin Dynamics and Epigenetic Modification (acetylation) Critical for Neurogenesis and Memory: Implications in Therapy"* at Albert Einstein College of Medicine, New York, USA
- 13th January 2024: Talk on *"Epigenetics: Life Beyond your Genes, Implications in Health and Disease"*, celebrating "Anusandhan Diwas" at AIIMS Jodhpur
- 25th January 2024: Talk at CBSI Scientific Meeting, CSIR-IICB, Kolkata

Prof. Ravi Manjithaya

Professor, MBGU and Chairperson, NSU

Neuronal communication occurs through synaptic connections, and disruptions in these connections can lead to widespread neuronal network dysfunction and subsequent brain damage. Our investigation focused on a fruit fly model of Spinocerebellar Ataxia Type 3 (SCA3), revealing motor neuron dysfunction and associated behavioural anomalies, including impaired locomotion and reduced lifespan. SCA3, characterised by the accumulation of Ataxin-3 with polyglutamine repeats, results in nuclear or perinuclear aggregates, precipitating cellular dysfunction and a spectrum of pathologies ranging from gait ataxia to peripheral muscular atrophy. To understand the underlying mechanisms, we investigated the neuromuscular junctions (NMJs) formed by motor neurons. Our study unveiled compromised NMJ morphology and function alongside diminished proteostasis within these synapses. Autophagy, a crucial proteostasis pathway, involves the formation of autophagosomes around misfolded protein cargo and their fusion with lysosomes for degradation. Hence, we targeted overexpression of Atg8a, a core autophagy protein, in motor neurons, which resulted in partially ameliorated behavioural deficits and synaptic dysfunction. Thus, our genetically tractable model offers a valuable platform for advancing insights into synaptopathies, particularly polyglutamine repeat-associated neurodegenerative disorders and broader motor neuron pathologies.

Events Organised:

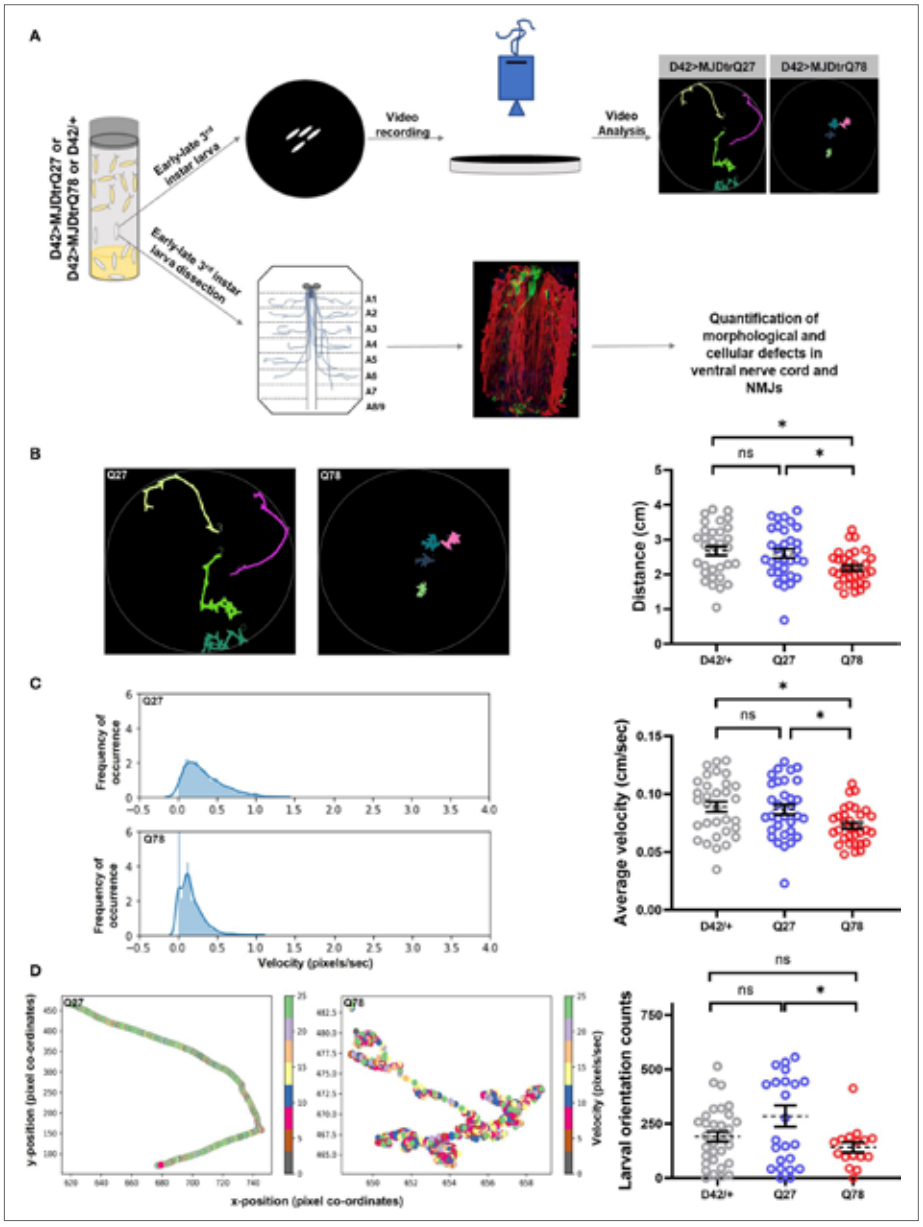
- 28th June 2023: Seminar on *"Potential role of Neuronal growth regulator 1 (NEGR1) adhesion molecules to dissect the sex-differences in the pathogenesis of neuropsychiatric disorder"* at JNCASR
- 10th November 2023: Seminar on *"Regulation of intracellular transport of kinesin-2 by inositol phosphorylation and metabolism"* at JNCASR

MBGU

- 21st November 2023: Seminar on *"Multipronged epigenetic maneuvering to impact host gene expression-an emerging strategy of M. tuberculosis for its success"* at JNCASR
- 19th February 2024: Seminar on *"Deciphering the Role of Non-coding RNAs in Epigenetic Regulation of Neurodegenerative and Psychiatric Disorder"* at JNCASR

Major Talk During 2023–24:

- Talk on *"Neuronal Determinants of Autophagy Flux"* at the *"Autophagy in Stress, Development and Disease: Molecular Mechanisms and Physiology"* conference, organised by Gordon Research Conference, Italy



(A) Approaches to characterise behavioural and cellular defects upon expression of mutant MJDtrQ78. (B) Path diagrams for Q27 and Q78 larvae plotted monitored in 1% charcoal agar plates and quantification of the total distance traversed by the driver-only control larvae (D42/+) vs. non-pathogenic Q27 and pathogenic Q78 larvae. (C) Representative images of the velocity distribution of non-pathogenic Q27 and pathogenic Q78 larvae and quantification of the average velocity of larvae. (D) A representative scatter plot showing instantaneous velocity per coordinate for non-pathogenic Q27 and pathogenic Q78 larvae.

Reference: *Front. Mol. Neurosci.* 15: 842772, 2022. doi: 10.3389/fnmol.2022.842772

Prof. Ranga Uday Kumar *F.N.A.*

Professor, MBGU

Our team identified 9 different promoter variant strains of HIV-1 subtype C (HIV-1C) emerging in the Indian population, with some variants being reported for the first time. Unlike previous studies in the same field, our work

focused on the evolving viral regulatory elements and not the coding sequences. We found that the emerging viral strains contained additional copies of the existing transcription factor binding sites (TFBS), including TCF-1α/LEF-1, RBEIII, AP-1, and NF-κB created by sequence duplication. Our analysis also revealed trends, but no significant associations, between any specific variant promoter and prognostic markers. Illumina sequencing of 4 co-infection clinical samples indicated the domination of one strain over the other and established a stable ratio with the second strain at the follow-up time points. As a single promoter regulates viral gene expression and constitutes the master regulatory circuit with Tat, our findings indicate that the acquisition of additional and variant copies of the TFBS can significantly impact viral latency and latent reservoir characteristics.

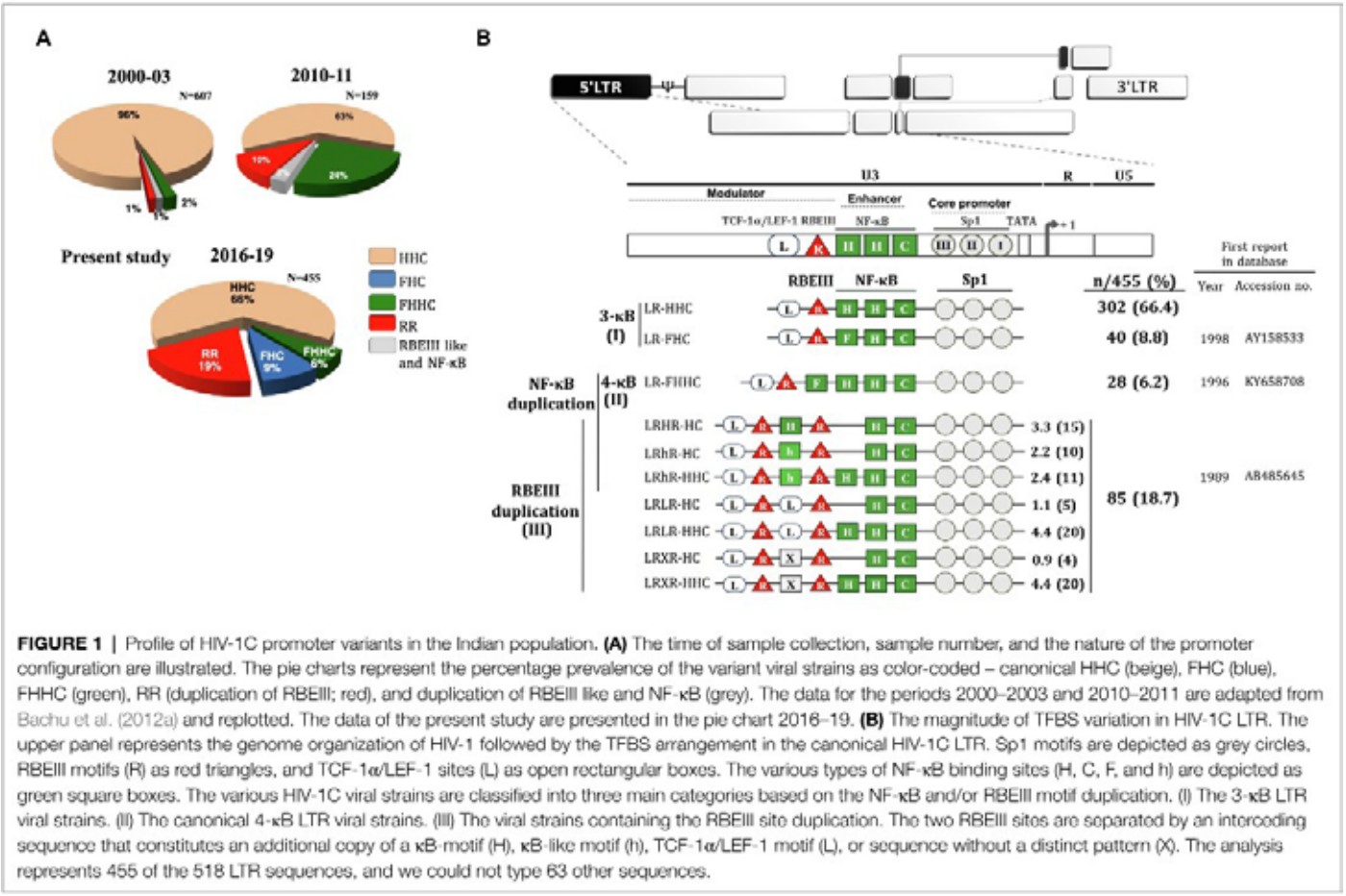


FIGURE 1 | Profile of HIV-1C promoter variants in the Indian population. **(A)** The time of sample collection, sample number, and the nature of the promoter configuration are illustrated. The pie charts represent the percentage prevalence of the variant viral strains as color-coded – canonical HHC (beige), FHC (blue), FHHC (green), RR (duplication of RBEIII; red), and duplication of RBEIII like and NF-κB (grey). The data for the periods 2000–2003 and 2010–2011 are adapted from Bachu et al. (2012a) and replotted. The data of the present study are presented in the pie chart 2016–19. **(B)** The magnitude of TFBS variation in HIV-1C LTR. The upper panel represents the genome organization of HIV-1 followed by the TFBS arrangement in the canonical HIV-1C LTR. Sp1 motifs are depicted as grey circles, RBEIII motifs (R) as red triangles, and TCF-1α/LEF-1 sites (L) as open rectangular boxes. The various types of NF-κB binding sites (H, C, F, and h) are depicted as green square boxes. The various HIV-1C viral strains are classified into three main categories based on the NF-κB and/or RBEIII motif duplication. (I) The 3-κB LTR viral strains. (II) The canonical 4-κB LTR viral strains. (III) The viral strains containing the RBEIII site duplication. The two RBEIII sites are separated by an intercoding sequence that constitutes an additional copy of a κB-motif (H), κB-like motif (h), TCF-1α/LEF-1 motif (L), or sequence without a distinct pattern (X). The analysis represents 455 of the 518 LTR sequences, and we could not type 63 other sequences.

The profile of HIV-1C promoter variants in the Indian population.
Reference: *Front. Microbiol.* 12: 779472, 2021. doi: 10.3389/fmicb.2021.779472

Event Organised:

- 14th July 2023: Seminar on *"SARS-CoV-2 Evolution, Pathogenesis, and Antivirals Development"* by speaker Prof. Siddappa Byrareddy, University of Nebraska Medical Center, held at JNCASR

Major Talks During 2023–24:

- 16th–18th May 2023: Talk on *"Cancer treatment wins a Nobel prize in Physiology or Medicine 2018"* as part of a science outreach programme organised by Himalayan Gram Vikas Samiti, Gangolihat and the C. N. R. Rao Education Foundation
- 21st July 2023: Talk on *"Sleep like HIV to win the world"* as part of the M.Sc. orientation programme 2023 at Nirma University, Ahmedabad
- 3rd–6th November 2023: Talk on *"The Symphony of the silent virus"* at the Guha Research Conference, organised by GRC-Swaraj Dweep, Havelock

MBGU

Dr. Varun Bhaskar
Assistant Professor, MBGU

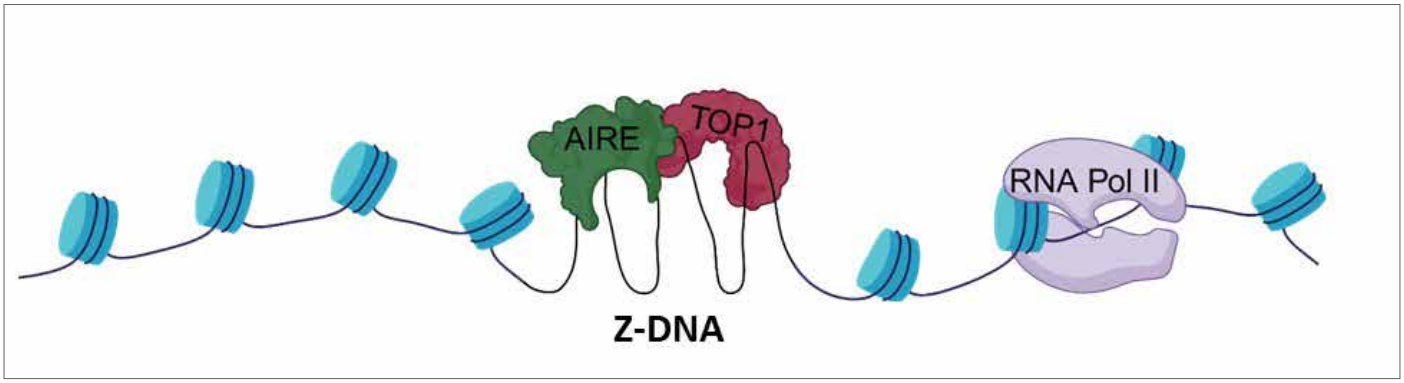
Our research focuses on the underpinning mechanisms and dynamics of RNA homeostasis in cells and their dysregulation in various disease conditions using single-molecule RNA imaging, sequencing, and structural approaches. The focus of the laboratory right now is studying the dysregulation of RNA homeostasis in ALS/FTD and certain subtypes of ataxia.

Major Talk During 2023–24:

- 8th–9th March 2024: Talk on *"Elucidating the combinatorial effects of C9ALS/FTD- associated disease factors on RNA metabolism"*, as part of the Nerve-storming: from Molecules to Behaviour symposium held at NSU, JNCASR

Dr. Kushagra Bansal
Faculty Fellow, MBGU

AIRE is a transcription factor that controls the expression of a battery of genes in medullary thymic epithelial cells (mTECs) to promote clonal deletion of self-reactive T cells. However, how AIRE identifies its gene targets remains largely unclear. In our study, Z-DNA was identified was as a key cis-regulatory element that guides AIRE to its target genes. Genome-wide mapping studies revealed that Z-DNA promotes the formation of double-stranded breaks as key requirement for AIRE-induced gene expression. The data revealed that Z-DNA anchors the AIRE-mediated transcriptional programme by enhancing double-stranded break generation and promoter poising. Our findings resolved long-standing questions on AIRE's choice of target genes.



Z-DNA guides AIRE to its gene targets.
Reference: *Nature* 628: 400–407, 2024. doi: 10.1038/s41586-024-07169-7

Events Organised:

- 27th April 2023: *FlowJo workshop,* co-organised with Prof. Udaykumar Ranga, Prof. Tapas Kumar Kundu (JNCASR), and Dr. Narendra Nala (BD Biosciences workshop team)
- 8th–11th May 2023: *Hands-on workshop on RNA-seq and data analysis,* co-organised with Prof. Anuranjan Anand (JNCASR), Tony Jose, and Dr. Rajasekhara Reddy (Clevergene Biocorp. Pvt. Ltd.)
- 16th–18th May 2023: *MS based proteomics data analysis workshop,* co-organised with Prof. Hemalatha Balaram, Prof. Tapas Kumar Kundu (JNCASR), and Chitralekha Sen (ThermoFisher Scientific)
- 3rd–5th July 2023: *Bio-imaging workshop,* co-organised with Prof. Ravi Manjithaya, Dr. Kushagra Bansal, and Suma B. S.
- 17th–18th July 2023: *5th BioGroup India Meeting*, co-organised with Prof. Ravi, Manjithaya, JNCASR

MBGU

- 24th January 2024: *BD Educational Tour workshop*, co-organised with Prof. Udaykumar Ranga, Prof. Tapas Kumar Kundu, and Dr. Narendra Nala, BD Biosciences workshop team

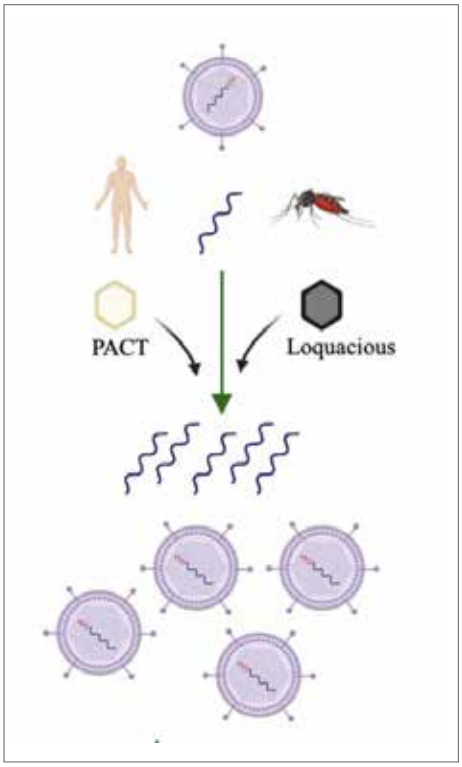
Major Talks During 2023–24:

- 3rd October 2023: Talk on *"T-cell development"* at St. Joseph's University, Bengaluru
- 18th–20th December 2023: Talk on *"Thymic development of T cell"* at the 92nd Annual Meeting of the Society of Biological Chemists, held at BITS-Pilani, Goa
- 29th–30th January 2024: Talk on *"Thymic development of T cells"* at the Neurobiology Symposium, held at NBRC, Manesar
- 28th February 2024: Talk on *"Thymic development of T cells"* at National Science Day Symposium, organised by MAHE-MIRM, Bengaluru

Dr. Shwetha Shivaprasad

SERB Ramanujan Fellow, MBGU

The dengue virus (DENV) is a single-stranded, positive-sense RNA virus that infects ~400 million people worldwide. Despite the disease affecting several lives, there is a lack of approved antivirals to treat dengue. Our laboratory established Protein Activator of Interferon-Induced Protein Kinase (PACT) as a key pro-viral factor for DENV infection in human liver epithelial cells. We propose that PACT modulates the endoplasmic reticulum stress response pathways in the cell to promote DENV infection. We performed a focused Clustered Regularly Interspaced Palindromic Repeats (CRISPR) library screen to discover the key host factors that are essential for DENV infection in human Huh7 cells and identified PACT as a novel pro-viral factor for DENV infection. We analysed global gene expression changes, which indicated that several ER-associated pro-viral genes such as *ERN1, DDIT3, HERPUD1,* and *EIF2AK3* were not upregulated in DENV-infected PACT knockout cells as compared to their expression in infected wildtype cells. These findings demonstrate a novel role for PACT in promoting DENV replication, possibly through modulating the expression of ER-associated pro-viral genes.



Event Organised:

- 16th–17th November 2023: Annual Faculty meeting and In-house symposium, MBGU, chaired by Prof. Kaustuv Sanyal, co-organised with Prof. Tapas Kumar Kundu and Dr. Kushagra Bansal

Major Talk During 2023–24:

- 19th March 2024: Talk and panel discussion on *"Crafting a Career in Science"* at the International Day of Women and Girls in Science event, organised by the Department of Life Science, Mount Carmel College, Bengaluru

Discovering novel regulators of Dengue virus infection across human and mosquito hosts.
Reference: *Viruses.* 16 (5): 725, 2024. doi: https://doi.org/10.3390/v16050725

MBGU

Unit Members

Faculty	
Professor and Chairperson	**Prof. Kaustuv Sanyal**
Resident Honorary Professor	**Prof. Hemalatha Balaram**
DBT Distinguished Biotechnology Research Professor	**Prof. Namita Surolia**
Professors	**Prof. Anuranjan Anand** **Prof. Maneesha S. Inamdar** (on deputation) **Prof. Tapas Kumar Kundu** **Prof. Ravi Manjithaya** (Chair, NSU) **Prof. Ranga Udaykumar**
Assistant Professor	**Dr. Varun Bhaskar**
Faculty Fellow	**Dr. Kushagra Bansal**
SERB Ramanujan Fellow	**Dr. Shwetha Shivaprasad**

Research Students	
Ph.D.: 32*	**Alice Sinha, Kamat Kajal Murli, Nivedita Pandey, Anusha Chandrashekarmath, Swarnima Mishra, Buch Hrimkar Bhargav, Shobith Suresh, Anushka Chakravorty, Cuckoo Teresa Jetto, Kumari Ruchika Ranjan, Aarti Pant, Prerana M., Amit Kumar (Mid-Year), Joshi Pooja Amrishkumar, Chinthapatla Sri Charani, Shree Krishna K., Pratiksha P. Bhat, Jaya Lakshmi P. R., Rohini Bhatt, Supriya Varsha Bhagat, Anchal Gupta, Nabanita Das, Nidhi Ray, Riya Manna, Oiendrila Das, Pavithra Umashankar, Simran Shabir, Manisha Sharma, Sukanya Sahoo, Sohini Bhattacharyya, Palash Sen, Parna Chakraborty**
Ph.D. through Int. Ph.D.: 20*	**Arpitha A. Suryavanshi, Chhavi Saini, Rashi Aggarwal, Kuladeep Das, Rohit Goyal, Srijana Dutta, Irine Maria Abraham, Akshaya C. Nambiar, Bhat Mallika Dattatray, Harshdeep Kaur, Pallawi Choubey, Vanshika Sood, Amrutha A. S., Dongre Prathamesh Rajesh, Ritoprova Sen, Aishwarya Prakash, Yashashwinee Rai, Arghakusum Das, Joyee Bhattacharya, Priyadarshini Ghosh**

*Students including those whose registrations were cancelled during 2023-24.

Administrative Staff	
Sr. Helper	**Rajeeva J.**
Helpers	**Mune Gowda N., Chandrashekara H. C., Lakkappa G., Raju B. N.**

Animal Facility	
Sr. Technical Officer	**Dr. Prakash R. G.**
Helpers	**Ambarisha G., Muniraju M.**

Bio-Imaging Facility

Technical Staff	
Technical Officer Gr II	**Suma B. S.**

MBGU

Technical Staff (On Contract)	
Technical Assistant Trainee	**Siddharth B. Patil**

Mass Spectrometry Facility

Technical Staff	
Technical Assistant (Inst)	**Mohan V.**

Technical Staff (On Contract)	
Lab Manager	**Bhuvana R.**
Project Technical Officer	**Kruthi H. T.**

Temporary Staff

Administrative Staff (On Contract)	
Administrative Assistant	**Sahana Ravi**

Technical Support	
Bioinformaticians	**Vishnu V. Ashok, Arufi Singh**
Laboratory Assistant	**Ganesh G. V.**
Laboratory Helper	**Sunil Kumar R.**

Teaching Staff (On Contract)	
Guest Instructor	**Dr. Amit Vij**
Guest Instructors for M.Sc. Interdisciplinary Biology course (for MBGU, NSU, and NCU)	**Dr. Megha Singhal, Dr. Divyashri Baraniya, Dr. Lavanaya Sivashanmugam, Dr. Varuna H. P.**
Guest Instructor for Int. Ph.D. and POBE programmes	**Dr. I. Christiana**

Research Staff (On Contract)	
DBT Research Associates	**Dr. Md. Hashim Reza, Dr. Mukesh Kumar Chaurasia**
ICMR-Research Associate	**Dr. Dileep Pullepu**
Junior Research Fellows	**Tulika Khargonkar, Aboli Srikant Varunjikar, Nivedita Pandey, Badal Singh Chauhan, Manjusri Anbarasu, Prajjval Mishra, Charanraj C. A., Tanya Pareek, Rishana Farin S., Resmi Ravi, Dr. Arpitha Suryavanshi, Joshi Aditya Pradeepbhai**
Project Assistants	**Nada R. S., Satya Santoshi**

MBGU

Research Staff (On Contract)	
Project Associates-I	**Anagha R., Agnita Roychowdhury, Krittika Dey, R. Vishnuvardh, Anusha C.**
R&D Assistants	**S. Kalpitha, Vidhi Agarwal, Anusa Ganguly, Deepika S., Sohini Bhattacharyya, Deepak S., Priyanka Panchal, Sai Krishna A. V. S., Tanvi Sharad, Divya S., Niyati Navaneeth**
Research Associates	**Dr. U. D. Kumaresan, Dr. Banishree Sahoo, Dr. Akash Kumar Singh, Dr. Aswathy Narayanan, Dr. Vijay Suresh Akhade, Dr. Pankaj Sharma, Dr. Siddharth Singh**
Research Associate (P)	**Polisetty V. S. Satya Dev**
Research Associate II	**Dr. Mamta Negi**
Research Associate III	**Dr. Sangeeta Dutta**
Senior Research Fellows	**Sannannagari Boya Vinay, Ankit Kumar Tamta**
SERB-National Post Doctoral Fellow	**Dr. Subha S.**
SERB-TARE	**Dr. Uttara Chakraborty**

Unit at a Glance

Honours/Fellowships/Memberships Received

5 Faculty Members **9** Students

Faculty Achievements

Prof. Kaustuv Sanyal

- Awarded GN Ramachandran Gold Medal 2022 by CSIR

Prof. Hemalatha Balaram

- Appointed as Chair of Science Education Programmes, Indian Academy of Sciences
- First woman President in 90 years of the existence of Society for Biological Chemists, India (SBC(I))
- Elected as a committee member of DST-FIST Life Sciences

Prof. Anuranjan Anand

- Appointed as member of the Public Education and Awareness Committee, American Society of Human Genetics (ASHG), Rockville, USA

Prof. Tapas Kumar Kundu

- Entrusted as the RC Chair of CSIR-IICB, by DG CSIR, for 3 years w.e.f. September 2023
- Invited to join as a Reviewing Editor of *eLife*

MBGU

Dr. Shwetha Shivaprasad

- Received the SERB Ramanujan Fellowship, Department of Science and Technology, India
- Received the DBT-Ramalingaswami Fellowship, Department of Biotechnology, India
- Received the DBT-India Alliance Wellcome Trust Early Career Fellowship, India, Department of Biotechnology, India

Student Achievements

Dr. Md. Hashim Reza (DBT-Research Associate III; research supervisor: Prof. Kaustuv Sanyal)

- Received the EMBO Scientific Exchange Grant, EMBO
- Received the EMBL CPP Fellowship EMBL Heidelberg

Dr. Banishree Sahoo (Research Associate; research supervisor: Prof. Kaustuv Sanyal)

- Received the WISE-PDF Fellowship, DST

Kajal Kamat (Ph.D. Student; research supervisor: Prof. Maneesha Inamdar)

- Selected for the ISSCR Travel Award by the International Society for Stem Cell Research (ISSCR) to attend its 2023 Annual Meeting

Amit Kumar (Ph.D. Student; research supervisor: Dr. Kushagra Bansal)

- Received the Best Poster and Travel Award in Global Immunology Summit 2024 (GIS-2024), THSTI, Faridabad

Prerana Muralidhara (Ph.D. Student, MBGU; Research Supervisor: Dr. Kushagra Bansal)

- Received a travel grant from SERB to present the research work at the meeting *"Gene Expression & Signalling in the Immune System"* held at Cold Spring Harbor Laboratory, New York from 16th–20th April 2024

Pallawi Choubey (Int. Ph.D. Student; research supervisor: Dr. Kushagra Bansal)

- Won Best Poster in JNCASR's In-House Symposium 2023, JNCASR
- Received the Best Poster Award in Global Immunology Summit 2024 (GIS-2024), THSTI, Faridabad

Kuladeep Das (Int. Ph.D. Student; research supervisor: Prof. Kaustuv Sanyal)

- Received the EMBO Scientific Exchange Grant, EMBO

Harshdeep Kaur (Int. Ph.D. Student; research supervisor: Dr. Kushagra Bansal)

- Won the Best Talk in JNCASR's In-House Symposium 2023, JNCASR

Priyesh Singh Parihar (Int. Ph.D. Student; research supervisor: Prof. Kaustuv Sanyal)

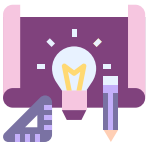
- Received the Best Participant Award at School in Chronobiology 2023 held at NEHU and organised by the Indian Society for Chronobiology

Total Publications

31 Peer-reviewed articles indexed in Web of Science/Scopus

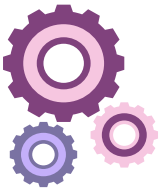
MBGU

Sponsored Projects



16 New Projects

₹2.87 cr. Grant Amount Received During 2023–24



24 Ongoing Projects

₹11.66 cr. Grant Amount Received During 2023–24

Students Graduated During 2023–24

Ph.D.: 5
Sreshtha Pal, Priya Brahma, Smitha A. S., Siddharth Singh, Akash Kumar Singh

M.S. (Int. Ph.D.): 5
Aman Sharma, Souradip Mukherjee, Ritoprova Sen, Deepam Bhattacharya, Vishal Rajesh Lolam

Student Admitted During 2023–24

Ph.D.: 7
Pavithra Umashankar, Simran Shabir, Manisha Sharma, Sukanya Sahoo, Sohini Bhattacharyya, Palash Sen, Parna Chakraborty

Current Student Strength

47*

*Students with valid registration as on 31st March 2024.

NEW CHEMISTRY UNIT

The New Chemistry Unit (NCU) was created by JNCASR as part of the 11th 5-year plan. Researchers at NCU work on interdisciplinary aspects of Chemical Science. The actively pursued areas are Chemical Biology, Chemical Science, and Materials Science, especially the chemistry of carbon nanostructures. The projects usually involve the development of new strategies for the synthesis of solid-state materials that address contemporary energy and environmental concerns. At NCU, a host of organic and inorganic multidimensional nanomaterials are synthesised with an aim to understand their electronic structure for their application in magnetic, optical, and electrical devices.

Renewable energy research, development of materials for thermoelectrics, photovoltaics, batteries, fuel cells, lasers, organic synthesis of polymers, supramolecules, and multi-functional metal-organic frames are some of the major research areas being investigated at NCU. Researchers also look into the synthesis of peptide/protein-based materials and programmable DNA-based materials for biomaterial and therapeutic applications. A wide range of advanced equipment has been curated for complete characterisation and analysis of the materials pursued in the laboratories.

Researchers at NCU often collaborate with various national and international research centres for the exchange of resources and knowledge. Further, the microscopic understanding of exotic phenomena is an area of interest for the theoretical group. At NCU, researchers have developed novel methods to study concepts such as quantum magnetism, charge transfer, electrical transport phenomena, new carbon systems, and cold atom phenomena. The unit also houses excellent facilities for computational and theoretical studies to complement experimental research.

Research Areas

- Thermoelectric materials
- Two-dimensional materials
- Silk-inspired and cyclic dipeptide (CDP)-based biomimetics and biomaterials
- Organic phosphors
- Molecular architectonics
- Study of electronic and optical properties
- Understanding conformational properties
- Carbon dioxide reduction
- Supramolecular chemistry and organic materials
- Circularly polarised luminescent (CPL) materials
- Water splitting/H_2 generation
- Semiconductor nanocrystals, nanoplasmonics, and their heterostructures
- Halide-based perovskites
- Solid-state chemistry

NCU

Research Areas

- Diagnostic Therapy (Theranostics)
- Atomic Layer Deposition and Pulsed Laser Deposition
- Topological Insulators
- Chemical Biology, Medicinal Chemistry, Drug Discovery, Biomaterials, Antimicrobial Resistance
- Synthesis of Novel Materials
- Understanding the $n \rightarrow \pi^*$ Interaction
- Fuel Cell
- Solid-state Chemistry of Metal Chalcogenides/Chalcohalides
- Catalysis

Research Highlights

- Controlled supramolecular polymerisation was realised through bioinspired, liquid–liquid phase separation of monomers.
- An innovative small molecular adjuvant that enhanced antibiotic effectiveness against resistant gram-negative bacteria was developed.
- A new strategy to optimise disorder rooted in the thermodynamic phase diagram and maximise zT in Ag vacant $Ag_{1-x}SbTe_2$ was presented.
- Cross-talk between ferroptosis and Alzheimer's disease was established, and therapeutic molecules to synergistically tackle them were identified.
- Two metalated porous organic polymers, Zn-POP and Co-POP, for producing syngas from gaseous CO_2 were presented.
- 2D nanosheets of layered double perovskites were synthesised and their photostable bright orange emission and photoluminescence blinking phenomenon were investigated.
- The effect of acylhydrazides as peptoid submonomers and C-terminus capping agents was explored.
- A new high-capacity multi-redox NASICON- $Na_{1.5}V_{0.5}Nb_{1.5}(PO_4)_3$ anode Na-ion batteries was reported.
- Structural characteristics of 3 new molybdenum chloride double perovskites with dimensionality controlled by optical and magnetic properties were investigated.
- Janus PNAs were shown to form supramolecular polyplexes with complementary DNA/RNA ranging from double duplexes, triplex of duplexes to triple duplexes and tetra-duplex of tetraplex.

RESEARCH ACTIVITIES AND ACHIEVEMENTS OF 2023–24

Prof. Subi Jacob George *F.A.Sc., F.N.A.Sc.*

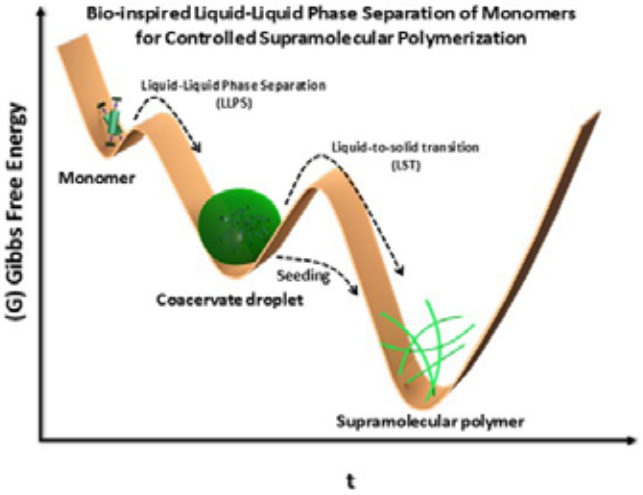
Professor and Chairperson, NCU

Dynamic supramolecular assemblies, driven by non-covalent interactions, pervade the biological realm. In the synthetic domain, their counterparts, supramolecular polymers, endowed with remarkable self-repair

and adaptive traits, are often realised through bio-inspired designs. Recently, controlled supramolecular polymerisation strategies have emerged, drawing inspiration from protein self-assembly. A burgeoning area of research involves mimicking the liquid-liquid phase separation (LLPS) observed in proteins to create coacervate droplets, recognising their significance in cellular organisation and diverse functions. In our group's latest article published in JACS, we delve into the fascinating realm of synthetic coacervates, drawing inspiration from proteins' LLPS. We introduce a novel perspective on synthetic coacervates, extending beyond their established role in synthetic biology as membrane-less phases. We're pushing boundaries by exploring how these coacervates can enable structural control in synthetic supramolecular polymers. Drawing parallels with the cooperative growth of amyloid fibrils through LLPS phase, we present metastable coacervate droplets as dormant monomer phases to craft dynamic assemblies with unprecedented precision. Our work thus opens up new avenues in the exciting field of supramolecular polymerisation, offering general design principles and controlled synthesis of precision self-assembled structures in confined environments.

Major Talks During 2023–24:

- 28th October 2023: Talk on *"Advancing the structural landscape of supramolecular polymers"* at the IISC-Thieme Organic Chemistry Symposium 2023, organised by Thieme and IISc
- 4th November 2023: Talk on *"Advancing the structural landscape of supramolecular polymers"* for Chemistry Day Seminar, at IIT Roorkee
- 29th November 2023: Talk on *"Molecular programming at the higher hierarchical level of supramolecular polymers"* at TIFR Annual Chemistry Conference 2023, organised by Tata Institute of Fundamental Research, Mumbai
- 10th December 2023: Plenary lecture on *"Molecular programming at the higher hierarchical level of supramolecular polymers"* at the 17th International Conference on Polymer Science and Technology (SPSI-MACRO-2023), organised by the Society for Polymer Science (SPSI), India
- 18th December 2023: Talk on *"Secondary nucleation triggered supramolecular polymerization"* at the International Conference on Molecular Matter—Emerging Directions for Sustainability (ICMM) 2023, organised by IIT Madras



Schematic of the proposed synthetic strategy of using coacervate droplets obtained by bioinspired liquid-liquid phase separation (LLPS) as a metastable dormant phase of monomers for the controlled supramolecular polymerization process..
Reference: *J. Am. Chem. Soc.* 146 (18): 12577–12586, 2024.
doi: 10.1021/jacs.4c01377

Prof. Jayanta Haldar *F.A.Sc., F.R.S.C.*

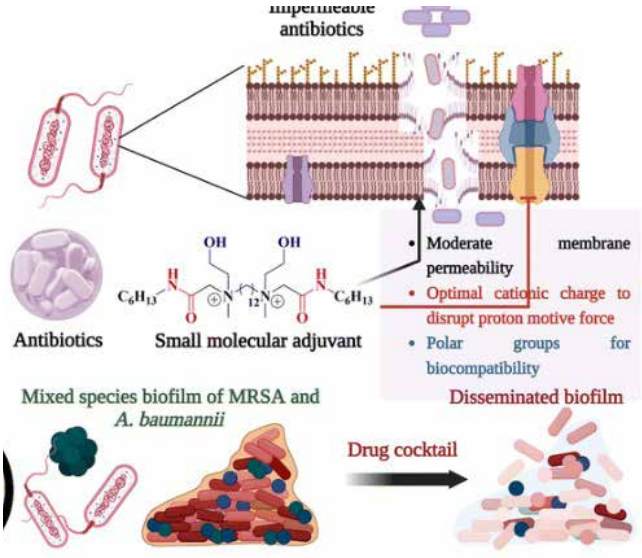
Professor and Associate Chair, NCU

The rise of antimicrobial resistance (AMR) among pathogenic bacteria, accelerated by the overuse and misuse of antibiotics, requires urgent therapeutic and preventive interventions. Our laboratory contributes actively to both these aspects.

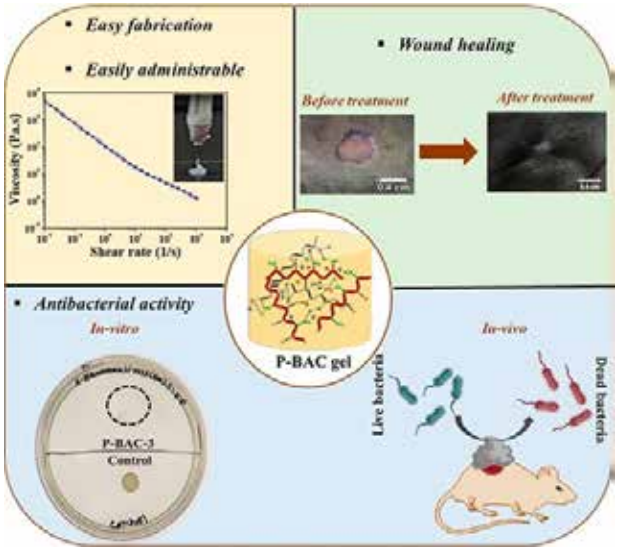
We have recently developed a small molecular adjuvant that revitalises the effectiveness of antibiotics against resistant Gram-negative bacterial infections. This adjuvant achieves its results by moderately disrupting bacterial membranes, which enhances antibiotic internalisation and hampers bacterial efflux mechanisms, thus improving antibiotic efficacy by 32–512-fold without harming mammalian cells. This innovative approach shows great potential in treating multi-drug resistant infections and reduces the likelihood of new resistance development. We

have also recently published work related to the development of P-BAC hydrogel, an advanced wound dressing with broad-spectrum antibacterial properties. The P-BAC hydrogel is designed for simple administration and promotes efficient wound healing by significantly reducing bacterial load and effectively eradicating biofilms. It accelerates collagen deposition at wound sites, enhancing the healing process. The hydrogel's practicality and effectiveness against both Gram-positive and Gram-negative bacteria make it a promising solution for addressing chronic wound infections in various healthcare settings. Together, these advancements represent significant strides in improving the treatment of antibiotic-resistant infections and chronic wounds.

Concurrently, we have also been working on and publishing papers related to other aspects of therapeutic development, such as semi-synthetic glycopeptides, membrane-targeting cationic biocides, etc. On the biomaterial front, we have recently published work on multifunctional anti-infective coatings and hydrogels.



Innovative small molecular adjuvant enhances antibiotic effectiveness against resistant Gram-negative bacteria without toxicity to mammalian cells.



P-BAC hydrogel: A broad-spectrum antibacterial wound dressing that promotes rapid and effective healing by eradicating biofilms.

