Azadi Ka Amrit Mahotsav

JNCASR

Jawaharlal Nehru Centre for Advanced Scientific Research

G20 भारत 2023 INDIA

ANNUAL REPORT 2022-2023

ISSN.0973-9319

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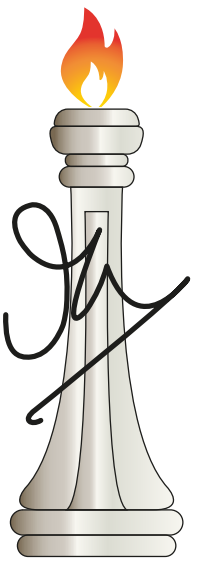
This report is published in September 2023

Content writing and copyediting by:
JNCASR and Impact Science
www.impact.science

Design by:
Impact Science
A division of CACTUS Communications Pvt. Ltd.
www.impact.science

ANNUAL REPORT
2022-2023



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

I am pleased to present the 34th Annual Report of JNCASR, which serves as a record of the various achievements of the Centre during this financial year. I would like to extend my heartfelt gratitude to each member of the Centre for putting in hard work and staying committed to the vision of our Centre.

Many of our members have won various accolades and awards. Bharat Ratna Prof. C. N. R. Rao received the SMC Lifetime Achievement Award from the Society of Materials Chemistry, and D.Sc. *Honoris Causa* from the Assam Royal Global University, 2022. Recently, DST Vigyan Prasar released a book titled *Vigyan Vidushi – 75 Women Trailblazers of Indian Science*, which celebrates the valuable contributions of several Indian women scientists, and I am delighted to say that our colleague Prof. Hiriyakkanavar Ila is featured in the book. One of our start-ups, M/s Breathe Applied Sciences Pvt. Ltd., won the National Award for Technology Start-Ups from the Technology Development Board (TDB) and MaterialNEXT 4.0 Award from Tata Steel. While our Council Chair Prof. V. Ramgopal Rao has been appointed as Group Vice Chancellor of BITS Pilani, Council Member Prof. K .N. Ganesh received the Padma Shri Award from the Government of India. Prof. Raghavendra Gadagkar, Honorary Professor, was elected as a Fellow of American Academy of Science. Ten eminent scientists from various disciplines have been inducted as Honorary Professors at the Centre, taking the strength to 14. Congratulations to Prof. Santosh Ansumali for receiving the prestigious IIT Bombay International Award for Excellence in Research in Engineering & Technology. I also congratulate other faculty colleagues and students who have received honours and recognitions.

The number of publications and patents achieved this year also reflects the progress made by our Centre in the field of research and is a testimony to the growth of our scientific contributions. We have published 307 articles, several of which are in high-impact factor journals. Additionally, with the signing of ten new agreements with various industries, I am pleased to reflect on the value our Centre places on academia–industry partnerships in taking our research and innovation to benefit our society.

On the academic front, we have continued to keep up with our past performance. This year, we awarded 77 degrees and diplomas, including Ph.D., Integrated Ph.D., M.S., M.Sc. Chemistry, and P.G.D.M.S., to the graduating students. With the intake of 83 new students who joined us in the academic year 2022–2023, our current student strength stands at 331.

It gives me great joy to note that our outreach programme continues to be vibrant. Education Technology Unit together with C. N. R. Rao Hall of Science, has conducted several science outreach programmes across the country, benefitting students and teachers. Orientation programmes for teachers were conducted to facilitate the integration of improved teaching methodologies and practices at various schools. With the on-campus joining of several fellows under different fellowship programmes, those programmes that had been dormant due to the pandemic are now flourishing.

We have recently made some additions to our Centre. The Mazumdar-Shaw Laboratory for Frontier Biology at JNCASR was formally inaugurated by Dr. Kiran Mazumdar-Shaw, the Founder and Chairperson of Biocon. This new facility will support research in more recent fields of biology, like synthetic biology and nanobiotechnology. The Placement, Alumni,