References:
1. *Chem. Sci.* 15: 259–270, 2024. doi: 10.1039/D3SC05124B
2. *ACS App. Bio. Mat.* 6 (11): 4867–4876, 2023. doi: 10.1021/acsabm.3c00608

Events Organised:

- 31st January 2024: *Harnessing Biomimicry with Self-Assembled Bioconjugates: From Therapeutics to Protocells*, a special lecture by Prof. Sébastien Lecommandoux, Editor-in-Chief, Biomacromolecules, Université de Bordeaux, France, organised at NCU, JNCASR
- 12th February 2024: *When small things matter, a special lecture* by Prof. Shiladitya Sengupta, Director, Centre for Engineered Therapeutics, Brigham and Women's Hospital, Harvard Medical School, USA, held at NCU, JNCASR
- 29th February 2024: *Nanoparticle Conversion Pathway to High Entropy Alloy Electrocatalysts,* Special lecture by Prof. Sara E. Skrabalak, Editor-in-Chief, *ACS Materials Letters and Chemistry of Materials*, Indiana University, USA, organised at NCU, JNCASR
- 1st March 2024: *India Road Show, ACS on Campus, Symposium,* co-organised with American Chemical Society

Major Talks During 2023–24:

- 19th April 2023: Invited Talk om *"Innovative functional biomaterials for tackling antimicrobial resistance and infection"* organised by Becton-Dickinson Biosciences, Bengaluru, India
- 25th–26th May 2023: Talk on *"Development of new approaches to overcome MBL-related resistance in bacteria"* at the Conference on Biomedical Sciences and Technologies, organised by BRICS STI-FP, India

NCU

- 6th–9th July 2023: Talk on *"Outwitting antibiotic resistance: A perpetual battle"* Kaleidoscope: A Discussion Meeting in Chemistry, organised at Udaipur
- 21st July 2023: Talk on *"Conquering Antibiotic Resistance: An Endless Struggle",* at the Frontiers in Chemical Biology and Organic Materials symposium and Felicitation of Professors Santanu Bhattacharya and Uday Maitra, organised at IISc, Bengaluru, India
- 11th August 2023: Talk on *"Chemical Strategies to Tackle Antimicrobial Resistance and Infection Conference"* at the 5th Antimicrobial Science and Technology Forum (ASTF 2023), organised at Shenyang, China
- 11th–14th September 2023: Talk on *"Chitin and Chitosan: Unleashing the Potential of Glucosamines against Drug-Resistant Microbes"* at the EUCHIS 2023 Conference, organised at Siglufjörður, Iceland
- 18th September 2023: Invited Talk on *"Outwitting antibiotic resistance: A perpetual battle"*, organised at University of Strasbourg, France
- 18th October 2023: Talk on *"Pursuit of next-generation glycopeptides: A journey with vancomycin"* at the National Chemistry Week, ACS Webinar, organised by American Chemical Society
- 23rd–24th November 2023: Talk on *"Outwitting antibiotic resistance: A perpetual battle"* at the Interactive International Conference on Convergence of Scientific Disciplines to Advance Biotechnology, organised by IISER Berhampur, India
- 12th-15th December 2023: Talk on *"Biomaterials for Tackling Antimicrobial Resistance and Infection"* at the 34th Annual General Meeting of MRSI and 5th Indian Materials Conclave Functional, organised by IIT BHU, Varanasi
- 5th January 2024: Talk on *"Outwitting antibiotic resistance: A perpetual battle*" at the Chemical Biology/Chemistry Seminar, organised at Stanford University, USA
- 8th January 2024: Talk on *"Outwitting antibiotic resistance: A perpetual battle"* at the Seminar Series organised by the Skaggs School of Pharmacy and Pharmaceutical Science, University of California, San Diego, USA
- 19th–21st January 2024: Talk on *"Outwitting antibiotic resistance: A perpetual battle"* at the 4th Frontiers Symposium in Chemistry, organised by IISER Thiruvananthapuram, Kerala
- 29th–31st January 2024: Talk on *"Outwitting antibiotic resistance: A perpetual battle"* at the Asia Pacific Conclave on Engineering, Healthcare-Bridging Innovation and Wellness, ACS International Student Chapter-IISc Bengaluru, organised at Mysuru
- 6th–7th February 2024: Talk on *"Discovery of Semi-synthetic Antibiotics and Adjuvants"* at the GARD-P and BSAC Antimicrobial Chemotherapy Conference (ACC) 2024 (Online)

Prof. Kanishka Biswas *F.A.Sc., F.R.S.C.*

Professor, NCU

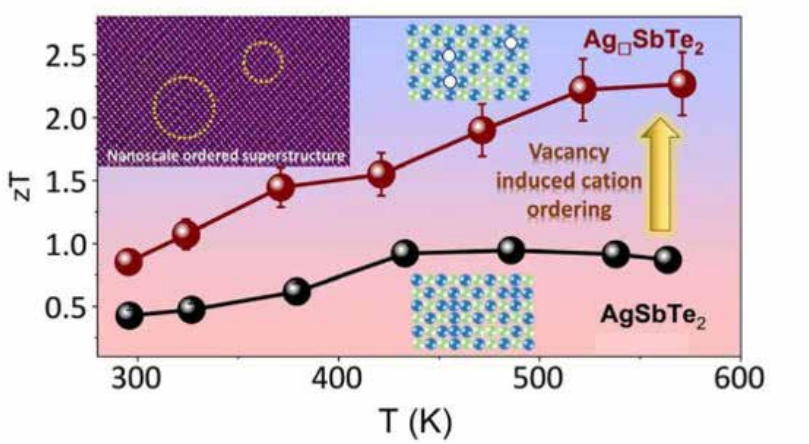
High thermoelectric performance is often found in solid-solution alloyed or heavily doped semiconductors. However, the resulting atomic disorder has a trade-off in the thermoelectric figure of merit, zT.

We demonstrated a strategy to optimise disorder rooted in the thermodynamic phase diagram and achieve a maximum zT = 2.3 in Ag vacant $Ag_{1-x}SbTe_2$. The formation of $AgSbTe_2$ in the Ag_2Te–Sb_2Te_3 pseudo-binary phase space led to the precipitation of Ag_2Te impurities due to thermodynamic instabilities. We showed that Ag vacancies partially removed the disorder from the cation sub-lattice along with the suppression of the secondary Ag_2Te impurities. This led to an increase in the electrical conductivity and power factor, while the formation of nanoscale superstructures due to local cation ordering led to a reduction in the lattice thermal conductivity. Our strategy enabled the realisation of a high output power density in a double-leg thermoelectric device. Our work provided a pathway to optimise the intrinsic atomic disorder using vacancy formation and thermoelectric performance.

NCU

Events Organised:

- 30th November–2nd December 2023: *Quantum Materials,* Conference, co-organised with Prof. Indra Dasgupta, IACS, Kolkata, Prof. D. D. Sharma, IISc, Bengaluru and Prof. Jaejun Yu, Seoul National University, South Korea
- 12th–14th March 2024: *India@DESY Users' Workshop,* co-organised with A. N. Jayachandra, held at JNCASR



Nanoscale ordered superstructures and vacancy-induced ordering in Ag vacant $Ag_{1-x}SbTe_2$.
Reference: *Energy Environ. Sci.* 16: 3110–3118, 2023.
doi: 10.1039/D3EE01033C

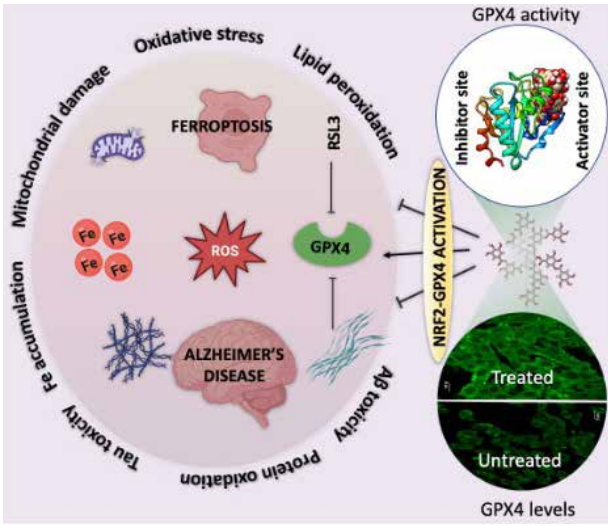
Major Talks During 2023–24:

- 20th September 2023: Talk on *"Enhanced atomic ordering leads to ultra-high thermoelectric performance"* at the 19th European conference on Thermoelectrics-2023, organised by the European Thermoelectric Society at Prague, Czech Republic
- 22nd December 2023: Talk on *"Antibonding Electronic States: Not Always a Devil"* at the Hybrid Halide Perovskite-2023 Conference, organised by IACS, Kolkata

Prof. Govindaraju T. *F.A.Sc., F.R.S.C.*

Professor, NCU

Ferroptosis, an iron-dependent cell death pathway, plays a crucial role in the pathology of Alzheimer's disease (AD). Several characteristics of AD, including excessive iron accumulation, elevated lipid peroxide and reactive oxygen species (ROS) levels, and decreased glutathione peroxidase 4 (GPX4) levels, align with the features of ferroptosis. While traditional methods of inhibiting ferroptosis have centered on chelating Fe and trapping radicals, therapeutic strategies that modulate the GPX4 axis to mitigate ferroptosis in AD are yet to be explored. We reported on naturally occurring polyphenols (PPs) as dual-acting therapeutic agents to synergistically alleviate ferroptosis and AD. The mechanisms of action encompass modulation of amyloid and tau cascade, reduction of oxidative stress, mitochondrial rescue, and inhibition of ferroptosis. For the first time, we showed that a single multifunctional molecule, tannic acid (TA), binds at the activator site of GPX4, augmenting both its activity and cellular levels, providing a conceptually innovative and integrated approach for treating AD via the GPX4–ferroptosis axis. The ability of TA to enhance GPX4 levels under conditions of AD pathology opens up newer promising therapeutic avenues for combating the crosstalk between ferroptosis and AD.



Natural polyphenol mitigating the pathological nexus between ferroptosis and Alzheimer's disease.
Reference: *Chem. Sci.* 14: 9427–9438, 2023.
doi: 10.1039/D3SC02350H

NCU

Major Talks During 2023–24:

- 15th June 2023: Talk on *"Small Molecule Theranostics"* at IIT Bombay
- 26th June 2023: Talk on *"Confronting the complex etiology of Alzheimer's disease"*, at the Advances in DNA/RNA Therapeutics conference, organised at CSIR-NCL, Pune
- 25th–27th July 2023: Talk on *"Amino Acid and Peptide-guided Molecular Architectonics"* at the Peptide Self-assembly (PSA2023) conference, organised by the University of Manchester, UK
- 28th July, 2023: Two talks on *"Confronting the Complex Etiology of Alzheimer's Disease"* and *"Molecular Architectonics"*, both organised at Durham University, England
- 12th–14th September 2023: Talk on *"Small molecule theranostics"* at the 5th RSC-CRSI Joint Symposium in Chemical Sciences, organised by University of Bristol, UK
- 6th October 2023: Talk on *"Alzheimer's Disease and Dementia"* at the 82nd CSIR Foundation Day Lecture, organised by CSIR-CIMAP Research Centre, Bengaluru
- 8th–10th November 2023: Talk on *"Designer Peptidomimetics to study and modulate multifaceted toxicity of Alzheimer's disease"* at the 60th JPS, organised at Otsu, Shiga, Japan
- 11th November 2023: Talk on *"Amino Acid and Peptide-guided Molecular Architectonics"* at the International Mini-Symposium on Peptide Design and Functional Extension, organised by Kyoto University, Japan
- 15th–17th December 2023: Talk on *"Ferroptosis in the context of Alzheimer's disease"* at the ACBI meeting, Kuala Lumpur
- 18th–20th December 2023: Talk on *"The Pathological Nexus between Ferroptosis and Alzheimer's disease"* at the 13th IUPAC's International Symposium on Bioorganic Chemistry (ISBOC-13), organised by the National Technology University (NTU), Singapore
- 18th January 2024: Talk on *"Translating Laboratory Research (Molecular diagnostics and therapeutics)"* at India International Science Festival (IISF)-Young Scientists Conference (YSC)

Prof. Sebastian Chirambatte Peter *F.A.Sc., F.R.S.C., F.I.A.A.M.*

Professor, NCU

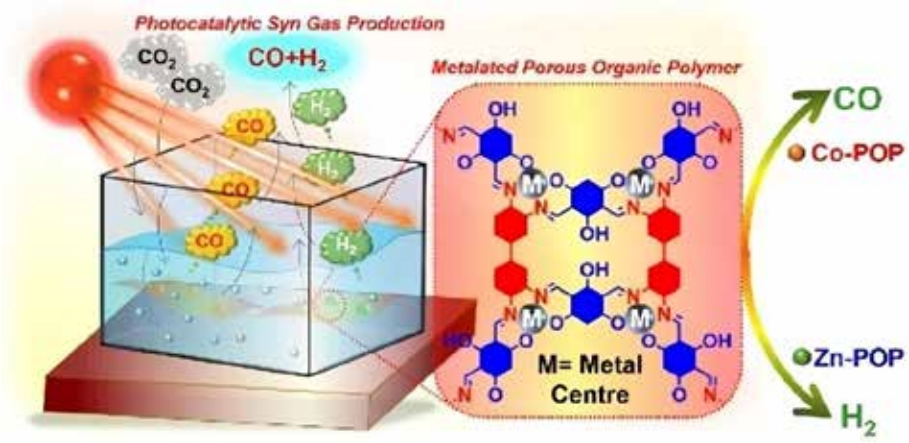
We have developed 2 metalated porous organic polymers, Zn-POP and Co-POP, for producing syngas (a mixture of CO and H_2) from gaseous CO_2. The most efficient variable H_2/CO ratio in syngas was achieved in a water medium, without the need for an organic hole scavenger or photosensitiser, by applying the basic principles of Lewis acid-base chemistry. Additionally, distinct major products were observed during photocatalytic CO_2 reduction and water splitting with these catalysts: CO production was favoured with Co-POP, while H_2 production was favoured with Zn-POP.

Further investigations using XPS, XANES, and NH_3-TPD revealed that Co-POP has a higher electron density and better Lewis basic properties, enhancing its capacity for CO_2 activation. The structure-activity relationship was confirmed through in-situ DRIFTS and DFT studies, which demonstrated the formation of the COOH* intermediate and the thermodynamic feasibility of CO_2 reduction with Co-POP, while Zn-POP was more suited for water splitting.

The different Lewis acidic properties of these metal POPs allowed for tuneable product selectivity in generating syngas from CO_2 photoreduction. Notably, Zn-POP exhibited superior charge transfer kinetics and electron-hole separation, leading to more efficient electron generation. Conversely, Co-POP demonstrated better CO_2 adsorption and activation capabilities, along with greater visible light absorption. We also introduced a catalyst combining Co and Zn in various ratios to achieve syngas with an adjustable H_2/CO ratio.

NCU

While previous studies have noted metal or ligand-dependent selectivity changes, our findings elucidate the underlying reasons from the perspective of frustrated Lewis acidity. This work presents a novel approach to producing syngas with a variable H_2 to CO ratio, which is crucial for gas-to-liquids (GTL) fuel production technology.



Zn and Co-based POP with different Lewis acidity has been developed for controlling water splitting and CO_2 reduction under sunlight. The low-cost option of syngas production with an adjustable H_2/CO ratio was demonstrated, obtained by skipping the use of any sacrificial electron donors (SEDs), cocatalysts, or photo-sensitizers.
Reference: *Angew. Chemie. Int. Ed.* 62 (50): e202311304, 2023.
doi: 10.1002/anie.202311304

Events Organised:

- 10th August 2023: National CoE-CCU, Evaluation Meeting, with National Centre of Excellence in Carbon Capture and Utilization (NCoE-CCU), IIT Bombay, organised by Department of Science and Technology (DST), held at JNCASR
- 8th–9th November 2023: JIWES-2023, conference, co-organised with RICE University (USA), held at JNCASR
- 17th–20th November 2023: IISF 2023, National Science Exhibition, co-organised with DST, India

Major Talks During 2023–24:

- 23rd May 2023: Talk on *"Carbon Recycling for Sustainable Energy: A Journey from Fundamental Chemistry to Green Technologies"* at the One Week One Lab (OWOL) Workshop, organised by NCL, Pune
- 19th–22nd July 2023: Talk on *"Technology Demonstration on CO_2 reduction and H_2 production"* at the CEM14/MI-8 Ministerial technology showcase event, organised by DST at Shyama Prasad Mukherjee, Goa
- 4th August 2023: Talk on *"Carbon Recycling for Sustainable Energy: From Fundamental Chemistry to Green Technologies"* at the First CSIR-Industry-Academia meet, organised by IIT Bombay
- 18th August 2023: Talk on *"Integrated solution for conversion of anthropogenic CO_2 into value-added products: Prospects & Challenges from steel value chain prospectives"* at the Workshop on Carbon Capture, Storage, and Utilization (CCUS), organised by Process Tech Group, Tata Steel
- 1st September 2023: Talk on *"Water Recycling: From Fundamental Science to Technological Applications"* at the Industry-Academia Conclave on Green H_2, organised by IIT Roorkee
- 12th September 2023: Talk on *"Carbon Recycling for Sustainable Energy: A Journey from Fundamental Chemistry to Green Technologies"*, at the UK-INDIA Symposium in Chemical Sciences 2023, organised at York, UK
- 21st September 2023: Talk on *"Carbon Recycling for Sustainable Energy: A Journey From Fundamental Chemistry to Green Technologies"* at CatCE2 conference, organised by BITS PILANI Hyderabad
- 9th October 2023: Talk on the CoE and CCU at the CRS Research Partnerships and Industry Translation Award and presentation of the Award Lecture in the One-Day Symposium, *Science Beyond Boundary: Invention, Discovery, Innovation and Society*, organised by Jain University, Bengaluru
- 9th–10th October 2023: Talk on *"Carbon and Water Recycling for Sustainable Energy: A Journey From Fundamental Chemistry to Green Technologies"* at the International Technical workshop on Advanced Materials Challenges and Standardisation Needs for Net Zero Technologies, organised by National Physical Laboratory
- 18th October 2023: Talk on *"Design and Tuning the Structure of the Fuel Cell Components"* at the Fuel Cell workshop, organised by VIT Vellore

NCU

- 30th October–2nd November 2023: Talk on *"Design and Scale-up of Catalysts for Carbon Recycling to Sustainable Energy"* at the International Conference on Organometallics and Catalysis 2023, organised at The Zuri White Sands, Goa Resort and Casino
- 3rd November 2023: Talk on *"Materials and Methodologies in Carbon Recycling for Sustainable Energy and Net Zero Target"* at the 89th Annual Meeting of the Indian Academy of Sciences, organised by BITS Pilani Goa
- 5th–8th November 2023: Talk on *"Design and Scale-up of Catalysts for Carbon Recycling to Sustainable Energy"* at the Trends in Emerging Nano Science: Energy, Healthcare and Quantum Materials (TENS-2023) conference, organised by INST Mohali
- 8th–9th November 2023: Talk on *"Carbon Recycling for Sustainable Energy: A Journey from Fundamental Chemistry to green technologies"* at the JNCASR-Rice Workshop, organised by JNCASR
- 14th–15th November 2023: Talk on *"Carbon Recycling Towards Net-Zero Emissions"* at the In-house symposium 2023, organised by JNCASR
- 22nd–24th November 2023: Talk on *"Carbon Recycling for Sustainable Energy: A Journey from Fundamental Chemistry to Green Technologies"* at Climate Resilience and Sustainable Development workshop, organised by KSTA
- 28th November 2023: Talk on CCU at the DST's roadmap towards Net zero targets through Carbon Capture, Utilization and Storage (CCUS) Brainstorm Meeting, organised by DST
- 2nd December 2023: Talk on *"Green Hydrogen Production and Utilization"* at the Hydrogen Production Workshop, organised by HSBC and IIT Bombay
- 29th November–1st December 2023: Talk on *"Materials and Methodologies in Carbon Recycling for Sustainable Energy and Net Zero Target"* at the 8th International Conference on Advanced Nanomaterials and Nanotechnology at Centre for Nanotechnology, IIT Guwahati
- 13th–14th December 2023: Talk on *"Carbon and Water Recycling for Sustainable Energy: A Journey from Fundamental Chemistry to Green Technologies"* at MRSI AGM 2023, organised by IIT BHU
- 16th–18th December 2023: Talk on *"Substitutional Effects in Materials to Design Efficient Catalysts for CO_2 Reduction, Hydrogen Production and Fuel Cell Operation"* at the International Conference on Molecular Matter (ICMM)—Emerging Directions for Sustainability, organised by IIT Madras
- 19th–21st December 2023: Talk on *"Carbon Recycling for Sustainable Energy: A Journey from Fundamental Chemistry to Green Technologies"*, at EFCS-2023, organised by Farook College, Kerala
- 4th–5th January 2024: Talk on *"Substitutional Effects in Materials to Design Efficient Catalysts for CO_2 reduction, Hydrogen Production and Fuel Cell Operation"* at the NCE-23 Conference, organise dby SRM Chennai
- 10th–11th January 2024: Talk on *"Carbon and Water Recycling for Sustainable Energy: A Journey from Fundamental Chemistry to Green Technologies"* at the International Conference on Advances in Interdisciplinary Nanoscience (ICAINS-24), organised by the Government Engineering College for Women at TVM
- 27th–29th February 2024: Talk on *"Carbon Recycling for Sustainable Energy: A Journey from Fundamental Chemistry to Green Technologies"* at the Carbon Management in Chemical Industry event organised by BASF Mumbai
- 12th March 2024: Talk on *"XAFS as a fundamental tool to investigate the local environment in catalysts during CO_2 reduction, hydrogen production and fuel cell operation"* at India@DESY Synchrotron X-ray Users Workshop, organised by DST, DESY, and JNCASR

Prof. Sarit S. Agasti

Associate Professor, CPMU and NCU; Faculty In-charge, Sports Facility

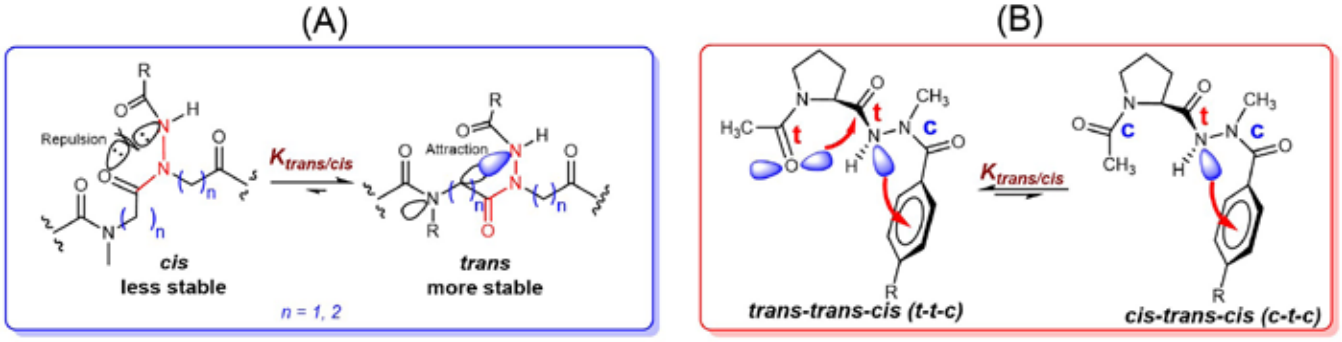
Please refer to pg. 67 for research activities

NCU

Prof. Bani Kanta Sarma

Associate Professor, NCU

Our group is interested in the conformational properties of acyl and diacylhydrazines and understanding the effect of their incorporation in peptidomimetic molecules.[1] In our recent studies,[2-3] we have shown that instead of primary amines, acylhydrazides can be effectively used as submonomers to synthesise α/β-azapeptoids. We observed that unlike α- and β-peptoids, whose tertiary amide bonds exist in equilibrium mixture of cis-and trans isomers, the α/β-azapeptoid amide bonds adopted trans geometries. We proposed that lp-lp repulsion between the sidechain heteroatom (N) lone pair and the backbone CO oxygen lone pairs destabilise the cis amide geometries of these molecules and a backbone-sidechain $n_N \rightarrow \sigma^*_{C\text{-}C}$ noncovalent interaction stabilises their trans amide conformations *(See Image, A)*. Our study also revealed that the staggered conformational preference of the backbone methylene carbons and a novel backbone $n_O \rightarrow \sigma^*_{C\beta\text{-}N}$ interaction enforce confined Θ and Ψ values in β-azapeptoids. However, the φ (Cβ-N) torsion angle in β-azapeptoids remains freely rotatable and depending on φ the sidechains can adopt parallel, perpendicular, and anti-parallel relative orientations. In fact, we observed parallel and perpendicular relative orientations of sidechains in the crystal geometries of β-azapeptoid dimers. Theoretical studies indicate that φ can be controlled by incorporating a bulky substituent at the β-carbon and, therefore, it is plausible to get a complete control over the backbone dihedrals of β-azapeptoids. Overall, incorporation of acylhydrazides provides a convenient strategy to rigidify the backbone dihedrals of α/β peptoid molecules.



Acyl hydrazides as (A) submonomers for the synthesis of α/β-peptoids and (B) capping agents of peptide proline C-terminus.

References:

1. *J. Org. Chem.* 2023. doi: 10.1021/acs.joc.2c01891
2. *Chem. Eur. J.* 30: e202303330, 2024. doi: 10.1002/chem.202303330
3. *Chem. Eur. J.* 29: e202300178, 2023. doi: 10.1002/chem.202300178

Major Talk During 2023–24:

- 1st–2nd March 2024: Talk on *"Leveraging Local Interactions to Affect Global Structures of Peptides and Peptidomimetics"* at the Recent Trends in Chemical Science and Technology (RTCST-2024) conference, organised by the Department of Chemistry, IIT Patna, Bihar

Prof. Premkumar Senguttuvan

Associate Professor, ICMS and NCU; and Head, CompLab

Please refer to pg. 98 for research activities

Dr. Abhishek Kumar

Assistant Professor, ICMS and NCU

Please refer to pg. 98 for research activities

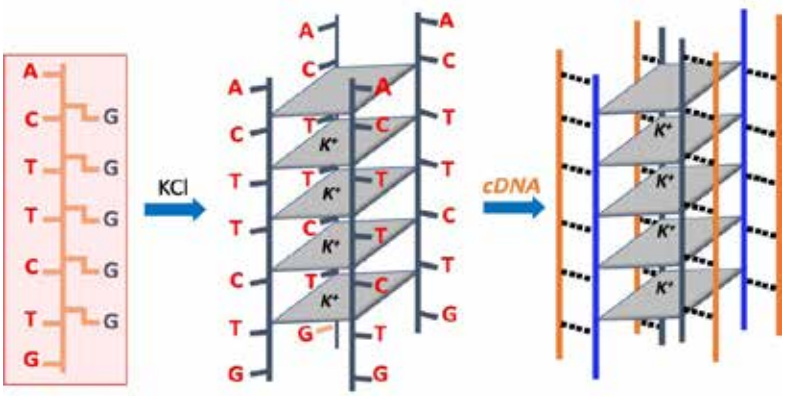
NCU

Dr. Pratap Vishnoi
Assistant Professor, ICMS and NCU

Please refer to pg. 99 for research activities

Prof. K. N. Ganesh *F.A.Sc., F.N.A.Sc., F.N.A., F.T.W.A.S.*
SERB National Science Chair, NCU

We have recently designed Janus-like bimodal PNAs endowed with 2 different nucleobase sequences on either side of single PNA backbone and shown that these can simultaneously bind to 2 complementary DNA sequences from both faces of PNA. This leads to formation of supramolecular polyplexes such as double duplexes, triple duplexes and triplex of double duplexes with appropriate complementary DNA/RNA. Janus/bimodal PNA with poly G-sequence on triazole side of the PNA backbone and mixed bases on the t-amide side templates the initial formation of $(PNA\text{-}G5)_4$ tetraplex (triazole side), followed by formation of PNA:DNA tetraduplex (t-amide side). Such a polyplex shows synergistic overall stabilisation compared to isolated duplexes/tetraplexes. Assembly of such polyplexes with shared backbone for duplex and tetraplex is programmable and may have potential applications in self-assembly of nucleic acid nano and origami structures. It was also shown that Janus PNAs enter the cells better than standard *aeg*-PNA oligomers and hence have implications for *in-vivo* applications as well. In collaboration with Prof. Prabal Maiti (Department of Physics, IISc), we have delineated factors that are responsible for sequential melting of the DNA triplex and the concerted mechanism of the PNA_2:DNA triplex.



bm-PNA-G5 as precursor for non-covalent self-assembly of G4-tetraplex followed by hybridisation with complementary DNA to yield tetra-duplex of tetraplex.

References:

1. Supramolecular Polyplexes from Janus Peptide Nucleic Acids (bm-PNA-G5): Tetraplex and its Tetraduplex with complementary DNA, cell permeability and mechanism of polyplex melting. Iranna Annappa Todkari, Preeti Chaudhary, Mahesh J Kulkarni, and Krishna N. Ganesh, 2024, (Manuscript submitted)
2. Dynamics of terminal fraying-peeling and hydrogen bonds dictate the sequential vs co-operative melting pathways of nanoscaleDNA and PNA triplexes, Sandip Mandal, Krishna N. Ganesh, and Prabal K. Maiti, 2024 (Manuscript submitted and under revision)
3. *ACS Omega* 9: 21680–21685, 2024. doi: 10.1021/acsomega.4c03540

Major Talks During 2023–24:

- 24th July 2023: Talk on *"Second generation, Peptide Nucleic Acids (PNA 2.00): 'JANUS' PNAs with Non-Identical Faces for Programmable Supramolecular Assemblies"* at the Felicitation event for Prof. Uday Maitra and Prof. S. Bhattacharya, organised by the Department of Organic Chemistry, IISC, Bengaluru
- 28th–30th July 2023: Talk on *"Life - with and without chemistry"* at the RSC—Yousuf Hamid Chemistry Camp, organised by IISER Tirupati
- 31st August 2023: Invited talk on *"Making medicines from DNA, RNA and PNA"*, at the Research and Academics Advisory Council meeting, organised by IISER Berhampur
- 27th September 2023: Talk on *"PNAs: Programmable Supramolecular Nano Assemblies"* at the Nanobiotechnology: beyond the conventional 'JANUS' conference, organised by Centre for Nanoscience and Engineering, IISc, Bengaluru
- 9th October 2023: Talk on *"Making medicines from DNA, RNA and PNA, at the Science beyond Boundary: invention,*

discovery, innovation and society conference", organised by Jain University, Bengaluru

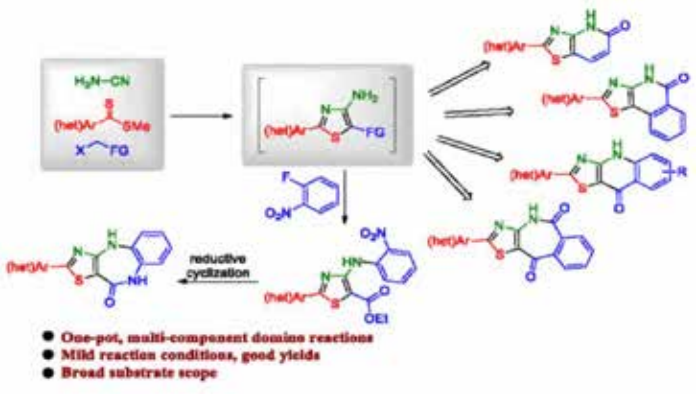
- 17th October 2023: Talk on *"Life - with and without chemistry"*, at an outreach programme organised by Centre for Nanoscience and Soft Materials Bengaluru
- 23rd November 2023: Talk on *"JANUS Peptide Nucleic Acids (j-PNA) with non-identical faces for programmable supramolecular assemblies"* at the CSDAB-2023 Conference, organised by IISER Berhampur
- 30th November 2023: Prof D. B. Ingle Memorial Lecture on *"Making medicines from DNA, RNA and PNA"*, organised by Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
- 4th–5th December 2023: Talk on *"Rotamers in Peptide Nucleic Acids (PNA) and their effects on PNA:DNA/RNA hybridization"* at the International Conference on Advances in Chemistry; ICAC 2023, organised by The American College, Madurai
- 18th December 2023: Talk on *"An old friend with new face: Janus PNA derived polyplexes"* at Chemsymphoria, organised by IISER Pune
- 23rd February 2024: Talk on *"Self-assembly of PNA-DNA polyplexes"* at the Indian Peptide Society Students symposium, organised by Gujarat Biotech University, Gandhinagar, Ahmedabad
- 2nd March 2024: Talk on *"What is science and why we do science?"* at the National Science Day event organised by the Department of Chemistry, University of Mysore
- 4th March 2024: Talk on *"JANUS Peptide Nucleic Acids (PNA): An old friend with a new face"* organised to celebrate Department Day by the Department of Chemistry, IIT Ropar
- 8th March 2024: Talk on *"Multistrand polyplexes from Janus PNA: DNA hybrids"* at the Supramolecular Chemistry 2024 conference, organised by SRM University, Amaravati, AP
- 11th March 2024: Talk on *"Emerging Careers in Chemical Sciences"* at the RSC Chem Careers INDIA 2024 Workshop, organised by IIT–Tirupati
- 18th March 2024: Talk on *"Peptide Nucleic Acids (PNA 2.00): JANUS PNAs with non-identical faces for programmable biomimetic supramolecular assemblies"* at the ACS National Meeting Spring 2024 Symposium, organised by ACS, New Orleans, USA
- 28th March 2024: Talk on *"The same and NOT the same: Mirror symmetry in life JNCASR"* as part of the Dhwani Talk event, organised by JNCASR

Prof. Hiriyakkanavar Ila *F.A.Sc., F.N.A.*

Hindustan Lever Research Professor (up to 31st Dec 2023) and Indian National Science Academy Honorary Scientist, NCU

We present a 1-pot synthesis strategy for novel 2-(het) aryl-substituted thiazolo-fused 6- and 7-membered heterocycles via intramolecular heteroannulation of *in-situ*-generated 2-(het) aryl-4-amino-5-functionalised thiazoles. The 4-amino-5-functionalised thiazoles were readily obtained in a 1-pot process by treating of a range of (het)aryldithioesters with cyanamide in the presence of NaH. This step was followed by *in situ* S-alkylation-intramolecular condensations of the resulting thioimidate salts with appropriately activated methylene halides. The corresponding 4H-benzo[b]thiazolo[4,5-e] [1,4] diazepin-10(9H)-ones, on the other hand, were synthesised via a 2-step process which included prior isolation of 5-carboethoxy-4-(2-nitrophenyl) aminothiazoles followed by their subsequent reductive cyclisation. We used methyl bromocrotonate, ethyl 2-(bromomethyl) benzoate, 2-fluorophenacyl bromides, ethyl 2-(2-bromoacetyl) benzoate, and ethyl bromoacetate as activated methylene halides during the synthesis of various thiazolo-fused heterocycles. Our study not only provided facile preparation methods, but also carried out absorption and emission spectroscopy, which revealed that several of the thiazolo-fused heterocycles displayed yellow-green to green fluorescence.

NCU



Schematic representation of 1-pot synthesis of novel 2-(het)aryl-substituted thiazolo-fused 6- and 7-membered heterocycles.
Reference: *J. Org. Chem.* 87 (18): 12397–413. 2022. doi: 10.1021/acs.joc.2c01673

Major Talks During 2023–24:

- 22nd–24th February 2023: Talk on *"New Directions in Heterocycle Synthesis"* at the Recent Trends in Sustainable Chemistry conference, organised by the Department of Chemistry, IIT Indore
- 5th–7th October 2023: Felicitation Lecture on *"Reminescences in Research"* at the Women in Chemical Science Conference, organised by the Department of Chemistry, IIT Kanpur
- 9th October 2023: Invited lecture on *"New Strategies in heterocycle synthesis"* organised by the Medicinal Chemistry Division, Central Drug Research Institute, Lucknow
- 10th October 2023: Invited lecture on *"New Directions in Synthesis of Biologically Important Heterocycles"* organised by the Centre for Biomedical Research, Lucknow
- 14th–15th December 2023: Keynote Lecture on *"Design and Development of New Synthetic Methods for Biologically Important Heterocycles"* at the Emerging Trends in Chemical Science Conference, organised by the Department of chemistry, Benaras Hindu University, Varanasi
- 3rd–4th January 2024: Keynote Lecture on *"Design, Development and Synthesis of Biologically Important Heterocycles"* at the Frontiers in Catalysis FIC-2024 conference, organised by Central University of Rajasthan, Kishangarh
- 8th January 2024: Invited Lecture on *"New Directions in heterocycle Synthesis"*, organised by the Department of Chemistry, IIT Jodhpur
- 28th–29th February 2024: Keynote Lecture on *"New Strategies in Heterocycle Synthesis"* at the Recent Trends in Chemical Science conference, organised by the Department of Chemistry, Mahatma Gandhi University, Motihari, Bihar
- 1st–2nd March 2024: Keynote Lecture on *"New synthetic strategies towards biologically important heterocycles"* at the Recent Trends in Chemical Science and Technology conference, organised by the Department of Chemistry, IIT Patna, Bihar

Unit Members

Faculty	
Professor and Chairperson	**Prof. Subi Jacob George**
Professor and Associate Chair	**Prof. Jayanta Haldar**
Linus Pauling Research Professor; Honorary President, JNCASR; and Director, ICMS	**Bharat Ratna Prof. C. N. R. Rao**
Professors	**Prof. Kanishka Biswas** **Prof. Govindaraju T.** **Prof. Sebastian Chirambatte Peter**
Associate Professors	**Prof. Sarit S. Agasti** (jointly with CPMU; Faculty In-Charge, Sports Facility) **Prof. Bani Kanta Sarma** **Prof. Premkumar Senguttuvan** (jointly with ICMS; and Head, CompLab)

NCU

Faculty	
Assistant Professors	**Dr. Abhishek Kumar** (jointly with ICMS) **Dr. Pratap Vishnoi** (jointly with ICMS)
SERB National Science Chair	**Prof. K. N. Ganesh**
Hindustan Lever Research Professor (up to 31st Dec 2023) and Indian National Science Academy Honorary Scientist	**Prof. Hiriyakkanavar Ila**

Associate Faculty

- **Prof. Sundaresan A.** (Professor and Chairperson, CPMU)
- **Prof. Tapas Kumar Maji** (Professor, CPMU)
- **Prof. Eswaramoorthy M.** (Associate Director, ICMS; and Dean, Academic Affairs)
- **Prof. Swapan K. Pati** (Professor, TSU)
- **Prof. Sridhar Rajaram** (Professor, ICMS)
- **Prof. Ranjani Viswanatha** (Professor, ICMS)

Research Students	
Ph.D. and M.S. in Chemical Science through Int. Ph.D.: 33	**Adrija Ghosh, Taraknath Das, Darshana Deb, Aditi Saraswat, Sudip Mukherjee, Riddhimoy Pathak, Animesh Das, Akshay Saroha, Ivy Maria, Sayan Chakravarty, Ritika Raghuvanshi, Arghya Ghosh, Vandana Kushwaha, Tamagna Mandal, Geetansh, Aritra Naha, Vishwajith N. S., Shreyasri Sain, Shenoy Pralhad Shankar, Debranjan Hati, Shuva Biswas, Ayon Phukan, Amrendra Kumar Gupta, Brundha A., Sayan Goswami, Priyanshi Bahuguna, Sovan Kundu, Saikat Das, Bastab Panja, Kavitha N., Tambavekar Akshay Popat, Ayan Chowdhury, Yashas V. Bharadwaj**
M.Sc. Chemistry: 21	**Naren Ghandhi K. K., Debmalya Bhattacharya, Sudipa Aich, Subarna Panda, Mridul Krishna Sharma, Karushuda Anita, Subhajit Pal, Priyanka, Kausik Kundu, Soumyadip Maiti, Abhirup Guha, Sharanava Dasgupta, Chandrayee Mitra, Arpitha R., Sumedha Ganguly, Pratyush Pandit, Soumitri Chatterjee, Tanu Sharma, Dexi Polachan, Anindita Phukan, Afrin Ahamed**
Ph.D.: 57	**Satyajit Patra, Anju A. K., Saikat Ghosh, Rohit Attri, Dikshaa Padhi, Hariharan M., Sabyasachi Mandal, Acharya Yash Sanjay, Devender Goud G., Soumi Mondal, Subhajit Chakraborty, Gauttam Dash, Subham Das, Animesh Bhui, Anustoop Das, Arindam Ghosh, Bhaskar Kakoty, Biplab Patra, Debajit Kalita, Paramesh Das, Krithi K. Bhagavath, Subhankar Maity, Nandini Saha, Vaishali Taneja, Nilutpal Dutta, Soumya Panja, Sushanta Show, Debashree Borah, Anshulata, Devesh Chandra Binwal, Keshavkrishna Mondal, Sumedha Gupta, Piyasi Garai, Milind Kumar Anand, Rubu Rinya, Subhradeep Barman, Diku Raj Deka, Sayan Das, Priyanka, Indrajit Haldar, Saswata Bandyopadhyay, Samprete Bhattacharyya, Saurav Saha, Alka Chahal, Aagustya Gupta, Neeraj Chauhan, Deepsikha Debnath, Jagmeet Kaur, Nisha, Navami V. V., Kishmita Kalita, Ayan Ganguly, Alapan Samanta, Priyanka Kanaujiya, Samina Dastagir Mulla, Rahul Kumar, Jikesh Bhoi**

Administrative Staff	
Scientific Administrative Assistant	**Ragina K. K.**

NCU

Temporary Staff	
Project Scientist III	**Dr. Aruna Satyamurthy**
Project Scientist I	**Dr. Sonali Ghosh**

Technical Staff	
Technical Assistant (Inst)	**Shivakumar K. M.**

Technical Staff (On Contract)	
Technical Assistant	**Shivaprasad P. S.**
Technical Assistant Trainees	**Dr. Samiran Misra, D. Kannan**
Laboratory Assistants	**Sreelakshmi V., Savitha N.**
Secretarial Assistant Trainee	**Prema M. S.**

Research Staff (On Contract)	
Junior Research Fellows	**Rittika Chatterjee, Madhurima Sarkar, Arnold Arun Thomas, Anu P., Ajay Prasad J., Aparna R. Nair, Anjana S., Manami Banerjee, Christeena Sabin, Meera R., Rashmi Devaru Hegde, Saurav K. V.**
Project Associates-I	**Sanjay Sajeev, Rajat H. S., Ashwini Panjabrao Bodade, Gaurav A. Borkar**
R&D Assistants	**Sayantoni Choudhury, Upasha Acharyya, Sucheta Biswas, Ramjayakumar Venkatesh, Hasem Ansari**
Research Associates	**Dr. Jayita Pradhan, Dr. Jyotshna Phukon, Dr. Chandan Ramanna, Dr. Madhu R., Dr. Abu Sufiyan, Dr. Wagalgave Sopan Mahadev, Dr. Amar Ghosh, Dr. Kediya Siddhiben Bakulbhai, Dr. Bitan Ray, Dr. Saptarshi Chakraborty, Dr. Keshav Kumar, Dr. Sreyan Ghosh, Dr. Ashutosh Kumar Singh, Dr. Arka Som, Dr. Reetendra Singh, Dr. Suryakanta Mishra, Dr. Anindita Goswami, Dr. Amir Mehtab, Dr. Chethana A., Dr. Vasudhar Bhat S. V., Dr. Himani Singh, Dr. Rajib Dey, Dr. Draksharapu Rammohan, Dr. Subrata Sahoo, Dr. Mohd Riyaz, Dr. Shikha Agrawal, Dr. Mujeeb Alam, Dr. Kumar Saurabh, Dr. Prabir Dutta, Dr. Geetika Dhanda, Dr. Ashish Kumar, Dr. Angshuman Das, Dr. Prasenjit Mandal, Dr. Kalpita Baruah, Dr. Arnab Mandal, Dr. Subarna Das, Dr. Ananya Chattaraj, Dr. Kousik Das**
Research Associates (P)	**Sandeep Howlader, Monika Bhakar**
Senior Project Associates	**Dr. Bisweswar Das, Dr. Bishnubasu Giri**
Senior Research Fellow	**Kajal M. Kamat**
SERB-National Post Doctoral Fellows	**Dr. Suresh R., Dr. Soumik Dinda**

Research Staff (On Contract)	
SERB-TAREs	**Dr. Srinatha N., Dr. B. N. Ramesh, Dr. Manjunatha S. O.**
UGC: Dr. D. S. Kothari Post-Doctoral Fellow	**Dr. Veenu Mishra**

NCU

Unit at a Glance

Honours/Fellowships/Memberships Received

8 Faculty Members **19** Students

Faculty Achievements

Prof. Subi Jacob George
- Appointed Fellow of the National Academy of Sciences, India (NASI), 2023
- Received the Chirantan Rasayan Sanstha (CRS) Award for Research and Innovation Excellence 2023
- Appointed Associate Editor of *Chemical Science*, a flagship journal of RSC
- Appointed Editorial Advisory board member, *Journal of the American Chemical Society* (JACS)
- Invited to become Editorial Advisory board member, *Physical Chemistry Chemical Physics*
- Appointed Editorial Advisory board member, *Chemistry-An Asian Journal*

Prof. Jayanta Haldar
- Received Fellowship of the Indian Academy of Sciences
- Awarded the MRSI Medal by the Materials Research Society of India (MRSI) 2023
- Invited to join as Member of American Society of Microbiology (ASM)
- Appointed Editor-in-chief of *ACS Infectious Diseases*, Editorial board
- Editorial board member of the journal *RSC Medicinal Chemistry*

Prof. Kanishka Biswas
- Received the Chirantan Rasayan Sanstha (CRS) Award for Research and Innovation Excellence 2023
- Received the Khosla National Award (Sciences), 2023, IIT Roorkee
- Selected amongst the 2022–23 Pioneering Investigator Lectureship—Highly Commended Researchers of Chemical Society Reviews by the Royal Society of Chemistry

Prof. Govindaraju T.
- Invited to join as Editorial Advisory Board Member of *ACS Medical Chemistry Letters*
- Received the Vividhlaxi Audyogik Samshodhan Vikas Kendra (VASVIK) Award 2022 for outstanding contributions in the chemical biology of 'functional & disease amyloids'
- Awarded the National Technology Award 2023 for "Outstanding Contribution of Scientists in Commercialising Innovative Indigenous Technologies" by Dr. Jitendra Singh, the Union Minister for Science and Technology, on 14th May 2023

Prof. Sebastian C. Peter
- Received Rajiv Goyal Prize for Young Scientists (Chemical Sciences) from Kurukshetra University
- Received International Association for Advanced Materials (IAAM) Scientist Medal
- Received National StartUp Awards 2023 (Sustainability Champion) for Breathe Applied Sciences Pvt. Ltd., from the Department for Promotion of Industry and Internal Trade (DPIIT), Govt. of India
- Received Material Science Annual Prize 2023 by the Materials Research Society of India (MRSI)
- Received the Chirantan Rasayan Sanstha (CRS) Research Partnerships and Industry Translation Medal 2023
- Received Fellowship of the Indian Academy of Sciences
- Appointed as Editorial Advisory Member, RSC's *Chemical Science Journal*
- Appointed as Editorial Advisory Board Member, *Journal of the American Chemical Society* (JACS)
- Invited to join as Editorial Advisory Board Member, *ChemSusChem* (Wiley-VCH)

NCU

Prof. Sarit S. Agasti

- Awarded the National Prize for Research in Bio-Physical Chemistry (C.N.R. Rao Education Foundation) on 31st July 2023 (along with Prof. Pinaki Talukdar, IISER, Pune)

Prof. K. N. Ganesh

- Honoured with the Chirantan Rasayan Sanstha (CRS) Life Science Achievement Award 2023

Prof. Hiriyakkanavar Ila

- Invited for the Sri Krishna Endowment Lecture and Prize by the Department of Organic Chemistry, IISc, Bengaluru, in April 2023
- Invited for the Professor Deodhar Endowment Lecture and Prize by the Departmnet of Chemistry, IIT Bombay in January 2024
- Received Indian National Science Academy Honorary Scientist position for a period of 3 years

Student Achievements

Dr. Debattam Sarkar (Alumnus, JNCASR; research supervisor: Prof. Kanishka Biswas)

- Received KPIT Shodh Best Research Award (For Best Ph.D. Thesis) (2024), KPIT Technologies
- Received Goldsmid Award, International Thermoelectric Society (ITS)

Dr. Prasenjit Mandal (Research Associate; research supervisor: Prof. Ranjani Viswanatha)

- Received International Travel Grant from Science and Engineering Research Board (SERB) International Travel Support (ITS)

Dr. Angshuman Das (Research Associate; research supervisor: Prof. Subi Jacob George)

- Winner of the Saransh – Thesis Competition for Ph.D. students 2023, Indian National young academy of sciences (INYAS)

Dr. Kalpita Baruah (Research Associate; research supervisor: Prof. Bani Kanta Sarma)

- Received Best Poster Award at the 4th Student Indian Peptide Symposium 2024

Anju A. K. (Ph.D. Student; research supervisor: Prof. Subi Jacob George)

- Received Best Poster Award in Thieme Organic Chemistry Symposium 2023, Thieme Group

Anshulata (Ph.D. Student; research supervisor: Prof. Bani Kanta Sarma)

- Received Best Oral Presentation Award at the 4th Student Indian Peptide Symposium 2024

Yash Sanjay Acharya (Ph.D. Student; research supervisor: Prof. Jayanta Haldar)

- Selected for Oral Presentation, GRS on New Antibacterial Drug Discovery 2024, Ventura, California, USA
- Selected for Poster Presentation, GRC on New Antibacterial Drug Discovery 2024, Ventura, California, USA
- Selected for Oral Presentation at ChemSci2023, JNCASR
- Selected for Poster Presentation at GRC Staphylococcal Diseases, 2023, USA

Samprete Bhattacharyya (Ph.D. Student; research supervisor: Prof. Bani Kanta Sarma)

- Received Best Poster Award at the Annual Faculty Meeting and In-House Symposium 2023, JNCASR

Paramesh Das (Ph.D. Student; research supervisor: Prof. Bani Kanta Sarma)

- Received Travel Award, International Peptide Symposium, 2023 Brisbane, Australia. Sponsor: International

NCU

Peptide Symposium organising committee

Debajit Kalita (Ph.D. Student; research supervisor: Prof. Bani Kanta Sarma)
- Received Travel Award, International Peptide Symposium, 2023, Brisbane, Australia. Sponsor: Ambiopharm

Soumi Mondal (Ph.D. Student; research supervisor: Prof. Sebastian C. Peter)
- Received Best Poster Award from the Materials Research Society of India

Riddhimoy Pathak (Ph.D. Student; research supervisor: Prof. Kanishka Biswas)
- Received Young Researcher Award from the European Materials Research Society, Strasbourg, France
- Received Materials Next 5.0 Award at the Tata Steel's Advanced Materials Research Centre

Satyajit Patra (Ph.D. Student; research supervisor: Prof. Subi Jacob George)
- Received Best Poster Award in SPSI Macro 2023, The Society for Polymer Science (SPSI), India

Nandini Saha (Ph.D. Student; research supervisor: Prof. Jayanta Haldar)
- Selected for Poster Presentation at the Annual Faculty Meeting and In-House Symposium 2023, JNCASR

Vaishali Taneja (Ph.D. Student; research supervisor: Prof. Kanishka Biswas)
- Received Materials Next 5.0 Award at the Tata Steel's Advanced Materials Research Centre

Shuva Biswas (Int. Ph.D. Student; research supervisor: Prof. Kanishka Biswas)
- Received Student Chanakya Fellowship for Quantum Technology Research, I-Hub Quantum Technology Foundation

Sayan Chakravarty (Int. Ph.D. Student; research supervisor: Prof. Jayanta Haldar)
- Selected Participant for "C-CAMP AMR Innovator School-2024", Bengaluru

Sudip Mukherjee (Int. Ph.D. Student; research supervisor: Prof. Jayanta Haldar)
- Selected for Poster Presentation at the Nature Conference "Nanomaterials in biomedical applications" 2024, Nature Conferences, Manipal, India
- Selected for Oral Presentation at the 17th International Conference on Polymer Science and Technology ("SPSI-MACRO-2023") 2023, IIT Guwahati, India

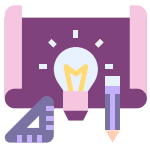
Dipanjana Patra (Int. Ph.D. Student; research supervisor: Prof. Jayanta Haldar)
- Selected for Poster Presentation at the Nature Conference "Nanomaterials in biomedical applications" 2024, Nature Conferences, Manipal, India
- Received Best Poster Award, at the Annual Faculty Meeting and In-House Symposium 2023, JNCASR
- Selected for Oral Presentation at the 17th International Conference on Polymer Science and Technology ("SPSI-MACRO-2023") 2023, IIT Guwahati, India
- Selected for Poster Presentation at the International Conference on Recent Advances in Materials (RAM-90), JNCASR

Total Publications

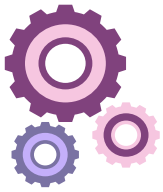
115 Peer reviewed articles indexed in Web of Science/Scopus

NCU

Sponsored Projects



15 New Projects **₹2.46 cr.** Grant Amount Received During 2023–24



25 Ongoing Projects **₹116.81 cr.** Grant Amount Received During 2023–24

Students Graduated During 2023–24

Ph.D.: 7
Arka Som, Sapatarshi Chakraborty, Rajib Dey, Sreyan Ghosh, Madhu R., Reetendra Singh, Suchi Smita Biswas

M.S. (Int. Ph.D.): 7
Ritika Raghuvanshi, Vandana Kushwaha, Ivy Maria, Sayan Chakravarty, Arghya Ghosh, Surya Pravo Mookerjee, Prabhat Thapliyal

M.Sc. in Chemistry: 5
K. Palani Ganesh, Arpita Panda, Jatin Chauhan, Ramjayakumar V., Kashish Kumar Taneja

Students Admitted During 2023–24

Ph.D.: 13
Aagustya Gupta, Neeraj Chauhan, Deepsikha Debnath, Jagmeet Kaur, Nisha, Navami V. V., Kishmita Kalita, Ayan Ganguly, Alapan Samanta, Priyanka Kanaujiya, Samina Dastagir Mulla, Rahul Kumar, Jikesh Bhoi

M.S. in Chemical Science (through Int. Ph.D.): 5
Bastab Panja, Kavitha N., Tambavekar Akshay Popat, Ayan Chowdhury, Yashas V. Bharadwaj

M.Sc. Chemistry: 14
Kausik Kundu, Soumyadip Maiti, Abhirup Guha, Sharanava Dasgupta, Chandrayee Mitra, Arpitha R., Sumedha Ganguly, Pratyush Pandit, Soumitri Chatterjee, Tanu Sharma, Dexi Polachan, Anindita Phukan, Afrin Ahamed, Nikita Tuwani

Current Student Strength

111

NEUROSCIENCE UNIT

Neuroscience is a frontier area of research both at a fundamental and applied level. At the Neuroscience Unit (NSU), researchers work on understanding neuronal cells' unique molecular and biophysical properties and the emergent properties of neuronal networks. Furthermore, we are engaged in finding novel therapeutic interventions to tackle disorders of the nervous system.

Currently, we are investigating processes underlying mammalian brain development, circadian rhythms and sleep, molecular and cellular mechanisms causing human brain and mind disorders and also designing biomaterials for interfacing sensory organs with soft analogue devices. The diversity in the individual research themes pursued by the faculty members also reflects the widely differing types of scientific approaches and methodologies used in understanding how the nervous system functions and determining the various behaviours of organisms, including humans.

NSU intends to expand its activities to the broad areas of neurophysiology, computational neuroscience, cellular neuroscience, and developmental neurobiology using a diversity of model systems. To enhance its the biomedical translational capability and to investigate synaptic function, morphology, and neuronal circuit function, establishing advanced imaging technologies is on the anvil.

Research Areas

- Developmental and translational neurobiology
- Deciphering mechanisms and potential therapies for brain malformations, hydrocephalus, and epilepsy
- Cerebellar development and disorders, using clinically relevant mouse models
- Investigating bidirectional relationship between circadian clocks and neurodegeneration - genetic and lifestyle interventional approaches
- Role of gap junctional proteins in circadian rhythm circuitry
- Chronotype evolution or the evolution of "owl" and "lark" phenotypes
- Dysregulated autophagy in neurodegenerative diseases
- Understanding autism spectrum disorders using Syngap1 heterozygous mutant mice as a model
- Circadian clock evolution under semi-natural conditions
- Plasticity of circadian waveforms
- Genetic mechanisms underlying epileptic encephalopathies, generalised epilepsies and autism.

Research Highlights

- It was demonstrated that ataxin-3-associated synaptic dysfunction in motor neurons of flies could be rescued by genetic intervention of the autophagy pathway.
- Locomotor activity bifurcation and accompanied pacemaker circuit reorganisation in the fly model under novel right regimes with dim light at night was investigated.
- Common developmental and behavioural mechanisms underlying genetic hydrocephalus using a clinically relevant mouse model were determined.

NSU

RESEARCH ACTIVITIES AND ACHIEVEMENTS OF 2023–24

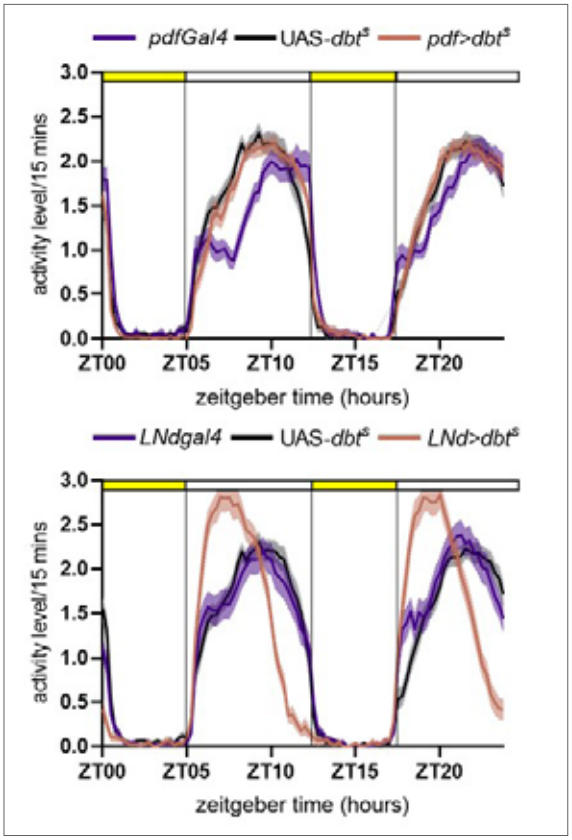
Prof. Ravi Manjithaya
Professor (jointly with MBGU) and Chairperson, NSU

Please refer to pg. 110 for research activities

Prof. Sheeba Vasu *F.N.A.*
Professor, NSU

Appropriate timing of physiological and behavioural rhythms of organisms in accordance with environmental cycles is regulated by endogenous timekeepers or circadian clocks. Changes in external cycles due to natural and anthropogenic factors induce changes in work-driven novel light/dark cycles. Studies using a nocturnal rodent model showed that novel light regimes with alternating light and dimly lit periods caused wheel-running activity to bifurcate such that mice showed 2 bouts of activity restricted to the dimly lit phases.

Our studies using a fly model demonstrated the conservation of features of the light regime, i.e., dim scotopic illumination of specific light durations induces activity bifurcation. We leveraged the genetic toolkit of the *Drosophila* model to also show evidence for the reorganisation of the circadian pacemaker neuronal network upon exposure to such novel light regimes. Our findings indicated that conserved effects of specific features of the environmental regimes can be exploited to design light regimes that ease the waveform into synchronising with challenging conditions, such as during shift work, jetlag, and photoperiodic changes.



Speeding up the molecular circadian clock (red curve) in only the "evening" neurons (bottom) causes an advanced phase of both bifurcated activity bouts, whereas "morning" neurons (top) fail to do so, suggesting circadian pacemaker circuit reorganisation under this novel light regime where light (yellow shaded duration) and dim light phases (white shaded duration) alternate in 12 hours.
Reference: *bioRxiv*, 2024. doi: 10.1101/2024.05.07.592876

Events Organised:

- 18th August 2023: Seminar on *"Circadian plasticity evoked by photo- and chemosensory cues"* by Dr. Abhishek Chatterjee, Scientist, Sensory Ecology department, iEES-Paris (INRAE), France, held at JNCASR
- 4th January 2024: Seminar on *"Sleep is plastic and supports plasticity"* by Dr. Krishna Melnattur, Assistant Professor of Psychology and Biology, Ashoka University Haryana, held at JNCASR
- 26th February 2024: Seminar on *"Understanding the genetic basis of mitochondrial dysfunction and neurodegeneration"* with speaker Dr. Debdeep Dutta, Postdoctoral Associate, Department of Molecular and Human Genetics, Baylor College of Medicine, held at JNCASR
- 8th–9th March 2024: "*Nerve-storming: from molecules to behaviour symposium*" co-organised with Dr. Achira Roy, JNCASR

NSU

Major Talks During 2023–24:

- May 2023: Talk on *"Biological clocks"* as part of science outreach activity organised by Himalayan Gram Vikas Samiti and C. N. R. Rao Hall of Science, Champawat, Uttarakhand
- 23rd–24th May 2023: Three talks: "*a) Models to study circadian rhythms; b) Underlying genetic and molecular basis of circadian clocks; c) Sleeping flies and what we can learn from them, as part of workshop for pedagogical teaching of theory and laboratory exercises"* at the Chronobiology School, North Eastern Hill University, NEHU, Shillong
- 8th July 2023: Webinar on *"The tick-tock of daily clocks – neuronal underpinnings of circadian pacemakers"* organised by the Biology club La Vida at IISER Behrampur
- 9th August 2023: Seminar on *"Biological timekeeping – the neuronal and genetic basis of our tick-tock world"* at Zoology Department, Mount Carmel College, Bengaluru
- 13th September 2023: Webinar on *"Targeting the circadian clock to find mitigators of HD – lessons from fly models"* as part of the National Workshop in Circadian Biology organised by the Zoology Department, MSU, Baroda
- September 2023: Talk on *"Glial gap junctions for rhythmic locomotion in the fly"* as part of MBGU-NSU Day (Annual department day) organised by JNCASR Faculty and students
- 9th November 2023: Talk on *"Targetting the circadian system to find mitigators of HD- lessons from fly models"* as part of the NCRTBS-2023 workshop organised by the Department of Zoology, Mangalore University
- 24th November 2023: Talk on *"Targeting the circadian clock to find mitigators of HD – lessons from fly models"* for Biology Colloquium organised by Ashoka University, Sonipat
- 6th December 2023: Talk on *"Circadian clocks – their evolution and neuronal circuitry – lessons from Drosophila evolving under seminatural conditions"* at the 89th Annual General meeting of Indian National Science Academy INSA, organised by CCMB-IICT and NGRI, Hyderabad
- 12th December 2023: Talk on *"The many mysteries of sleep"* as part of Science Outreach Activity organised at School Chandan, Lakshmeshwar
- 14th December 2023: Talk on *"Can the circadian circuit serve as a target for remediation of neurodegeneration"* at the Social Brain—from Brain Function to Society symposium, organised by National Brain Research Centre, Manesar
- 23rd December 2023: Talk on *"Clocks that time us – what, where and how?"* as part of the National Workshop on Training, Teaching and Learning with *Drosophila*, organised at the Department of Zoology, Mysuru University
- 31st January 2024: Talk on *"Clocks that time us – what, where and how?"* at the Department of Lifescience, Mount Carmel College, Bengaluru
- 2nd February 2024: Talk on *"Thermal cues as drivers of circadian clock evolution"* as part of the Frontiers in Biology symposium organised at IISER, Thiruvananthapuram

Dr. Achira Roy

Assistant Professor and Associate Warden, NSU

Absence of Neurofibromin 1 (NF1) has been reported to cause malformation of cortical development (MCD) in humans. Ongoing work in our lab addresses brain overgrowth and hydrocephalus using a conditional loss-of-function mouse model of *NF1*. Diallelic NF1 loss driven by early-onset brain-specific care resulted in a hydrocephalus phenotype with varying severity. We also identified an interesting motor dysfunction in these hydrocephalic mice that reciprocates the clinical phenotype observed in patients with NF1 mutations. Using a hindlimb clasping scoring paradigm, we video-recorded the different genotypes and analysed them for 10 seconds. We found the mutant to retain score 4, that is, clasping all 4 limbs together, for a significantly longer duration than any other group. This will be tested further using other behavioural assays (e.g., rotarod) for further characterisation of how cerebrospinal fluid flow and non-functional ependymal cells can affect motor functions.

Reference: *Annals of Neurosciences.* 30 (1): 3–139, 2023. doi: 10.1177/09727531231205772

NSU

Events Organised:

- 16th June 2023: NSU Seminar *"Developmental programmes unique to humans provide vital clues on mechanisms of pathogenesis of cerebellar disease"* by speaker Dr. Parthiv Haldipur, Seattle Children's Research Institute, Seattle, USA, held at JNCASR
- 10th July 2023: NSU Seminar *"How to make a hippocampus"* by Prof. Shubha Tole, Professor, Tata Institute of Fundamental Research, (TIFR), Mumbai, India, and Honorary Professor, JNCASR
- 10th July 2023: Student discussion on *"How career planning is different for women: A session for all genders"* by Prof. Shubha Tole, Professor, Tata Institute of Fundamental Research, (TIFR), Mumbai, India, and Honorary Professor, JNCASR
- 8th–9th March 2024: "*Nerve-Storming: from Molecules to Behaviour symposium*" Co-organised with Prof. Sheeba Vasu, JNCASR

Major Talks During 2023–24:

- 4th–6th October 2023: Talk on *"Modelling a spectrum of early-onset human neurodevelopmental disorders – timing and mechanisms"* as part of the XLI Annual Conference of Indian Academy of Neurosciences and International Conference on *"Brain: Chemistry to Cognition"*, organised by Jiwaji University, Gwalior, and Indian Academy of Neurosciences (IAN)
- 18th–20th January 2024: Talk on *"Modelling a spectrum of early-onset human developmental brain disorders – timing, mechanism, and therapy"* at the Manipal Genetics Update VII on Cellular and Animal Models for Rare Genetic Diseases conference organised by the Department of Medical Genetics, Kasturba Medical College, Manipal
- 29th–30th January 2024: Talk on *"Modelling early-onset human neurodevelopmental disorders – brain overgrowth, hydrocephalus, epilepsy"* at the Brain Disorders: Perspectives from Developing and Aging Brain symposium, organised by NBRC, Manesar
- 21st–24th February 2024: *"In search of convergent mechanisms underlying developmental hydrocephalus"* at the Biennial meeting of the Indian Society of Developmental Biologists (InSDB), organised by Bengaluru Life Science Cluster (BLiSC), Bengaluru and the Indian Society of Developmental Biologists (InSDB)

Unit Members

Faculty	
Professor and Chairperson	**Prof. Ravi Manjithaya** (Professor, MBGU)
Professor	**Prof. Sheeba Vasu**
Assistant Professor and Associate Warden	**Dr. Achira Roy**

Associate Faculty

Prof. Anuranjan Anand (Professor, MBGU)
Prof. Tapas Kumar Kundu (Professor, MBGU)
Prof. K. S. Narayan (Professor, CPMU)

Research Students	
Ph.D.: 14	**Mansi Rathi, Lipali Priyadarshini, Surajit Dawn, Rahul Dubey, Anjali Sharma, Debopriya Choudhury, Badigannavar Neeti Anand Geeta, Rupareliya Vimal Pravinbhai, Shubham Singhal, Geetha V. C., Yashasvi Sharma, Smruti Rekha Sahoo, Mahalakshmi N., Pritiben Pankajbhai Prajapati**

NSU

Research Students	
Ph.D. through Int. Ph.D.: 5	**Vishal Rajesh Lolam, Kulkarni Rutvij Kaustubh, Ankit Sharma, Sharma Pragya Niraj, Kamakshi Tomar**

Administrative Staff	
Sr. Helper	**Samuel S.**

Research Staff (On Contract)	
R&D Assistants	**Anuj Menon, Aqsa Yashfeen, Sushma S. Rao, Cuckoo Teresa Jetto, Ankit Sharma, N. S. Neeta**
Research Associate	**Dr. Roshan Fatima Begum**
Senior Research Fellow	**Viveka Singh**

Unit at a Glance

Honours/Fellowships/Memberships Received

5 Faculty Members **2** Students

Faculty Achievements

Prof. Sheeba Vasu
- Received Fellowship of the Indian National Science Academy

Dr. Achira Roy
- Selected as the runner-up of Ben Barres Spotlight Award 2023
- Received the SERB Grant for Symposia/Conferences, Science and Engineering Research Board (SERB), Department of Science and Technology (DST), Government of India
- Appointed as Assistant Content Editor, *Bio-protocol Journal* since July 2023

Prof. Anuranjan Anand
- Appointed as member of the Public Education and Awareness Committee, American Society of Human Genetics (ASHG), Rockville, USA

Prof. Tapas Kumar Kundu
- Entrusted as the RC Chair of CSIR-IICB, by DG CSIR, for a period of 3 years w.e.f. September 2023
- Invited to join as Reviewing Editor of *eLife*

Prof. K. S. Narayan
- Appointed as Distinguished Visiting Professor, IIT Bombay, 2024–26
- Selected as Editorial Board Member for *Materials Horizon–RSC(UK), ACS Applied Electronic Materials, Elsevier–Synthetic Metals*
- Selected as Committee Member of Department of Science and Technology, Government of India, FIST and SAIF programme

NSU

Student Achievements

Vishal Rajesh Lolam (Int. Ph.D. Student; research supervisor: Dr. Achira Roy)

- Received First Prize in Oral Presentation at the Manipal Genetics Update VII international event on *"Cellular and Animal Models for Rare Genetic Diseases"*, Manipal Academy of Higher Education (MAHE), Manipal
- Received Best Poster Award in Annual Faculty Meeting and In-house Symposium 2023, JNCASR
- Received Best Paper Award from the Organisers, Indian Academy of Neurosciences (IAN) and Jiwaji University, Gwalior
- Received Ravindra and Lalita Nath Travel Fellowship from the Indian Academy of Neurosciences (IAN)
- Ranked 25th in CSIR-NET for Lectureship/Assistant Professor (LS)

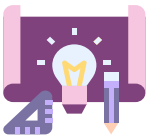
Pragya Sharma (Int. Ph.D. Student; research supervisor: Prof. Sheeba Vasu)

- Received the DBT-CTEP Travel Grant to attend Gordon Research Conference in Chronobiology, DBT-CTEP

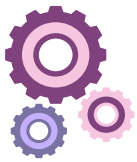
Total Publications

3 Peer-reviewed articles indexed in Web of Science/Scopus

Sponsored Projects



1 New Project



1 Ongoing Project

₹54.89 lac Grants Received During 2023–24

Student Admitted During 2023–24

Ph.D.: 8

Badigannavar Neeti Anand Geeta, Rupareliya Vimal Pravinbhai, Shubham Singhal, Geetha V. C., Yashasvi Sharma, Smruti Rekha Sahoo, Mahalakshmi N., Pritiben Pankajbhai Prajapati

Current Student Strength

19

THEORETICAL SCIENCES UNIT

The Theoretical Sciences Unit (TSU) at JNCASR seeks to address, explain, and understand the rich diversity found in the physical world. The aim is to predict new phenomena and design innovative materials, with an interdisciplinary approach that incorporates techniques and theories from Physics, Chemistry, and Biology. Two complementary approaches are used to study matter and life: the search for universality and the exploration and explanation of diversity.

TSU researchers use various analytical and computational techniques to unravel the perplexing and fascinating properties and behaviours shown by materials, looking into their structures and properties at a fundamental level. They are particularly interested in the concept of "emergence", where simple natural laws manifest as complex behaviour in larger systems.

The faculty members at TSU have expertise in many-body physics, computational chemistry, quantum mechanical density functional theory, statistical mechanics, and mathematical physics, and frequently collaborate with researchers within and outside JNCASR. The research is highly interdisciplinary, foraying into Theoretical Physics, Chemistry, Mathematics, and Evolutionary Biology. As such, students and researchers from diverse academic backgrounds, including Chemistry, Physics, Engineering, and Computer Science are welcomed.

Research Areas

- Evolutionary biology
- Quantum many-body systems
- Statistical physics of living and non-living matters
- Statistical physics of disordered systems
- Computational nanoscience

Research Highlights

- Structure and dynamics concerning phase transitions in passive and active matter systems were explored.
- Coarsening and Kibble-Zurek scalings in slowly quenched classical systems were studied.
- Non-resonant exciton–plasmon interaction in metal–chalcogenide (Cu_xS)/perovskite ($CsPbBr_3$)-based colloidal heterostructure was demonstrated
- Noncovalent charge transfer interactions and ambient triplet harvesting pathways in arylene diimides were uncovered
- Dependence of the glass transition and jamming densities on spatial dimension was analysed
- A quantum critical Mott transition was demonstrated and characterised in a new model Hamiltonian.
- Ultralow thermal conductivity in low dimensional metal halide arising from extended antibonding states and phonon localisation was studied
- (i) Operator Theory: Factorisation of isometric semigroup, Hilbert-Helson matrices, and their spectral properties; (ii) Estimation Problem in Quantum Theory of Observations.

TSU

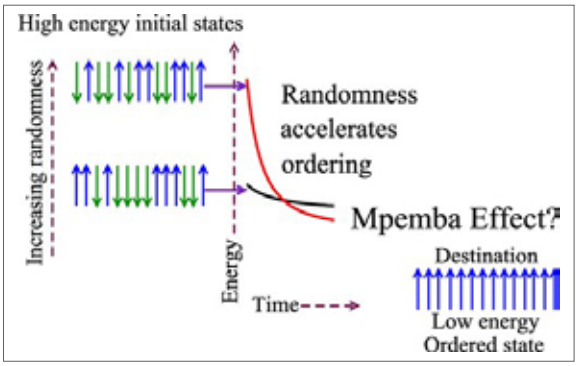
RESEARCH ACTIVITIES AND ACHIEVEMENTS OF 2023–24

Prof. Subir Kumar Das
Professor and Chairperson, TSU

In recent times, our group has been engaged in research related to phase transitions associated with passive as well as active matter systems. A primary focus is identifying and understanding the puzzling Mpemba effect (ME). ME is originally related to the faster freezing of a hotter sample of water than a colder one when quenched to the same subzero temperature. In the context of a generalised definition, our group is interested in studying ME in a variety of other phase transitions via computer simulations of model systems. In the most recent work involving a class of spin systems, we observed a universality in the strength of the effect.

Events Organised:

- 9th June 2023: *"Phases of q-state Active Potts Model (APM)"*, TSU Seminar by Prof. Raja Paul
- 8th November 2023: *"Making sense of the glass transition"*, TSU Seminar by Prof. Sanjay Puri
- 22nd March 2024: *"Mathematical modelling of epidemics",* TSU Seminar by Sourav Chowdhury



Schematic depiction of Mpemba effect for para-to-ferromagnetic transitions.
Reference: *Langmuir* 39 (31): 10715–10723, 2023. doi: 10.1021/acs.langmuir.3c00668

Major Talks During 2023–24:

- 6th April 2023: Invited Seminar on *"From milk to magnets: An overview of the not so well-known' Mpemba effect"* at IISER Tirupati
- 10th April 2023: Invited Seminar on *"Phase Transitions in the Beautiful World of Active Matter"*, at Physics Department, IIT Jodhpur
- 15th April 2023: Talk on *"Mpemba Effect: History and Scope"* for Department Day Talk, organised by IIT Jodhpur Physics Society
- 12th September 2023: Invited talk on *"Mpemba Effect in a Few Magnetic and Active Matter Systems"* at the Computational Statistical Physics in the 21st Century: The Legacy of Kurt Binder event, organised at Mainz, Germany
- 17th November 2023: Talk on *"Finite-Size Behavior in Phase Transitions and Scaling in the Progress of an EPIDEMIC"* at the In-house Symposium, JNCASR
- 12th December 2023: Talk on *"Mpemba Effect in Ising-like Dead and Living Systems"* at the Statistical Physics after Hundred Years of the Ising Model event, organised by Rajabazar Science College, University of Calcutta
- 8th–10th February 2024: Talk on *"Kinetics of Phase Transitions in Systems of Aligning Active Particles"* at Physics of Life: Active and Living Matter, organised at Puri, India

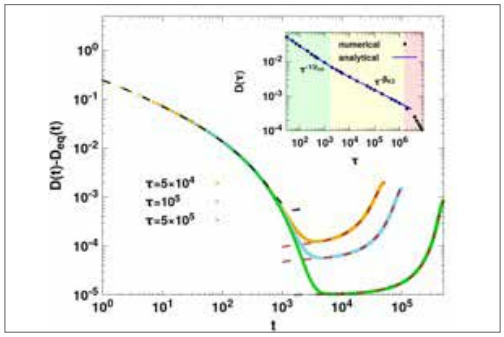
Prof. Kavita Jain
Professor, TSU

Following a rapid quench from a disordered to an ordered phase, a classical system exhibiting a second-order phase transition approaches the stationary state via coarsening. But if the system is quenched slowly, the excess defect density at the end of the quench is captured by the Kibble-Zurek mechanism. We showed that depending on the initial condition, there can be crossover from coarsening to Kibble-Zurek dynamics, and obtained exact results for the residual defect density for several cooling protocols in an Ising chain.

TSU

Events Organised:

- 16th–18th December: The 3rd AsiaEvo conference, co-organised with Parul Johri at University of North Carolina, USA.
- 12th–23rd February 2024: Sixth Bengaluru School on Population Genetics and Evolution, Co-organised with Deepa Agashe (NCBS, India)

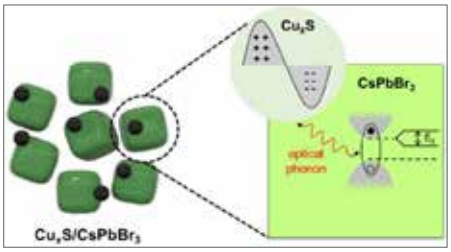


Dynamics of the excess defect density (main) and crossover from coarsening to Kibble-Zurek regime at the end of quench (inset) in Glauber Ising chain.
Reference: *Phys. Rev. E* 109: 054116, 2024.
doi: 10.1103/PhysRevE.109.054116

Prof. Shobhana Narasimhan *F.A.Sc., F.N.A.Sc., F.A.A.A.S., I.H.M*

Professor, TSU

Exciton–plasmon coupling between 2 materials is often exploited by heterostructures, leading to enhanced optical properties. For this, an essential criterion is the resonant energy coupling between the 2 materials. Recent studies have shown that non-resonant exciton–plasmon interaction can occur in a single semiconductor plasmonic nanomaterial, where the plasmonic and excitonic absorptions share no energy overlap. In line with this concept, our team designed a colloidal heterostructure composed of plasmonic Cu_xS and excitonic $CsPbBr_3$ without any spectral overlap to study the non-resonant interaction across the 2 materials. We found that the heterostructure had different structural and optical properties such as a strained interface between the 2 parent components. They exhibited higher Urbach energy compared to perovskite, and photoluminescence quenching, thus suggesting possible interaction. We also discovered that magnetic circular dichroism properties had clear signature of strong non-resonant exciton–plasmon interaction. Our study presented one of the first demonstrations of non-resonant exciton–plasmon interaction that can open new possibilities in plasmontronics.

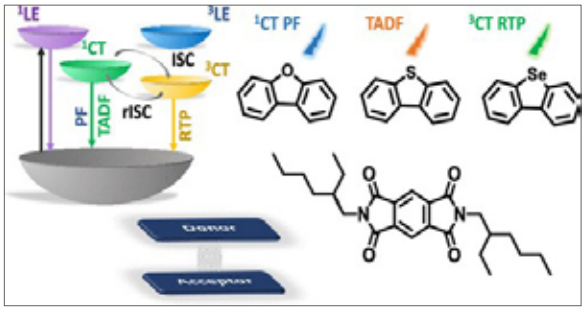


Non-resonant exciton–plasmon interaction in metal–chalcogenide colloidal heterostructure composed of Cu_xS and $CsPbBr_3$.
Reference: *J. Phys. Chem. C.* 127: 15353–15362, 2023.
doi: 10.1021/acs.jpcc.3c03331

Prof. Swapan K. Pati *F.A.Sc., F.N.A.Sc., F.N.A., F.T.W.A.S.*

Professor, TSU

Organic molecules that can harvest triplet excitons under ambient conditions hold great promise in the field of photophysics. Our team developed a strategy for precise control in tuning the triplet harvesting pathways in donor-acceptor cocrystals by engineering CT complexation between them. We used pyromellitic diimide (PmDI) phosphor to co-crystallise with different donors, such as dibenzofuran (DBF), dibenzothiophene (DBT), and dibenzoselenophene (DBS), that augment CT complexation. These also carefully toggle the emission into singlet CT fluorescence, thermally activated delayed fluorescence, and triplet CT phosphorescence in their



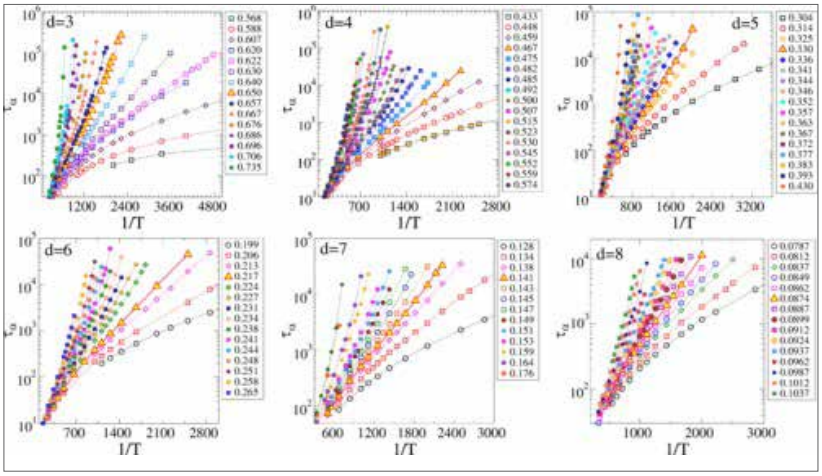
Noncovalent charge transfer interactions and ambient triplet harvesting pathways in arylene diimides.
Reference: *Chem. Mater.* 35 (18): 7781–7788, 2023.
doi: 10.1021/acs.chemmater.3c01667

respective cocrystals. On moving from PmDI-DBF to PmDI-DBT, the emission was biased from 1CT fluorescence to TADF. Furthermore, the synergistic involvement of the strong heavy-atom effect with CT complexation diverted the excited emission from TADF to exclusively 3CT phosphorescence in PmDI-DBS. Most importantly, we not only put forward a methodology for biasing the excited state to various ambient triplet harvesting pathways but also elevated a modular noncovalent donor-acceptor strategy without complicated synthetic efforts unlike conventional covalent donor-acceptor molecular designs.

Prof. Srikanth Sastry *F.A.Sc., F.N.A.Sc., F.N.A.*

Professor, TSU

Our team investigated the dynamics of soft sphere liquids through computer simulations for spatial dimensions from d = 3 to 8 over a wide range of temperatures and densities. We employed a scaling of density-temperature-dependent relaxation times to precisely identify the density ϕ_0 that represents the ideal glass transition in the hard sphere limit, and a crossover from sub- to super-Arrhenius temperature dependence. The differences between ϕ_0 and the athermal jamming density ϕJ, small in 3 and 4 dimensions, increased with dimension, with $\phi_0 > \phi_J$ for d > 4. Finally, we compared our results with recent theoretical calculations.



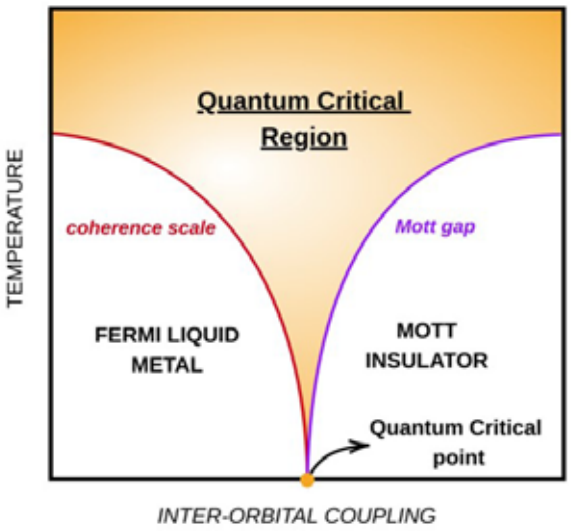
Relaxation times as a function of inverse temperature are plotted in a semilog scale for several densities in different dimensions.
Reference: *Phys. Rev. Lett.* 131: 168202, 2023.
doi: 10.1103/PhysRevLett.131.168202

Prof. N. S. Vidhyadhiraja

Professor, TSU and Dean, Fellowships and Extension Programmes

Metal–insulator (MI) transitions hold immense importance in fundamental investigations and technological applications. Interaction-driven MI transitions are quite elusive, and very few examples of such transitions exist. Theoretically, the paradigm for studying such transitions is a one-band Hubbard model, which shows a first-order MI transition. Quantum criticality is a separate paradigm characterised by continuous quantum phase transitions at absolute zero. Although quantum critical points cannot be directly accessed in experiments, measurements of energy scales and extrapolation have provided conclusive evidence of their existence in many materials, such as heavy-fermion systems and low-dimensional spin systems. We have discovered a model Hamiltonian system where the two paradigms of MI transitions and quantum criticality have come together to yield a rich phase diagram that exhibits interaction and hybridisation-driven continuous MI transitions at absolute zero. These novel quantum critical points host a soft-gap hybridisation and separate Fermi liquid metallic and Mott insulating ground states. The finite-temperature quantum critical region is characterised by power laws that are expected to manifest in exotic behaviour of transport and thermodynamic observables.

TSU



A schematic phase diagram of a modified periodic Anderson model in the temperature-hybridisation plane for a fixed interaction strength. The quantum critical point is found by the vanishing of the Fermi liquid scale and the Mott gap. The quantum critical region is characterised by power laws in single-particle and two particle quantities.

Reference: *Phys. Rev. B* 107: 205104, 2023.
doi: 10.1103/PhysRevB.107.205104

Events Organised:

- 18th April 2023: Seminar on *"Towards simulating fluid flows on quantum computers"*, by Sachin S. Bharadwaj, organised in collaboration with Katepalli R. Sreenivasan, NYU, USA
- 24th November 2023: Seminar on *"Science through Entrepreneurship: Synthesis and Characterization of 2dim Materials"*, by Prof. Deshdeep Sahdev, Director, Quazar Technologies, New Delhi at TSU, JNCASR
- 9th–12th December 2023: International Science Outreach Program, Co-organised with School Chandan, Laxmeshwar, and C.N.R. Rao Education Foundation, JNCASR, Bengaluru

Major Talks During 2023–24:

- 6th–8th April 2023: Workshop-cum-Discussion Meeting (WQM23) on *"Deliberations on thermal signatures of quantum entanglement in quantum materials"* organised by IISER, Thiruvananthapuram
- 24th–26th July & 27th–28th July: Workshop on *"Material-specific investigations of strongly correlated electron systems through DFT+DMFT"* at NAMMA Psi-k 2023: New Approaches and Machine learning Methods for Ab initio calculations, held at JNCASR and IISc respectively, organised by Gour P. Das from TCG CREST, Kolkata, Ananth Govind Rajan from IISc Bengaluru, Manish Jain from IISc Bengaluru, Phani Motamarri from IISc Bengaluru, and Shobhana Narasimhan from JNCASR
- 12th–13th October 2023: Talk on *"Correlated systems"* at the Symposium on Materials and Computational Chemistry Applications on HPC platform, organised by C-DAC Pune
- 27th–29th October: Talk at the Outreach Programme on *"Learning Physics through experiments"*, at the Annual Science Camp, organised by Sagar Science Forum, Sagara and C.N.R. Rao Education Foundation, JNCASR
- 27th–30th November 2023: Talk on *"Steady state DC transport through a quantum dot coupled to leads with spin-orbit coupling"*, at the Quantum Condensed Matter (QMAT-23) Conference, organised by National Institute of Science Education and Research (NISER) Bhubaneswar
- 10th – 12th December 2023: Talk at the International Science Outreach Programme on *"Learning Physics through experiments"*, co-organised by School Chandan, Laxmeshwar, and C.N.R. Rao Education Foundation, JNCASR
- 6th–7th March 2024: Talk on *"Metal-Insulator transitions and quantum criticality: A theoretical perspective"*, at the 4th International Conference on Recent Trends in Materials Science (ICRTMS-24), organised by Kristu Jayanti College in association with Indian Association for Crystal Growth (IACG) and Indian Association of Physics Teachers (IAPT), and sponsored by DST-SERB

TSU

Prof. Umesh V. Waghmare *F.A.Sc., F.N.A.Sc., F.N.A., F.N.A.E.*

Professor TSU and Dean, Faculty Affairs

Tailoring the thermal conductivity of a material requires an in-depth understanding of its structural and chemical properties. To expand our knowledge in this arena, we investigated the nature of chemical bonding and its influence on the thermal transport properties (2–523 K) of all-inorganic halide perovskite $Cs_3Bi_2I_9$. We found that κ_L exhibited an ultralow value of ≈0.20 W $m^{-1}K^{-1}$ in 30–523 K temperature range. The antibonding states just below the Fermi level in the electronic structure arising from the interaction between bismuth 6*s* and iodine 5*p* orbitals weakened the bond and created soft elasticity in $Cs_3Bi_2I_9$. We carried out first-principle density functional theory (DFT) calculations, which revealed the highly localised soft optical phonon modes originating from Cs-rattling and dynamic double octahedral distortion of 0D $[Bi_2I_9]^{3-}$ in $Cs_3Bi_2I_9$. Furthermore, we discovered that while the extended antibonding states gave rise to a soft anharmonic lattice, the Cs rattling provided sharp localised optical phonon modes responsible for strong lattice anharmonicity and ultralow κ_L.

Reference: *Adv. Funct. Mater.* 33 (41): 2304607, 2023. doi: 10.1002/adfm.202304607

Prof. K. B. Sinha *F.A.Sc., F.N.A., F.T.W.A.S.*

INSA Senior Scientist

Herglotz' representation theorem for bounded operator-valued holomorphic function on the unit disc, with non-negative real part has been intuitively expected and even used, without proper correct proof; and that is what has been provided here. This has also been used to establish the well-known spectral (diagonalization-) spectral theorem for unitary operators.

Reference: *Infinite-dimensional Analysis and Quantum Probability,* 2024. (To appear)

Major Talks During 2023–24:

- 1st–5th June 2023: Talk on *"Convex Analysis and Application to Machine Learning Theory: Classical and Quantum"*, at the International Conference on Quantum Probability, organised by the Mathematics Department, Ohio State University, Columbus, Ohio, USA
- 27th November 2023: Talk on *"Spectral Distribution of Unbounded Selfadjoint Operators"*, at the International Conference on Spectral and Approximation Theory, organised by the Mathematics Department, Cochin University of Science and Technology, Kerala
- 27th March 2024: Talk on *"Folner sequences, Szego-pair and Spectral distribution"*, at the National Conference on Operator Theory, organised by the Mathematics Department, Shiv Nadar University, Delhi-NCR

TSU

Unit Members

Faculty	
Professor and Chairperson	**Prof. Subir Kumar Das**
Professor	**Prof. Kavita Jain** **Prof. Shobhana Narasimhan** **Prof. Swapan K. Pati** **Prof. Srikanth Sastry** **Prof. N. S. Vidhyadhiraja** (Dean, Fellowships and Extension Programmes) **Prof. Umesh V. Waghmare** (Dean, Faculty Affairs)
INSA Senior Scientist	**Prof. K. B. Sinha**

Research Students	
Ph.D.: 25*	**Anita Gemmy Francis, Alok Kumar Dixit (ERP), Ankit Kumar, Arijit Sinha, Bhuvaneswari R., Ritam Chakraborty, Sujan K. K., Soumik Ghosh, Purnendu Pathak, Khandare Pushkar Gopalrao, Krishna Kanhaiya Tiwari, Lakshita Jindal, Mayank Sharma, Sayan Paul, Swarnendu Maity, Debargha Sarkar, Garima Ahuja, Md Wasim Akram, Raghav T. S., Sougata Saha, Kaushik Dey, Tanuja Shridhar Joshi, Shiv Praksh Mishra, Venu Goswami, Rubee Swarnkar**
Ph.D. through Int. Ph.D.: 10*	**Narendra Kumar, Shashank Chaturvedi, Surabhi Menon, Gurshidali P., Aashish Kumar, Sohini Chatterjee, Brijesh, Soumya Satpathi, Sakshi Verma, Utkarsh Singh**

*Students including those whose registration was cancelled during 2023–24.