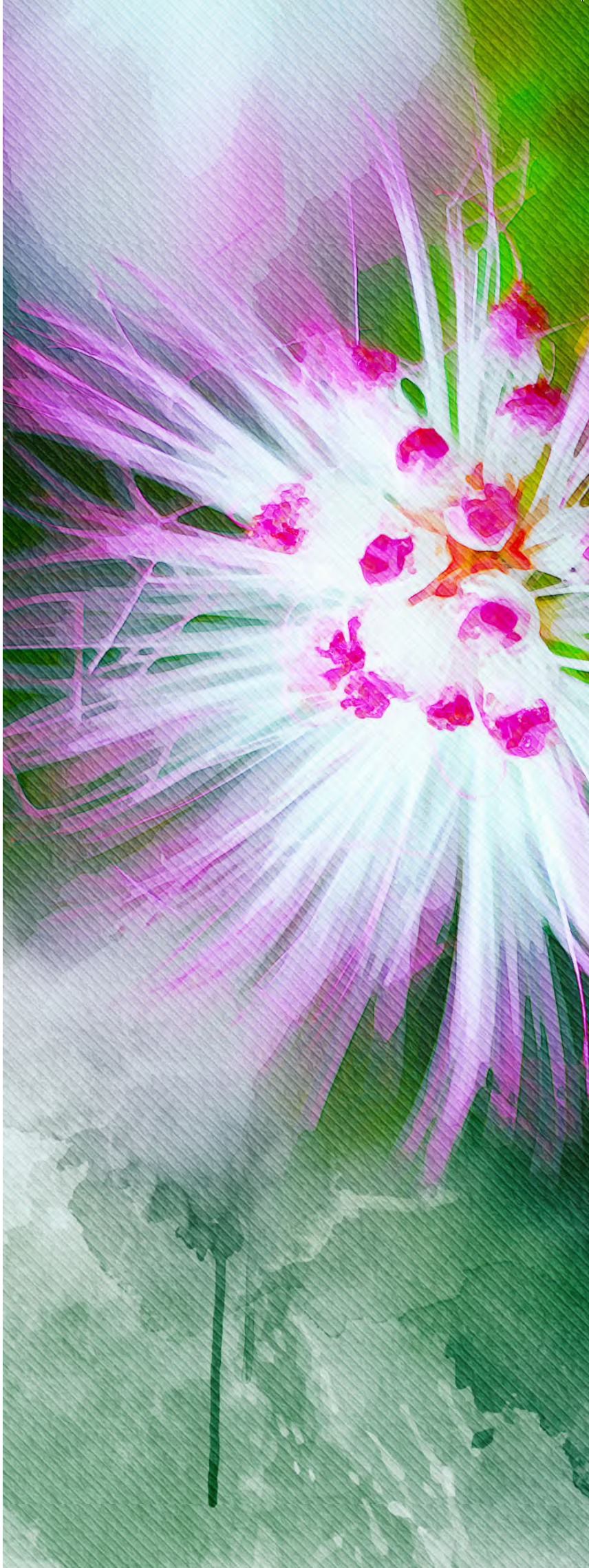
FOREWORD

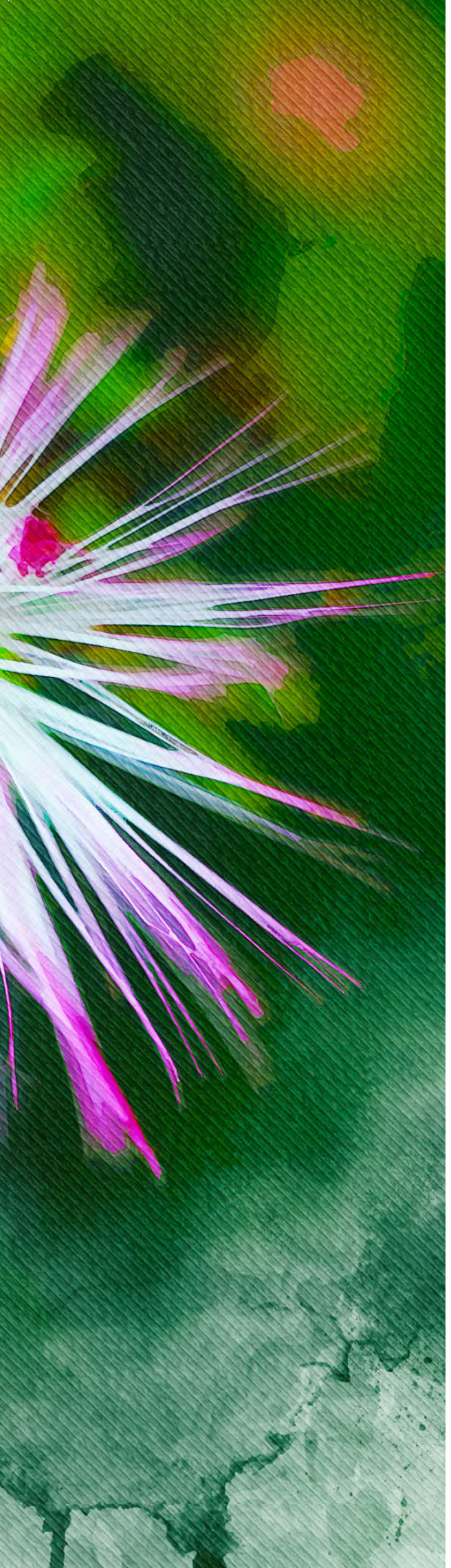
and International Relations (PAIRs) Office was also established to create a proactive network between our alumni, students, and faculty members. The PAIRs Office has been diligently working towards compiling the alumni database.