Temporary Staff	
Secretarial Assistant	**Bhumika S.**

Research Staff (On Contract)	
Research Associates	**Dr. Jishnu N. Nampoothiri, Dr. Vipin Raj K., Dr. Supriya Ghosal, Dr. Gour Jana, Dr. Durgesh Kumar Sharma**
Research Associates (P)	**Jami Prashanti, Anirudha Mirmira, Arpan Das**
Research Associates-III	**Dr. Jaishri Sanwal Bhatt, Dr. Matukumilli V. D. Prasad**
R&D Assistants:	**Aparna C., Varghese Babu**

Unit at a Glance

Fellowships/Memberships Received

3 Faculty Members **1** Student

TSU

Faculty Achievements

Prof. Kavita Jain
- Selected as Member, Scientific Advisory Board of SFB on polygenic adaptation, Austrian Research Fund (FWF)

Prof. Swapan K. Pati
- Appointed as Adjunct Research Professor at IISER, Kolkata for a period of 2 years

Prof. Srikanth Sastry
- Awarded Gauss-Professorship in 2024 by the Göttingen Academy of Sciences and Humanities, Germany

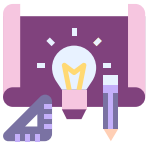
Student Achievement

Sujan Kashivasi Krishna Prasad (Ph.D. Student; research supervisor: Prof. N.S. Vidhyadhiraja)
- Received International Travel Support from Science and Engineering Research Board, DST

Total Publications

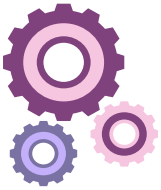
66 Peer-reviewed articles indexed in Web of Science/Scopus

Sponsored Projects



1 New Project

₹7.45 lac Grant Amount Received During 2023–24



14 Ongoing Projects

₹5.29 cr. Grant Amount Received During 2023–24

Students Graduated During 2023–24

Ph.D.: 5

Abhishek Kumar Adak, Koyendrilla Debnath, Supriti Dutta, Bidhan Chandra Garain, Varghese Babu

TSU

Student Admitted During 2023–24

Ph.D.: 5

Kaushik Dey, Tanuja Shridhar Joshi, Shiv Praksh Mishra, Venu Goswami, Rubee Swarnkar

Current Student Strength

33*

*Students with valid registration as on 31st March 2024

SCHOOL OF ADVANCED MATERIALS (SAMat)

In 2018, the School of Advanced Materials (SAMat) was established as an umbrella structure to bring all the materials research activity at JNCASR together under one roof and also to give it international visibility. SAMat includes 28 faculty members from the International Centre for Materials Science (ICMS), Chemistry and Physics of Materials Unit (CPMU), New Chemistry Unit (NCU), and the Theoretical Sciences Unit (TSU), with Bharat Ratna Prof. C. N. R. Rao being the Chairperson.

SAMat organised the following activities from 1st April 2023 to 31st March 2024:

International Conference on Recent Advances in Materials (RAM-90)

SAMat hosted the "Recent Advances in Materials (RAM-90)" conference at JNCASR from 7th to 9th December 2023. The conference comprised about 25 talks by global leaders in Materials Science and focused on the most recent developments in a wide range of fields of contemporary importance. The organisers for the event were Prof. Eswaramoorthy M., Prof. Subi J. George, Prof. Ram Seshadri, Prof. Sundaresan A., and Prof. Umesh V. Waghmare.

Photos from the RAM-90 Conference.

Fourth C. N. R. Rao Annual Materials Lecture

Prof. C. N. R. Rao and Prof. G. U. Kulkarni with Prof. Arindam Ghosh during the Annual Materials Lecture.

The lecture, held on 20th March 2024, was delivered by Prof. Arindam Ghosh, Department of Physics, Indian Institute of Science, Bengaluru. The talk was titled, *"Designing functional emergence at the nanoscale".*

SCHOOL OF ADVANCED MATERIALS (SAMat)

FACULTY MEMBERS OF SAMat

Linus Pauling Research Professor & Honorary President	Prof. C. N. R. Rao
Professors	Prof. T. Govindaraju
	Prof. Jayanta Haldar
	Prof. Kanishka Biswas
	Prof. K. S. Narayan
	Prof. Rajesh Ganapathy
	Prof. Ranjan Datta
	Prof. Ranjani Viswanatha
	Prof. Sebastian Chirambatte Peter
	Prof. Shobhana Narasimhan
	Prof. Sridhar Rajaram
	Prof. Srikanth Sastry
Associate Professor	Prof. Premkumar Senguttuvan
	Prof. Sarit S. Agasti

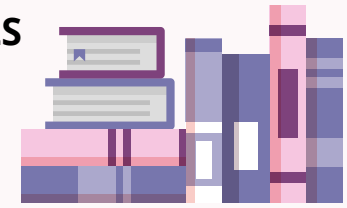
PUBLICATIONS

TOTAL NUMBER OF PUBLICATIONS IN 2023–24

259	24	18	14	11	4
Research Articles and Early Access Articles	Book/Book Chapter	Review Articles	Notes, Conference Papers, Meeting Abstracts and News Items	Biographical items, Editorials and Editorial Material	Corrections and Erratums
78.48%	7.27%	5.45%	4.24%	3.33%	1.21%

TOTAL PUBLICATIONS IN IMPACT FACTOR JOURNALS

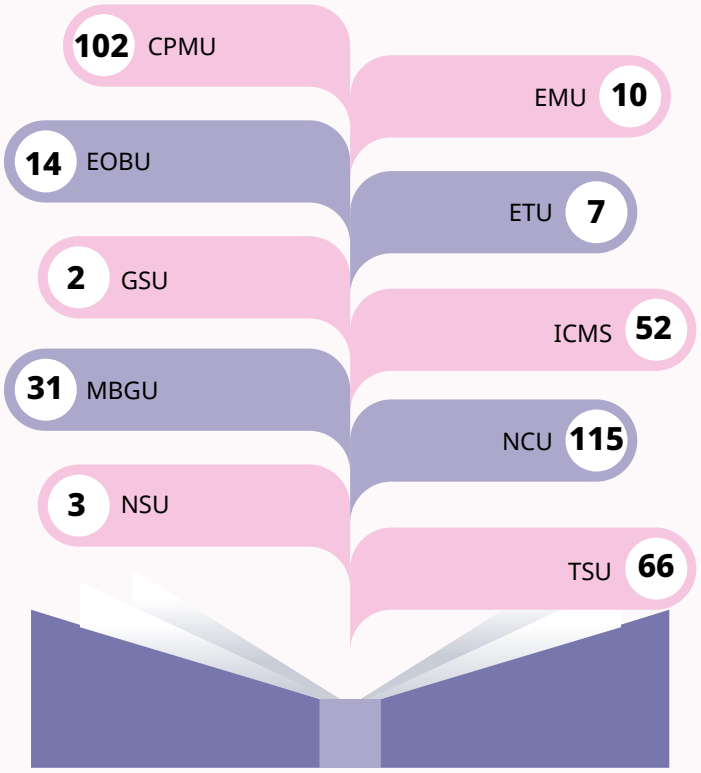
296



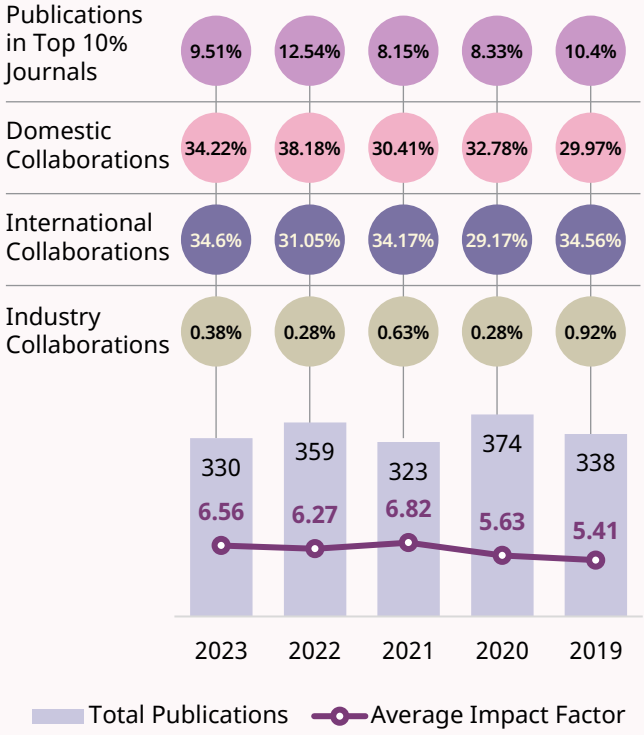
AVERAGE IMPACT FACTOR

6.55

UNIT-WISE PUBLICATIONS



KEY INFORMATION YEAR-WISE



RESEARCH AND DEVELOPMENT ACTIVITIES

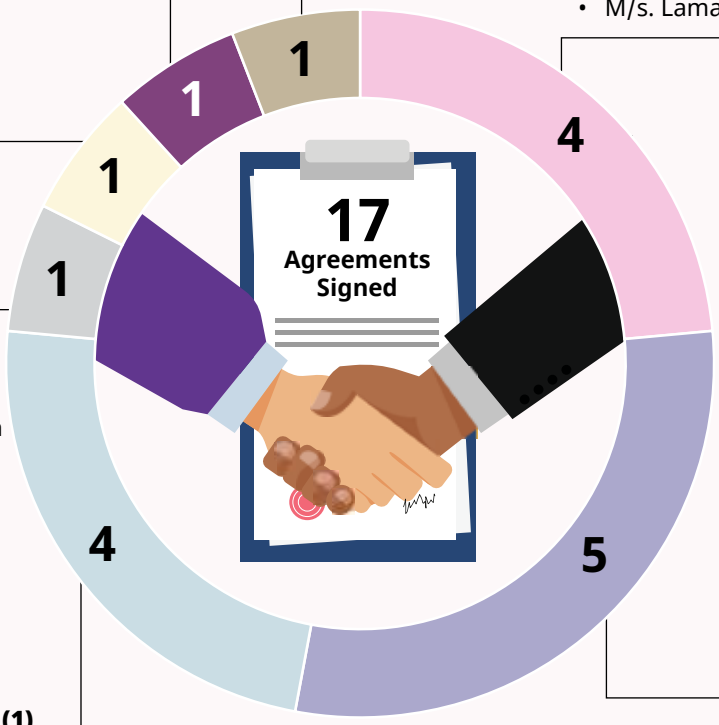
OVERVIEW OF RESEARCH AND DEVELOPMENT ACTIVITIES (2023–24)

R & D Research Support Agreement
- M/s. WATSAN Envirotech Pvt. Ltd., Tamil Nadu **(1)**

Confidential Disclosure Agreement
- Immuneel Therapeutics Pvt. Ltd. **(1)**

Non Disclosure Agreements
- ITC Ltd., Kolkata **(1)**
- GenoPhe, Bengaluru **(2)**
- M/s. Lamark Biotech Pvt Ltd., Gujarat **(1)**

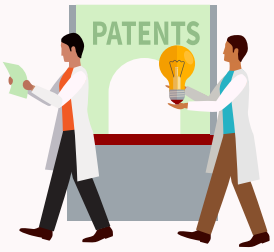
Consultancy Agreement
- SankhyaSutra Labs Ltd., Bengaluru **(1)**



IP License and Share Transfer Agreement
- Hbaromega Pvt. Ltd **(1)**

Memorandums
- ICAR-Indian Institute of Horticultural Research, Bengaluru **(1)**
- The Singareni Collieries Company Limited, SCCL, Telangana **(1)**
- Department of Biotechnology, Minsitry of Science and Technology, Govt. of India, New Delhi **(1)**
- National Institute of Pharmaceutical Education and Research, Kolkata **(2)**

Research Agreements
- CSIR-Central Drug Research Institute, Lucknow and Post Graduate Institute of Medical Education and Research, Chandigarh **(1)**
- National Institute of Pharmaceutical Education and Research, Kolkata **(1)**
- Tata Steel Ltd., Kolkata **(1)**
- Tata Steel Ltd., Jamshedpur **(1)**



PATENT APPLICATIONS FILED

20

India:	8	PCT:	5
USA:	4	Europe:	3

PATENTS GRANTED

7 India: 7

RESEARCH AND DEVELOPMENT ACTIVITIES

INTELLECTUAL PROPERTY

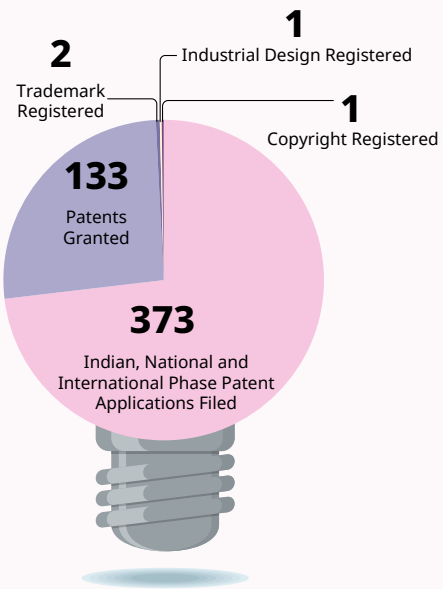
Intellectual property assets (IPAs) are collections of intellectual properties—patents, trademarks, copyrighted works, industrial designs, geographical indications, trade secrets, etc. IPAs have tremendous economic significance because of their ability to enhance the value and financial returns from technologies, products, and services.

The Centre has been one of the foremost research institutes in the country to realize the importance of IPAs created by its researchers. The Centre encourages and facilitates the creation, development, protection, and management of commercially exploitable IPs and their enforcement in addition to fostering academia–industry partnerships.

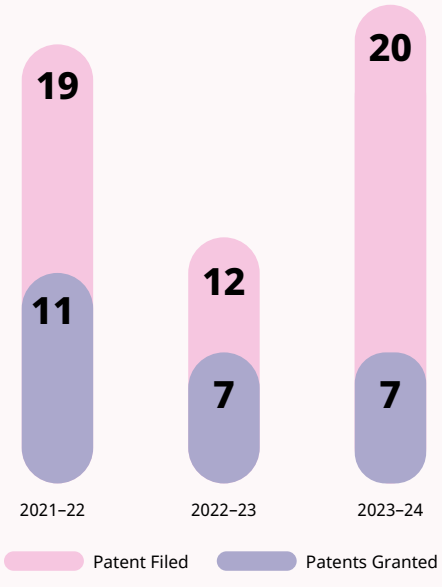
The Centre has so far filed 373 *(India: 135, PCT: 77, ARIPO: 2, Australia: 7, Brazil: 3, Canada: 10, China: 7, Europe: 33, Hong Kong: 2, Israel: 1, Japan: 10, Korea: 3, OAPI: 2, Singapore: 4, South Africa: 5, South Korea: 3, USA: 68, and Vietnam:* 1) national phase (i.e. foreign countries) and international phase (i.e. PCT) patent applications filed under Patent Cooperation Treaty and obtained 133 *(India: 53, ARIPO: 2, Australia: 3, Brazil: 2, Canada: 1, China: 5, Europe: 13, Japan: 5, Korea: 2, OAPI: 2, Singapore: 2, South Africa: 4, South Korea: 1, and USA: 38)* patent grants.

During 2023–24, 20 patent applications were filed *(India: 8, PCT: 5, Europe: 3, and USA: 4)* for inventions meeting territorial patentability criteria. The Centre has also obtained 7 *(India: 7)* patent grants.

TOTAL IPR OVER THE YEARS UNTIL MARCH 2024



PATENTS FILED AND GRANTED (PAST 3 YEARS)



Indian Patent Applications

Title of the Invention	Inventors	Unit	Territory	Application No.	Date of Filing
A Sorbent for Carbon dioxide Capture and Methods Thereof	Sebastian Chirambatte Peter, Sathyapal Churipard R, Bitan Ray	NCU	India	202341026934	11-Apr-2023
A Polymer Nanocomposite for Radiative Cooling	Bivas Saha, Prasanna Das	ICMS	India	202341040136	12-Jun-2023

RESEARCH AND DEVELOPMENT ACTIVITIES

Title of the Invention	Inventors	Unit	Territory	Application No.	Date of Filing
An Electrode Composite and Processes Thereof	Eswaramoorthy Muthusamy, Divya Bhutani	CPMU	India	202341066630	4th Oct 2023
Confidential*	Sebastian Chirambatte Peter, Bitan Ray, Anu P.	NCU	India (Prov)	202341079163	21st Nov 2023
Confidential*	Jayanta Haldar, Sudip Mukherjee, Himani Singh	NCU	India (Prov)	202341083890	8th Dec 2023
An Electrochromic Device, an Anode and Processes Thereof	Giridhar Udapi Rao Kulkarni, Ashutosh Kumar Singh, Ganesha Krishna V. S., Mukhesh K. Ganesha, Chirag Sarthi J.	CPMU	India	202341090016	29th Dec 2023
A Nasicon-type Anode Active Material and Processes Thereof	Premkumar Senguttuvan, Biplab Patra	NCU	India	202441015484	1st Mar 2024
Confidential*	Tapas Kumar Maji, Adrija Ghosh, Sandip Biswas	CPMU	India (Prov)	202441020616	19th Mar 2024

*Title of the invention not to be disclosed during the provisional stage

International Phase Patent Applications

Title of the Invention	Inventors	Unit	Territory	Application No.	Date of Filing
Hemostatic Composite, Its Method and Applications Thereof	Jayanta Haldar, Rajib Dey	NCU	PCT	PCT/ IN2023/050784	18th Aug 2023
Modulators of Tau Liquid-Liquid Phase Separation and Methods Thereof	Govindaraju Thimmaiah, Madhu Ramesh	NCU	PCT	PCT/ IN2023/050789	22nd Aug 2023
Acoustophoresis Assisted Fluid Jet Machining/ Polishing	Diwakar Seyyanur Venkatesan, Abhijit Krishna Dhamanekar, Arunachalam Naryanaperumal	EMU	PCT	PCT/ IN2023/050793	23rd Aug 2023
A Catalyst Composition and Processes Thereof	Sebastian Chirambatte Peter, Devender Goud	NCU	PCT	PCT/ IN2023/050858	13th Sep 2023
A Method for the Treatment of Epilepsy	Upendra Nongthomba, Thilagar Pakkiriswamy, James Premdoss Clement Chelliah, Sambit Pradhan, Shefali Mishra	NSU	PCT	PCT/ IN2023/051224	26th Dec 2023

National Phase Patent Applications

Title of the Invention	Inventors	Unit	Territory	Application No.	Date of Filing
Indirubin Compounds and Methods Thereof	James Premdoss Clement Chelliah, Ravi Manjithaya, Sridhar Rajaram,Vijaya Verma, Kavita Sharma, Suresh Santhi Natesan	NSU + MBGU + ICMS	USA	18/557,800	27th Oct 2023

RESEARCH AND DEVELOPMENT ACTIVITIES

Title of the Invention	Inventors	Unit	Territory	Application No.	Date of Filing
Soluble Analogues of 6Bio Thereof and Implementation Thereof	James Premdoss Clement Chelliah, Ravi Manjithaya, Sridhar Rajaram, Vijaya Verma, Kavita Sharma, Suresh Santhi Natesan	NSU + MBGU + ICMS	USA	18/557,822	27th Oct 2023
Soluble Analogues of 6Bio Thereof and Implementation Thereof	James Premdoss Clement Chelliah, Ravi Manjithaya, Sridhar Rajaram, Vijaya Verma, Kavita Sharma, Suresh Santhi Natesan	NSU + MBGU + ICMS	Europe	22795165.4	29th Nov 2023
Indirubin Compounds and Methods Thereof	James Premdoss Clement Chelliah, Ravi Manjithaya, Sridhar Rajaram, Vijaya Verma, Kavita Sharma, Suresh Santhi Natesan	NSU + MBGU + ICMS	Europe	22795166.20	29th Nov 2023
Small Molecule Modulator Targeting a Rare Histone Modification, Regulating Adipogenesis and Pharmaceutical Formulation Thereof	Tapas Kumar Kundu, Aditya Bhattacharya, Sourav Chatterjee, Venkata Sashidhara Koneni, Suriya Pratap Singh, Prabhat Ranjan Mishra, Aamir Nazir, Rajdeep Guha	MBGU	USA	18/565,911	30th Nov 2023
Small Molecule Modulator Targeting a Rare Histone Modification, Regulating Adipogenesis and Pharmaceutical Formulation Thereof	Tapas Kumar Kundu, Aditya Bhattacharya, Sourav Chatterjee, Venkata Sashidhara Koneni, Suriya Pratap Singh, Prabhat Ranjan Mishra, Aamir Nazir, Rajdeep Guha	MBGU	Europe	22815524.8	2nd Jan 2024
A Catalyst, Its Application in Production of Hydrogen	Sebastian Chirambatte Peter, Soumi Mondal	NCU	USA	18/684,615	16th Feb 2024

Patents Granted (April 2023–March 2024)

Title of the Invention	Inventors	Unit	Territory	Patent Number	Granted on
Small Molecular Probes, Processes and Use Thereof	Giridhar Udapi Rao Kulkarni, Kunala Durga Mallikarjuna Rao, Ritu Gupta, Boya Radha, Shanmugam Kiruthika	NCU	India	429713	21st Apr 2023
Carbon Nanosphere-Folate Receptor Targeting Ligand Conjugate, Complex and Composition and Method of Preparation Thereof	Jayanta Haldar, Geetika Dhanda	MBGU and CPMU	India	440416	25th Jul 2023
Composition, Injectable Hydrogel and Methods Thereof	Kottigegollahalli Ramanna Sreenivas, Jaywant Hanumappa Arakeri, Suhas Bannur	NCU	India	444970	14th Aug 2023
Self-Cleaning Nanoscale Metal-Organic Frameworks and Process of Preparation Thereof	Govindaraju Thimmaiah, Nagarjun Narayanaswamy	CPMU	India	476612	4th Dec 2023
Method and System to Assess Solar Cells	Tapas Kumar Maji, Swapan K. Pati, Venkata Suresh M., Arkamita Bandyopadhyay	CPMU	India	478362	7th Dec 2023

RESEARCH AND DEVELOPMENT ACTIVITIES

Title of the Invention	Inventors	Unit	Territory	Patent Number	Granted on
Topochemical Bottom-up Processes and Implementations Thereof	Giridhar Udapi Rao Kulkarni, Umesha Mogera	NCU	India	482649	14th Dec 2023
Dynamic Host-Guest Interactive System	Govindaraju Thimmaiah, Nagarjun Narayanaswamy	NCU	India	504815	30th Jan 2024

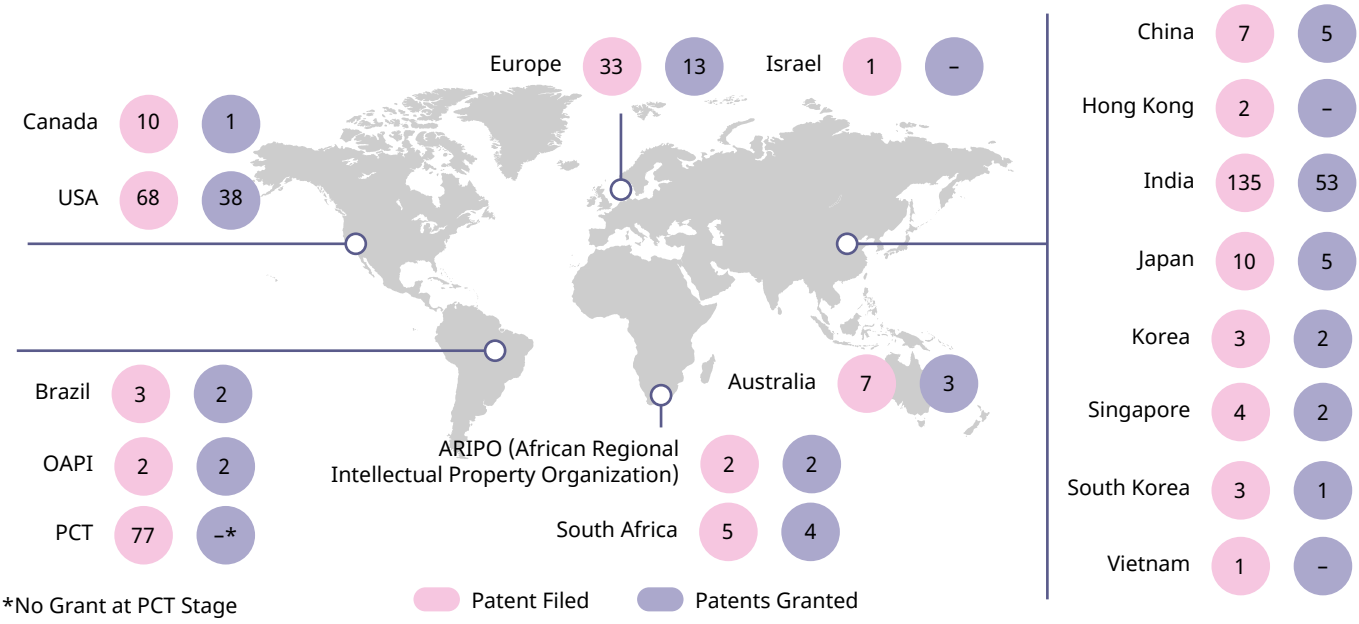
Technologies Transferred

Title of the Invention	Name of the Principal Inventor	Licensee	Effective Date
Fluid Flow Assembly for Cell Culture and Measurements	Kavassery Sureswaran Narayan	M/s. HbarOmega Pvt. Ltd., Bengaluru	1st Nov 2023
Method and System to Assess Solar Cells	Kavassery Sureswaran Narayan	M/s. HbarOmega Pvt. Ltd., Bengaluru	1st Nov 2023

Overview of Intellectual Property (2023–24)

Territory	Patent Applications Filed	Patent Applications Filed
India	8	7
PCT	5	No Grant at PCT Stage
Europe	3	–
USA	4	–

TERRITORY-WISE DISTRIBUTION OF IPs (SINCE INCEPTION TILL 31ST MARCH 2024)



*No Grant at PCT Stage

RESEARCH AND DEVELOPMENT ACTIVITIES

AGREEMENTS SIGNED

Non-Disclosure: 4

- **Dr. Bivas Saha** from CPMU entered into a **Non-Disclosure Agreement** with **ITC Ltd., Kolkata** from 5th June 2023. The title of the NDA is: *For contemplating a research collaboration relating to optical properties.*

- **Prof. Ravi Manjithaya** from MBGU entered into a **Non-Disclosure Agreement** with **GenoPhe, Bengaluru** from 11th August 2023.
  The title of the NDA is: *For the limited purpose of exploring the scope of screening, development of therapeutic candidates through services and/or collaboration.*

- **Prof. Sridhar Rajaram** from ICMS entered into a **Non-Disclosure Agreement** with **GenoPhe, Bengaluru** from 11th August 2023.
  The title of the NDA is: *For the limited purpose of exploring the scope of screening, development of therapeutic candidates through services and/or collaboration.*

- **Prof. Jayanta Haldar** from NCU entered into a **Non-Disclosure Agreement** with **Lamark Biotech Pvt. Ltd.,** Gujarat from 7th September 2023.

Memorandums: 5

- **Prof. Ravi Manjithaya** from MBGU entered into a **Memorandum of Understanding** with ICAR-Indian Institute of **Horticultural Research, Bengaluru,** for the collaborative project: *"Interdisciplinary collaborative research on Agriculture/Horticulture domain expertise and on cell biology"* from 4th July 2023.

- **Prof. Sebastian C. Peter** from NCU entered into a **Memorandum of Understanding** with **The Singareni Collieries Company Limited (A Government Company), SCCL, Telangana,** for a project titled: *"Construction of Sheds and allied works for Conversion of CO_2 into Methanol plant including plumbing, and electrical works at STPP, Jaipur Mancherial District, Telangana State. (Inclusive of all charges including GST, etc.)"* on 4th September 2023.

- **Prof. Sarit S. Agasti** from CPMU and NCU entered into a **Memorandum of Association** with the **Department of Biotechnology, Ministry of Science and Technology, Government of India, New Delhi,** for a project titled: *"MitoBlood: Investigating mitochondrial regulation of hematopoietic heterogeneity in development and aging"*, from 26th December 2023.

- **Prof. Tapas Kumar Kundu** from MBGU entered into a **Memorandum of Understanding** with the **National Institute of Pharmaceutical Education and Research, Kolkata (NIPER-Kolkata)** on 11th January 2024.

- **Prof. Kushagra Bansal** from MBGU entered into a **Memorandum of Understanding** with the **National Institute of Pharmaceutical Education and Research, Kolkata (NIPER-Kolkata)** from 11th February 2024 for a project titled: *"Development of anti-obesity oral drug targeting histone acylation"*. Preclinical studies involving db/db mice, toxicity studies, and pharmacokinetics studies will be carried out by NIPER-Kolkata in this collaborative research project between JNCASR and NIPER.

RESEARCH AND DEVELOPMENT ACTIVITIES

Research Agreements: 4

- **Prof. Kaustuv Sanyal** from MBGU, entered into a **Collaborative Research Agreement** for a project titled: *"Development of indigenous multiplex real time-PCR based diagnostic kit for detection of clinically relevant fungal species"*, with **CSIR-Central Drug Research Institute (CDRI), Lucknow** and **Post Graduate Institute of Medical Education and Research (PGIMER), Chandigarh** from 8th September 2023.

- **Prof. Tapas Kumar Kundu** from MBGU entered into a **Collaborative Research Agreement** for a project titled: *"Development of anti-obesity oral drug targeting histone acylation"*, with **National Institute of Pharmaceutical Education and Research, Kolkata (NIPER-Kolkata)** from 16th October 2023.

- **Prof. Sebastian C. Peter** from NCU entered into a **Research Agreement** for a project titled: *"Thermo-catalytic conversion of CO_2 to Syngas"*, with **TATA Steel Ltd., Kolkata** from 23rd February 2024.

- **Prof. Kanishka Biswas** from NCU entered into a **Research Agreement** with **Tata Steel Ltd., Jamshedpur** from 26th March 2024.

Others: 4

- **Prof. K. S. Narayan** from CPMU entered into an **IP License and Share Transfer Agreement** with **Hbaromega Pvt. Ltd., Bengaluru** from 1st November 2023.

- **Prof. Santosh Ansumali** from EMU, entered into a **Consultancy Agreement** with **SankhyaSutra Labs Ltd., Bengaluru** from 1st November 2023.

- **Prof. Tapas Kumar Maji** from CPMU entered into a **R&D Research Support Agreement** for a project titled: *"To study and screen libraries of potential materials suitable for water harvesting from air, and identify 10 potential materials"*, with **WATSAN Envirotech Pvt. Ltd., Tamil Nadu** from 1st December 2023.

- **Prof. Kushagra Bansal** from MBGU entered into a **Confidential Disclosure Agreement** for a project titled: *"To evaluate the possibilities of entering into a mutually beneficial collaboration in relation to research in immunology and genomics",* with **Immuneel Therapeutics Pvt. Ltd., Bengaluru** from 27th February 2024.

RESEARCH AND DEVELOPMENT VISITS

The following R&D Teams visited the Centre for a discussion meeting for possible collaborative research projects/ research funding:

1. Collins Aerospace, Bengaluru on 28th April 2023
2. University of Manchester on 17th May 2023
3. L&T Green Energy, Baroda on 9th June 2023
4. Lamark Biotech Pvt. Ltd., Vellore, TN, on 1st August 2023
5. ITC, Bengaluru on 3rd October 2023
6. WATSAN Envirotech Pvt., Ltd., Tamil Nadu on 30th November 2023
7. TATA Steel, Chennai on 30th November 2023

8. Meeting with CNRS to discuss Indo-French Centre for Applied Mathematics (IFCAM) on 19th December 2023
9. Dheya Engineering Technologies Pvt. Ltd. (DheyaTech), Bengaluru on 25th January 2024
10. Dr. Vamsi Krishna Devabathi, Software Engineer, Google on 9th February 2024

INDUSTRY–ACADEMIA MEET

On 22nd September 2023, JNCASR organised an Industry–Academia Meet with the participation of ~25 industries/ R&D organisations from Bengaluru and adjoining states engaged in the fields of health, energy, agriculture, services, life sciences, and manufacturing. A poster session was also organised to showcase the latest research work done at JNCASR.

Prof. G. U. Kulkarni, President, JNCASR, welcomed the participants and Prof. Ramgopal Rao, Chair, CoM, JNCASR and Group Vice Chancellor, BITS-Pilani, addressed the gathering. Prof. K. R. Sreenivas, Dean, R&D, JNCASR, moderated the deliberation.

(Left to right): Prof. Hemalatha Balaram, Chair-IPMC, Prof. G. U. Kulkarni, President, JNCASR, and Prof. Ramgopal Rao, Chair, CoM and Group VC, BITS, Palani addressing the participants.

A view of industry participants in the industry–academia meet.

Poster presentation on the eve of the industry–academia meet.

VISIT OF EUROPEAN UNION DELEGATION

A delegation of the European Union (EU) along with its Research and Innovation Counsellors from the member states visited JNCASR on 25th September 2023. They explored avenues to foster research and innovation cooperation between the EU, its member states and associated countries, and leading Indian research institutions. In this meeting, discussions were focused on understanding the innovative research projects undertaken by JNCASR and their alignment with the EU's goals of promoting cutting-edge research and developing sustainable solutions to global challenges.

Snapshots from the European Delegation visit

RESEARCH AND DEVELOPMENT ACTIVITIES

UNIT MEMBERS

Dean, Research and Development	Prof. K. R. Sreenivas
Coordinator, R&D and F&E (on contract)	Dr. Panneer K. Selvam
Office Executives (on contract)	Kavyashree H. C., Kavitha B. P.
Jr. Admin Assistant	Ande Akhil
Sr. Lab Helper	Varadaiah K.

TECHNICAL RESEARCH CENTRE

JNCASR and the Department of Science and Technology (DST), Government of India, launched the Technical Research Centre (TRC) programme in 2016 to help the scientific community at JNCASR to translate discoveries and inventions into technologies, products, and services of social and industrial relevance. The TRC programme was curated to facilitate effective research that solves health challenges, climate change, energy scarcity, and resource management.

During the TRC Phase-I (2016–21), the programme supported various R&D activities at the Centre. DST approved funding for TRC Phase-II (2022–26) to support the translational research activities to build upon IP, incubation space, maintenance of research facilities, and legal help in the commercialisation of inventions.

VARIOUS ACTIVITIES UNDERTAKEN BY TRC IN 2023–24

TRC Phase-II

Facilitating Translation of R&D projects

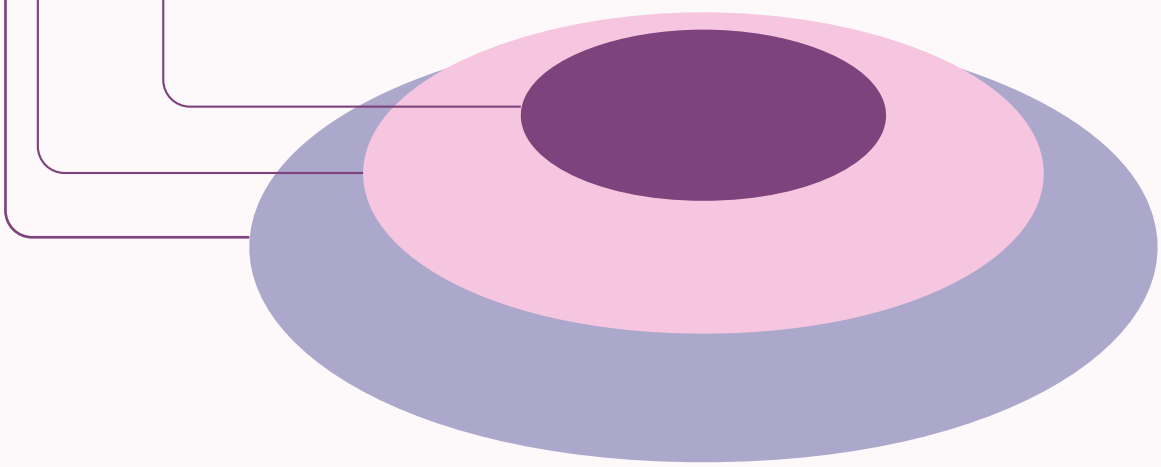
Number of Translational Research Projects Undertaken	**25**
Number of Products and Technologies Developed	**8**
Number of Inventions Commercialised	**2**

Supporting Patents

Number of Patent Applications Filed	(Indian: 8, PCT: 5, Foreign: 7)	**20**
Number of Patents Granted	(Indian: 7)	**7**

Facilitating Signing of Agreements

Number of MoUs Signed	**4**
Number of NDAs Signed	**4**
Number of Other Agreements Signed (such as Research Agreement, License Agreement, etc.)	**9**



MEDIA REPORTS

JNCASR, in collaboration with the Department of Science and Technology (DST) Media Cell, announces the latest accomplishments of its faculty members. Utilising a structured approach for releasing and disseminating press releases, the DST Media Cell aims to amplify the exposure of these scientific advancements across national and regional print and online platforms. Additionally, both DST and JNCASR utilise social media platforms to broaden the reach of these press releases. Below is a summary of these scientific stories, detailing their coverage in different news outlets and their promotion through social media channels during the period of 2023–24.

2023–24 NEWS REPORTS

Prof. Govindaraju T. won the National Technology Award

Prof. Govindaraju T. (Professor, New Chemistry Unit, JNCASR) won the National Technology Award from Technology Development Board (TDB), DST, for his outstanding contribution to commercialising innovative indigenous technologies.

Prof. Govindaraju T. receiving the National Technology Award for Translational Research from Dr. Jitendra Singh, MoS for Science and Technology on 26th May 2023.

News Source:

- *Press Information Bureau,* 14th May 2023. https://bit.ly/46fZEvR
- *Deccan Herald,* 26th May 2023. https://rb.gyW/w6nadv

JNCASR-incubated startup Breathe Applied Sciences Pvt. Ltd. won two prestigious national awards

Prof. Sebastian C. Peter's startup Breathe Applied Sciences Pvt. Ltd. has won 2 awards, MaterialsNEXT 4.0 award hosted by Tata Steel and the Sustainability Champion Award at the National Startup Awards 2023. The Sustainability Champion Award was given by the Ministry of Commerce and Industry, Government of India, on the occasion of National Startup Day 2024.

Co-founder of Breathe Applied Sciences Pvt. Ltd., Prof. Sebastian C. Peter and Dr. Rakshit receiving the award from Shri Piyush Goyal, Hon'ble Minister of Commerce and Industry.

MEDIA REPORTS

News Sources:

- *The Avenue Mail,* 13th May 2023. https://rb.gy/ie71qo
- *Biz Industry,* 14th May 2023. https://rb.gy/l1s34o
- *The Graphene Council,* 20th May 2023. https://rb.gy/yx9v9o
- *Inc42,* 16th January 2024. https://bit.ly/4f3tFmN
- *TICE News,* 17th January 2024. https://bit.ly/3Wdzfuc
- Tweet by @startupindia, 17th January 2024. https://twitter.com/startupindia/status/1747590831811224026

Bharat Ratna Prof. C. N. R. Rao received the prestigious M. P. Varghese Award 2023

Bharat Ratna Prof. C. N. R. Rao was honoured with the prestigious M P Varghese Award 2023, established by the Mar Athanasius College Association and Organisation of Farmers for Establishment of Rights (OFFER) in recognition of his seminal contributions to science.

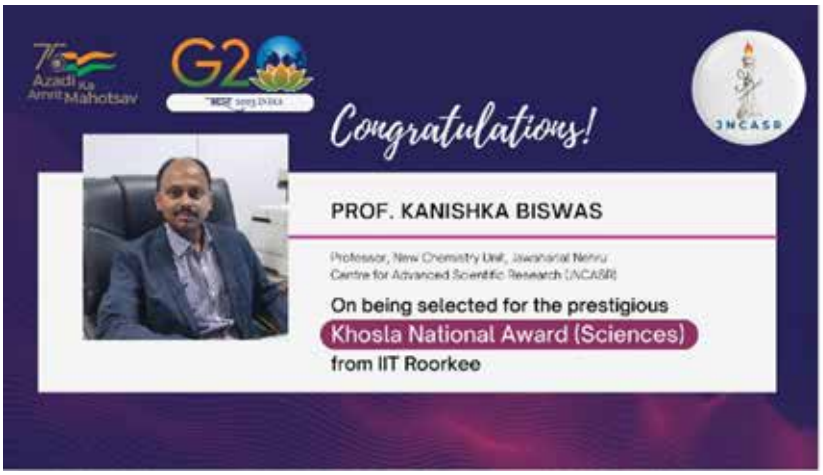
News Source:

- *OnManorama*, 6th July 2023. https://bit.ly/3RZeMb2

Prof. Kanishka Biswas awarded the Khosla National Award (Sciences)

Prof. Kanishka Biswas of the New Chemistry Unit was selected for the prestigious Khosla National Award (Sciences) from IIT Roorkee. This award is presented every year to recognise the awardees' outstanding contributions to their chosen careers. Prof. Kanishka Biswas has reported original and significant discoveries in the field of thermoelectric and solid-state inorganic chemistry in the last 10 years of his independent career, which is marked by high-quality publications and recognised by several international and national honours.

MEDIA REPORTS



Prof. Kanishka Biswas receiving the Khosla National Award

News Sources:

- *HTDS Content Services,* 17th July 2023. https://bit.ly/3Lfoi6c
- *Press Information Bureau,* 17th July 2023. https://bit.ly/4cMseaK
- *The Indian Express,* 18th July 2023. https://rb.gy/g7j21e

'The Chemist of the Century' Award

The Indian Chemical Society conferred the 'Chemist of the Century' award to Prof. C. N. R. Rao on 23rd January 2024 in recognition of his pathbreaking contributions to the field of chemistry. Prof. Rao was felicitated by Prof. G. D. Yadav, President of the Indian Chemical Society, in the presence of Prof. G. U. Kulkarni, President, JNCASR, and Dr. Indumati Rao, Honorary Coordinator, ETU, JNCASR, as dignitaries.

Photos from the 'The Chemist of the Century' Award and Felicitation function

News Source:

- *SiliconIndia*, 24th January 2024. https://rb.gy/uhulrr
- *Biospectrum,* 9th February 2024. https://rb.gy/z0ckeq

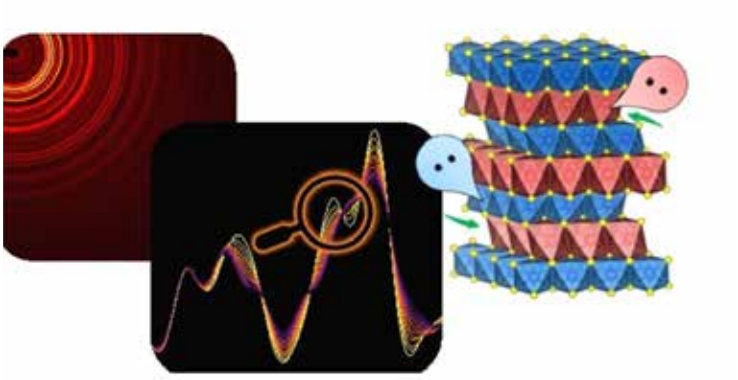
RESEARCH NEWS

New ways to enhance thermoelectric performance in quantum material

Metavalent bonding—a new type of chemical bonding in solids—can be used to tailor the thermoelectric performance in quantum materials and efficiently convert waste heat to electricity, which could open a new direction for the country's newly launched Quantum Mission. Prof. Kanishka Biswas and his Integrated Ph.D.

MEDIA REPORTS

student Ivy Maria, JNCASR, provided fundamental insights on how novel chemical bonding can be used to optimise thermoelectric performance in quantum material. They also showed how, by rational chemical designing, intriguing emergent properties can be realised in quantum materials, towards which India's Quantum Mission is working. The work has recently been published in the *Journal of American Chemical Society* (doi: 10.1021/jacs.3c02146).



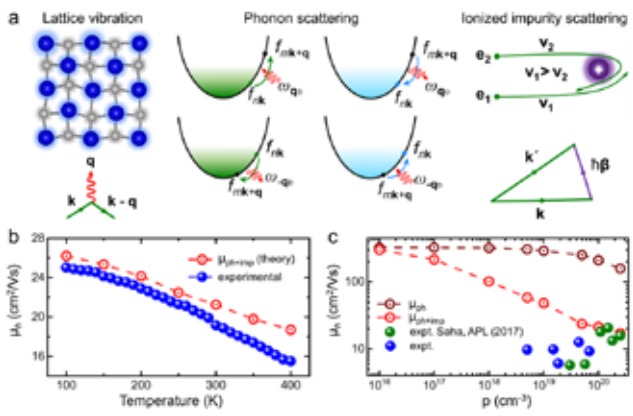
Metavalent bonding-mediated local distortion in the crystal structure of $TlBiSe_2$
Image credit: Journal of American Chemical Society

News Sources:

- *DST Vigyan Samachar*, 3rd May 2023. https://bit.ly/4bGTDcB
- Tweet by @IndiaDST, 3rd May 2023. https://twitter.com/IndiaDST/status/1653634552827633665
- *Press Information Bureau (PIB),* 3rd May 2023. https://bit.ly/4cDSofW

Enhancing hole mobility in nitride semiconductors

Dr. Bivas Saha and his team have designed a strategy to improve the hole mobility in semiconducting p-type scandium nitride (ScN) using state-of-the-art Boltzmann transport formalism from first principles theoretical calculations. Their work, published in *Nano Letters* (doi: 10.1021/acs.nanolett.3c02350), significantly advances the quest to develop high-efficiency devices with semiconducting ScN and nitride heterostructures in general.