The 2nd SCO Young Scientist Conclave held in the second week of February 2023, was yet another great privilege for our Centre to organise and host. More than 70 scientists from six SCO member countries—India, Russia, Kazakhstan, Uzbekistan, China, and Tajikistan—participated in this 5-day event, which was inaugurated by Dr. Jitendra Singh, Hon'ble Minister of State (Independent Charge) for Science and Technology and Earth Sciences, Government of India.

As we move forward in this academic journey, let's make a strong commitment to strengthen and expand JNCASR's academic and research capabilities.

To conclude, let me thank each one of you for your support in upholding the Centre's objectives. I once again reiterate my hope and belief of dedicating our efforts towards the fulfilment of the Centre's goals! I take this opportunity to thank the Department of Science and Technology, Government of India, for their continued faith and support.





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I.

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 331 students, several renowned faculty members, and nine 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 Department of Science and Technology, Government of India, founded Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR) as an autonomous institution in 1989 to mark the birth centenary of Pandit Jawaharlal Nehru, India's first Prime Minister.

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 JNCASR's developmental journey through his valuable expertise and knowledge. The Indian Institute of Science (IISc), one of India's oldest and most esteemed research institutions, has also supported the growth of JNCASR through a mutually beneficial partnership.

JNCASR was designated as an Institution Deemed-to-be-University by the University Grants Commission, Government of India, in 2002. Today, JNCASR's Governing Council is presided over by Prof. V. Ramgopal Rao, and its President is Prof. G. U. Kulkarni.

The Centre was designated as a Category-I Deemed-to-be-University and 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 Integrative Biology Unit (EIBU), Engineering Mechanics Unit (EMU), Geodynamics Unit (GDU), International Centre for Materials Science (ICMS), New Chemistry Unit (NCU), Neuroscience Unit (NSU), Theoretical Sciences Unit (TSU), and the School of Advanced Materials (SAMat).

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 2022–2023, JNCASR's academicians were granted 7 patents out of 12 filed; and collaborated extensively with government and industry for the cause of scientific advancement. The Centre's total number of patent grants currently stands at 126.

The Centre's commitment to scientific outreach was demonstrated further this year with 23 programmes that saw over 14,000 participants. Furthermore, 22 new projects with funding of over ₹2 crores have been added to the research repository of JNCASR in 2022–2023.

JNCASR's students and faculty members bagged a total of 58 prestigious awards, pointing to the Centre's research excellence and impactful contribution this year. Awards and recognition included the coveted International Research Donation by M-CM Network, the C. N. R. Rao Prize in Advanced Materials, and the Sun Pharma Science Foundation Research Award among others. The Centre also had the honour of one of its honorary faculty members, Prof. Ajay K. Sood, being appointed as the Principal Scientific Adviser to the Government of India. And 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 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 2022–2023, there were no cases pertaining to the Centre that appeared before the CAT.

YEAR AT A GLANCE

AWARDS AND ACHIEVEMENTS

24 Faculty Members

36 Students, Postdoctoral Fellows, and Alumnus

EVENTS

169 Lectures, Seminars, and Conferences

23 Outreach Programmes

SCIENCE OUTREACH PROGRAMMES CONDUCTED BY EDUCATION TECHNOLOGY UNIT

23 Programmes

14,980 Participants

1,358 Teachers

13,622 Students

PUBLICATIONS

307

FACULTY FELLOWSHIPS

5

PATENTS GRANTED

7

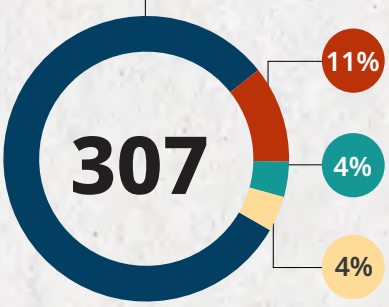
NEW ADMISSIONS

83

DEGREES AND DIPLOMAS AWARDED

77

FACULTY PUBLICATIONS



81% **249** Articles (papers, features, communication, comparative studies, and edge articles)

11% **33** Review articles

4% **12** Book chapters, communications, editorials, short surveys, and news & views