(Left) Major types of scattering effects that govern the low hole mobility in p-type ScN. The temperature-dependent mobility, calculated from the ab initio Boltzmann transport formalism matches well with the experimental result at 10^{20} cm^{-3} carrier concentration.
Image credit: Nano Letters

(Above) Prof. Bivas Saha and his team outside their lab building at JNCASR
Image credit: Prof. Bivas Saha

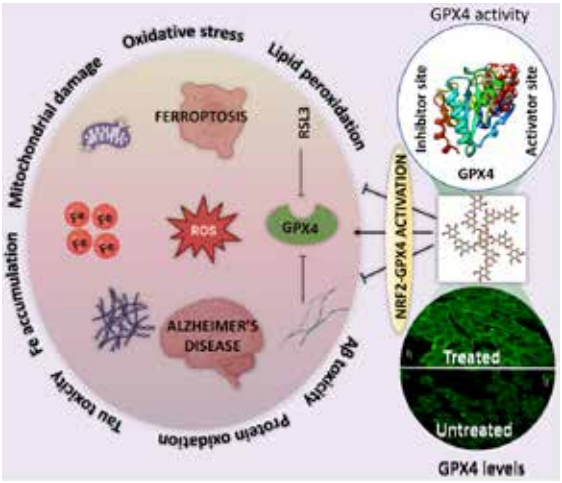
News Sources:

- *DST Vigyan Samachar.* https://rb.gy/ch9lp
- Tweet by @IndiaDST, 6th September 2023. https://twitter.com/IndiaDST/status/1699283415840035201

MEDIA REPORTS

Novel therapeutics against Alzheimer's disease

Prof. Govindaraju T. and his team have demonstrated that a naturally occurring polyphenol, specifically tannic acid, behaves as a dual-acting therapeutic agent to synergistically alleviate ferroptosis and Alzheimer's disease (AD). Ferroptosis is an iron-dependent cell death mechanism that plays a key role in AD pathology. This research provides a basis for developing novel therapeutics targeting the crosstalk between ferroptosis and AD. This work has been published in *Chemical Sciences* (doi: 10.1039/D3SC02350H).



News Sources:

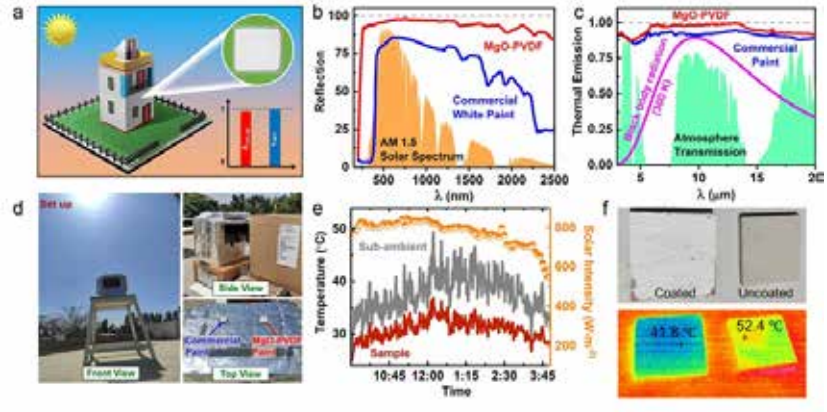
- *DST Vigyan Samachar.* https://rb.gy/vw60l
- Tweet by @IndiaDST, 13th September 2023. https://twitter.com/IndiaDST/status/1701828730656899145
- *The Times of India,* 14th September 2023. https://rb.gy/1iqbk

Graphical representation of the mechanism of action of the new potential Alzheimer's treatment discovered by Prof. Govindaraju T.
Image credit: Chemical Sciences

Novel Radiative Paint to Cool Buildings Sustainably

Prof. Bivas Saha and his team developed a groundbreaking radiative paint from a novel MgO-PVDF polymer nanocomposite that can significantly curtail the reliance on air conditioning, thus contributing to a reduction in associated environmental impacts. This work has been published in *Advanced Materials Technologies* (doi: 10.1002/admt.202301174).

Professor Bivas Saha with his team member featured holding a ceramic paver coated with the radiative cooling paint at JNCASR
Image credit: Prof. Bivas Saha.



(a) A schematic of a building with radiative cooling paint. (b) The MgO-PVDF coating reflection spectra compared to that of a commercial white paint, along with the AM 1.5 solar spectrum. (c) Thermal emission spectra of MgO-PVDF coating, commercial paint, blackbody (BB) spectrum at 300 K, and atmospheric transmission profile. (d) A photo from a field text where radiative cooling measurement setup was employed on a flat roof in Bengaluru, India. (e) Real-time outdoor cooling results of the MgO-PVDF coating with respect to sub-ambient conditions. (f) Photograph and thermal image of a coated and an uncoated ceramic paver placed outdoors.
Image credits: Advanced Materials Technologies.

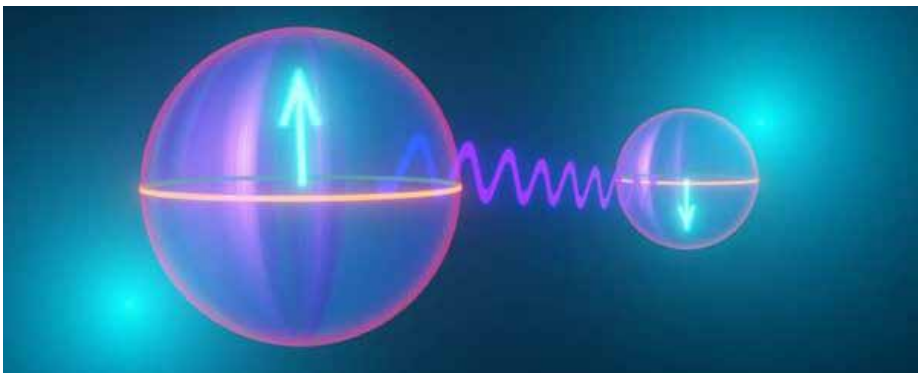
MEDIA REPORTS

News Sources:

- *DST Vigyan Samachar,* 6th November 2023. https://shorturl.at/niK0s
- Tweet by @IndiaDST, 6th November 2023. https://twitter.com/IndiaDST/status/1721579020700270831
- *Press Information Bureau,* 6th November 2023. https://bit.ly/3XUfaLI
- Tweet by @PIB_India, 6th November 2023. https://twitter.com/PIB_India/status/1721529550293635476
- *Paint Square,* 7th November 2023. https://bit.ly/3xWbxKO
- *Mysuru Infra Hub,* 7th November 2023. https://bit.ly/3XXH9dy
- *The Pioneer,* 7th November 2023. https://bit.ly/4bDstmW
- *The Hindu,* 9th November 2023. https://bit.ly/3VY9uOl

Novel quantum-based model system for better understanding new materials

A group of scientists from the Theoretical Sciences Unit of JNCASR led by Prof. N. S. Vidhyadhiraja and his team identified a model system that can help scientists in gaining a better understanding of the unusual behaviour of materials when they reach close to the quantum critical point. Their study is published in the APS journal Physical Review B (doi: 10.1103/PhysRevB.107.205104) and could be a key piece of the puzzle of quantum entanglement and quantum computing.



Stock image depicting quantum computing and entanglement.

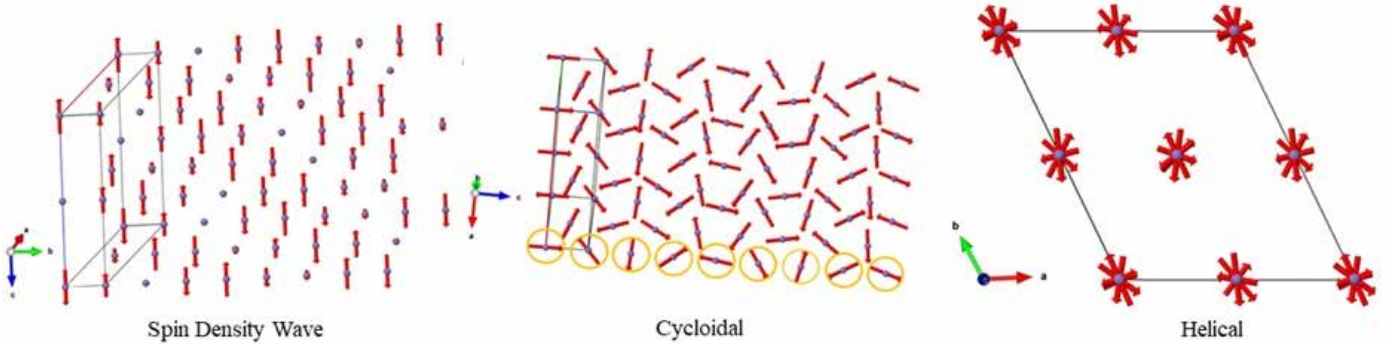
News Sources:

- *DST Vigyan Samachar*, 13th February 2024. http://bit.ly/4bL5k26
- Tweet by @IndiaDST, 13th February 2024: https://x.com/IndiaDST/status/1757264052181492078
- *Press Information Bureau,* 16th February 2024. https://bit.ly/3zDahgh
- Tweet by @PIB_India, 16th February 2024: https://x.com/PIB_India/status/1758457895753040375

MEDIA REPORTS

New multiferroic material with potential for use in energy-efficient data storage

Prof. A. Sundaresan and team from JNCASR have identified a unique mechanism of electric polarization via magnetic ordering in a novel material $MnBi_2S_4$. The three distinct multiferroic structures discovered by the team at various temperatures could be useful for energy-efficient data storage. The findings are published in APS journal Physical Reviews B (doi: 10.1103/PhysRevB.109.024401)



The three distinct magnetic structures in $MnBi_2S_4$ at different temperatures.
Image credit: Physical Reviews B.

News Sources:

- *Press Information Bureau,* 16th February 2024, https://shorturl.at/o3MCb
- *DST Vigyan Samachar,* 19th February 2024. https://bit.ly/3Wkyrok

A unique methodology to harness and convert carbon dioxide to ethylene: Helping India march towards clean fuel

Prof. Sebastian C. Peter and his research team from JNCASR have synthesised a novel and highly efficient photocatalyst that can convert carbon dioxide to the high-value products, ethene and ethylene, which are used as fuel gases and in the polymer industry.

The team's groundbreaking investigations led to the development of a novel and highly efficient photocatalyst with an unprecedented selectivity of 99% toward C_2H_4, a typically high-value product obtained from CO_2; this work has been published in the *Journal of the American Chemical Society* (doi: 10.1021/jacs.2c10351). Another interconnected study, findings of which have been published in *Angewandte Chemie International Edition* (doi: 10.1002/anie.202216613), reported the facile colloidal synthesis of the wurtzite phase of $CuGaS_2$, a photocatalyst for CO_2 reduction reaction.

These studies have facilitated the development of the country's 1st plant that can convert CO_2 into methanol. This involves connecting directly to flue streams from a power generation plant in the state of Telangana.

MEDIA REPORTS

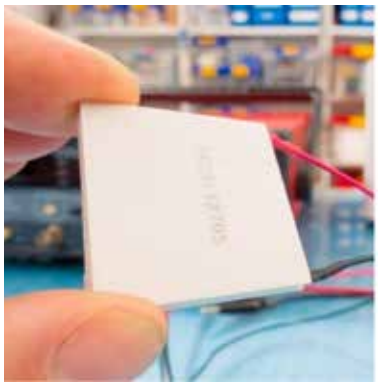
(Left to right) A stock image, Prof. Sebastian C. Peter and his research student who worked on this project.

News Sources:

- *DST Vigyan Samachar,* 6th March 2024. https://bit.ly/4czvBBE
- *Bhaskar Live,* 7th March 2024. https://bit.ly/3xQsZ3i
- *The Hindu,* 14th March 2024. https://bit.ly/4bGITLs

New material with metal and glass properties promises efficient energy conversion

Prof. Kanishka Biswas and his research team from New Chemistry Unit have synthesised a material that exhibits the properties of both glass and metal and can efficiently convert waste heat to electricity. The research can help advance processes in thermoelectric energy conversion, wherein waste heat from sources such as industrial processes in power plants, households, and vehicle exhausts, can be converted into electricity. This research has been published in *Advanced Materials* (doi: 10.1002/adma.202307058).




(Left) a stock image, (right) Prof. Kanishka Biswas and his research group for the reported research work.

News Sources:

- *DST Vigyan Samachar,* 6th March 2024. https://bit.ly/45Zc6Qx
- *Deccan Herald,* 7th March 2024. https://bit.ly/3LiGWu6
- Tweet by @IndiaDST, 11th March 2024. https://twitter.com/IndiaDST/status/1767047408800661523

MEDIA REPORTS

Pancreas-mimicking system for responsive insulin delivery in diabetes treatment

(Left) a stock image, (right) Prof. Govindaraju T.

Prof. Govindaraju T. and his research team from the Bioorganic Chemistry Laboratory, New Chemistry Unit, were motivated by the success of a previously developed passive insulin release system. In that study, insulin was encapsulated in the silk protein "fibroin" and injected under the skin, resulting in the slow diffusion of insulin over a period of 5 days. Building on these findings, Prof. Govindaraju's team modified the silk protein to create a super smart system that releases insulin in response to glucose levels in the blood. This research has been published in *ACS Applied Matter & Interfaces* (doi: 10.1021/acsami.3c07060).

News Sources:

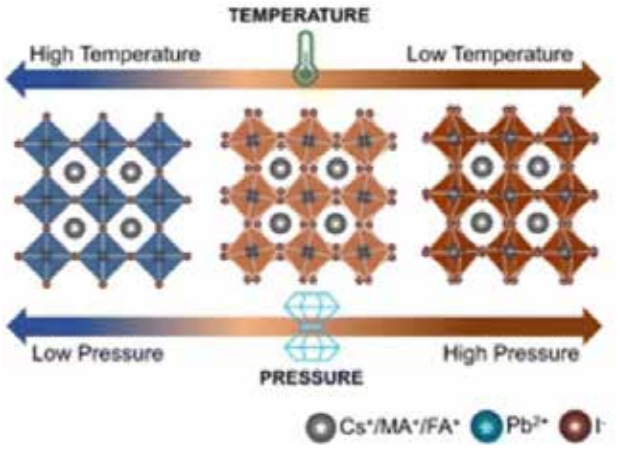
- *DST Vigyan Samachar,* 19th March 2024. https://bit.ly/3zL5fOs
- *DD News*, 19th March 2024. https://bit.ly/3VZ3cOw
- *The Times of India*, 20th March 2024. https://bit.ly/3LipaXW
- *The Hindu*, 21st March 2024. https://bit.ly/3RVPCu8

MEDIA REPORTS

Scientists advance our understanding of structural transitions in hybrid perovskites for renewable energy generation

Bharat Ratna Prof. C. N. R. Rao, Dr. Pratap Vishnoi, and their research team explored the precise atomic rearrangements that occur in each phase transition of lead iodide perovskites due to altered temperature and pressure, and their resulting effects on optoelectronic properties. The team reviewed over a hundred reported literature on phase transitions and crystal structures, with a focus on the reported structures based on X-ray, synchrotron, and neutron diffraction data. This review has been published in the *Journal of Materials Chemistry A* (doi: 10.1039/D3TA05315F).

Prof. Vishnoi and Bharat Ratna Prof. C. N. R. Rao.



The possible phase transitions of iodide perovskites Image credit: Journal of Materials Chemistry A).

News Sources:

- *Press Information Bureau,* 11th March 2024. https://bit.ly/45W9C5q
- *DST Vigyan Samachar,* 11th March 2024. https://bit.ly/45U3mv3
- Tweet by @IndiaDST, 13th March 2024. https://twitter.com/IndiaDST/status/1767782282297848086

04

FELLOWSHIPS AND OUTREACH ACTIVITIES

Science shapes societal progress, which in turn helps inspire scientific breakthroughs. Therefore, outreach activities to help build trust and interest in science can be fruitful for all. Recognising the importance of making science accessible to all, JNCASR has initiated several fellowships and extension programmes as well as science outreach programmes that are organised by the Office of Fellowships and Extension Programmes (F&E) and the Education Technology Unit (ETU), respectively.

The Centre offers several programmes to students and scientists from colleges and universities across India, which gives them the chance to work, conduct research, and take various courses at JNCASR. Our scientists also travel far and wide in the country to conduct several events to inspire school and college students to pursue science and scientific thinking, as well as to provide guidance to science teachers.

This section provides a brief overview of the achievements and activities of the outreach wing of JNCASR in the 2023–24 financial year.

FELLOWSHIPS AND EXTENSION PROGRAMMES

In addition to providing opportunities to pursue academic degrees in various areas, the Centre offers a range of fellowship programmes to school and undergraduate students studying science, and scientists working in research and development (R&D) institutes. A brief description of the different fellowship programmes is given below.

STUDENT BUDDY PROGRAMME FOR CLASS 11 AND 12 STUDENTS

This programme aims to help school and junior college students (class 11 and 12) learn about the latest advances in Science and Engineering, in addition to giving them a taste of the researcher's life. It also provides research scholars at the Ph.D. and postdoctoral levels with the opportunity to participate in educational programmes and inculcates a sense of responsibility towards education. Each school student spends a day interacting with a research scholar, observing and/or participating in ongoing research or discussion. During 2023–24, schools could not participate in this programme owing to busy academic schedules. Since its inception in 2015, 434 students and 33 teachers have participated in this programme.

SUMMER RESEARCH FELLOWSHIP PROGRAMME (SRFP) FOR UNDERGRADUATE AND POSTGRADUATE STUDENTS

Launched in 1991, this is a flagship programme at JNCASR. Science and Engineering students at the Bachelor's and Master's levels are placed at reputed institutions across the country for 2 months to receive training in their areas of interest, including Life Sciences, Chemical Sciences, Physical Sciences, Mathematics, and Engineering. Selection is based on merit on an all-India basis. About 150 fellowships are offered each year. The admitted students are given a fellowship of ₹10,000/- per month. The programme is highly acclaimed in the Centre, and the students are very appreciative of its benefits. It enables them to get inspired towards scientific research at an early stage in their education. Several SRFP fellows have later pursued a career in Science, Mathematics, or Engineering, and have held positions of great responsibility in India and abroad. During 2023–24, 67 students carried out project work under this programme. Since its inception in 1991, 2,589 students have benefitted from this programme.

PROJECT-ORIENTED CHEMISTRY EDUCATION (POCE)

Launched in 2004, POCE is a diploma programme that aims to promote an interest in science education and research amongst undergraduate students studying science. Each year, about 10 meritorious students pursuing Bachelor's degree in Chemistry are selected from across the country. In this 3-year programme, students visit JNCASR during semester breaks after completing their first year of B.Sc. They learn through structured lecture programmes organised by highly accomplished scientists of the Centre and other institutes in Bengaluru. On successfully completing the programme, the students are awarded a diploma in Chemistry. Most of these students then pursue higher education in science or research in institutions in India and overseas. During 2023–24, 10 students carried out project work under this programme. Since its inception in 2004, about 150 students have benefited from this programme.

FELLOWSHIPS AND EXTENSION PROGRAMMES

PROJECT-ORIENTED BIOLOGY EDUCATION (POBE)

Like POCE, POBE selects 10 meritorious students every year, pursuing first-year B.Sc. in Life Sciences from colleges across the country. On successfully completing the programme, they are awarded a diploma in Biology. Since its inception in 2006, 103 students have benefited from this programme.

VISITING FELLOWSHIPS PROGRAMME

To foster collaborations with the Centre's faculty members and provide research opportunities, the Centre offers visiting fellowships to faculty and scientists working in state or central universities and R&D laboratories in India. Visiting fellows are associated with the faculty of JNCASR, and the research work is carried out at JNCASR.

The Centre also offers Visiting Scientist Fellowships to research scientists in educational institutions and R&D laboratories to enable them to work with the faculty of JNCASR. This programme has been welcomed by many young researchers, as they can hone their skills or develop research laboratories in their parent establishment after undergoing training at the Centre. Faculty members could not participate in this programme due to their busy academic schedules. Since its inception in 2006, 113 research scientists/faculty members have benefited from this programme.

INSTITUTIONAL VISITS

To popularise science and encourage motivated students to pursue science education and research, the Centre encourages visits by students and teachers from colleges, universities, and schools to the Centre. During 2023–24, 569 students visited the Centre and its research facilities. Since its inception in 2019, 1,695 students and teachers from 44 different schools/colleges have participated in this programme.

GRADUATE RESEARCH INTERNSHIP PROGRAMME (GRIP)

A new programme called the Graduate Research Internship Programme (GRIP), initiated in 2021, aims at attracting bright final year B.E./B.Tech./Master's in Science and Engineering/M.B.B.S. students to carry out quality research project work at JNCASR. The project work forms a part of the degree requirement. The project's duration is for a semester or can be extended to a period of up to 1 year, depending on the requirement for the award of the degree. During 2023–24, 24 final-year students pursuing in UG/PG programmes in Engineering/Sciences carried out project work under this programme. Since its inception in 2021, 68 students from different colleges have benefited from this programme.

SHORT-TERM/LONG-TERM VISITING STUDENTS PROGRAMME (SVSP/LVSP)

With a view to support students pursuing various academic programmes, starting from undergraduate to Ph.D. and to carry out research projects pertaining to their course of study, the Centre introduced Short-term Visiting Students Programme (SVSP) and Long-term Visiting Students Programme (LVSP) in 2022. Since its inception, 34 students from different colleges have benefited from this programme.

FELLOWSHIPS AND EXTENSION PROGRAMMES

MAJOR EVENTS ORGANISED BY FELLOWSHIPS AND EXTENSION OFFICE

EXPOSURE VISIT PROGRAMME FOR CBSE SCHOOL PRINCIPALS

In tune with NEP 2020 guidelines, CBSE has started a novel initiative to expose school principals to institutions of eminence to give them a real-time experience of witnessing world-class state-of-the-art research facilities and outreach activities carried out by premier institutions.

At the request of CBSE, JNCASR organised a 2-day Exposure Visit Programme on 3rd and 4th May 2023 for about 50 principals of CBSE schools spread across India. During the visit, the Dean, F&E, Dean, R&D, and Chair, ETU made a presentation on various ongoing F&E and Outreach activities and an overview of the research activities carried out at the Centre. The participants visited various research facilities/laboratories in MBGU, NSU, NCU, CPMU, and other units.

VISIT FROM KARNATAKA RESIDENTIAL EDUCATIONAL INSTITUTIONS SOCIETY

The Social Welfare Department, Government of Karnataka, organised an institutional visit to JNCASR for a group of 20 principals from the Karnataka residential educational institutions society on 17th June 2023. During the visit, the Dean, F&E made a presentation on various ongoing F&E and Outreach activities and an overview of the research activities carried out at the Centre. This event was also considered as a "Jan Bhagidari" event, and related details were posted on the relevant social platforms.

ICAR-ARS PROFESSIONAL ATTACHMENT TRAINING (PAT) PROGRAMME

Dr. Nikhil K. C., Scientist (Animal Biochemistry), ICAR-Indian Institute of Agricultural Biotechnology (IIAB), Ranchi (112th FOCARS) completed the ICAR-ARS PAT Programme at JNCASR, for a period of 3 months from 11th September 2023 to 10th December 2023 for the project titled: *"To understand the molecular mechanisms of xerophagy"* under the mentorship of Prof. Ravi Manjithaya, MBGU.

VISIT OF SCIENTISTS/ASSISTANT PROFESSORS FROM ICAR INSTITUTES, SAUs, AND KVKs

A group of 19 scientists/assistant professors from ICAR institutes, State Agricultural Universities (SAU), and Krishi Vigyan Kendras (KVK) visited the Centre on 17th February 2024. The primary aim of the programme was to provide the participants with a comprehensive understanding of nanotechnology approaches and their applications in pest and disease management. They visited Prof. Eswaramoorthy's laboratory facilities to learn about the world-class facilities for synthesis and characterisation of nanomaterials.

CELEBRATION OF NATIONAL SCIENCE DAY 2024 AT JNCASR

JNCASR celebrated National Science Day (NSD) as Open Day on 28th February 2024 with the participation of about 500 students/teachers from 15 different schools and colleges in Bengaluru. The theme for this year's NSD was: *"Indigenous Technologies for Viksit Bharat"*.

FELLOWSHIPS AND EXTENSION PROGRAMMES

The departments organised various science experiments, demonstrations, and hands-on learning experiences to promote scientific curiosity among the participants. The event provided an opportunity for the students and teachers to engage with the faculty and students through live scientific experiments/demonstrations/poster presentations. The NSU, MBGU, EOBU, CPMU, NCU, GSU, and ETU participated in the event by organising scientific events, including laboratory visits and scientific demonstrations.

Interaction with the school/college students.

F&E OFFICE MEMBERS

Dean, Fellowships and Extension Programmes	Prof. N. S. Vidhyadhiraja
Coordinator, F&E and R&D (On Contract)	Dr. Panneer K. Selvam
Sr. Administrative Assistant Grade I	Bannaiah R.
Junior Administrative Assistant	Ande Akhil
Office Executive	Raju Dhar
Office Helper	Prashanth M.

FELLOWSHIPS AND EXTENSION PROGRAMMES

TOTAL NUMBER OF PUBLICATIONS IN 2023

INCEPTION YEAR

	PROGRAMME	PARTICIPATION TILL DATE
1991	Summer Research Fellowship Programme (SRFP)	**2,589** students
2004	Project-Oriented Chemistry Education (POCE)	**150** students from colleges across India
2006	Project-Oriented Biology Education (POBE)	**103** students
2006	Visiting Fellowships Programme	**113** research scientists and faculty members
2015	Student Buddy Programme	**434** students | **33** teachers
2019	Institutional Visits	**1,695** students and teachers
2021	Graduate Research Internship Programme (GRIP)	**68** students from colleges across India
2022	Short-term/Long-term Visiting Students Programme (SVSP/LVSP)	**34** students from colleges across India

EDUCATION TECHNOLOGY UNIT

The Education Technology Unit (ETU), in collaboration with the C. N. R. Rao Hall of Science, organised and facilitated an intensive list of community science events that attracted a remarkable level of participation, not only from the state of Karnataka but also from across the nation. Science camps, interactive lectures, and outreach events were organised throughout the year at various schools and colleges. Some events were also facilitated via the hybrid mode to encourage larger participation from across the country.

The programmes were as follows:

The **Exposure Visit Programme** was an enlightening initiative organised and conducted in association with F&E, JNCASR on 3rd and 4th May 2023. This programme welcomed approximately 50 distinguished school principals from across India, all affiliated with the Central Board of Secondary Education (CBSE). The core objective of this two-day programme was to provide a unique and immersive "Exposure Visit" experience to the JNCASR, a renowned institution of higher education. Eminent speakers for this event, including Prof. G. U. Kulkarni, President, JNCASR, Prof. K. R. Srinivas, Prof. N. S. Vidhyadhiraja, and Prof. T. Govindaraju, graced the occasion with their insights and expertise. Participants had the privilege of exploring JNCASR's state-of-the-art laboratories and engaging with the fascinating ChemExpo and Galleries showcasing the rich history of scientific exploration. One of the programme highlights was a series of captivating experiment demonstrations led by Shri Vinayak Pattar, an expert from JNCASR. These demonstrations enthralled the participants and deepened their understanding of various scientific concepts.

Snapshots of the 2-day Exposure Visit Programme organised at ETU, Hall of Science, on 3rd and 4th May 2023

Science Outreach Programmes were organised and conducted at Champavat and Gangolihaat, Uttarakhand between 14th to 18th May 2023. The C.N.R. Rao Education Foundation sponsored these programmes, which were organised and conducted by the Geosciences Unit, ETU, JNCASR, in association with the Himalayan Gram Vikas Samiti, Gangolihaat. The resource persons for these programmes from JNCASR were Prof. Umesh Waghmare, Prof. Ranga Uday Kumar, Prof. Eswaramoorthy, Prof. N. S. Vidhyadhiraja, Prof. Sheeba Vasu, Prof. A. N. Jayachandra, Dr. Jaishri Sanwal Bhatt, Dr. Pratap Vishnoi, Dr. Arun Panchapakesan and others who delivered lectures on various subjects, igniting curiosity. Chemistry and physics experiments further enthralled participants, making the event a resounding success. About 210 students and 40 teachers participated from over 15 colleges.

A 5-day workshop focused on **Scientific Writing and Scientific Computation** was organised between 23rd to 27th May 2023. Sponsored by the C.N.R. Rao Education Foundation and organised by the ETU, JNCASR and Sagar Science Forum, this event featured notable experts, including Shri G. D. Veerappa Gowda (TIFR), Dr. Sudarshan Kumar K. (IISER, Thiruvananthapuram), and Prof. N. S. Vidhyadhiraja (JNCASR). About 22 final-year B.Sc. students (PCM and CS) participated from in and around Sagara, Shivamogga District, offering a valuable learning experience for the students.

EDUCATION TECHNOLOGY UNIT

Orientation Programme for Science and Mathematics Teachers was held between 8th to 10th June 2023. This event took place in the Sagara, Shivamogga District, was sponsored by the C.N.R. Rao Education Foundation, and organised by ETU, JNCASR and Sagar Science Forum. Lectures on diverse topics were delivered by Dr. S. Hiriyanna (ISRO), Shri Shashikanth Joshi (TGT), Dr. H. S. Jeevan, Dr. Shivanand S. Bhat, and Shri Sumanth Raj C. N. The programme aimed to enhance teaching skills and pedagogical approaches for these dedicated educators. About 41 Science and Mathematics teachers participated from government high schools.

Science Outreach Programme was exclusively designed for 14 Principals from Ekalavya Residential Schools, who held the esteemed position of Class I officers within the KREIS (Karnataka Residential Educational Institutions Society) educational system under the Government of Karnataka. This programme was organised by ETU, JNCASR and hosted at the Hall of Science in association with F&E, JNCASR on 17th June 2023. The programme featured the expertise of Prof. N. S. Vidhyadhiraja and Shri Vinayak Pattar, both from JNCASR, who provided valuable insights and knowledge to the participants. It served as a platform to exchange ideas and foster a greater understanding of science education within the state's educational leadership.

1-day Science Outreach Programme for school principals on 17th June 2023, at the ETU Hall of Science.

The **Outstanding Science Teachers Award Programme** was a standout event within the Science Outreach Programme, organised with the C.N.R. Rao Education Foundation on 28th June 2023. It featured a special lecture by renowned ecologist Prof. R. Sukumar from IISc, Bengaluru, followed by an engaging science experiment demonstration by Dr. Pratap Vishnoi and Shri Vinayak Pattar. This event, attended by 192 participants, including 170 students and 22 teachers from grades X, XI, and XII, from Laxmeshwar and in & around Bengaluru, aimed to honour exceptional science educators and deepen the appreciation for science education in the Laxmeshwar and Bengaluru regions.

Prof. R. Sukumar, Prof. Pratap Vishnoi, and Shri Vinayak Pattar at the "Outstanding Science Teachers Award" - Special Lecture and Experiment Demonstration at ETU and Hall of Science, JNCASR, on 28th June 2023.

EDUCATION TECHNOLOGY UNIT

The **Science Outreach Programme** took place at Poddar International School in Bengaluru on 4th July 2023. Prof. N. S. Vidhyadhiraja and Shri Vinayak Pattar from JNCASR delivered a lecture and demonstrated experiments for high school students. The goal was to ignite curiosity and a deeper passion for science. Approximately 220 students and 22 teachers took part in the programme.

Excited and stimulated students at the half-day Science Outreach Programme led by Prof. N. S. Vidhyadhiraja and Shri Vinayak Pattar, from ETU, JNCASR on 4th July 2023.

Vijnana Manthana, a one-day event, convened 36 participants, including 2 teachers from grades XI and XII on 23rd July 2023. The event was hosted in Sagara, sponsored by the C.N.R. Rao Education Foundation and organised by ETU, JNCASR and Sagar Science Forum. Dr. Prasad N. Bapat from PESITM, Shivamogga, delivered enlightening insights and provided a valuable opportunity for students and educators to engage in thought-provoking discussions and deepen their understanding of science.

The **Learn Science with Fun: Experiment Demonstration** event unfolded on 24th August 2023, offering a half-day of engaging learning. The event featured Shri Vinayak Pattar from ETU, JNCASR, as the expert demonstrator. About 116 students (grades XI and XII) and 8 teachers from Chrysalis High-Horamavu and Trillium School and College-Hegade Nagar, Bengaluru participated in the event.

Participants of the Learn Science with Fun: Experiment Demonstration event at ETU, JNCASR on 24th August 2023.

An interactive session titled **Learn Science Through Experiments,** conducted by Shri Vinayak Pattar from ETU, JNCASR, on 31st August 2023, aimed to spark curiosity and interest in science among attendees through interactive sessions and demonstrations. The programme had 47 participants, including girl students (Vijnan Jyoti) from grades XI and XII from JNV, Bagalur, Bengaluru.

EDUCATION TECHNOLOGY UNIT

Shri Vinayak Pattar from ETU, JNCASR conducting the 1-Day Science Outreach Programme titled "Learning Science Through Experiments" on 31st August 2023.

An enlightening event titled **Artificial Intelligence and Machine Learning** was conducted on 3rd September 2023, in collaboration with the Sagar Science Forum, generously sponsored by the C.N.R. Rao Education Foundation. The event featured Shri Ravi Hegde from Bengaluru, a specialist in the field. This gathering served as an excellent opportunity for students and educators to delve into the fascinating realms of AI and Machine Learning, expanding their knowledge in these cutting-edge fields. About 40 students and 2 teachers of grades XI & XII from government colleges of Sagara, Shivamogga District, participated in the programme.

Participants captivated by Shri Ravi Hegde's talk at the half-day programme on "Artificial Intelligence and Machine Learning" at Sagar Science Forum, Sagara, Shivamogga District, on 3rd September 2023.

An **Interactive Lecture Programme in Physics** was held on 15th September 2023, which drew a substantial number of students and teachers, 180 in-person attendees and 100 online participants, for a total of 280 participants from grades X, XI, and XII. The programme featured the renowned speaker, Prof. C. V. Yelamaggad, from CeNS, Bengaluru. The lecture was followed by "Fun with Science" experiment demonstration conducted by Shri Vinayak Pattar from ETU, JNCASR. This event was attended by various educational institutions in Bengaluru, providing an enriching learning experience in the field of physics.

Prof. C. V. Yelamaggad speaking at the 1-day Interactive Lecture Programme in Physics at ETU, JNCASR, on 15th September 2023.

EDUCATION TECHNOLOGY UNIT

The **Professor K.S. Valdiya 3rd Memorial Lecture** was organised and conducted on 6th October 2023 in association with the Geosciences Unit. A special lecture titled *"Unearthing Earth's Past: how Geology Reveals the Story of Our Planet"* was delivered by Dr. R. Sajeev, Director, Geological Survey of India (GSI), Karnataka & Goa. This was followed by an Interactive session in Geosciences with Dr. Jaishri Sanwal Bhatt, Research Scientist, JNCASR, and then by "Fun with Science Experiments" by Shri Vinayak Pattar, ETU, JNCASR. The programme was attended by 200 students and 30 teachers representing various academic levels, including PUC, B. Sc., M.Sc., and Ph.D. Additionally, 100 participants joined online. About 12 colleges/schools participated in the programme. Following the programme, the participants got a chance to explore the Galleries and ChemExpo.

Snapshots from the 1-Day Interactive Lecture Programme in Geosciences at ETU, JNCASR, on 6th October 2023 featuring Dr. R. Sajeev, Director, Geological Survey of India (GSI).

Interactive Lecture Programme in Physics and Biology held on 20th October 2023, was a remarkable event, comprising two captivating sessions: *"The Fascinating World of RNA Viruses"* by Dr. Arun Panchapakesan, JNCASR and "Fun with Physics Experiments" by Shri Vinayak Pattar, JNCASR. About 180 students and 20 teachers participated in this enlightening programme. In addition to the informative lectures, attendees had the opportunity to visit & explore Galleries and ChemExpo, enhancing their overall learning experience.

Scenes from the 1-day Interactive Lecture Programme in Physics and Biology at ETU, JNCASR, on 20th October 2023, featuring talks by Dr. Arun Panchapakesan and Shri Vinayak Pattar from JNCASR.

ETU, in collaboration with Sagar Science Forum in Sagara, Shivamogga District, organised and hosted the **Annual Science Camp for PUC Students**, between 27th to 29th October 2023. The event was sponsored by the C.N.R. Rao Education Foundation. The three-day event featured interactive workshops and hands-on activities aimed at inspiring curiosity and deepening understanding of science and technology among participants. Distinguished speakers included Dr. A. S. Kiran Kumar, Former Chairman of ISRO, Dr. N. S. Vidhyadhiraja from JNCASR, Shri S. Hiriyanna, Shri Manjunath from ISRO, Dr. H. S. Jeevan, Shri H. R. Madhusudan from Nehru Planetarium Bangalore, and Dr. L. K. Sripathi and Dr. Dwijesh Ray from PRL Ahmedabad. A total of 56 students and 8 teachers from grades XI and XII participated in the event.

EDUCATION TECHNOLOGY UNIT

The **Fun with Science Experiments and Lab Visit** event held on 30th and 31st October 2023, aimed to enhance participants' understanding of scientific concepts through hands-on activities led by Dr. Pratap Vishnoi and Shri Vinayak Pattar. 40 students from grades XI and XII, along with four teachers from Shikshayatan School, Kolkata, participated. Additionally, participants had the opportunity to visit ChemExpo and Galleries.

Fun with Science Experiments and Laboratory Visits in progress at ETU, JNCASR, on 30th and 31st October 2023.

Science in Action: Workshop for Teachers was organised and led by Prof. N. S. Vidhyadhiraja and Shri Vinayak Pattar from JNCASR on 21st November 2023. The workshop aimed to enhance teachers' understanding of scientific concepts and teaching methodologies, fostering scientific literacy and innovative teaching practices in classrooms. About 30 teachers participated from across Karnataka.

Vijnana Manthana was sponsored by the C.N.R. Rao Education Foundation and hosted at Sagar Science Forum in Sagara, Shivamogga District on 3rd December 2023. The event featured Shri Venkatesh K. S. from Shivamogga. The programme promoted the exploration of science-related topics through interactive sessions and discussions. The event had around 20 participants, which included students and teachers from grades XI and XII.

Snippets of the 3-day Science Outreach Programme at School Chandan, Laxmeshwar, from 10th to 12th December 2023, featuring distinguished speakers including Bharat Ratna Prof. C. N. R. Rao, Prof. Indumati Rao, Prof. G. U. Kulkarni, and others from JNCASR and beyond.

A three-day **Science Outreach Programme** engaged 300 students and teachers from grades X, XI, and XII between 10th to 12th December 2023. Hosted at School Chandan, Laxmeshwar, and sponsored by the C.N.R. Rao Education Foundation, the programme featured a distinguished panel of speakers including Bharat Ratna Prof. C. N. R. Rao, Dr. Indumati Rao, Prof. G. U. Kulkarni, Prof. S. M. Shivaprasad, Prof. Eswarmoorthy, Prof. N. S. Vidhyadhiraja, Prof. Sheeba Vasu, Shri A. N. Jayachandra, Dr. Jaishri Sanwal Bhatt, Dr. Arun Panchapakesan, Shri Vinayak Pattar from JNCASR and Prof. B. L. V. Prasad, CeNS, Prof. Timothy Fisher, University of California, USA, Prof. Prashant Kamat, University of Notre Dame, USA, and Prof. Radha Boya, Royal Society, University of Manchester, UK. It aimed to provide comprehensive insights into various scientific disciplines, fostering a holistic understanding of science among participants from different educational backgrounds across Karnataka (North).

EDUCATION TECHNOLOGY UNIT

Science in Action: Fun with Science Experiments held on 22nd December 2023, began with an exciting physics experiment demonstration by Shri Vinayak Pattar and a colourful chemistry Experiment demonstration by Dr. Pratap Vishnoi, JNCASR. Following this, a special lecture titled *"Origin of Life on Earth"* was delivered by Prof. Vinod Chandra Tewari from the Wadia Institute of Himalayan Geology, Dehradun. The programme was attended by 230 students and 20 teachers, including those from the 10th, 11th, 12th and B.Sc. levels. After the programme, participants had the opportunity to explore the Galleries and ChemExpo. Finally, there was a lab visit for the participants. It was a captivating and educational experience, fostering curiosity in science.

(Left): Snippets from the Science in Action: Fun with Science Experiments event at ETU, JNCASR, on 22nd December 2023.
(Right): Prof. Vinod Chandra, Shri Vinayak Pattar, and Prof. Pratap Vishnoi presenting at the event.

A half-day session on **Nano Science and Technology and Experiment Demonstration** was held at Government Degree College, Chitradurga on 6th January 2024. The special lecture delivered by Shri Vinayak Pattar from ETU, JNCASR event aimed to introduce participants to the fascinating world of nanoscience and nanotechnology, showcasing its applications and significance through practical demonstrations. This session attracted 76 participants, including B.Sc. VII semester students.

A successful half-day Nano Science and Technology and Experiment Demonstration event at Government Science College, Chitradurga, on 6th January 2024.

Vijnana Manthana Programme focused on "Nano Science & Technology" and "Fun with Science Experiments". This one-day event, held on 7th January 2024, attracted 24 participants, including students and teachers from grades XI and XII. Hosted at Sagar Science Forum in Sagara, Shivamogga District, and sponsored by the C.N.R. Rao Education Foundation, the programme aimed to stimulate curiosity and interest in nanoscience among participants. Led by Shri Vinayak Pattar from ETU, JNCASR, the event included interactive sessions and hands-on experiments, offering participants a glimpse into the world of nanotechnology and encouraging them to explore scientific concepts through experimentation such as Raman Effect and superconductivity.

EDUCATION TECHNOLOGY UNIT

The Vijnana Manthana: Nano Science and Technology and Fun with Science Experiments at Sagar Science Forum, Sagara, Shivamogga District, on 7th January 2024.

An **Interactive Lecture Programme in Science** was organised at Dr. Ambedkar Residential School in Badami on 13th January 2024. This one-day event engaged 134 participants, including students from grades IX and X. Led by Shri Vinayak Pattar from ETU, JNCASR, the programme aimed to enhance students' understanding of various scientific concepts through interactive sessions, fostering a deeper interest in science among the participants.

Students at the 1-Day Interactive Lecture Programme in Science at Dr. Ambedkar Residential School, Badami, on 13th January 2024.

Learning Science Through Experiments was held on 18th January 2024, and the programme attracted 104 participants, primarily consisting of students from Grade X. Led by Shri Vinayak Pattar from ETU, JNCASR, the programme aimed to promote active learning and deeper understanding of scientific concepts through hands-on experimentation. Participants were encouraged to engage in various experiments, fostering their curiosity and enthusiasm for science. Following the demonstration, participants visited the Galleries and ChemExpo.

Shri Vinyak Pattar at the Learning Science Through Experiments event organised at ETU, JNCASR, on 18th January 2024.

EDUCATION TECHNOLOGY UNIT

An event focused on **Nano Fertilizer Awareness Programme - Introduction to Nano Fertilizers** was organised on 20th January 2024. Sponsored by the C.N.R. Rao Education Foundation and hosted in collaboration with IFFCO and Sagar Science Forum at Sagara, the event featured Dr. H. S. Jeevan, Shri Rajendra Prasad, and Shri B. L. Raju. It aimed to enlighten farmers about the benefits of nanotechnology in agriculture, specifically highlighting the advantages of nano fertilizers. About 25 farmers from Sagara, Shivamogga district, participated in the programme.

Farmers being educated about the benefits of nanotechnology for farming at the Nano Fertilizer Awareness Programme at IFFCO and Sagar Science Forum, Sagara, Shivamogga District, on 20th January 2024.

An **Interactive Lecture Programme in Physics** and **Learning Science Through Experiments** was organised on 1st February 2024. This half-day event engaged 52 participants, including students from grades XI and XII. Led by Prof. S. M. Shivaprasad, Dean of IIT Dharwad, Dr. Jaishri Sanwal Bhatt, Research Scientist, and Shri Vinayak Pattar from ETU, JNCASR, the programme aimed to deepen students' understanding of physics concepts and promote active learning through practical experiments. Participants had the opportunity to engage in hands-on activities, enhancing their scientific skills and knowledge.

Prof. S. M. Shivaprasad from IIT Dharwad, Dr. Jaishri Sanwal Bhatt from JNCASR, and Shri Vinayak Pattar with the participants from Kerala at the half-day Interactive Lecture Programme in Physics and Learning Science Through Experiments event held at ETU, JNCASR, on 1st February 2024.

At JNV Urban, Bengaluru, an awe-inspiring **Star Gazing Programme** unfolded on 18th February 2024, drawing in 271 participants, ranging from students in grades IX to XII. Guided by Dr. Arun Panchapakesan, Chhavi Saini, Swarnima Mishra, and Hrimkar Buch, this captivating half-day event aimed to instil a deep appreciation for astronomy and space science. Participants were treated to breathtaking views of celestial objects through telescopes while immersing themselves in enlightening discussions about various astronomical phenomena. The session ignited their curiosity about the vast mysteries of the universe, leaving them inspired to explore further.

EDUCATION TECHNOLOGY UNIT

Students attending a presentation at the "star gazing session" at JNV Urban, Bengaluru, on 18th February 2024 before looking at the sky through telescopes.