4% **13** Notes, conference papers, and letters

AVERAGE IMPACT FACTOR

6.81

YEAR AT A GLANCE

PROMOTIONS

PROFESSOR

- Prof. Sridhar Rajaram
- Prof. Ranjani Viswanatha
- Prof. Santosh Ansumali
- Prof. Sebastian C. Peter
- Prof. Kanishka Biswas

ASSOCIATE PROFESSOR

- Dr. Premkumar Senguttuvan

PATENT APPLICATIONS FILED

12

5 India | **7** PCT

PATENTS GRANTED

7

5 India | **2** Singapore

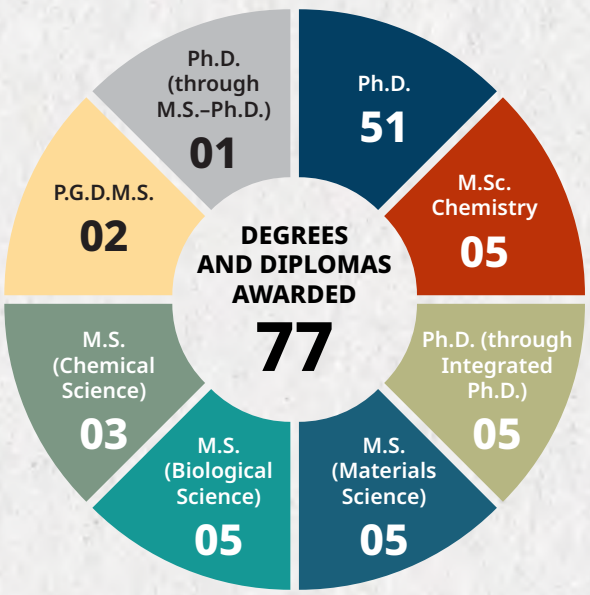
STUDENT STRENGTHS

331 Total Students

83 New Admissions

52 Ph.D.	**1** M.S. (Engineering)	**9** Integrated Ph.D. in Biological Science	**2** Integrated Ph.D. in Physical Science
6 Integrated Ph.D. in Chemical Science	**8** M.Sc. Chemistry	**5** P.G.D.M.S.	

DEGREES AND DIPLOMAS AWARDED



NEW SPONSORED PROJECTS

22

TOTAL GRANT RECEIVED FOR NEW PROJECTS

₹2.95 cr

AWARDS AND ACHIEVEMENTS

INSTITUTIONAL ACHIEVEMENTS

CENTRE FOR WORLD UNIVERSITY RANKING 2022–23, GLOBAL 2000 LIST JNCASR RANKS

in India

in the world

NATURE INDEX INSTITUTIONS TABLE 2022 JNCASR RANKS

among top 266 institutions in India across all sectors and subject areas

FACULTY ACHIEVEMENTS

AWARDS

Dr. Sarit S. Agasti
- Awarded the INSA Medal for Young Scientists 2022

Prof. Santosh Ansumali
- Received the most prestigious IIT Bombay International Award for Excellence in Research in Engineering & Technology on 5th September 2022, for his significant and impactful contributions to engineering and technology

Prof. T. Govindaraju
- Received the Sun Pharma Science Foundation Research Award 2022 under the category of 'Pharmaceutical Sciences'
- Received the National Technology Award 2023 (Translational Research) from DST-TDB, Govt of India
- Received the Bhagyatara Award 2022 from Punjab University

Prof. Jayanta Haldar
- Selected as the Guest Editor of a special issue of Royal Society of Chemistry's (RSC's) *Medicinal Chemistry* on antimicrobial resistance

Prof. Hiriyakkanavar Ila
- Featured in the book titled *"Vigyan Vidushi – 75 Women Trailblazers of Indian Science"* released by DST Vigyan Prasar

AWARDS AND ACHIEVEMENTS

Prof. G. U. Kulkarni
- Received the C. N. R. Rao Prize in Advanced Materials, which was presented during the MRSI AGM from 19th–23rd December 2022
- Honoured at the S. V. Narasaiah Memorial lecture at Hind High Vacuum
- Received the Chirantan Rasayan Sanstha Gold Medal

Prof. Tapas Kumar Kundu
- Selected for Sir M. Visvesvaraya Senior Scientist State Award for the year 2021 of Department of Electronics, IT, BT & S&T, Government of Karnataka, instituted by Karnataka State Council for Science & Technology
- Received the ICBS Global Lectureship Award 2022

Prof. Chandrabhas Narayana
- Received ISAS Raja Ramanna Award from Indian Society of Analytical Scientists

Prof. K. S. Narayan
- Received the Kaushal Kishore Memorial Lecture Prize 2023 from IPC, IISc