As part of the **"राजभाषा सम्मेलन" (Hindi Conference),** ETU conducted a half-day **Science Outreach Programme** on 23rd February 2024. Engaging 105 participants, including students from grades X and XI from both JNV urban and rural areas, the event featured a special lecture delivered by Prof. Amitabh Joshi and Dr. Jaishri Sanwal Bhatt. Aimed at promoting scientific awareness among attendees, the programme provided a platform for participants to delve into various scientific concepts and developments, fostering a deeper understanding of science. Following the lecture, participants had the opportunity to visit the Gallery and ChemExpo, further enriching their scientific experience.

Moments from the राजभाषा सम्मेलन *(Hindi Conference) and Science Outreach Programme at ETU, JNCASR on 23rd February 2024, featuring Prof. Amitabh Joshi and Dr. Jaishri S. Bhatt.*

EDUCATION TECHNOLOGY UNIT

An Open Day event was organised by ETU in association with F&E, JNCASR to celebrate **National Science Day** on 28th February 2024. The theme for this year was "Indigenous Technologies for Viksit Bharat". The event included interactive sessions, demonstrations, and tours of various labs such as MBGU, NSU, EOBU, GSU, ETU, C.N.R. Rao Hall of Science, ChemExpo, CPMU, NCU, and ICMS. The main objective of this event was to celebrate the spirit of science and innovation, giving participants opportunities to engage with cutting-edge research and experiments. The event attracted a significant turnout of 525 participants, including students from grades IX, X, XI, XII, B.Sc., M.Sc., and Ph.D.

Snapshots of the Open Day event organised at ETU, JNCASR, on 28th February 2024, National Science Day.

The **Institutional Visit** was organised and conducted in association with the F&E, JNCASR on 7th March 2024. It featured an interactive session on the outreach activities of JNCASR and a visit to Galleries and ChemExpo, followed by a stimulating lab visit. Shri Vinayak Pattar facilitated the session from ETU. Participants actively engaged in discussions, gaining insights into the latest advancements in scientific research and the role of JNCASR in fostering scientific curiosity. The lab visit provided firsthand exposure to state-of-the-art facilities and ongoing research projects, inspiring participants to pursue further exploration in the field of science. This visit was part of an international conference held at Kristu Jayanti College in Bengaluru and was attended by a diverse group of 70 research scholars from across India.

The many activities organised as part of the Interactive Session on JNCASR Outreach Activites and Laboratory Visit at ETU, JNCASR, on 7th March 2024.

Visit to Galleries and ChemExpo was arranged as a part of the India@DESY Users' Workshop, JNCASR, which included engaging science experiment demonstrations on 14th March 2024. Shri Vinayak Pattar from ETU, JNCASR led the event, providing practical insights into the potential applications of nanoscience and its impact on various fields. The event was attended by a total of 90 M.Sc. and Ph.D. research scholars, accompanied by 10 faculty members from Jain University and Reva University, Bengaluru.

EDUCATION TECHNOLOGY UNIT

A successful event called Nano Science and Fun with Science Experiments in progress at ETU, JNCASR, in association with the India@DESY Users' Workshop on 14th March 2024.

Writing Research Proposal, Nano Science and Experiment Demonstration held on 19th March 2024, focused on enhancing research skills. Hosted by KSTA, Bengaluru, as a part of our outreach programme, a special talk was delivered by Shri Vinayak Pattar from ETU, JNCASR. The event comprised sessions on effective writing of research proposals, showcasing the importance of basic Science, and conducting a few experiment demonstrations, providing participants with valuable insights into the research process and fostering a deeper understanding of nano-science concepts. This FDP programme was attended by 35 B.Sc. students and 20 degree college faculty members.

EDUCATION TECHNOLOGY UNIT

32

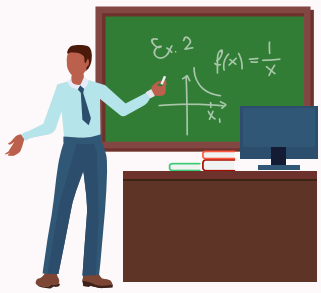
NUMBER OF PROGRAMMES

4,119

TOTAL PARTICIPANTS

3,258+

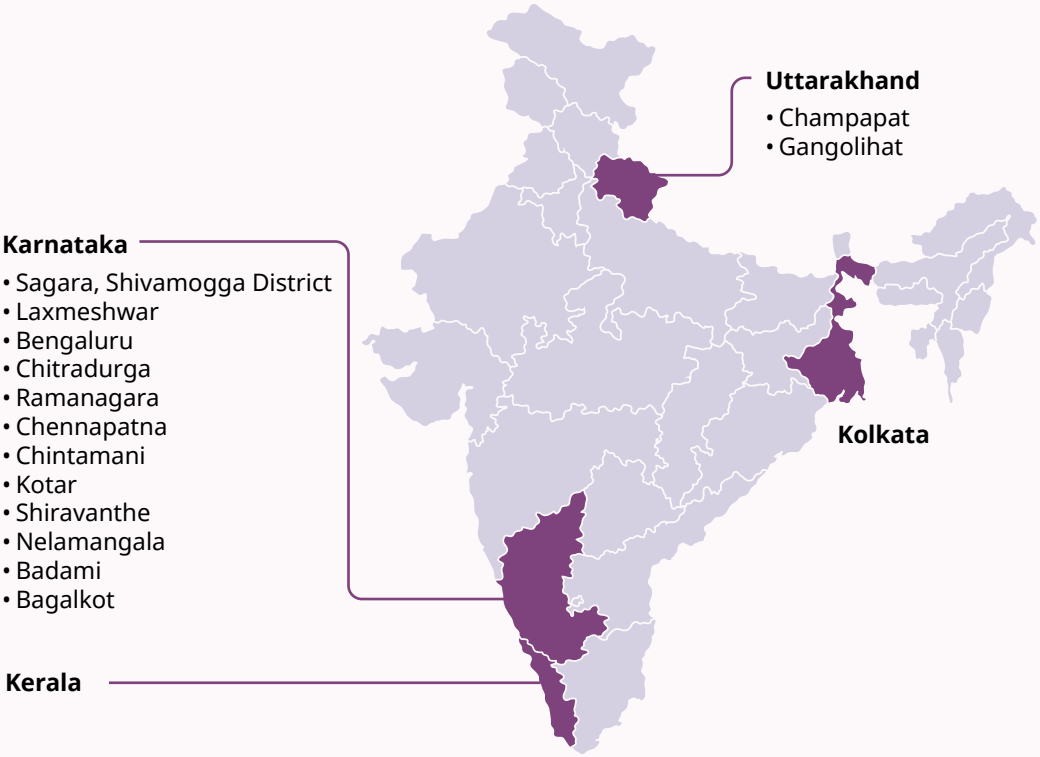
Students



536+

Teachers

OUR OUTREACH



MEMBERS OF ETU

Chair, ETU (November 2023 onwards)	Prof. Sheeba Vasu
Former Chair, ETU (up to October 2023)	Prof. Govindaraju T.
Honorary Co-ordinator, ETU, Multimedia Group	Dr. Indumati Rao
Assistant Co-ordinator	Shri Vinayak Pattar
Honorary Assistant, ETU, Multimedia Group	Sanjay S. R. Rao

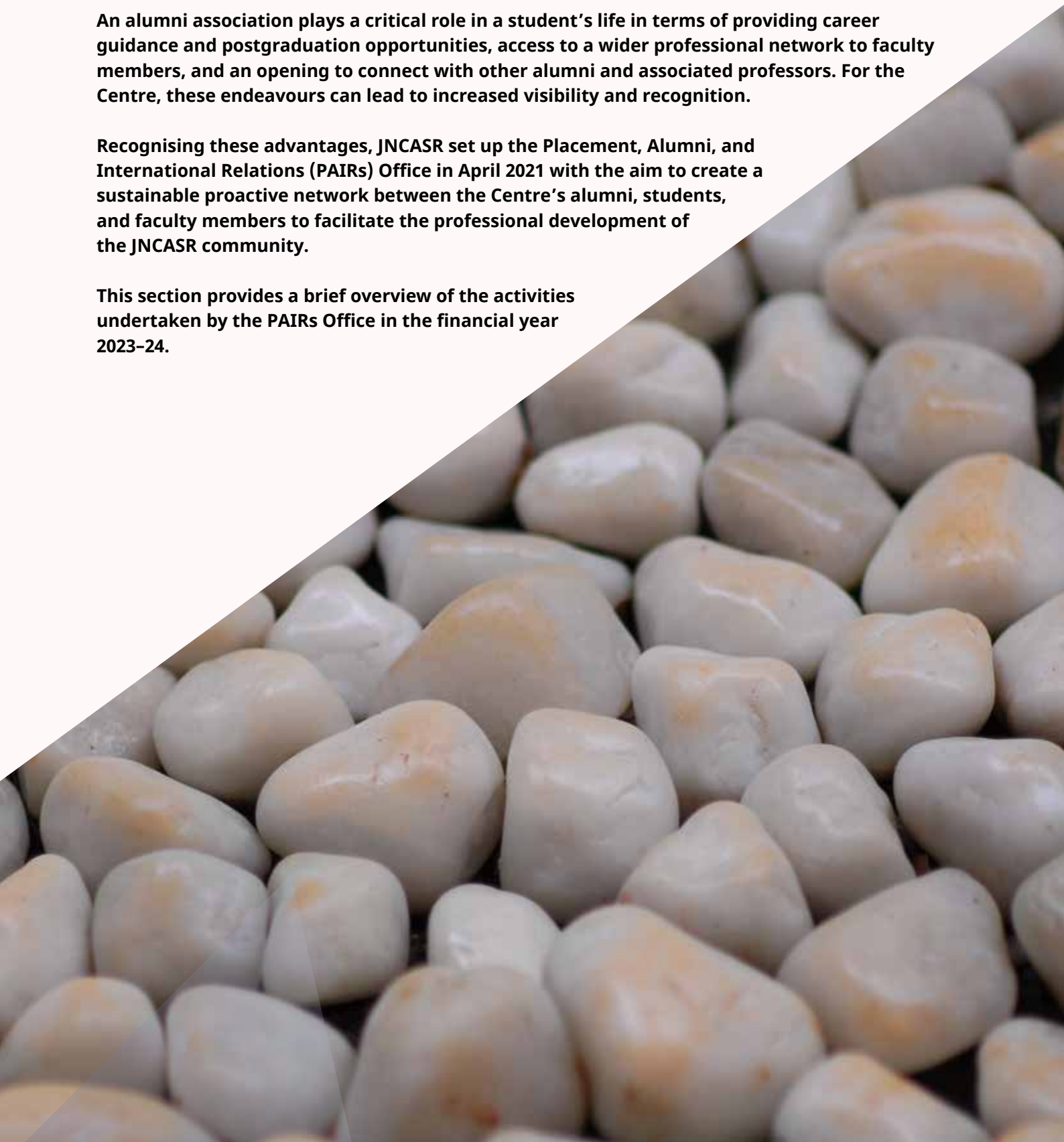
05

ALUMNI AND PLACEMENTS

An alumni association plays a critical role in a student's life in terms of providing career guidance and postgraduation opportunities, access to a wider professional network to faculty members, and an opening to connect with other alumni and associated professors. For the Centre, these endeavours can lead to increased visibility and recognition.

Recognising these advantages, JNCASR set up the Placement, Alumni, and International Relations (PAIRs) Office in April 2021 with the aim to create a sustainable proactive network between the Centre's alumni, students, and faculty members to facilitate the professional development of the JNCASR community.

This section provides a brief overview of the activities undertaken by the PAIRs Office in the financial year 2023–24.



PLACEMENT, ALUMNI, AND INTERNATIONAL RELATIONS (PAIRs)

The Placement, Alumni, and International Relations (PAIRs) office was established in April 2021 with a vision of creating and sustaining a proactive network between our alumni, students, and faculty members of the Centre in order to empower and facilitate the academic and professional development of the JNCASR community.

Recently, the PAIRs office completed making a unique database of 868 esteemed alumni of the Centre and connected with each of them via email. Through the dedicated platform of the JNC newsletter, the PAIRs office shares updates on the Centre's academic and research endeavours as well as celebrate its notable achievements with our extensive alumni network.

Looking ahead, the PAIRs office is committed to actively pursuing several objectives in the upcoming months. These include creating employment opportunities through leveraging our alumni and industry contacts as well as facilitating placement and internship opportunities within various industries. To achieve these goals, the PAIRs office hopes to establish a placement centre in JNCASR where final year degree (M.S. and Int. Ph.D./Ph.D.) students can enroll.

The Centre eagerly looks forward to the support of its alumni as it forges the road ahead, leading the Centre to greater heights.

MEMBERS OF THE OFFICE

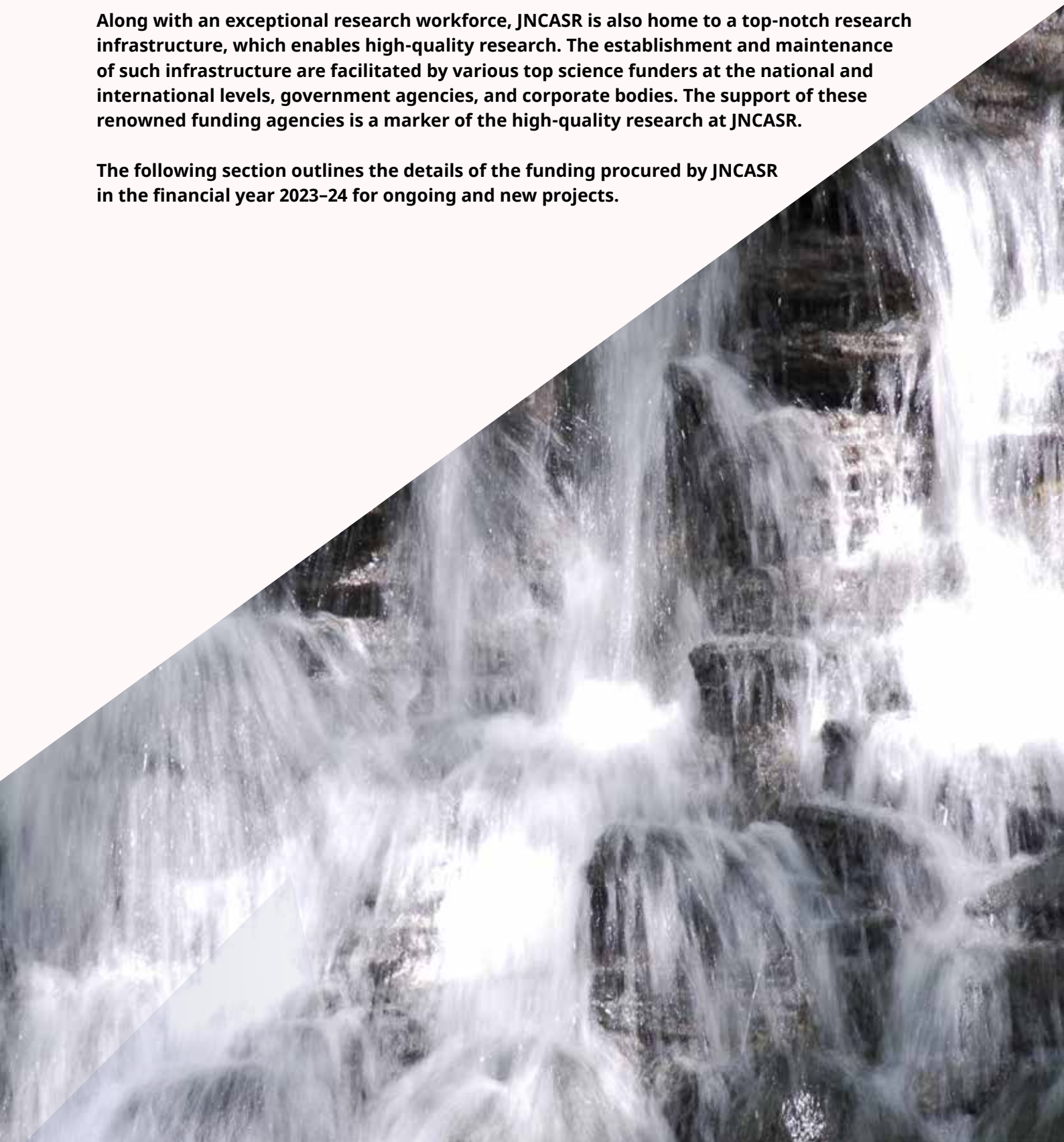
Faculty In-charge, PAIRs	Prof. Kanishka Biswas (w.e.f. 1st November 2023),
	Prof. Shobhana Narasimhan (upto 31st October 2023)
Academic Coordinator	Dr. Princy J. Pereira
Senior Library cum Information Assistant Gr. I	Dr. Nandakumari E.

06

FUNDING

Along with an exceptional research workforce, JNCASR is also home to a top-notch research infrastructure, which enables high-quality research. The establishment and maintenance of such infrastructure are facilitated by various top science funders at the national and international levels, government agencies, and corporate bodies. The support of these renowned funding agencies is a marker of the high-quality research at JNCASR.

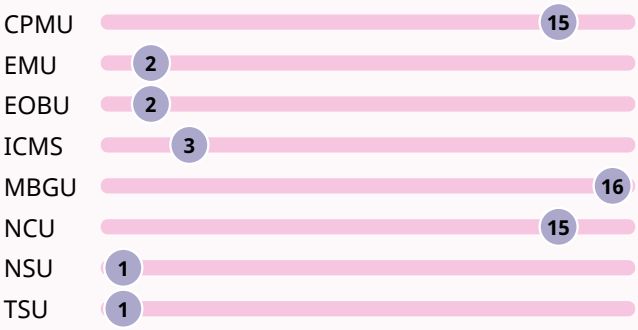
The following section outlines the details of the funding procured by JNCASR in the financial year 2023–24 for ongoing and new projects.



SPONSORED PROJECTS

NEW PROJECTS 2023–24

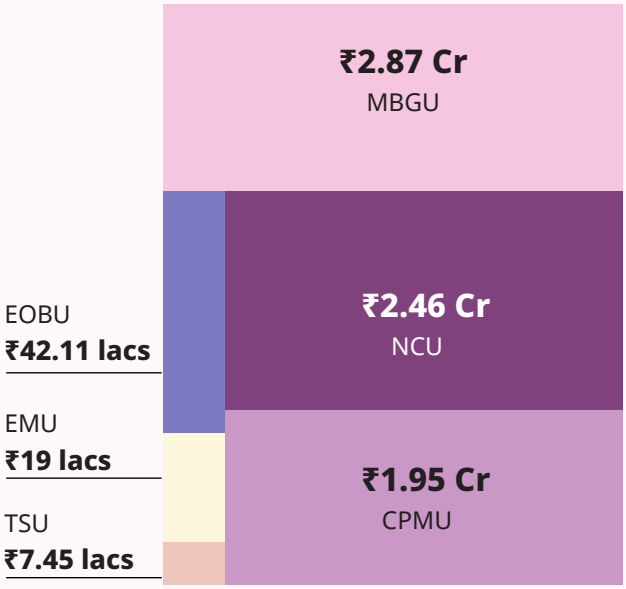
Number of Projects



55
New sponsored projects

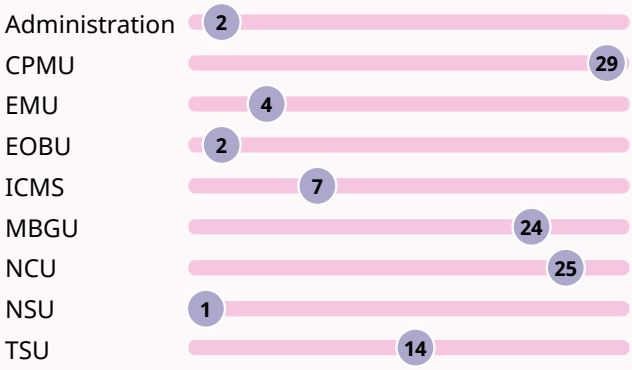
₹7.97 Cr
Total grant received for new projects

Unitwise Grants



ONGOING PROJECTS 2023–24

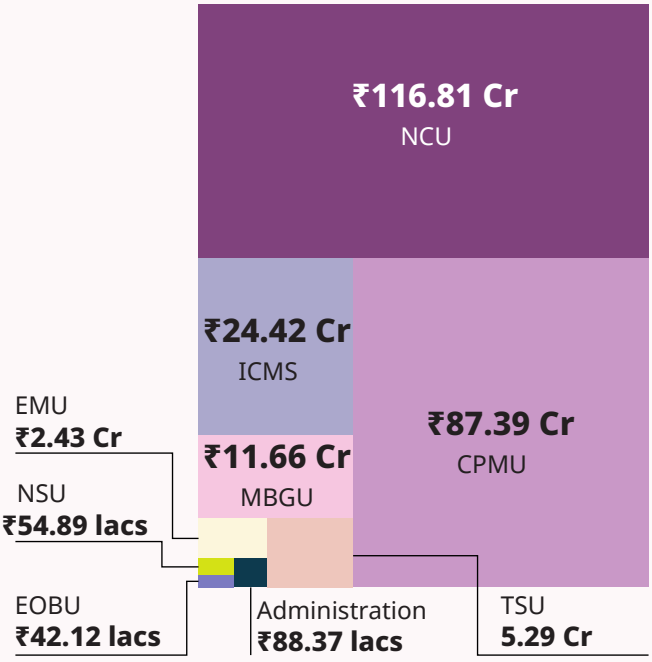
Number of Projects



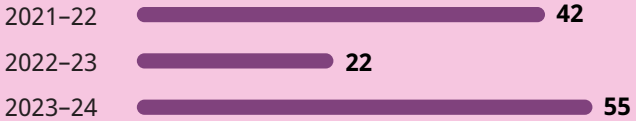
107
Ongoing sponsored projects

₹249.47 Cr
Total grant received for ongoing projects

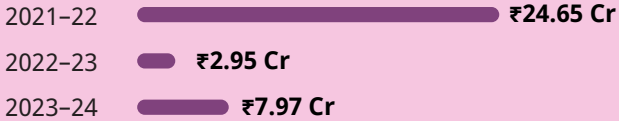
Unitwise Grants



NEW PROJECTS (PAST 3 YEARS)



GRANTS RECEIVED (PAST 3 YEARS)



SPONSORED PROJECTS

NUMBER OF NEW PROJECTS PER FUNDING PARTNER 2023–24

25	Department of Science and Technology
15	Science and Engineering Research Board
3	Department of Biotechnology
1	Biotechnology Industry Research Assistance Council
1	HHV Advanced Technologies Pvt. Ltd.
1	I-Hub Quantum Technology Foundation
1	Indian Council of Medical Research
1	Indian National Academy of Engineering
1	Indo French Centre for the Promotion of Advanced Research
1	National Chemical Laboratory
1	National Institute of Pharmaceutical Education and Research Kolkata
1	Science and Engineering Research Board-J C Bose Fellowship
1	Watsan Envirotech Pvt. Ltd.
1	Y R Gaitonde Medical Educational and Research Foundation

NUMBER OF ONGOING PROJECTS PER FUNDING PARTNER 2023–24

26	Science and Engineering Research Board
14	Department of Science and Technology
11	DST Inspire Fellowship
7	Science and Engineering Research Board-J C Bose Fellowship
6	Department of Biotechnology
4	Science and Engineering Research Board-TARE
4	Shell India Markets Pvt. Ltd.
2	Indian Council of Medical Research
2	Indian Institute of Science
2	Indo-Korea Science and Technology Center
2	National Institute of Pharmaceutical Education and Research Kolkata
1	Asian Office of Aerospace Research and Development
1	Bangalore International Airport Ltd.
1	Biotechnology Industry Research Assistance Council
1	Central Mine Planning and Design Institute Ltd.
1	Cookson India Pvt. Ltd.
1	Department of Atomic Energy-Board of Research in Nuclear Sciences
1	European Union
1	Gennova Biopharmaceuticals Ltd.
1	Hamsa Biopharma India Pvt. Ltd.
1	I-Hub Quantum Technology Foundation
1	Indian National Academy of Engineering
1	Indian National Science Academy
1	Indo French Centre for the Promotion of Advanced Research
1	Instruments R and D Establishment
1	National Chemical Laboratory
1	Regional Centre for Biotechnology
1	Renalyx Health Systems Pvt. Ltd.
1	Sheikh Saqr Laboratory
1	Tata Steel Ltd.
1	The World Academy of Sciences
1	Watsan Envirotech Pvt. Ltd.
1	Wellcome Trust/DBT India Alliance
1	Y R Gaitonde Medical Educational and Research Foundation

07

CENTRAL FACILITIES

A key factor that contributes to rapid and high-quality research at JNCASR is accessibility to various important resources and facilities. Every Unit at JNCASR is equipped with infrastructure and facilities specific to that discipline. In addition, the Centre maintains common facilities and resources, which cater to research needs, safety, and healthcare of the entire JNCASR community.

This section outlines the major developments in these facilities and services.

LIBRARY

The JNCASR library is well-stocked, with 10,113 books in its collection and access to over 4,000 scientific journals. The library continues to acquire, organise, and disseminate informational resources to render need-based information services to the faculty, students, and researchers. The library also offers services such as document delivery, interlibrary loan, current awareness, and bibliometric studies.

In the year 2023–24, 155 books were newly added. In addition, 144 new patrons became part of the library, increasing the current number of patrons to 465.

The total expenditure this year was ₹1,89,236 for procuring books and ₹58,05,254 for the journals.

LIST OF USER ORIENTATION PROGRAMMES ORGANISED

1. Online training on *"SciFinder Discovery Platform"* organised by Chemical Abstracts Service (CAS), a division of the American Chemical Society, on 26th June 2023
2. Online training on *"Grammarly for Administrators"* organised by National Knowledge Resource Consortium (NKRC) on 15th June 2023
3. Webinar on *"Can AI Substitute Chemists?"* organised by Elsevier Science on 4th July 2023
4. Online workshop on *"Improving Research and Publication Output using Grammarly"* organised by Total Library Solutions on 3rd August 2023
5. Online training on *"SciFinder Discovery Platform"* organised by CAS, the American Chemical Society on 12th September 2023
6. Online training on *"Web of Science"* organised by Clarivate Analytics on 19th October 2023
7. Online webinar series on *"SciFinder"* organised by CAS, the American Chemical Society on 13th, 15th, 20th, and 22nd March 2024

STAFF MEMBERS OF THE LIBRARY

Senior Library cum Information Officer	Nabonita Guha
Senior Library cum Information Assistant Grade I	Nagesh Hadimani
Junior Admin Assistants	Shubha S., Yadunath K.
Senior Driver	Venkataiah V.
Library Trainees	Shruti Kude, Manjunath B.

LIBRARY

OVERVIEW OF LIBRARY RESOURCES AND SERVICES (2023–24)

155
New books added

10,113
Total books in collection

149
Number of journal subscriptions

4,000+
Number of resources supported by the National Knowledge Resource Consortium (NKRC)

3,958
Total books circulated

144
New patrons

465
Total number of patrons

198
Article requests fulfilled

10
User orientation programmes organised

₹59,94,490
Total expenditure:
₹1,89,236 for books
₹58,05,254 for journals

COMPUTER LABORATORY (COMPLAB)

Since its establishment, the CompLab team at JNCASR has diligently pursued the modernisation of the organisation's network, security, and email infrastructure. Continuously integrating innovative technologies, the group consistently aims to enhance operational efficiency and support the evolving needs of JNCASR members.

NEW IMPLEMENTATIONS (2023–24)

NETWORK CORE SWITCHES AND NETWORK ACCESS SWITCHES

We implemented new network core switches and replaced few outdated network access switches in our campus environment for improving performance, scalability, security, management capabilities, and ensuring compatibility with emerging technologies, ultimately leading to a more reliable and efficient network infrastructure.

ARUBA ACCESS POINTS

We have implemented and replaced all the outdated AP's to new Aruba access points in our campus environment. This will deliver significant benefits in terms of Wi-Fi performance, user experience, security, management, scalability, and integration, ultimately leading to a more efficient, reliable, and secure network infrastructure.

FIREWALL FOR HIGH AVAILABILITY

We added and implemented a new Firewall for High Availability on our Network, to ensure reliability, performance, and continuous protection of network resources against various threats and disruptions. This will help the organisation maintain seamless network operations, mitigate risks, and meet compliance requirements, ultimately contributing to a more secure and resilient network infrastructure.

NETWORK

We implemented and upgraded the internet bandwidth from 700 Mbps to 1 Gbps internet connection in April 2023 for the Primary ISP, and the intranet speed is up to 10 Gbps.

UPGRADES (2023–24)

FIREWALL

We have recently upgraded to the latest firmware OS and implemented new best practice compliance rules to enhance security.

COMPUTER LABORATORY (COMPLAB)

WI-FI CONTROLLER

We have recently upgraded to the latest firmware OS to enhance security and also to provide optimal Wi-Fi performance for campus users.

STORAGE SERVER

We have recently upgraded to the latest firmware code to address bugs and improve performance.

VIRTUALISATION

We have upgraded the virtualisation hosts and cluster applications, from version 6 to 7 in accordance with the required OEM compliance standards.

STEPS BEING TAKEN TO ADHERE TO CYBER SECURITY COMPLIANCE GUIDELINES

1. **Maintaining Inventory of Authorised Hardware and Software:** This involves keeping a comprehensive record of all hardware devices (computers, servers, networking equipment) and software applications used within the Centre. It ensures that only approved and licensed hardware and software are utilised, which helps in maintaining security and compliance standards.
2. **Changing Network Device Credentials for Security Reasons:** Regularly updating the credentials (like passwords) for network devices such as routers, switches, and access points helps prevent unauthorised access and strengthens network security.
3. **Providing Protection of Systems and Servers With XDR Endpoint Antivirus and Host Firewall:** XDR (Extended Detection and Response) endpoint manager provides advanced threat detection, investigation, and response capabilities for endpoints (like computers and servers). Host firewalls add an additional layer of defence by monitoring and controlling incoming and outgoing network traffic based on predetermined security rules.
4. **Enabling Automatic Patch Updates for System and Software Applications:** Enabling automatic updates ensures that operating systems and software applications are regularly patched with the latest security fixes and updates.
5. **Restricting Network Access for Outdated Operating Systems:** Outdated operating systems often lack security updates and patches, making them vulnerable to cyber-attacks. By restricting network access to such systems, JNCASR prevents potential security breaches and data compromises.
6. **Implementing Multi-Factor Authentication (MFA) for Email Accounts:** MFA adds an extra layer of security by requiring users to provide multiple forms of identification before gaining access to email accounts. This typically involves something the user knows (like a password) combined with something they have (like a smartphone for receiving a 1-time code), making it harder for unauthorised users to gain access.
7. **Scheduled Regular Backups for Servers to Protect From Data Loss:** Regularly backing up data ensures that critical information is not lost in the event of hardware failures, data corruption, or cyber-attacks. It's an essential part of disaster recovery planning and helps the Centre recover quickly from potential data loss incidents.

COMPUTER LABORATORY (COMPLAB)

8. **Deployed Unified Threat Management Device for Internet Traffic Control:** A UTM device integrating with multiple security features such as intrusion detection/prevention, antivirus, and content filtering provides centralised management and control over internet traffic, enhancing security and compliance.
9. **Authorisation of Only Authorised Applications and Software:** Allowing only authorised and licensed applications to be installed ensures that JNCASR maintains control over its software environment, reduces the risk of malware infections from pirated software, and ensures compliance with licensing agreements.
10. **Blocking Remote Desktop Software for Enhanced Security:** Blocking certain remote desktop applications, such as Anydesk and Teamviewer, prevents potential unauthorised access to systems and data, reducing the risk of remote exploitation by attackers.
11. **Mandatory VPN Usage for Remote Access:** Requiring the use of a virtual private network (VPN) for accessing resources from remote locations encrypts the connection between the user's device and the JNCASR network. This ensures data confidentiality and integrity, especially when accessing sensitive information over public networks like the internet.
12. **Segmentation of LAN and Wi-Fi Networks using VLANs:** Segmenting LAN and Wi-Fi networks enhances network security by isolating traffic and limiting the scope of potential security breaches.
13. **Deployment of Multiple Zones for Network Segmentation:** Creating multiple zones for trusted, untrusted, and cloud tunnel networks to further enhance network segmentation and security. It allows JNCASR to enforce stricter access controls and policies based on the level of trust associated with different network segments.
14. **Customised Access Policies for Wi-Fi SSIDs:** Tailoring access policies for Wi-Fi service set identifiers (SSIDs) based on specific requirements allows JNCASR to control access to wireless networks more effectively. This includes defining authentication methods, encryption standards, and access permissions for different SSIDs.
15. **Change of Default Configurations for Wireless Access Points:** Changing default configurations regularly helps mitigate the risk of unauthorised access to wireless networks. Attackers often target default settings to gain entry into network infrastructure.
16. **Use of 802.1x for Wi-Fi Authentication:** Using 802.1x is an IEEE standard for port-based network access control that provides an additional layer of authentication for devices connecting to a network. Implementing 802.1x ensures that only authorised devices can access the network, strengthening overall security.
17. **Hosted Websites, Applications, and Services Only at On-Premises Data Centres and Designated Cloud Provider:** Hosted the server/services at our on-premises data centres and the designated cloud provider to ensure physical security, redundancy, and compliance with regulatory requirements. Government or reputable cloud providers often offer robust security measures and compliance certifications, reducing the risk of data breaches.

COMPUTER LABORATORY (COMPLAB)

OTHER ACTIVITIES

ENHANCED SECURITY FOR SYSTEM AND NETWORK

We have frequently communicated with a member of JNCASR to bring awareness regarding security issues, mainly cybercrime. To prevent hacking, we have blocked the use of 3rd party apps and software in the institute. In addition, we have done network and internet security auditing to fix any loopholes in the system.

CENTRALISED SOFTWARE LICENSE FOR FACULTY AND STUDENTS

We have a free campus license policy where all faculty members and students get access to Mathematica, GraphPad, Origin, MATLAB, Intel Parallel Studio, CorelDraw, Bio render, Mnova, Overleaf, ICSD, ICDD, and Microsoft Office 365 licenses support up to 5 device installations per user and 5 TB of cloud storage for each user.

MEMBERS OF COMPLAB

Head, CompLab	Prof. Premkumar Senguttuvan
Onsite Engineers	Chandan N., Vinoth P., Madasamy S., Yallappa N., Dhanesh S.

DHANVANTARI (JNCASR HEALTH CENTRE)

Dhanvantari, the health centre at JNCASR, serves the permanent staff members, their dependents, students, and retired staff along with their spouses who are covered under the contributory medical scheme (CMS). It also provides free health-related consultations to temporary staff, including security personnel, gardeners, housekeeping personnel, and guests of JNCASR.

At present, Dhanvantari has 4 doctors, including 1 Chief Medical Officer and 3 female Medical Officers, a physiotherapist, and 2 in-house clinical psychologists attending outpatients, 4 nurses who work round the clock in shifts, and 2 laboratory technicians. Online consultation of a clinical psychologist is also available for the JNCASR community members via the YourDOST online counselling and emotional wellness platform.

Dhanvantari offers daily outpatient services and attends to emergency calls round the clock. It has a clinical laboratory, minor OT, and an ECG, and physiotherapy unit. A new ward has been commissioned beside the Estate Office for admission and treatment of infectious diseases, including COVID-19, chicken pox, and dengue.

Members who have registered to CMS of the Centre are covered for cashless medicines drawn from designated medical stores through prescriptions given by doctors at Dhanvantari. An MoU has been signed for cashless facilities, such as OPD, inpatient, laboratories, and X-ray services (but not dental services) with Aster CMI Hospital, MS Ramaiah Memorial Hospital, Baptist Hospital, and Manipal Hospital Malleswaram. As per the MoU, a specific category of CMS members can avail of the services after obtaining referrals given by Dhanvantari doctors and showing their identity cards at the hospital. At present, only Aster CMI Hospital offers CHSS rates to all our CMS members. Students and retired staff are not offered cashless services in these hospitals. An MoU has also been signed with R. V. Metropolis Laboratory, Malleswaram, through which all our CMS members can get biochemistry tests, including cultures, done at CHSS rates. As per the MoU, blood drawn during working hours for special tests at Dhanvantari will be sent to the R. V. Metropolis Laboratory under the cashless scheme, and the report will be procured the next day. Annual health checkup for CMS members above 40 years is also organised on a regular basis.

DHANVANTARI (JNCASR HEALTH CENTRE)

Dhanvantari also conducts annual orientation programmes for all newly joined students. This includes discussion on health and first aid and laboratory safety measures. It also advises on preventive health measures during emergency times and conducts vaccination services, including for HPV vaccine.

MEMBERS OF DHANVANTARI

Chief Medical Officer (on contract):

Dr. Nagabhushana G. R., M.B.B.S., F.C.C.P., F.C.G.P., P.G. Diploma in M&CHL

Medical Officers (on contract):

Dr. Kavitha Sridhar, M.B.B.S.

Dr. Senthamarai S. Manoharan, M.B.B.S., P.G.D.M.L.S., Diploma in Preventive and Promotive Health Care, Diploma in Counselling Skills, P.G.D.H.H.M., M.B.A. (HA)

Dr. Chandralekha H. V., M.B.B.S.

Clinical Psychologist (on contract):

Shridhar B. G., M.Sc. (Clinical Psychology)

Savitha M. S., M.Sc. (Clinical Psychology), Diploma in Clinical Psychology

Physiotherapist (on contract):

Y. Yogesh, B.P.T

DAY CARE FACILITY

An independent day care facility with a play area for the children of our staff members started operating in June 2010 in the JNCASR campus. The facility is open for children in the age group of 1–10 years.

The interior of this building has beautiful wall stickers, toys, bookshelves, 2 locker rooms for the children, a kitchen, and 2 washrooms. It has a tiny playground with swings and slides, free spaces, and lush greenery, with grass mats for children to play and move around. This playground is surrounded by fences to ensure the safety of the kids. A CCTV camera helps the staff to always keep an eye on the children. The facility, thus, serves as a safe space and clean environment for children to play and learn through stimulating activities supervised by experienced staff members who consider the individual personalities and needs of each child.

Images: (Left) Interiors of the Day Care Facility; (Right) Playground

At the day care, children are taught basic skills, such as recognising colours, shapes, numbers, and letters, personal hygiene, and social skills. Accurate and detailed records of staff and children, related to enrolment, attendance, health, and safety emergency contact information and incident reports are well maintained. Every child's parents or guardians are regularly updated about their child's activities, behaviour-related issues, and performances.

Various festivals and special days are celebrated such as Annual day, Fancy Dress on Children's Day, Halloween Day, Christmas, Holi, Krishna Janmashtami, Independence Day, Vijayadashami, Karnataka Rajyotsava, and Birthday celebrations.

DAY CARE FACILITY

Images: Snapshots of various celebrations at the Day Care Facility

The Day Care facility currently consists of 3 staff members, 1 in-charge, and 2 caregivers to look after the needs of 7 children. This facility is currently being utilised by most of the faculty members, RAs, officers, and permanent and temporary employees.

MEMBERS OF DAY CARE FACILITY

Chairperson	Prof. Ranjani Viswanatha, ICMS
Member	Prof. Bivas Saha, CPMU and ICMS
	Chitra C. S., Assisstant Administrative Officer (SG)
	Gayathri Arun, Parent
Member-Secretary (Outsourced)	Anitha Kumari M., DCF Supervisor

CAMPUS INFRASTRUCTURE

New infrastructural facilities and developmental activities undertaken during the period 2023–24 are:

COMPLETED PROJECTS

CONSTRUCTION OF SAMAT BUILDING AT JNCASR, JAKKUR CAMPUS

As proposed by the International Review Committee, the lab facility called SAMaT (School of Advanced Materials) is being constructed in front of the CCMS Lab block under the SSL fund. M/s. Mindspace, who designed the ICMS and CCMS blocks, are the architects for this project, and they have designed the building under the inputs and directions of Bharat Ratna Prof. C. N. R. Rao.

Spanning 22,000 sq.ft. of built-up area, the building consists of ground plus 2 floors, which include a lobby, entrance, 11 labs, 1 conference room, 5 faculty offices, toilet blocks, UPS, and electrical room.

With a total estimated cost of ₹6,60,75,530/- (based on KPWD SR 2021–22), the Tender Committee and Buildings and Works committee recommended that the work be entrusted to the lowest tenderer M/s. Anand Shree Infra Pvt. Ltd., who proposed a budget of ₹5,90,38,428/-, which was 10.65% below the estimated cost. The building is currently in the completion stage.

BEFORE

AFTER

BEFORE

AFTER

CAMPUS INFRASTRUCTURE

CONSTRUCTION OF ADDITIONAL SPACE FOR ANIMAL HOUSE ANNEX BUILDING AT JNCASR, JAKKUR CAMPUS

The additional lab facility adjacent to the Annex animal house under Centre fund was designed and constructed by M/s. Mindspace, who also designed the Animal House. The Unit chair provided inputs and directions for the building, which consists of 2,850 sq.ft. built-up area on the ground floor with one office, an electrical room, and a laboratory and store room on the first floor.

The architects provided the designs and proposed a total estimated cost of ₹1,02,60,272/- (based on KPWD SR 2021–22). The Tender Committee and Buildings and Works committee reviewed the invited tenders and approved the lowest tenderer M/s. Anand Shree Infra Pvt. Ltd., at ₹91,59,644/-, which is 10.73% below the estimated cost. The building has been completed and handed over to the concerned department.

BEFORE

AFTER

BEFORE

AFTER

ELECTRICAL UPGRADATIONS

Occupancy sensor switches were installed in the common area toilets to save electricity. Fluorescent and CFL lamps were also replaced with more energy-efficient LED fittings in the corridors to save electricity.

CAMPUS INFRASTRUCTURE

ON-GOING PROJECTS

CONSTRUCTION OF STORM WATER DRAIN (SWD) BY BBMP AUTHORITIES

The unprecedented heavy floods that occurred on 22nd November 2021 caused a massive overflow of water from around 19 neighbouring lakes into JNCASR, causing significant and severe damage to the entire campus, including laboratories. Due to the heavy flooding, STP overflowed and caused infiltration of sewage water, resulting in poor quality of STP water.

Shri Basavaraj S. Bommai, Former Chief Minister of Karnataka, along with BWSSB and BBMP Commissioners visited our campus and issued instructions to construct a Storm Water Drain on a priority basis.

The BBMP authorities have completed the SWD construction from the Nano building to the STP. The SWD from behind the Dining Hall leading to the STP is under progress and about 70% of the work has been completed. The BBMP authorities have taken this initiative to avoid future flooding in the JNCASR campus.

BEFORE

AFTER

BEFORE

AFTER

CAMPUS INFRASTRUCTURE

FACELIFT IMPROVEMENT WORKS AT JNCASR, JAKKUR CAMPUS

The SWD work carried out by the BBMP authorities to mitigate the effects of the flooding that occurred on campus on 22nd November 2021 caused significant difficulties for vehicular and pedestrian movement at the entrance to JNCASR. The aesthetic appearance of the entrance was also compromised due to this work.

In response to the situation, the architects were directed by the President to design a facelift plan. The plan included the construction of SSM walls, planter boxes near the old NCU building, an RCC ramp connecting to AMRL, and SWD nala fencing.

The architects prepared the drawings and the estimate based on the request and after necessary approval from the Tender Committee, the works were assigned to the Centre's empanelled contractors. The facelift of the entrance has been completed, and work on the main gate is under progress.

BEFORE

AFTER

CAMPUS INFRASTRUCTURE

MEMBERS OF THE ESTATE OFFICE

Project Engineer (on contract)	Mahadevan N.
Project Engineer Grade II (Civil)	Nadiger Nagaraj
Junior Project Engineer (Civil)	Veeresha N. R.
Assistant Project Engineer (Electrical)	Sujeeth Kumar S.
Helpers Grade I	Sham Sundar, Krishnaiah M. N.
Helper	Krishna Murthy
Site Engineers (on contract)	Vivek N. Kagali, Jagadeesh S. Agadikar

RESEARCH FACILITIES

JNCASR strives to provide its researchers with state-of-the-art technologies, facilities, equipment, and software to facilitate high-quality research. Below is an overview of the research facilities made available to the researchers at JNCASR during the year 2023-24.

SAMat RESEARCH FACILITY

Launched in 2022, the SAMat Research Facility (SRF) at JNCASR is devoted to high impact, interdisciplinary scientific research. Several sophisticated research equipment have been brought under the umbrella of the SRF to extend support to in-house researchers and all academic institutions and industries. The facilities, managed by a team of professionals and skilful staff, provide expert technical support enabling efficient data collection with feasibility to analyse and interpret the same.

JNCASR, with encouragement from the Department of Science and Technology (DST), Government of India, has dedicated this facility to help researchers from varied institutions and industries. Presently, SRF hosts 32 high-end sophisticated research equipment, which are available for usage by around 350 in-house researchers, 250 researchers from other academic institutes, and 25 from industries who have registered with SRF through its online portal. The users are from diverse scientific disciplines, including physics, chemistry, biology, materials science, and engineering, and the hope is to increase the number of facilities and expand the user base every year.

These facilities are accessible to all researchers across the country at very nominal and affordable charges. The services are provided through a complete online booking system for both internal and external users, who are required to do a one-time online registration with the SRF portal.

The main objectives of the SRF are:

- Provide access to sophisticated research equipment for measurements and characterisation in their research and development activities.
- Provide efficient data collection and interpretation with an expert technical support.
- Organise training sessions/workshops once in a while to educate new researchers about the capabilities and progress of the high-end equipment and its role in modern cutting-edge interdisciplinary research.
- Motivate and encourage students from schools, colleges, and universities to take up research by showcasing these instruments and their capabilities as part of outreach programmes.

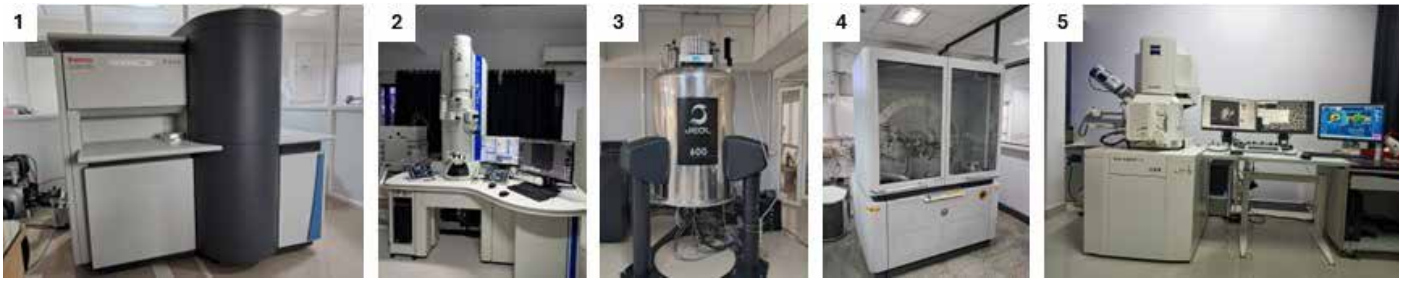


Image: Photographs of some of the high-end equipment that SRF offers access to. (1) X-ray photoelectron spectroscope (Thermofisher); (2) Transmission electron microscope JEOL JEM 2100 plus; (3) Nuclear magnetic resonance JEOL 600 MHz; (4) Powder X-ray Diffractometer; (5) Field Emission Scanning Electron Microscope (Zeiss GeminiSEM500).

RESEARCH FACILITIES

List of the high-end equipment made available for research through SRF:

AMRL 003

- 2019 • Field emission Scanning electron microscope (Zeiss)
- Gold sputtering (Quorum Q150R S)

Chair CPMU

- 2018 • Transmission electron microscopy (JEOL 200kV)

Chair CPMU/ Prof. Sarit S. Agasti

AMRL 004

- 2021 • Micro Raman Spectrometer

Chair CPMU

Measurement Lab, NCU

- 2021 • Electron paramagnetic resonance spectroscopy
- 2019 • FTIR-DRIFTS-Thermal Emissivity

Chair CPMU

CCMS

- 2019 Photoluminescence (temperature Dependent)
- 2017 Matrix Assisted Laser Desorption/Ionization (MALDI)
- 2012 High Resolution Mass Spectroscopy (HRMS)

Chair NCU

- 2014 • Single Crystal X-ray
- Diffractometer (SCXRD)

Chair CPMU/Prof. Sebastian C. Peter

ICMS 104D

- 2021 • Differential scanning calorimeter (DSC 3)

ICMS Associate Director

ICMS

- 2022 • Xray Photoelectron Spectroscopy (XPS Thermofisher)
- 2017 • Plasma Treatment system
- 2010 • Atomic force microscope
- 2005 • Dynamic Light Scattering

ICMS Associate Director

- 2020 • Confocal microscopy (LEICA)

Subi J. George/Prof. Sarit S. Agasti

- 2021 • Optical Microscope (Keyence)

Prof. G. U. Kulkarni

- 2010 • Nuclear Magnetic resonance - (400 MHz, Bruker)

Chair NCU

ICMS 004A

- 2011 • Superconducting Quantum Interference Device (SQUID)

Prof.. Sundaresan

ICMS 004D

- 2017 • Diamond wire Saw (DWS Well)

ICMS Associate Director

Nanolab

- 2021 • Confocal Micro Raman Microscope (Horiba)

Prof. G. U. Kulkarni

- 2021 • Field emission Scanning electron microscope (Apreo 2 S)

Chair NCU

CCMS

- Powder XRD system (Pan Analytical)

Chair CPMU

ICMS

- Thermogravimetric analysis (TGA Perkin Elmer)

ICMS Associate Director

- Nuclear Magnetic resonance (600 MHz, JEOL)

Chair NCU

ICMS 004C

- Nuclear Magnetic resonance Solid State (400 MHz, Bruker)

Chair NCU

Main Building

- Powder XRD system (Bruker)
- Powder XRD system (Rigaku)

Chair CPMU

Measurement Lab, NCU

- Differential scanning calorimeter (TA-DSC 250)
- Photoluminescence (Horiba)
- Thermogravimetric analysis (TGA Mettler)
- UV-Vis-NIR Spectroscopy (Agilent)

Chair CPMU

Year of Establishment Faculty In-Charge

RESEARCH FACILITIES

BIOLOGY RESEARCH FACILITY

The JNCASR Biology Research Facility (BRF), launched in 2023, is a unique blend of research infrastructure in the frontier of biology. The facility offers an impressive array of sophisticated research tools, including those for flow cytometry, bio-imaging, mass-spectrometry, and genomics. The BRF is not limited to biological sciences; it also supports research in chemistry, biomedical sciences, materials science, and geological sciences, making it a multidisciplinary hub for scientific exploration and innovation. The facility services are accessible to all researchers across the country at a very nominal and affordable charge.

BRF is presently offering facility services to external users from academia, startup, and industries. To use the facility, researchers have to register on BRF online portal. BRF currently hosts 10 high-end sophisticated research equipment, which are available for usage by ~75 in-house researchers and 20 individuals from other academia, startups, and industries.

The list of equipment made available via BRF is:

Mazumdar-Shaw Laboratory for Frontier Biology_Flow cell facility

2020 Yokogawa High content Imaging system (CQ1)

Internal + External Users
- *Academia & Startups from Chemistry, Biology, Biomedical sciences*

2020 Olympus Multiphoton system (FVMPERS)

Internal
- *Academia from Chemistry & Biology*

Prof. Ravi Manjithaya

2013 BD FACS Aria III

Internal
- *Academia from Chemistry & Biology*

2023 BD FACSymphony A3 Cell Analyzer

Internal
- *Academia from Chemistry & Biology*

2023 BD FACS Aria Fusion

Internal
- *Academia from Chemistry & Biology*

Prof. Ranga Uday Kumar

MBGU Bioimaging facility

2004 Carl Zeiss LSM 510 META

Internal
- *Academia from Chemistry & Biology*

2016 Carl Zeiss LSM 880 AIRY Scan

Internal
- *Academia from Chemistry & Biology*

2016 Carl Zeiss LSM 880 AIRY Scan with Live cell system

Internal + External Users
- *Academia, Startups & Industry from Chemistry, Material science, Biology, Biomedical sciences, Geological Sciences*

Prof. Ravi Manjithaya

Mazumdar-Shaw Laboratory for Frontier Biology

2019 Thermo Fisher Q Exactive HF

Internal
- *Chemistry & Biology*

Prof. Hemalatha Balaram

Year of Establishment | Users | Faculty In-Charge

RESEARCH FACILITIES

The facilities are managed by a team of professionals and skilful staff, who provide expert technical support, enabling efficient data collection with feasibility to analyse and interpret the same. Facility in-charges work closely with students and trainees, offering guidance and support in their experiments and analysis.
The BRF also routinely conducts in-house, and national workshops designed to train students and research staff in the latest techniques and technologies. These workshops are an integral part of the BRF's mission to support the next generation of scientists. The workshops provide hands-on experience with the facility's equipment and software as well as opportunities to learn from and network with experts in the field.

The main objectives of the BRF are:

- Provide access to sophisticated research equipment for characterisation, measurements, and analysis in their research and developmental activities.
- Provide expert technical support for efficient data collection and interpretation.
- Organise training sessions/workshops once in a while to educate new researchers about the capabilities and progress of the high-end equipment and its role in modern cutting-edge interdisciplinary research.
- Motivate and encourage students from schools, colleges, and universities to take up research by showcasing these instruments and their capabilities as part of outreach programme.

NEW RESEARCH FACILITIES

Research facilities and equipment created/procured at the centre during the financial year 2023–24 are:

COMPLAB

- Palo Alto Networks PA-3220 Firewall
- Extreme Core Switch
- Extreme Access Switch
- Aruba Access Points

LIBRARY

- RFID Security Gate

EMU

- Audio Visual System
- Messzylinder B-CC46-85/AL/CX/ COST with various parts

CPMU

- Research Syring Pump
- Four channel LED source and controller
- AntsPROSYS MS Powder Coated Tubular Furnance, Length 1208
- Hotpress
- Sputter Ion Pump
- Upgradation of Pulser Laser Deposition System, Upgradation of Existing Deposition System with EB Source
- Alicat Mass Flow Controllers, Flow range 10–500 ml/min
- Electrolyzer
- SCC12-35 set cyto cell chamber high cost performance reusable dish outer diameter 12 mm observation range 9.6–25 mm
- Pressure Vessel
- Glass Pressure Jacketed Autoclave with Heating Circulator
- Photon Count Module
- Spring Clip type sample board

RESEARCH FACILITIES

EOBU

- Sennheiser wired supercardioid Microphone
- Acoustic Enclosure, Movable stand with PU wheels
- AudioMoth Recorder
- Acoustic recorder model song meter minimake wildlife acoustic
- Snapmaker J1
- 3D Scanner with IR mode and inbuilt colour camera

MBGU

- Refrigerated Centrifuges
- ACM Diaphragm Pump
- Eppendorf Refrigerated Centrifuge with LCD display Model: 5430R
- VACUSAFE-Aspiration System with Integrated Pump
- BIO-DOT APPARATUS Microfiltration bloting device, ROCKYVACT Vacuum pump
- Thermo Scientific Heratherm General Protocol Microbiological Incubator
- Automated Cell Counter
- Fume hoods for laboratory with cupboard
- Aspiration system, LN2 Container, Pipette Dispenses, Bench top and Vortex Mixer

ICMS

- Muffle Furnace
- Transmission Electron Microscope
- LED Solar Simulator
- Lambda beam 405–75 405 nm, 75 mW, single mode Beam Laser System Make: Atos
- IKA NA Electrically Tissue Homogenizer
- Elmasonic P 30H Sonicator Int-Tank Dimension
- Electric Crimping Machine
- Langmuir Blodgett system
- Aalborg Mass Flow Controller
- Fusionstor workstation with AMD Threadripper PRO 5975WX Processor 128 GB
- Optics and Opto-Mechanics
- Highpower and Ultrabroadband Terahertz Source
- Retroreflector
- Planetary Micro Mill Pulverisette 7 with grinding bowls and grinding balls
- PIPS II system

NCU

- Thermal Mass Flow Controller
- Dry Scroll Vacuum Pump
- Laboratory Shaker
- Planetary Micro Mill
- 3D laser scanning confocal Raman spectrometer Confotec MR520
- Precision Multiferroic Test System
- Dissolved Oxygen meter
- Upgrade Kit, WFC III w/Empower v1-10, Waters Fraction Collector III, KIT, ACCESSORY #1, WFC SERIES
- Tunable LED sources with photoreactor
- Vertical Electrophoresis system
- Upgradation OF DLS instrument with replacement laser
- Stericox Vacuum Oven Capacity 50 Liter
- Spectroelectrochemistry Setup
- Thermo Scientific Nicolet iS20 Mid-Infrared FT-IR Spectrometer with Diffuse Reflectance
- Agilent 1260 HPLC infinity II 400 bar
- Spin Coater Unit
- ADM Flow Meter
- Brooks Make Thermal Flow Controller
- Rotary Evaporation, Vacuum Pump and Recirculation Chiller
- Magnetic Stirrer, clamp, Heat on-1, Heat on-2, Heat on-3, Dish and Oil
- GC and GCMS

RESEARCH FACILITIES

NSM

- Audio Visual System

TSU

- Storage server
- Server
- 4U server with Dual Power Supply

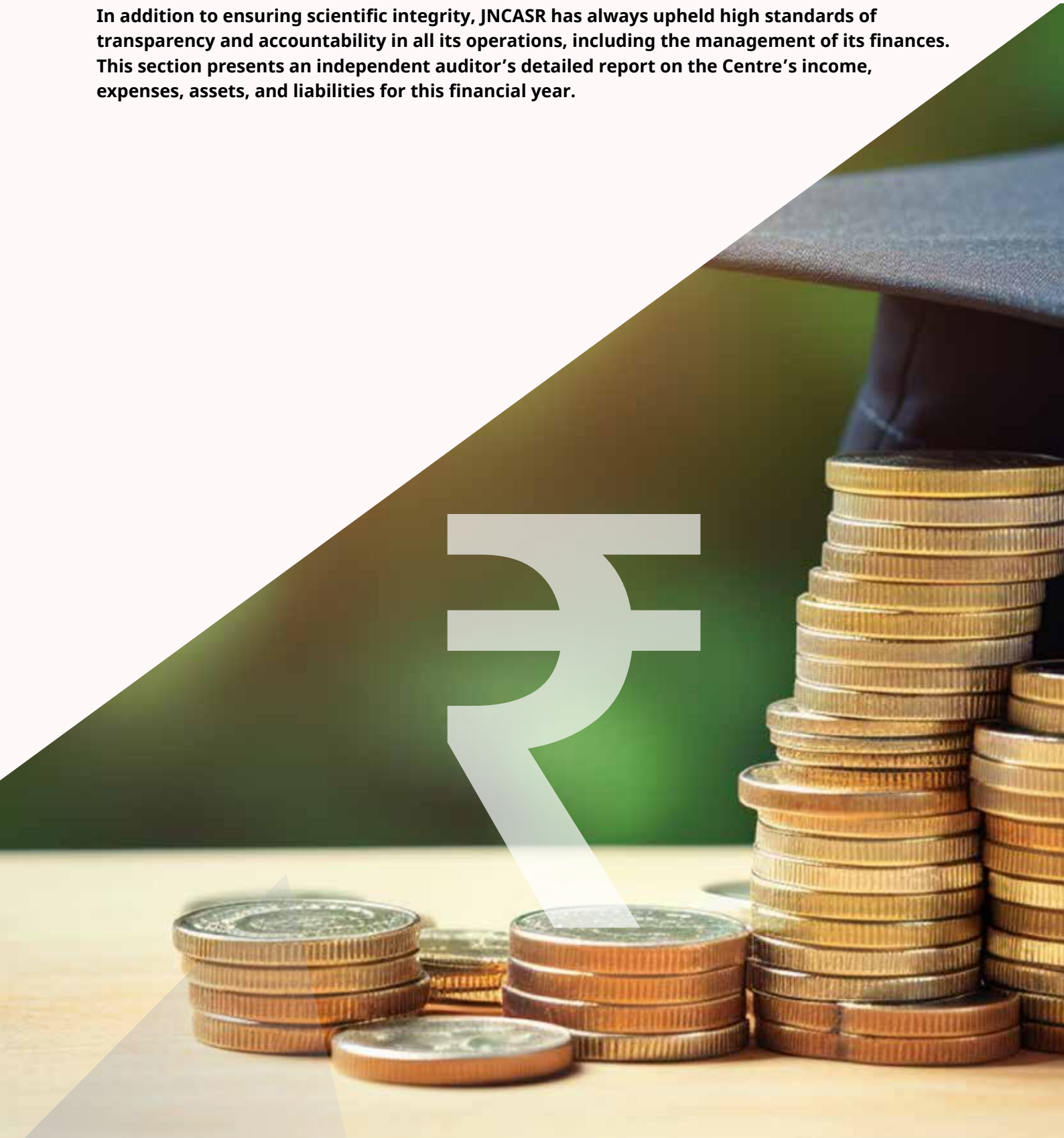
NSU

- Olympus DP28 Colour Camera
- Integrated Platform for DART Date Acquisition and Analyses
- Nanoject III Programmable Nanoliter injector power source, Nanoject III Footswitch
- Supply and Installation of Workstation
- Stereo zoom Binocular
- 760 nm Non Descan DM, and Filter Cube for Red and CY5 Fluorescence
- APS Autocave
- Nanophotometer
- ZEISS stereo microscope (version 1.0) stereo zoom binocular
- Automated Cell Counter

07

FINANCIAL STATEMENTS

In addition to ensuring scientific integrity, JNCASR has always upheld high standards of transparency and accountability in all its operations, including the management of its finances. This section presents an independent auditor's detailed report on the Centre's income, expenses, assets, and liabilities for this financial year.



Mallya & Mallya
Chartered Accountants

INDEPENDENT AUDITOR'S REPORT

To
Members of Jawaharlal Nehru Centre for Advanced Scientific Research

Auditor's Opinion

We have audited the accompanying financial statements of **M/s Jawaharlal Nehru Centre for Advanced Scientific Research, ("Institute")**, Jakkur, Bengaluru 560064, which comprises of the balance sheet as at March 31st 2024, the Income & Expenditure Account for the year then ended, the Receipts and Payment Account for the year then ended, and notes to the financial statements, including a summary of significant accounting policies.

In our opinion and to the best of our information and according to the explanations given to us, the accompanying financial statements give a true and fair view of the financial position of the Institute as at March 31, 2024, and of its financial performance and its receipts and payments for the year then ended in accordance with the Accounting Standards issued by the Institute of Chartered Accountants of India (ICAI).

Basis for Opinion

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 Code of Ethics issued by ICAI and we have fulfilled our other ethical responsibilities in accordance with the Code of Ethics. We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our opinion.

Mallya & Mallya Bangalore Chartered Accountants

CS Prashanth

Digitally signed by CS Prashanth
Date: 2024.07.24 20:07:29 +05'30'

Head Office : #29, 1st Floor, Parijatha Complex, Race Course Road, Bengaluru - 560 001. Ph. : 91-80 4123 9157/4120 2379/2220 8934
Davanagere Branch : No. 25, Akkamahadevi Samaj Complex, 2nd Main, 6th Cross, P J Extension, Davanagere -577 002. Mob. : +91 99010 73095
Mysore Branch : No. 52, Gravity One, Disha Layout, Near Vijayanagar 4th Stage, Mysore - 570 026. Mob. : +91 81058 90095

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

Institute's Management is responsible for the preparation of these financial statements that give a true and fair view of the state of affairs, results of operations and receipts and payments of the Institute in accordance with the accounting principles generally accepted in India. This responsibility includes the design, implementation, and maintenance of internal control relevant to the preparation and presentation of the financial statements that give a true and fair view and are free from material misstatement, whether due to fraud or error.

In preparing the financial statements, the Institute's management is responsible for assessing its 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'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.

As part of an audit in accordance with SAs, we exercise professional judgment and maintain professional scepticism throughout the audit. We also:

- Identify and assess the risks of material misstatement of the financial statements, whether due to fraud or error, design and perform audit procedures responsive to those risks, and obtain audit evidence that is sufficient and appropriate to provide a basis for our opinion. The risk of not detecting a material misstatement resulting from fraud is higher than for one resulting from error, as fraud may involve collusion, forgery, intentional omissions, misrepresentations, or the override of internal control.

CS Prashanth

Digitally signed by CS Prashanth
Date: 2024.07.24 20:07:47 +05'30'

- Obtain an understanding of internal control relevant to the audit in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of the Institute's internal control.
- Evaluate the appropriateness of accounting policies used and the reasonableness of accounting estimates and related disclosures made by management.
- Conclude on the appropriateness of management's use of the going concern basis of accounting and, based on the audit evidence obtained, whether a material uncertainty exists related to events or conditions that may cast significant doubt on the Institute's ability to continue as a going concern. If we conclude that a material uncertainty exists, we are required to draw attention in our auditor's report to the related disclosures in the financial statements or, if such disclosures are inadequate, to modify our opinion. Our conclusions are based on the audit evidence obtained up to the date of our auditor's report. However, future events or conditions may cause the Institute to cease to continue as a going concern.

We communicate with those charged with governance regarding, among other matters, the planned scope and timing of the audit and significant audit findings, including any significant deficiencies in internal control that we identify during our audit.

We also provide those charged with governance with a statement that we have complied with relevant ethical requirements regarding independence, and to communicate with them all relationships and other matters that may reasonably be thought to bear on our independence, and where applicable, related safeguards.

For *Mallya & Mallya*
Chartered Accountants
FRN: 001955S

CS Prashanth
Digitally signed by CS Prashanth
Date: 2024.07.24 20:08:02 +05'30'

CA CS Prashanth
M.No.218355
Partner
UDIN: 24218355BKAMHF1726
Place: Bengaluru
Date: 24th July, 2024.

Mallya & Mallya Bangalore Chartered Accountants

JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH
BALANCE SHEET AS AT 31ST MARCH 2024

Amount in Rs.

Description	Schedule No.	Current year 2023-24	Previous year 2022-23
Liabilities			
Capital/Centre's Development Fund	1	1,00,14,10,510	99,68,74,624
Reserves & surplus	2	2,61,39,21,625	2,48,84,22,788
Earmarked and endowment funds	3	97,03,05,692	98,54,07,388
Secured loans and borrowings	4	0	0
Unsecured loans and borrowings	5	0	0
Deferred credit liabilities	6	0	0
Current liabilities and provisions	7	12,52,09,520	5,12,22,920
Total		**4,71,08,47,348**	**4,52,19,27,721**
Assets			
Fixed assets	8	2,61,39,21,625	2,48,84,22,788
Investments-From earmarked/endowment funds	9	66,38,31,760	62,58,31,760
Investment - Others	10	16,90,08,890	45,68,807
Current assets, loans, advances etc.	11	1,26,40,85,073	1,40,31,04,366
Total		**4,71,08,47,348**	**4,52,19,27,721**
Significant accounting policies	24		
Contingent liabilities & notes on accounts	25		

Schedules 1 to 25 are integral part of accounts

For Jawaharlal Nehru Centre for Advanced Scientific Research

SAMPAD PATRA
Digitally signed by SAMPAD PATRA
Date: 2024.07.24 19:01:28 +05'30'

Sampad Patra
Accounts Officer

As per our report of even date,
For *Mallya & Mallya*
Chartered Accountants
FRN : 001955S

Mallya & Mallya Bangalore Chartered Accountants

CS Prashanth
Digitally signed by CS Prashanth
Date: 2024.07.24 19:39:35 +05'30'

C S PRASHANTH
Partner
Membership No. : 218355
UDIN : 24218355BKAMHF1726
Place : Bengaluru,
Date : 24/07/2024

GIRIDHAR UDAPI RAO KULKARNI
Digitally signed by GIRIDHAR UDAPI RAO KULKARNI
Date: 2024.07.24 19:17:17 +05'30'

Prof. G.U. Kulkarni
President

JOYDEEP DEB
Digitally signed by JOYDEEP DEB
Date: 2024.07.24 19:14:16 +05'30'

Joydeep Deb
Administrative Officer

JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH
INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH 2024

Amount in Rs.

Description	Schedule No.	Current year 2023-24	Previous year 2022-23
Income			
Income from sales/services	12	0	0
Grants/subsidies	13	76,83,00,000	83,80,00,000
Fees/subscriptions	14	79,23,400	60,68,704
Income from investments	15	0	0
Income from royalty, publication, licence fee etc.	16	6,50,952	6,13,855
Interest earned	17	2,19,69,923	89,88,711
Other income	18	2,38,31,276	1,75,54,599
Increase/decrease in stocks	19	0	0
Total (A)		**82,26,75,550**	**87,12,25,869**
Expenditure			
Establishment expenses	20	43,28,87,088	54,80,28,184
Other administrative expenses etc.	21	43,19,36,506	28,87,68,146
Expenditure on grants, subsidies etc.	22	0	0
Interest & bank charges	23	23,502	35,085
Depreciation		18,62,48,202	20,09,38,805
Less: Transferred from Capital Reserve		18,62,48,202	20,09,38,805
Total (B)		**86,48,47,096**	**83,68,31,415**
Balance being excess of income over expenditure **(A-B)**		-4,21,71,546	3,43,94,454
Less: Prior period expenses		43,99,597	17,09,551
Balance being surplus/deficit carried to Capital Fund		**-4,65,71,143**	**3,26,84,903**
Significant accounting policies	24		
Contingent liabilities & notes on accounts	25		

Schedules 1 to 25 are integral part of accounts

For Jawaharlal Nehru Centre for Advanced Scientific Research

SAMPAD PATRA
Digitally signed by SAMPAD PATRA
Date: 2024.07.24 19:02:04 +05'30'

Sampad Patra
Accounts Officer

As per our report of even date,
For *Mallya & Mallya*
Chartered Accountants
FRN : 001955S

Mallya & Mallya Bangalore Chartered Accountants

CS Prashanth
Digitally signed by CS Prashanth
Date: 2024.07.24 19:40:18 +05'30'

C S PRASHANTH
Partner
Membership No. : 218355
UDIN : 24218355BKAMHF1726
Place : Bengaluru,
Date : 24/07/2024

GIRIDHAR UDAPI RAO KULKARNI
Digitally signed by GIRIDHAR UDAPI RAO KULKARNI
Date: 2024.07.24 19:17:55 +05'30'

Prof. G.U. Kulkarni
President

JOYDEEP DEB
Digitally signed by JOYDEEP DEB
Date: 2024.07.24 19:14:49 +05'30'

Joydeep Deb
Administrative Officer

JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH
Schedules forming part of the accounts for the year ended 31st March 2024

Description	2023-24 Amount in Rs.	2022-23 Amount in Rs.
SCHEDULE 1- Capital Fund :		
A: Capital fund		
Opening balance	44,49,18,750	41,22,33,847
Add : Surplus/deficit in income and expenditure account	-4,65,71,143	3,26,84,903
Sub total	**39,83,47,607**	**44,49,18,750**
Less : Funds-utilisation/expenditure incurred		0
Total (A)	**39,83,47,607**	**44,49,18,750**
B: Centre's Development Fund		
Opening balance	49,35,80,158	40,03,16,038
Additions during the year	1,86,09,968	6,11,23,749
Income from investments out of Centre's Development Fund	4,00,99,058	3,21,41,151
Sub total	**55,22,89,184**	**49,35,80,938**
Less : Funds-utilisation/expenditure incurred	33,94,581	780
Total (B)	**54,88,94,603**	**49,35,80,158**
C: Grants for creation of Capital Assets		
Opening balance	5,83,75,716	12,71,38,603
Add : Grants received during the year	28,33,00,000	28,00,00,000
Sub total	**34,16,75,716**	**40,71,38,603**
Less: Transferred to Capital Reserve upon acquisition of fixed assets	28,75,07,416	34,87,62,887
Total (C)	**5,41,68,300**	**5,83,75,716**
Total (A+B+C)	**1,00,14,10,510**	**99,68,74,624**
SCHEDULE 2- Reserves and surpluses :		
A: Capital Reserve		
Balance as at the beginning of the year	2,48,84,22,788	2,32,42,31,402
Add : Fixed assets addition during the Year out of Core grant	28,75,07,416	34,87,62,887
Add : Fixed assets addition during the Year out of Earmarked and endowment funds	2,54,84,093	1,63,67,304
Sub total	**2,80,14,14,297**	**2,68,93,61,593**
Less : Depreciation for the current year transferred to Income and Expenditure account	18,62,48,202	20,09,38,805
Less: Deductions during the year	12,44,470	0
TOTAL	**2,61,39,21,625**	**2,48,84,22,788**

Mallya & Mallya Bangalore Chartered Accountants

SAMPAD PATRA
Digitally signed by SAMPAD PATRA
Date: 2024.07.24 19:02:25 +05'30'

Sampad Patra
Accounts Officer

JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH
Schedules forming part of the accounts for the year ended 31st March 2024

SCHEDULE 3- Earmarked and endowment funds:	FUND - WISE BREAK UP			TOTAL	
	Scheme Funds	Endowment Others	Student Residence,VSH& Dinning Hall	2023-24	2022-23
A) Opening balance of the funds	**80,36,63,536**	**17,95,58,008**	**21,85,844**	**98,54,07,388**	**1,00,10,46,838**
B) Additions to the funds:					
i. Donations/grants	41,51,73,156	0	0	41,51,73,156	60,35,48,251
ii. Income from investment made on account of funds	3,86,69,791	1,07,40,035	0	4,94,09,826	5,87,70,879
iii. Others	0	0	2,69,56,151	2,69,56,151	2,26,54,071
Total (A+B)	**1,25,75,06,483**	**19,02,98,043**	**2,91,41,995**	**1,47,69,46,521**	**1,68,60,20,039**
C) Utilisation/expenditure towards objectives of funds					
i. Capital expenditure					
- Fixed assets	4,62,11,829	2,54,84,093	0	7,16,95,922	7,29,05,645
- Others	6,13,240	44,81,116	0	50,94,356	8,35,18,678
Total	**4,68,25,069**	**2,99,65,209**	**0**	**7,67,90,278**	**15,64,24,323**
i. Revenue expenditure					
- Salaries, wages & allowances etc	6,13,20,500	0	0	6,13,20,500	7,75,61,270
- Other administrative expenses	34,32,36,156	0	2,52,93,895	36,85,30,051	46,66,27,057
Total	**40,45,56,656**	**0**	**2,52,93,895**	**42,98,50,551**	**54,41,88,327**
Total (C)	**45,13,81,725**	**2,99,65,209**	**2,52,93,895**	**50,66,40,829**	**70,06,12,650**
Net balance as at the year end (A + B - C)	**80,61,24,758**	**16,03,32,834**	**38,48,100**	**97,03,05,692**	**98,54,07,388**

Mallya & Mallya Bangalore Chartered Accountants

SAMPAD PATRA
Digitally signed by SAMPAD PATRA
Date: 2024.07.24 19:02:40 +05'30'
Sampad Patra
Accounts Officer

JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH
Schedules forming part of the accounts for the year ended 31st March 2024

Description		2023-24 Amount in Rs.	2022-23 Amount in Rs.
SCHEDULE 4- Secured loans and borrowings:		0	0
SCHEDULE 5- Unsecured loans and borrowings:		0	0
SCHEDULE 6- Deferred credit liabilities:		0	0
Total		**0**	**0**
SCHEDULE 7- Current liabilities and provisions			
A. Current liabilities			
1. Sundry creditors :			
a. For goods	3,80,51,193		
b. Others - EMD/security deposit	1,28,38,134	**5,08,89,327**	**1,03,50,950**
2. Advances received :		**30,09,998**	**12,25,874**
3. Statutory liabilities :		**1,09,19,367**	**28,03,612**
4. Other current liabilities:		**1,63,77,110**	**2,71,51,752**
5. Intra-Group Payables			
a) Scheme Funds			
Payable to Scheme Account 18520	23,707		
Less: Receivables from Grant Account-13474	-23,707	**0**	**0**
b) Endowment			
Payable to Endowment Account -15889	3,15,000		
Less: Receivables from Grant Account-13474	-3,15,000	**0**	**0**
Total (A)		**8,11,95,802**	**4,15,32,188**
B. Provisions			
Stipend/salary payable		**3,79,86,225**	**40,89,009**
Expenses Payable		**60,27,493**	**56,01,723**
Total (B)		**4,40,13,718**	**96,90,732**
Total (A+B)		**12,52,09,520**	**5,12,22,920**

Mallya & Mallya Bangalore Chartered Accountants

SAMPAD PATRA
Digitally signed by SAMPAD PATRA
Date: 2024.07.24 19:03:03 +05'30'

Sampad Patra
Accounts Officer

JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH , JAKKUR POST, JAKKUR, BANGALORE 560 064

Schedules forming part of the accounts for the year ended 31st March 2024

SCHEDULE 8 - FIXED ASSETS

DESCRIPTION	GROSS BLOCK					DEPRECIATION				NET BLOCK	
	Rate	Cost/Value as at beginning of the year 2023-24	Additions during the year 2023-24	Dedn. during the year 2023-24	Cost/value at the end of the year 2023-24	Depre. as at the beginning of the year 2023-24	Depre. during the year 2023-24	On Dedn. during the year 2023-24	Total upto the year end 2023-24	as at the Current year - end 2023-24	as at the Previous year - end 2022-23
Land :											
Free hold land	0.00	1,77,15,351	0	0	1,77,15,351	0	0	0	0	1,77,15,351	1,77,15,351
Buildings :											
Buildings	1.63	10,43,33,880	38,37,354	0	10,81,71,234	4,04,92,929	17,32,600	0	4,22,25,529	6,59,45,705	6,38,40,951
Hostel building	1.63	1,56,60,055	0	0	1,56,60,055	73,22,662	2,55,259	0	75,77,921	80,82,134	83,37,393
Advanced material research lab	1.63	2,59,30,339	0	0	2,59,30,339	84,37,601	4,22,665	0	88,60,265	1,70,70,074	1,74,92,738
Animal house	1.63	67,88,701	0	0	67,88,701	31,33,547	1,10,656	0	32,44,203	35,44,498	36,55,154
Animal House Annex Building - Additional Space	1.63	38,94,008	44,04,003		82,98,011	0	1,35,258		1,35,258	81,62,753	0
Staff housing	1.63	43,19,353	13,601	0	43,32,954	16,55,666	70,516	0	17,26,183	26,06,771	26,63,687
ETU building	1.63	30,91,348	0	0	30,91,348	9,62,852	50,389	0	10,13,241	20,78,107	21,28,496
Other buildings like extn. of hostel , college etc	1.63	1,18,83,626	0	0	1,18,83,626	35,37,030	1,93,703	0	37,30,733	81,52,893	83,46,596
Nano science lab	1.63	65,95,209	0	0	65,95,209	18,00,302	1,07,502	0	19,07,804	46,87,405	47,94,907
Engineering & mechanical lab	1.63	74,26,272	0	0	74,26,272	19,33,648	1,21,048	0	20,54,696	53,71,576	54,92,624
Dining hall & kitchen block	1.63	1,43,43,962	0	0	1,43,43,962	32,95,230	2,33,807	0	35,29,037	1,08,14,925	1,10,48,732
Hostel phase II	1.63	1,95,52,377	0	0	1,95,52,377	50,99,261	3,18,704	0	54,17,965	1,41,34,412	1,44,53,116
Lecture hall & academic block	1.63	96,36,712	0	0	96,36,712	24,95,650	1,57,078	0	26,52,728	69,83,984	71,41,062
Intl. centre for material sciences	1.63	5,01,48,316	0	0	5,01,48,316	1,22,84,128	8,17,418	0	1,31,01,546	3,70,46,770	3,78,64,188
International house	1.63	2,31,42,418	0	0	2,31,42,418	57,48,955	3,77,221	0	61,26,176	1,70,16,242	1,73,93,463
Hostel phase III	1.63	2,75,01,103	0	0	2,75,01,103	66,60,768	4,48,268	0	71,09,036	2,03,92,067	2,08,40,335
Prof. CNR Rao hall of science	1.63	1,03,33,669	0	0	1,03,33,669	25,05,965	1,68,439	0	26,74,403	76,59,266	78,27,705
Extention to HIV lab	1.63	10,16,085	0	0	10,16,085	2,48,432	16,562	0	2,64,994	7,51,091	7,67,653
Security office building	1.63	21,01,625	0	0	21,01,625	2,42,564	34,256	0	2,76,820	18,24,804	18,59,061
Radio activity - lab II	1.63	30,35,391	0	0	30,35,391	4,45,121	49,477	0	4,94,598	25,40,793	25,90,270
Sewage treatment building (STP)	1.63	2,91,699	0	0	2,91,699	76,076	4,755	0	80,830	2,10,869	2,15,623
Residential quarters - Adm. Officer	1.63	36,59,034	0	0	36,59,034	7,83,816	59,642	0	8,43,458	28,15,576	28,75,218
Child care centre	1.63	9,36,699	0	0	9,36,699	1,70,977	15,268	0	1,86,245	7,50,454	7,65,722
Extension to biology lab -2009	1.63	1,94,24,005	0	0	1,94,24,005	36,86,159	3,16,611	0	40,02,770	1,54,21,235	1,57,37,846
Animal house - Additional block	1.63	82,92,632	0	0	82,92,632	19,89,332	1,35,170	0	21,24,502	61,68,130	63,03,300
Hoster phase IV (62 rooms)	1.63	2,59,34,842	0	0	2,59,34,842	51,65,810	4,22,738	0	55,88,548	2,03,46,294	2,07,69,032
Extention to pauling building - Bio block	1.63	47,66,109	0	0	47,66,109	24,35,377	77,688	0	25,13,065	22,53,044	23,30,732
SCADA-DG room	1.63	2,40,660	0	0	2,40,660	43,151	3,923	0	47,074	1,93,586	1,97,509
President's residence	1.63	77,88,054	0	0	77,88,054	13,84,871	1,26,945	0	15,11,816	62,76,238	64,03,183
Visiting students hostel	1.63	3,39,82,070	0	0	3,39,82,070	60,62,923	5,53,908	0	66,16,831	2,73,65,239	2,79,19,147
Health centre	1.63	34,56,099	0	0	34,56,099	5,83,279	56,334	0	6,39,614	28,16,485	28,72,820
Nano institute-Shivanapura	1.63	37,09,242	0	0	37,09,242	6,65,069	60,461	0	7,25,529	29,83,713	30,44,173
Matrl. science block - CCMS	1.63	5,54,31,961	0	0	5,54,31,961	94,61,006	9,03,541	0	1,03,64,547	4,50,67,414	4,59,70,955
Post doc housing- Srirampura	1.63	1,54,86,086	0	0	1,54,86,086	22,03,664	2,52,423	0	24,56,087	1,30,29,999	1,32,82,422
New auditorium	1.63	2,20,24,759	0	0	2,20,24,759	31,46,118	3,59,004	0	35,05,122	1,85,19,637	1,88,78,641
New auditorium phase II	1.63	4,99,08,687	0	0	4,99,08,687	48,63,073	8,13,512	0	56,76,584	4,42,32,103	4,50,45,614

Mallya & Mallya Bangalore Chartered Accountants

SAMPAD PATRA

Digitally signed by SAMPAD PATRA
Date: 2024.07.24 19:03:23 +05'30'

JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH , JAKKUR POST, JAKKUR, BANGALORE 560 064
Schedules forming part of the accounts for the year ended 31st March 2024 (SCHEDULE 8 - FIXED ASSETS - Contd...)

EOBU lab block	1.63	2,13,48,429	0	0	2,13,48,429	35,24,507	3,47,979	0	38,72,486	1,74,75,943	1,78,23,922
Modern Biomedical Science Research Laboratory	1.63	6,35,66,599	0	0	6,35,66,599	42,93,034	10,36,136	0	53,29,169	5,82,37,429	5,92,73,565
Chemical Heritage Exposition	1.63	2,04,76,876	0	0	2,04,76,876	13,01,488	3,33,773	0	16,35,261	1,88,41,614	1,91,75,387
Extension to Engineering & Machanical Unit (EMU)	1.63	1,46,16,712	0	0	1,46,16,712	8,58,501	2,38,252	0	10,96,753	1,35,19,959	1,37,58,211
Extension to Hall of Science	1.63	9,64,309	0	0	9,64,309	62,873	15,718	0	78,592	8,85,717	9,01,436
Infrastructure facility- Road, street lights, partitions etc	1.63	14,16,15,450	90,88,885	0	15,07,04,335	2,72,17,963	24,02,283	0	2,96,20,245	12,10,84,090	11,43,97,487
Basic Infrastructure Facilities -New Campus-Chokkanalli	1.63	2,90,95,819	0	0	2,90,95,819	9,48,524	4,74,262	0	14,22,786	2,76,73,033	2,81,47,295
Hostel Phase - V	1.63	8,16,49,476	0	0	8,16,49,476	25,81,525	13,30,886	0	39,12,411	7,77,37,065	7,90,67,951
Child Care Centre - Additional Room	1.63	13,98,667	0	0	13,98,667	45,597	22,798	0	68,395	13,30,272	13,53,070
Computer Lab - Pre Fab Structure	1.63	4,98,715	0	0	4,98,715	16,259	8,129	0	24,388	4,74,327	4,82,456
Estate Office	1.63	23,11,880	0	0	23,11,880	66,449	37,684	0	1,04,133	22,07,747	22,45,431
Pre - Fab Innovation & Development Centre - Arkavathi Campus	1.63	2,67,71,861	50,70,449	0	3,18,42,310	2,76,501	5,19,030	0	7,95,531	3,10,46,779	2,64,95,360
Library Renovation - Pre Fab Contruction	1.63	3,42,164	0	0	3,42,164	5,577	5,577	0	11,155	3,31,009	3,36,587
Equipments :											
Plant/machinery/scientific equipments	4.75	1,79,68,37,777	20,68,33,421	4,77,973	2,00,31,93,225	71,54,41,346	9,08,11,994	0	80,62,53,340	1,19,69,39,886	1,08,13,96,431
Equipments carbon & nano materials	4.75	3,42,21,009	0	0	3,42,21,009	3,42,21,008	0	0	3,42,21,008	1	1
Equipments physics & chemistry of matrl.	4.75	98,78,095	0	0	98,78,095	98,78,094	0	0	98,78,094	1	1
Equipments cluster studies	4.75	26,87,514	0	0	26,87,514	26,87,513	0	0	26,87,513	1	1
Equipments advance technology lab	4.75	2,02,02,562	0	0	2,02,02,562	2,02,02,561	0	0	2,02,02,561	1	1
Equipment magnet	4.75	70,90,855	0	0	70,90,855	70,90,854	0	0	70,90,854	1	1
ICMS-lab equipment/ lab facilities	4.75	39,93,37,774	0	58,177	39,92,79,597	18,07,83,328	1,89,65,781	0	19,97,49,109	19,95,30,488	21,85,54,446
Vehicles	9.50	61,63,340	0	0	61,63,340	61,63,339	0	0	61,63,339	1	1
Furniture and fixtures	6.33	16,95,46,077	1,45,74,574	1,29,919	18,39,90,732	11,64,89,339	1,13,65,759	0	12,78,55,098	5,61,35,634	5,30,56,738
Office equipments	4.75	3,23,28,576	2,48,84,959	5,78,401	5,66,35,134	1,96,68,472	21,37,191	0	2,18,05,663	3,48,29,472	1,26,60,105
Computer/peripherals	16.21	12,23,37,624	1,02,05,829	0	13,25,43,453	10,89,86,372	1,43,76,408	0	12,33,62,780	91,80,673	1,33,51,252
Electrical installations	1.63	13,76,65,739	0	0	13,76,65,739	2,77,92,450	22,43,952	0	3,00,36,401	10,76,29,338	10,98,73,289
Electrical Installations - 2000 KVA DG SET	1.63	2,33,56,842	0	0	2,33,56,842	14,99,738	3,80,717	0	18,80,454	2,14,76,388	2,18,57,104
Library books	4.75	2,99,63,902	1,99,518	0	3,01,63,420	2,40,71,800	14,29,860	0	2,55,01,660	46,61,760	58,92,102
Library Journals	4.75	23,57,88,804	59,15,136	0	24,17,03,940	13,12,72,971	1,13,41,832	0	14,26,14,803	9,90,89,137	10,45,15,833
Tubewells & water supply	1.63	8,43,537	2,07,576	0	10,51,113	90,291	17,133	0	1,07,424	9,43,689	7,53,246
Other fixed assets											
Intangeable assets-Softwares	40.00	13,12,44,627	19,24,111	0	13,31,68,738	11,52,07,293	1,64,22,321	0	13,16,29,615	15,39,123	1,60,37,334
Capital work in progress											
Samat Building	0.00	1,42,57,317	2,54,84,093	0	3,97,41,410	0	0	0	0	3,97,41,410	1,42,57,317
Sports Complex	0.00	0	3,48,000	0	3,48,000	0	0	0	0	3,48,000	38,94,008
Total		4,20,21,91,365	31,29,91,509	12,44,470	4,51,39,38,404	1,71,37,68,577	18,62,48,202	0	1,90,00,16,779	2,61,39,21,625	2,48,84,22,788
Previous year		3,83,70,61,174	39,74,89,594	3,23,59,403	4,20,21,91,365	1,51,28,29,772	20,09,38,805	0	1,71,37,68,577	2,48,84,22,788	2,32,42,31,402

Mallya & Mallya Bangalore Chartered Accountants

SAMPAD PATRA

Digitally signed by SAMPAD PATRA
Date: 2024.07.24 19:03:39 +05'30'

Sampad Patra
Accounts Officer

JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH
Schedules forming part of the accounts for the year ended 31st March 2024

Description	2023-24 Amount in Rs.	2022-23 Amount in Rs.
SCHEDULE 9- Investments - Earmarked/endowment funds (Long term)		
Fixed deposits - Housing development finance corporation limited	8,35,90,265	9,35,90,265
Fixed deposits - PNB housing finance limited	58,02,41,495	50,72,41,495
Fixed deposits - Stock holding corporation of india	0	2,50,00,000
Total	**66,38,31,760**	**62,58,31,760**
SCHEDULE 10- Investments - Others (Current)		
Short term deposits	16,90,00,000	45,59,917
Others	8,890	8,890
Total	**16,90,08,890**	**45,68,807**
Schedule 11- Current assets, loans, advances etc., Cash & bank balances (Schemes)		
Cash in hand	0	0
Cash at bank - Canara bank	10,82,84,258	5,73,96,266
ZBSA Bank-Bank of Maharashtra-60418511062	45,21,178	66,08,099
ZBSA Bank-Bank of Maharashtra-60419419634	5,14,08,755	7,94,32,043
ZBSA Bank-Union Bank of India-203022010000838	5,59,22,460	6,87,56,393
ZBSA Bank-ICICI Bank-754901000196	70,88,319	41,19,072
Fixed deposits - Canara bank	20,00,00,000	40,00,000
Fixed deposits - Housing development finance corporation limited	4,85,17,767	29,01,95,870
Fixed deposits - PNB housing finance limited	28,97,32,070	25,20,93,308
Sub total	**76,54,74,807**	**76,26,01,051**
Loans and advances (Schemes)		
Interest accrued on fixed deposits	92,98,651	1,02,05,611
TDS receivable	46,27,323	70,95,623
Receivables from various funding agencies	2,67,00,270	2,37,58,377
Sub total	**4,06,26,244**	**4,10,59,611**
Total of Schemes	**80,61,01,051**	**80,36,60,662**
Cash & bank balances		
Cash in hand -Student Residence & VSH	11,694	7,634
Cash in hand - Dinning Hall	1,882	6,103
Cash in hand - Grant account	0	0
Cash at bank - Canara Bank - Grants account	19,31,42,639	33,94,05,333
Cash at bank - Canara Bank - FCRA account	13,92,872	1,58,398
Cash at bank - Canara Bank - Endowments account	4,37,38,178	4,76,10,234
Cash at bank - SBI	1,99,964	1,94,643
Cash at bank - HDFC	15,23,58,482	14,38,73,009
Cash at bank - Student Residence & VSH	28,04,496	14,65,140
Cash at bank - Dinning Hall	37,39,893	14,51,829
Sub total	**39,73,90,100**	**53,41,72,324**

Mallya & Mallya Bangalore Chartered Accountants

SAMPAD PATRA
Digitally signed by SAMPAD PATRA
Date: 2024.07.24 19:03:57 +05'30'
Sampad Patra
Accounts Officer

JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH
Schedules forming part of the accounts for the year ended 31st March 2024

Cont...of Schedule-11

Description	2023-24 Amount in Rs.	2022-23 Amount in Rs.
Loans and advances		
Advances to staff	19,751	74,871
Deposits	39,98,967	39,98,967
Interest accrued on earmarked/endowment funds	18,12,362	13,37,508
Interest accrued on fixed deposits - Grant Account	55,47,995	0
Other advances & receivables	1,13,02,679	1,17,86,181
Receivables- CSIR, UGC, DBT, DST	1,23,00,906	2,01,49,862
Endowment account - Receivables	95,00,000	34,33,893
TDS receivable - Grant account	48,02,959	50,50,263
TDS receivable - Endowment account	14,33,001	17,92,557
Imprest balance	0	20,000
Student Residence & VSH - Receivables	42,62,134	44,53,418
Dinning Hall -Receivables	10,73,956	12,67,089
Prepaid Expenses	45,39,212	1,19,06,770
Intra-Group Receivables		
a) Endowment Account		
Receivables From Endowment	1,14,02,864	34,33,893
Less: Payable to Grant Account-13474	-1,14,02,864	-34,33,893
Sub total	**6,05,93,922**	**6,52,71,379**
Total of other than Schemes	**45,79,84,022**	**59,94,43,704**
Total	**1,26,40,85,073**	**1,40,31,04,366**

Mallya & Mallya Bangalore Chartered Accountants

SAMPAD PATRA

Digitally signed by SAMPAD PATRA
Date: 2024.07.24 19:04:15 +05'30'

Sampad Patra
Accounts Officer

JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH
Schedules forming part of the accounts for the year ended 31st March 2024

Description	2023-24 Amount in Rs.	2022-23 Amount in Rs.
SCHEDULE 12- Income from sales/services	**0**	**0**
SCHEDULE 13- Grants/subsidies :		
Grants - DST	76,83,00,000	83,80,00,000
Grants - From governement agencies/travel grants etc.	0	0
Grants - From other institutes	0	0
Grants - Other international agencies	0	0
Total	**76,83,00,000**	**83,80,00,000**
SCHEDULE 14- Income from fee/subscriptions etc :		
Income from fee, subscriptions, medical contribution etc.	79,23,400	60,68,704
Total	**79,23,400**	**60,68,704**
SCHEDULE 15- Income from investments;	**0**	**0**
SCHEDULE 16- Royalty income, publication, licence fee etc:		
From royalty	0	0
Licence fee	6,50,952	6,13,855
Total	**6,50,952**	**6,13,855**
SCHEDULE 17- Interest earned:		
From term deposits	57,32,091	17,63,158
Interest From SB Accounts	1,59,46,977	67,65,036
Interest earned - Others	2,90,855	4,60,517
Total	**2,19,69,923**	**89,88,711**
SCHEDULE 18- Other income:		
From visitors house, guest rooms, students residense etc.	1,17,59,208	1,01,41,184
Prior year receipts	82,46,292	52,50,108
Miscellaneous income	38,25,776	19,06,059
From others (tender fee & other fee collected)	0	2,57,248
Total	**2,38,31,276**	**1,75,54,599**
SCHEDULE 19- Increase/decrease in stock:	**0**	**0**

Mallya & Mallya Bangalore Chartered Accountants

SAMPAD PATRA

Digitally signed by SAMPAD PATRA
Date: 2024.07.24 19:04:47 +05'30'

Sampad Patra
Accounts Officer

JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH
Schedules forming part of the accounts for the year ended 31st March 2024

Description	2023-24 Amount in Rs.	2022-23 Amount in Rs.
SCHEDULE 20- Establishment expenses:		
Salaries & scholarship to students	38,75,61,606	33,60,33,137
Wages	0	16,12,00,552
Allowances (Medical reimbursements etc.,)	1,30,68,075	1,13,52,096
Contribution to CPF	19,40,713	20,36,307
Contribution to new pension scheme	2,52,21,433	2,27,94,449
Contribution to group gratuity scheme	1,32,951	95,02,083
Leave encashment benefits	34,38,924	31,43,051
LTC	15,23,386	19,66,509
Total	**43,28,87,088**	**54,80,28,184**
SCHEDULE 21- Other Administrative expenses		
Electricity & power	6,85,72,154	5,67,37,325
Water charges	51,66,286	46,43,704
Wages- Outsourced Employees	16,51,68,512	0
Insurance	25,43,736	16,67,853
Repairs & maintenance	10,48,42,215	9,65,25,736
Rents, rates & taxes	6,21,600	7,40,204
Vehicles running & maintenance	38,38,542	25,51,376
Postage, telephone & communication	34,75,914	40,92,329
Printing, stationery, books	39,45,228	55,04,575
Travelling and conveyance	76,15,263	51,06,762
Expenses on seminars/workshops/discussion meetings	1,81,10,571	1,79,33,683
Membership & subscriptions	26,92,441	28,43,830
Professional / Legal charges	13,68,779	43,45,539
Laboratory consumables	3,84,04,357	6,49,81,316
Advertisement & publicity	27,41,286	13,92,467
Student residence, guest house, I house, etc	9,16,358	17,88,379
Statutory audit fee	4,24,800	1,29,800
POBE & POCE prgramme	1,78,511	91,983
Summer research fellowship & student programme	12,94,278	9,76,509
Loss on Asset Disposal	0	1,67,08,650
Foreign Exchage - Loss	15,676	6,124
Total	**43,19,36,506**	**28,87,68,146**
SCHEDULE 22- Expenditure on grants, subsidies etc:	**0**	**0**
SCHEDULE 23- Interest and bank charges:	**23,502**	**35,085**

Mallya & Mallya Bangalore Chartered Accountants

SAMPAD PATRA
Digitally signed by SAMPAD PATRA
Date: 2024.07.24 19:05:08 +05'30'

Sampad Patra
Accounts Officer

JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH SCHEDULES FORMING PART OF THE ACCOUNTS FOR THE YEAR ENDED 31st MARCH, 2024

SCHEDULE 24: SIGNIFICANT ACCOUNTING POLICIES

OVERVIEW:

Jawaharlal Nehru Centre for Advanced Scientific Research is a society registered under the Karnataka Societies Registration Act, 1960. It is also registered under section 35(1)(ii) of the Income Tax Act, 1961. It is an autonomous institution recognised and substantially funded by the Department of Science and Technology, Government of India.

The main objects of the Centre are to establish and conduct world-class research in science & engineering, foster interdisciplinary & collaborative research, establish state-of-the-art laboratories, computational & infrastructural facilities for conduct of scientific research, generate human capital through high-quality PhDs in science & engineering, increase awareness about science & research among school & college students through science outreach & extension activities and take research from laboratory to society.

SIGNIFICANT ACCOUNTING POLICIES:

1. Basis of Preparation

a. **Accounting Conventions**: The financial statements are prepared in accordance with historical cost convention and on accrual basis of accounting unless otherwise stated.

b. The financial statements are prepared as per the uniform form of financial statements for the central autonomous bodies issued by the Ministry of Finance, Government of India. These financial statements have been prepared to comply with the Accounting Standards issued by the Institute of Chartered Accountants of India.

2. Investments:

a. Investments classified as long-term investments are carried in the financial statements at cost. However, provision for diminution, if any, are made to recognise a decline, other than temporary, in the value of the investments on an individual basis.

b. Investments classified as current Investments are carried in the financial statements at the lower of cost and fair value determined on an individual investment basis.

3. Fixed Assets:

a. Fixed assets are stated at cost of acquisition, inclusive of inward freight, duties, taxes, and incidental expenses related to acquisition.

b. Fixed assets received by way of non-monetary grants, are capitalised at values stated, by corresponding credit to Capital Reserve

c. Depreciation on Fixed assets are provided on straight-line method at the below mentioned rates.

Description of Asset	Depreciation Rate
Building, Electrical Installations, Tube wells & Water Supply	1.63%
Plant, Machinery, Scientific, Electric & Office Equipment and Library Books & Journals	4.75%
Vehicles	9.50%
Furniture & Fixtures	6.33%
Computers & Peripherals	16.21%
Intangible assets - Computer Software	40.00%

Depreciation is charged at 50% of the above rates for assets used for less than 180 days during the year.

4. Government Grants / Other Grants:

a. Grants are recognized in the accounts on realisation basis.

b. Grants towards acquisition of capital assets are treated as Capital Reserve upon utilisation of such grants. Amount equivalent to the depreciation for the year on fixed assets acquired out of such capital grants are recognised as income and credited to the Income and Expenditure Account.

c. Revenue Grants are directly recognised in the Income and Expenditure Account upon receipt.

5. Retirement Benefits:

a. The centre has obtained group gratuity policy from the Life Insurance Corporation of India in respect of gratuity liability for its employees and accordingly, expenditure is recognised to the extent of premium paid annually.

b. Expenditure on Leave Encashment are recognised upon actual payment i.e., the same is accounted on cash basis as and when the liability is discharged,

6. Allocation/Transfer to Schemes:

Interest earned on Bank Deposits (Investments) are allocated to various schemes based on the investment amount attributable to the Scheme.

7. Revenue/ Income Recognition

a. Income from fee, subscriptions, medical contribution etc. are recognised on accrual basis on billing

b. Royalty/ Licence fee is recognised on time proportion basis, based on the terms of agreement.

c. Rental income from visitors' house, guest rooms, students' residences etc. are recognised based on occupancy for the month.

8. Foreign Currency and its Fluctuations:

The Foreign currency transactions are translated at the rates prevailing on the date of payment. Outstanding party balances as at the year end, denominated in foreign currency are re-stated at the closing rate and the consequent exchange difference is charged to the Income and Expenditure Account, except where it relates to procurement of fixed assets, in which case such exchange differences are capitalized with the respective fixed assets.

9. Prior Period Items:

Prior period items, being any income or expense, which has arisen in the current period as a result of errors or omissions in the preparation of the financial statements of one or more prior periods, are recognized as and when they are noticed and are shown separately.

SCHEDULE 25: CONTINGENT LIABILITIES AND NOTES ON ACCOUNTS

A. CONTINGENT LIABILITIES:

Contingent liability	2023-24 (Amount)	2022-23 (Amount)
1. Claims against the entity not acknowledged as debts	Nil	Nil
2. Letter of Credit outstanding	Nil	Nil

B. NOTES ON ACCOUNTS:

1. Income Tax: The Centre is registered under Section 35(1)(ii) of the Income Tax Act, 1961 and is eligible for exemption from tax and hence no provision has been made towards Income Tax.
2. Balances carried under Loans and Advances & Current Liabilities are subject to reconciliation and confirmation by the parties. The management is in the process of reconciliation of balances including the ones which are long outstanding.
3. Figures have been rounded off to the nearest rupee.
4. Figures of previous year have been regrouped and reclassified to conform to current year's presentation.

5. Schedule 1 to 23 are annexed to and form an integral part of the Balance Sheet as at 31st March ,2024 and the Income and Expenditure Account for the year ended on that date.

GIRIDHAR UDAPI RAO KULKARNI
Digitally signed by GIRIDHAR UDAPI RAO KULKARNI
Date: 2024.07.24 19:46:57 +05'30'

JOYDEEP DEB
Digitally signed by JOYDEEP DEB
Date: 2024.07.24 19:45:33 +05'30'

SAMPAD PATRA
Digitally signed by SAMPAD PATRA
Date: 2024.07.24 19:44:50 +05'30'

Prof. G.U. Kulkarni	Joydeep Deb	Sampad Patra
President	Administrative Officer	Accounts Officer

For *Mallya & Mallya*
Chartered Accountants
FRN: 001955S

CS Prashanth
Digitally signed by CS Prashanth
Date: 2024.07.24 20:00:01 +05'30'

CA CS Prashanth
Partner
Membership No: 218355

Mallya & Mallya Bangalore Chartered Accountants

Place: Bengaluru
Date: 24-07-2024
UDIN: 24218355BKAMHF1726

JAWAHARLAL CENTRE FOR ADVANCED SCIENTIFIC RESEARCH
RECEIPTS AND PAYMENT ACCOUNT FOR THE YEAR ENDED 31ST MARCH 2024

Amount in Rs.

OPENING BALANCES & RECEIPTS	2023-24	2022-23	PAYMENTS & CLOSING BALANCES	2023-24	2022-23
I. Opening Balances :			I. Expenses :		
- Cash in hand & imprest at Centre	20,000	20,000	- Establishment Expenses	36,23,39,580	55,22,47,961
			- Administrative Expenses	32,07,31,172	29,10,73,890
Bank balances:			- Expenditure out of Endowments	2,51,92,404	1,57,62,059
In savings bank Accounts :			Sub Total :	70,82,63,156	85,90,83,911
- Canara Bank - Grant A/c	33,94,05,333	27,83,98,526			
- Canara Bank (Grant A/c) FCRA	1,58,398	1,22,632			
- Canara Bank - Endowment A/c	4,76,10,234	1,10,78,303			
- State Bank Of India	1,94,643	1,88,223			
- HDFC BANK	14,38,73,009	9,62,91,851	II. Expenditure on Fixed assets and Capital Work-in-progress :		
			- Purchase of fixed assets	26,70,65,519	38,31,16,738
In Deposit accounts :					
			III. Refund of surplus money/loans	0	0
- At HDFC Trust	9,35,90,265	9,35,90,265			
- At PNB	50,72,41,495	37,24,41,495	IV. Finance charges(Bank charges)	31,824	43,572
- At SHC of India	2,50,00,000	6,30,00,000			
- At Canara Bank (Grant A/c)	45,59,917	6,12,21,325			
Sub Total :	1,16,16,53,295	97,63,52,620	V. Other payments :		
II. Grants Received :			- Earnest money deposit returned	0	54,34,612
			- Staff advances (Festival adv. etc.)	0	0
- From DST-Grant in aid	1,05,16,00,000	1,29,28,61,139	- Other advances	7,90,80,916	31,09,01,893
- On behalf of endowments/Centre's Development Fund,others	0	0	- Security deposit returned	14,52,412	7,32,000
Sub Total :	1,05,16,00,000	1,29,28,61,139	- TDS payments	5,91,83,337	6,83,42,749
			- Professional tax	6,28,800	6,73,200
III. Income on Investments :			- Provident fund	4,97,28,921	4,75,35,348
Interest on FD's :			- Advances to faculty	0	59,371
- From earmarked/endowment funds	5,00,17,544	5,34,97,088	- Payment to sundry creditors	10,61,631	92,03,326
- From own funds	1,84,096	18,19,635	- Advances to CPF Account	0	0
Sub Total :	5,02,01,640	5,53,16,723	Sub Total :	19,11,36,017	44,28,82,499
IV. Interest received on SB accounts :			VI. Closing Balances :		
- From grant in aid	1,59,46,977	1,17,05,821			
Sub Total :	1,59,46,977	1,17,05,821	- Cash in hand & Imprest at centre	0	20,000
			- Bank balances:		
			In savings bank accounts at :		
			- Canara Bank - Grant A/c	19,31,42,639	33,94,05,333
V. Other Income :			- At Canara Bank (Grant A/c) FCRA	13,92,872	1,58,398
- Collections from visitors, guest room etc	1,16,54,353	69,57,826	- Canara Bank - Endowment A/c	4,37,38,178	4,76,10,234
- From fee, subscription etc	67,15,398	37,16,938	- State Bank Of India	1,99,964	1,94,643
- CSIR fellowships,UGC, DBT, SRFP	76,43,253	4,31,80,842	- HDFC BANK	15,23,58,482	14,38,73,009
Sub total :	2,60,13,004	5,38,55,606	Sub Total :	39,08,32,135	53,12,61,618
Balance carried forward	2,30,54,14,916	2,39,00,91,909	Balance carried forward	1,55,73,28,651	2,21,63,88,339

Mallya & Mallya Bangalore Chartered Accountants

SAMPAD PATRA

Digitally signed by SAMPAD PATRA
Date: 2024.07.24 19:05:34 +05'30'

JAWAHARLAL CENTRE FOR ADVANCED SCIENTIFIC RESEARCH
RECEIPTS AND PAYMENT ACCOUNT FOR THE YEAR ENDED 31ST MARCH 2024(Contd...)

Amount in Rs.

OPENING BALANCES & RECEIPTS	2023-24	2022-23	PAYMENTS & CLOSING BALANCES	2023-24	2022-23
Balance Brought Forward	2,30,54,14,916	2,39,00,91,909	Balance Brought Forward	1,55,73,28,651	2,21,63,88,339
VI. Other receipts :			*In deposit accounts at :*		
- Income tax refunds	51,75,220	28,85,887	- At HDFC Trust	8,35,90,265	9,35,90,265
- From Sundry Creditors	0	0	- At PNB	58,02,41,495	50,72,41,495
- Staff advances recovered	0	0	- At SHC of India	0	2,50,00,000
- Settlement of advance to faculty	3,62,719	4,23,621	- At Canara Bank (Grant A/c)	16,90,00,000	45,59,917
- Earnest money received	14,97,000	21,36,000			
- Project funding received	0	6,51,89,784			
- GSLI receipt	75,11,961	45,83,558			
- Support to meetings	1,06,26,733	0			
- Other	5,95,71,862	38,14,69,257			
Sub Total :	8,47,45,494	45,66,88,107	Sub Total :	83,28,31,760	63,03,91,677
TOTAL	2,39,01,60,411	2,84,67,80,016	TOTAL	2,39,01,60,411	2,84,67,80,016

For Jawaharlal Nehru Centre for Advanced Scientific Research

As per our report of even date,
For *Mallya & Mallya*
Chartered Accountants
FRN : 001955S

CS Prashanth
Digitally signed by CS Prashanth
Date: 2024.07.24 19:41:53 +05'30'

C S PRASHANTH
Partner
Membership No. : 218355
UDIN : 24218355BKAMHF1726
Place : Bengaluru,
Date : 24/07/2024

Mallya & Mallya ★ Bangalore ★ Chartered Accountants

GIRIDHAR UDAPI RAO KULKARNI
Digitally signed by GIRIDHAR UDAPI RAO KULKARNI
Date: 2024.07.24 19:19:24 +05'30'

Prof. G.U. Kulkarni
President

JOYDEEP DEB
Digitally signed by JOYDEEP DEB
Date: 2024.07.24 19:15:47 +05'30'

Joydeep Deb
Administrative Officer

SAMPAD PATRA
Digitally signed by SAMPAD PATRA
Date: 2024.07.24 19:06:13 +05'30'

Sampad Patra
Accounts Officer

JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH
STATEMENT OF ENDOWMENT, CENTRE'S DEVELOPMENT FUND & OTHER FUNDS BALANCES AS ON 31/03/2024
(2023- 24)

Rs. in Lakhs

PARTICULARS	Principal Endow. Fund	Opening balance 2023-24	Additions during 2023-24	Interest Received 2023-24	Interest Accrued 2023-24	Total 2023-24	Expen-diture 2023-24	Closing balance 2023-24
ENDOWMENT CHAIRS	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
Hindustan Lever Ltd. & Gharda Chemicals Chair	32.00	39.78	0.00	2.42	0.00	42.20	2.70	39.50
Astra Zeneca & IBM Chair	20.00	59.66	0.00	1.51	0.00	61.17	0.00	61.17
DAE - Dr.Vikram Sarabhai Chair	22.00	41.12	0.00	1.75	0.00	42.87	0.00	42.87
DRDO & CSIR Chair	30.00	76.11	0.00	2.27	0.00	78.38	0.00	78.38
Silver Jubilee Professorship -Prof. C.N.R. Rao	25.00	33.27	0.00	2.12	0.00	35.38	0.49	34.89
TOTAL- ENDOWMENT CHAIRS	**129.00**	**249.94**	**0.00**	**10.06**	**0.00**	**260.00**	**3.19**	**256.81**
RELIANCE INDUSTRIES								
Prof.Linus Pauling Professorship	**84.34**	**47.12**	**0.00**	**6.95**	**0.00**	**54.07**	**20.58**	**33.49**
OTHER ENDOWMENT FUNDS								
Contribution from Prof.CNR Rao	4.25	15.25	0.00	0.34	0.00	15.59	0.20	15.39
Shantha Seetharamaiah Award	1.00	3.40	0.00	0.08	0.00	3.48	0.16	3.32
Bapu Narayanaswamy Prize	1.00	3.16	0.00	0.08	0.00	3.24	0.06	3.18
Prof. Roddam Narasimha Prize	2.00	3.47	0.00	0.16	0.00	3.63	0.09	3.54
Prof. M.K.Chandrashekaran Fund	5.43	6.06	0.00	0.32	0.00	6.38	0.00	6.38
Sanjay S R Rao	25.00	28.49	0.00	1.94	0.00	30.43	1.20	29.23
Indumathi Rao	34.00	38.51	0.00	2.02	0.00	40.53	2.09	38.45
Reliance Fund - Sankhyasutra	431.37	547.39	0.00	35.42	0.00	582.81	0.00	582.81
TOTAL - OTHER ENDOWMENT FUNDS	**504.05**	**645.73**	**0.00**	**40.37**	**0.00**	**686.10**	**3.79**	**682.31**
LECTURE SERIES								
Dr. A.V.Rama Rao Fund	31.00	37.22	0.00	2.61	0.00	39.83	0.00	39.83
ISRO-Dr. Satish Dhawan	14.00	25.89	0.00	1.05	0.00	26.94	0.00	26.94
DAE-Dr. Raja Ramanna	15.00	19.25	0.00	1.25	0.00	20.50	0.00	20.50
DBT-Prof. V Ramalingaswamy	7.00	13.47	0.00	0.52	0.00	13.99	0.00	13.99
TOTAL - LECTURE SERIES	**67.00**	**95.82**	**0.00**	**5.43**	**0.00**	**101.26**	**0.00**	**101.26**
C.N.R. RAO HALL OF SCIENCE FUND	**170.00**	**226.43**	**0.00**	**14.23**	**0.00**	**240.66**	**17.25**	**223.41**
MATERIALS RESEARCH FUND	**341.45**	**532.56**	**0.00**	**28.33**	**0.00**	**560.89**	**254.84**	**306.04**
JNC - Centre's Development Fund	**1,682.07**	**4,933.78**	**186.10**	**392.36**	**8.63**	**5,520.87**	**31.93**	**5,488.94**
GRAND TOTAL	**2,977.91**	**6,731.38**	**186.10**	**497.74**	**8.63**	**7,423.85**	**331.58**	**7,092.27**

SAMPAD PATRA
Digitally signed by SAMPAD PATRA
Date: 2024.07.24 19:06:34 +05'30'

Sampad Patra
Accounts Officer

Mallya & Mallya Bangalore Chartered Accountants

JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH
CPF STATEMENT OF AFFAIRS FOR THE YEAR ENDED 31ST MARCH 2024

Particulars	Amount in Rs.	Amount in Rs.	Particulars	Amount in Rs.	Amount in Rs.
Contributory provident fund			Investment of funds :		
Subscription :			Fixed Deposits at HDFC Ltd.	5,30,00,000	
Opening balance	4,96,77,139		Fixed Deposits at PNB housing finance	2,80,00,000	8,10,00,000
Add : Subscriptions received during the year	46,61,576				
Advances repayments	4,35,454		Cash at Bank :		
Interest on subscriptions	34,09,827		Canara Bank, SB A/C No. 0683101017513	13,85,321	13,85,321
Sub total	5,81,83,996				
Less : Advances granted	4,37,432		TDS receivable :		
Less : Part final / Final settlement	93,33,763		For the F.Y. 2012-13	1,48,000	
Sub total	97,71,195		For the F.Y. 2014-15	1,48,000	
Closing balance		4,84,12,801	For the F.Y. 2015-16	1,49,400	
			For the F.Y. 2018-19	1,40,020	
Contribution :			For the F.Y. 2022-23	25,54,250	
Opening balance	3,51,32,262		For the F.Y. 2023-24	4,20,700	35,60,370
Add : Contribution during the year	19,50,424				
Interest on total contributions	23,64,504		Accrued interest :		
Sub total	3,94,47,190		Accrued interest on Deposit in PNB housing finance	57,37,176	
Less : Final settlement	33,64,922		Accrued interest on Deposit in HDFC Ltd.	42,57,376	99,94,552
Closing balance		3,60,82,268			
Balance surplus/deficit (-)		1,14,45,174			
Total		9,59,40,243	Total		9,59,40,243

For Jawaharlal Nehru Centre for Advanced Scientific Research

For Mallya & Mallya
Chartered Accountants
FRN : 001955S

CS Prashanth
Digitally signed by CS Prashanth
Date: 2024.07.24 19:43:22 +05'30'

C S PRASHANTH
Partner
Membership No.: 218355
UDIN : 24218355BKAMHF1726
Place : Bangalore,
Date : 24/07/2024

GIRIDHAR UDAPI RAO KULKARNI
Digitally signed by GIRIDHAR UDAPI RAO KULKARNI
Date: 2024.07.24 19:19:54 +05'30'

Prof. G.U. Kulkarni
President

JOYDEEP DEB
Digitally signed by JOYDEEP DEB
Date: 2024.07.24 19:16:22 +05'30'

Joydeep Deb
Administrative Officer

SAMPAD PATRA
Digitally signed by SAMPAD PATRA
Date: 2024.07.24 19:06:53 +05'30'

Sampad Patra
Accounts Officer

JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH

Details of Scheme funds for the financial year 2023-24

		Opening Balance		Additions to the Funds	Utilisation / Expenditure	Closing Balance	
Sl. No.	Code	Debit	Credit			Debit	Credit
1	4164	25,813	0	0	0	25,813	0
2	4238	0	16,42,830	0	0	0	16,42,830
3	4254	3,12,285	0	0	0	3,12,285	0
4	4272	3,219	0	0	0	3,219	0
5	4276	12,352	0	0	0	12,352	0
6	4277	0	5,66,048	0	30,044	0	5,36,004
7	4286	33,549	0	0	0	33,549	0
8	4288	6,16,803	0	0	0	6,16,803	0
9	4292	54,112	0	0	0	54,112	0
10	4294	18,36,463	0	0	0	18,36,463	0
11	4297	99,865	0	0	0	99,865	0
12	4298	2,85,189	0	0	0	2,85,189	0
13	4300	19,02,409	0	0	0	19,02,409	0
14	4301	1,89,347	0	0	0	1,89,347	0
15	4302	1,07,814	0	0	0	1,07,814	0
16	4312	1,52,000	0	0	0	1,52,000	0
17	4314	3,77,469	0	0	0	3,77,469	0
18	4318	1,212	0	0	0	1,212	0
19	4319	15,985	0	0	1,000	16,985	0
20	4320	62,558	0	0	0	62,558	0
21	4324	0	22,42,780	0	5,13,963	0	17,28,817
22	4327	47,323	0	0	0	47,323	0
23	4333	4,83,351	0	0	0	4,83,351	0
24	4334	5,41,134	0	0	0	5,41,134	0
25	4336	0	5,62,033	0	4,45,185	0	1,16,848
26	4337	3,02,836	0	0	0	3,02,836	0
27	4342	0	95,758	0	93,175	0	2,583
28	4344	1,09,450	0	0	0	1,09,450	0
29	4346	0	4,33,086	0	3,85,864	0	47,222
30	4351	1,59,277	0	0	0	1,59,277	0
31	4354	0	1,45,197	0	0	0	1,45,197
32	4355	63,842	0	0	0	63,842	0
33	4357	0	3,85,856	0	0	0	3,85,856
34	4360	93,562	0	0	0	93,562	0
35	4365	41,564	0	0	0	41,564	0
36	4371	2,63,624	0	0	0	2,63,624	0
37	4375	2,66,161	0	0	0	2,66,161	0
38	4376	0	2,84,74,489	0	0	0	2,84,74,489
39	4377	0	3,81,230	0	3,77,378	0	3,852
40	4378	3,42,097	0	0	0	3,42,097	0
41	4384	10,355	0	0	0	10,355	0
42	4386	0	1,45,78,203	50,00,000	1,95,78,203	0	0
43	4387	0	2,99,05,682	0	61,51,235	0	2,37,54,447
44	4394	0	1,05,894	0	1,05,894	0	0

Mallya & Mallya Bangalore Chartered Accountants

SAMPAD PATRA

Digitally signed by SAMPAD PATRA
Date: 2024.07.24 19:07:30 +05'30'

45	4400	90,586	0	0	0	90,586	0
46	4402	9,71,693	0	0	0	9,71,693	0
47	4404	2,48,492	0	0	0	2,48,492	0
48	4405	15,401	0	0	0	15,401	0
49	4406	10,31,359	0	0	0	10,31,359	0
50	4409	40,413	0	0	0	40,413	0
51	4411	8,35,737	0	0	0	8,35,737	0
52	4412	19,25,456	0	0	0	19,25,456	0
53	4422	0	7,58,919	4,86,350	12,45,034	0	235
54	4427	0	1,33,048	93,949	2,26,997	0	0
55	4428	41,75,852	0	0	0	41,75,852	0
56	4430	1,72,426	0	0	0	1,72,426	0
57	4442	1,22,569	0	0	0	1,22,569	0
58	4444	8,58,625	0	0	0	8,58,625	0
59	4448	62,018	0	62,018	0	0	0
60	4450	1,69,039	0	0	0	1,69,039	0
61	4455	0	1,21,075	0	0	0	1,21,075
62	4457	2,57,388	0	0	0	2,57,388	0
63	4458	49,698	0	0	0	49,698	0
64	4462	33,041	0	0	0	33,041	0
65	4467	4,604	0	0	0	4,604	0
66	4471	16,909	0	0	0	16,909	0
67	4475	6,324	0	0	0	6,324	0
68	4476	13,15,756	0	0	0	13,15,756	0
69	4477	83,763	0	0	0	83,763	0
70	4478	12,530	0	0	0	12,530	0
71	4483	1,22,931	0	0	0	1,22,931	0
72	4487	1,11,522	0	0	0	1,11,522	0
73	4494	0	1,23,234	0	96,565	0	26,669
74	4500	0	23,42,445	0	0	0	23,42,445
75	4501	1,26,595	0	0	0	1,26,595	0
76	4502	0	35,000	0	0	0	35,000
77	4503	32,417	0	12,21,329	12,19,850	30,938	0
78	4504	0	6,01,356	0	6,01,356	0	0
79	4505	0	42,714	0	0	0	42,714
80	4514	1,09,861	0	12,02,026	10,92,165	0	0
81	4519	0	29,969	0	0	0	29,969
82	4552	1,93,216	0	0	0	1,93,216	0
83	4554	0	1,52,908	6,02,078	7,54,986	0	0
84	4556	0	410	0	0	0	410
85	4558	2,65,924	0	0	0	2,65,924	0
86	4559	0	53,439	4,907	58,346	0	0
87	4564	7,930	0	0	0	7,930	0
88	4565	2,54,146	0	0	0	2,54,146	0
89	4566	0	1,93,201	37,25,582	39,18,783	0	0
90	4569	0	65,271	19,697	84,968	0	0
91	4570	4,94,197	0	0	0	4,94,197	0
92	4571	86,643	0	86,643	0	0	0
93	4574	30,176	0	0	0	30,176	0
94	4575	0	26,72,035	0	1,26,753	0	25,45,282

Mallya & Mallya Bangalore Chartered Accountants

SAMPAD PATRA

Digitally signed by SAMPAD PATRA
Date: 2024.07.24 19:07:44 +05'30'

95	4576	17,653	0	0	0	17,653	0
96	4578	0	30,48,167	0	0	0	30,48,167
97	4579	0	2,71,546	6,98,560	3,47,932	0	6,22,174
98	4580	0	23,166	0	23,166	0	0
99	4581	0	1,47,496	0	0	0	1,47,496
100	4582	0	31,57,673	15,97,893	17,95,800	0	29,59,766
101	4583	0	2,28,203	0	2,28,000	0	203
102	4586	0	2,51,56,738	20,00,00,000	20,47,88,731	0	2,03,68,007
103	4587	0	2,76,938	0	2,76,938	0	0
104	4588	82,404	0	0	0	82,404	0
105	4589	0	69,425	0	69,425	0	0
106	4590	95,713	0	0	65,904	1,61,617	0
107	4591	0	94,658	0	40,990	0	53,668
108	4592	3,29,746	0	0	0	3,29,746	0
109	4593	0	67,336	4,361	71,697	0	0
110	4594	0	2,35,843	6,34,667	5,50,779	0	3,19,731
111	4595	0	3,687	25,00,000	24,43,268	0	60,419
112	4596	0	8,78,974	10,23,617	18,06,689	0	95,902
113	4597	0	4,84,661	2,492	4,87,153	0	0
114	4598	0	3,41,580	15,74,461	18,84,418	0	31,623
115	4601	47,637	0	0	0	47,637	0
116	4602	0	15,12,332	0	15,12,215	0	117
117	4603	0	5,78,415	4,557	5,82,972	0	0
118	4604	0	4,72,888	27,395	5,00,283	0	0
119	4605	0	1,87,106	3,146	1,73,459	0	16,793
120	4606	0	11,988	6,01,258	6,13,246	0	0
121	4607	0	9,01,184	3,98,895	9,21,244	0	3,78,835
122	4609	0	5,75,089	5,091	4,29,174	0	1,51,006
123	4610	0	74,398	14,14,885	14,89,283	0	0
124	4611	0	75,799	9,96,000	13,270	0	10,58,529
125	4615	0	1,79,227	10,05,467	11,84,694	0	0
126	4616	0	15,35,799	10,98,158	18,00,771	0	8,33,186
127	4619	0	9,64,146	0	0	0	9,64,146
128	4620	0	2,01,188	0	0	0	2,01,188
129	4621	0	4,71,543	0	0	0	4,71,543
130	4622	0	16,698	7,33,846	7,33,974	0	16,570
131	4623	0	4,96,903	33,55,430	31,33,539	0	7,18,794
132	4624	0	14,21,465	0	0	0	14,21,465
133	4627	0	4,71,533	14,17,664	19,45,794	56597	0
134	4629	0	3,83,309	2,67,100	1,28,630	0	5,21,779
135	4630	0	30,139	0	1,500	0	28,639
136	4632	0	1,57,415	0	99,307	0	58,108
137	4633	0	5,11,357	47,520	10,000	0	5,48,877
138	4634	0	5,51,782	30,22,069	32,45,803	0	3,28,048
139	4635	36,967	0	0	0	36,967	0
140	4637	0	1,85,603	17,25,925	18,66,124	0	45,404
141	4638	0	8,478	19,09,628	19,58,445	40339	0
142	4640	0	11,89,000	0	0	0	11,89,000
143	4642	0	2,45,855	26,34,120	28,82,014	2039	0
144	4643	0	12,18,543	5,25,100	13,29,686	0	4,13,957

Malliga & Malliga Bangalore Chartered Accountants

SAMPAD PATRA

Digitally signed by SAMPAD PATRA
Date: 2024.07.24 19:08:10 +05'30'

145	4644	0	36,620	10,05,720	10,42,340	0	0
146	4645	0	4,96,160	6,945	3,97,714	0	1,05,391
147	4651	0	1,19,251	1,776	1,33,969	12942	0
148	4652	0	7,832	0	7,832	0	0
149	4653	0	12,632	1,87,102	1,99,734	0	0
150	4654	0	25,692	2,75,000	2,39,971	0	60,721
151	4655	0	25,48,028	25,43,373	34,34,286	0	16,57,115
152	4656	0	9,27,400	8,493	10,02,360	66467	0
153	4657	0	6,23,275	12,19,071	10,69,723	0	7,72,623
154	4658	0	4,92,251	14,05,787	13,76,387	0	5,21,651
155	4662	0	10,02,915	27,227	10,30,142	0	0
156	4663	0	2,10,035	1,444	2,11,479	0	0
157	4664	0	9,23,976	11,560	9,35,536	0	0
158	4674	0	3,55,607	6,68,264	9,90,232	0	33,639
159	4660	0	1,69,341	0	1,52,805	0	16,536
160	4661	0	12,010	78,923	90,933	0	0
161	4675	0	74,894	23,03,822	23,78,716	0	0
162	4676	0	13,62,446	0	2,16,446	0	11,46,000
163	4677	0	74,522	2,00,000	1,64,114	0	1,10,408
164	4679	0	4,60,016	15,00,000	11,51,103	0	8,08,913
165	4680	0	98,12,800	50,00,000	69,17,249	0	78,95,551
166	4681	0	5,74,818	3,35,877	6,76,065	0	2,34,630
167	4682	0	2,382	4,97,618	4,97,594	0	2,406
168	4683	0	6,26,556	12,88,016	5,44,855	0	13,69,717
169	4684	0	11,96,975	5,88,459	10,57,783	0	7,27,651
170	4685	0	10,25,800	0	5,37,583	0	4,88,217
171	4686	0	9,80,495	0	8,39,545	0	1,40,950
172	4687	0	12,84,62,886	2,92,37,289	73,67,539	0	15,03,32,636
173	4688	0	14,23,475	0	6,41,713	0	7,81,762
174	4689	0	21,30,956	9,66,086	26,55,486	0	4,41,556
175	4690	0	18,444	10,59,858	10,78,302	0	0
176	4691	0	19,437	10,54,860	10,74,297	0	0
177	4692	0	63,337	10,60,989	11,63,211	38885	0
178	4693	0	16,419	10,59,951	11,18,678	42308	0
179	4694	0	1,26,393	0	1,26,393	0	0
180	4696	0	3,12,22,147	75,88,212	42,42,791	0	3,45,67,568
181	4698	0	3,84,976	12,298	1,82,044	0	2,15,230
182	4699	0	3,04,469	0	3,04,469	0	0
183	4700	0	17,79,581	22,32,802	22,80,485	0	17,31,898
184	4701	0	1,03,774	11,05,239	2,14,881	0	9,94,132
185	4702	0	5,23,099	8,13,118	11,07,935	0	2,28,282
186	4703	0	7,87,196	12,790	9,26,021	126035	0
187	4704	0	14,547	10,59,823	10,74,370	0	0
188	4705	0	90,62,941	0	1,01,19,288	1056347	0
189	4705B	0	0	10,13,401	20,981	0	9,92,420
190	4706	0	1,42,50,341	0	44,34,196	0	98,16,145
191	4715	0	5,28,349	31,52,917	36,82,200	934	0
192	4716	0	9,26,181	5,98,234	13,22,571	0	2,01,844
193	4717	0	32,16,270	15,29,840	31,77,597	0	15,68,513
194	4718	0	14,97,300	32,035	15,14,348	0	14,987

Mallya & Mallya Bangalore Chartered Accountants

SAMPAD PATRA

Digitally signed by SAMPAD PATRA
Date: 2024.07.24 19:08:27 +05'30'

195	4721	0	3,13,739	6,673	2,32,534	0	87,878
196	4722	0	1,53,196	0	1,53,196	0	0
197	4723	0	25,68,238	62,654	11,77,333	0	14,53,559
198	4724	0	36,71,824	4,03,387	38,79,969	0	1,95,242
199	4725	0	17,50,000	0	0	0	17,50,000
200	4727	0	10,30,170	4,23,729	11,64,242	0	2,89,657
201	4728	0	17,98,954	0	28,75,872	1076918	0
202	4729	0	4,97,520	0	4,77,520	0	20,000
203	4730	0	2,24,967	3,37,568	5,60,730	0	1,805
204	4731	0	9,01,548	13,459	8,97,451	0	17,556
205	4732	0	1,75,000	3,29,657	4,90,289	0	14,368
206	4733	0	1,75,000	2,99,220	4,44,920	0	29,300
207	4734	0	1,75,000	3,28,600	4,90,167	0	13,433
208	4735	0	1,142	4,38,858	4,39,246	0	754
209	4736	0	1,69,155	3,92,567	5,41,413	0	20,309
210	4737	0	71,097	4,89,903	5,44,722	0	16,278
211	4738	0	69,645	5,15,165	5,37,446	0	47,364
212	4739	0	3,35,527	20,000	3,35,000	0	20,527
213	4740	0	10,18,273	91,440	8,00,050	0	3,09,663
214	4741	0	32,00,000	0	38,15,179	615179	0
215	4742	0	74,88,000	0	64,47,888	0	10,40,112
216	4743	0	4,92,440	2,26,560	7,19,000	0	0
217	4744	0	2,14,83,000	0	1,64,94,590	0	49,88,410
218	4756	0	0	3,41,065	3,40,223	0	842
219	4757	0	0	43,95,447	36,66,768	0	7,28,679
220	4758	0	0	3,42,703	1,63,851	0	1,78,852
221	4773	0	0	17,00,000	12,58,320	0	4,41,680
222	4774	0	0	1,81,000	1,81,000	0	0
223	4775	0	0	6,41,054	6,40,716	0	338
224	4776	0	0	23,19,076	15,32,604	0	7,86,472
225	4777	0	0	22,34,714	9,03,458	0	13,31,256
226	4778	0	0	18,63,507	18,61,452	0	2,055
227	4779	0	0	23,48,551	18,33,751	0	5,14,800
228	4780	0	0	3,87,660	3,87,660	0	0
229	4781	0	0	25,00,000	13,28,302	0	11,71,698
230	4782	0	0	27,46,280	26,05,712	0	1,40,568
231	4783	0	0	19,21,877	11,19,866	0	8,02,011
232	4784	0	0	19,00,000	1,34,720	0	17,65,280
233	4785	0	0	5,83,880	5,36,577	0	47,303
234	4786	0	0	22,00,000	19,17,600	0	2,82,400
235	4787	0	0	44,41,717	29,15,435	0	15,26,282
236	4788	0	0	2,26,007	2,26,007	0	0
237	4789	0	0	52,00,000	28,01,004	0	23,98,996
238	4790	0	0	9,08,508	2,45,735	0	6,62,773
239	4792	0	0	22,35,800	2,93,007	0	19,42,793
240	4793	0	0	48,65,454	3,95,499	0	44,69,955
241	4794	0	0	47,50,419	9,56,294	0	37,94,125
242	4795	0	0	4,45,320	2,52,157	0	1,93,163
243	4796	0	0	55,75,977	4,94,664	0	50,81,313
244	4797	0	0	17,43,826	1,73,006	0	15,70,820

245	4798	0	0	60,09,324	54,237	0	59,55,087
246	4799	0	0	24,00,000	25,000	0	23,75,000
247	4800	0	0	14,35,113	0	0	14,35,113
248	4801	0	0	38,09,280	22,168	0	37,87,112
249	4802	0	0	27,40,496	21,049	0	27,19,447
250	4803	0	0	22,92,344	17,404	0	22,74,940
251	4804	0	0	26,51,292	12,100	0	26,39,192
252	4805	0	0	7,46,966	0	0	7,46,966
253	4806	0	0	7,46,966	0	0	7,46,966
254	4807	0	0	7,46,966	0	0	7,46,966
255	4808	0	0	7,45,200	0	0	7,45,200
256	4809	0	0	7,47,073	0	0	7,47,073
257	4810	0	0	7,46,966	0	0	7,46,966
258	4811	0	0	7,48,459	0	0	7,48,459
259	4813	0	0	5,83,880	0	0	5,83,880
260	4814	0	0	5,83,880	0	0	5,83,880
261	4815	0	0	5,83,880	0	0	5,83,880
262	4816	0	0	5,83,880	0	0	5,83,880
263	6001	0	56,75,865	0	0	0	56,75,865
264	6004	0	8,00,94,366	0	2,93,67,866	0	5,07,26,500
265	6005	0	14,96,872	0	0	0	14,96,872
266	6006	0	95,53,374	52,68,906	2,96,646	0	1,45,25,634
267	P.D.F.	0	71,43,188	31,44,900	18,14,456	0	84,73,632
268	O.C.B.	0	29,49,59,806	8,86,66,815	4,43,35,218	0	33,92,91,403
		2,37,58,377	80,36,63,536	50,38,39,971	50,43,20,643	2,67,00,270	80,61,24,758

Mallya & Mallya Bangalore Chartered Accountants

SAMPAD PATRA

Digitally signed by SAMPAD PATRA
Date: 2024.07.24 19:09:00 +05'30'

Sampad Patra
Accounts Officer

NOTES

NOTES

NOTES

JNCASR

Jawaharlal Nehru Centre for
Advanced Scientific Research

Jakkur Post, Bengaluru 560 064
Karnataka, India
Phone: 91-80-22082750
E-mail: admin@jncasr.ac.in
Website: www.jncasr.ac.in
@jncasr