Prof. Sebastian C. Peter
- Received the prestigious J.C. Bose Diamond Jubilee Scientist Award 2022
- Received the National Award for Technology Start-Ups from the Technology Development Board, DST, for developing a pilot plant to convert CO_2 to methanol through the start-up he founded (M/s Breathe Applied Sciences Pvt. Ltd.)
- Received the National Prize 2021 for Research on Environmental Chemistry, including CO_2 Reduction and Green Hydrogen (instituted by the C. N. R. Rao Education Foundation) on 21st September 2022
- Received the Society for Materials Chemistry Bronze Medal 2022
- Competition Winner of MaterialNEXT 4.0 by TATA Steel

Bharat Ratna Prof. C. N. R. Rao
- Received the SMC Lifetime Achievement Award from Society for Materials Chemistry
- Received *Honoris Causa* from The Assam Royal Global University
- Received Lifetime Achievement Award from Chirantan Rasayan Sanstha

Dr. Achira Roy
- Received international research donation towards studying rare neurodevelopmental disorders from the M-CM Network, New York, USA in June 2022

Prof. Kaustuv Sanyal
- Received the Sun Pharma Science Foundation Research Award 2022 under the category of 'Medical Sciences-Basic Research'

Dr. Premkumar Senguttuvan
- Received the *Journal of Materials Chemistry A* Emerging Investigators 2023 Award

Dr. Pratap Vishnoi
- Received recognition as an Emerging Investigator 2022 by the Royal Society of Chemistry's *Journal of Materials Chemistry A*

FELLOWSHIPS

Prof. Raghvendra Gadagkar
- Elected as a Fellow of the American Academy of Sciences

AWARDS AND ACHIEVEMENTS

Prof. T. Govindaraju
- Elected as the Fellow of Indian Academy of Sciences 2023

Prof. Shobhana Narasimhan
- Elected as a Fellow of the American Physical Society

Prof. Chandrabhas Narayana
- Received Honorary Fellowship of the Indian Society of Analytical Scientists

Prof. Sebastian C. Peter
- Elected as a Fellow of the Royal Society of Chemistry
- Elected as a Fellow of International Association of Advanced Materials (F.I.A.A.M.)

Prof. Srikanth Sastry
- Elected as a Fellow of the American Physical Society

Prof. Ranga Udaykumar
- Received the INSA Fellowship from the Indian National Science Academy

MEMBERSHIPS

Dr. Kushagra Bansal
- Elected as Member of the American Association of Immunologists (AAI)

Prof. Kanishka Biswas
- Elected as Editorial Advisory Board Member of *Journal of Materiomics*, Elsevier
- Elected as Editorial Advisory Board Member, *Materials Lab*

Prof. T. Govindaraju
- Elected as Editorial Advisory Board member, *Journal of Peptide Science*, European Peptide Society and Wiley Publication

Prof. Maneesha S. Inamdar
- Appointed as Director of inStem, NCBS Bengaluru, w.e.f. 19th August 2022

Prof. Kavita Jain
- Appointed as Associate Editor, *Journal of Evolutionary Biology*

Prof. G. U. Kulkarni
- Appointed as Adjunct Faculty at Manipal Academy of Higher Education for 2 years

Prof. Tapas Kumar Kundu
- Appointed as Distinguished Visiting Professor in the Bioscience and Bioengineering department at IIT Bombay

Prof. K. S. Narayan
- Elected as Chair of Working Group16–Physics and Industry, IUPAP

Prof. Chandrabhas Narayana
- Elected as Life Member, Chemical Research Society of India

Dr. Premkumar Senguttuvan
- Elected as Member of JACS Au Early Career Advisory Board (ECAB) 2023

AWARDS AND ACHIEVEMENTS

Prof. Ajay K. Sood
- Appointed the SERB-National Research Chair
- Appointed as the Principal Scientific Adviser to the Government of India

Dr. Sheeba Vasu
- Elected as Member of Education Committee by the Society for Biological Rhythms Research
- Elected as Member of editorial board of *Journal of Biological Rhythms* by the Society for Biological Rhythms Research
- Elected as Vice-President of Indian Society for Chronobiology

Dr. T. N. C. Vidya
- Elected as Member of Board of Studies, Zoology at St. Joseph's University, Bengaluru

STUDENTS, POSTDOCTORAL FELLOWS, AND ALUMNUS

CHEMISTRY AND PHYSICS OF MATERIALS UNIT

Pragya Arora
- Received the Best Poster Prize at the Gordon Conference on Granular Matter at Stonehill College, Easton, Massachusetts, USA
- Invited speaker at the highly selective Rising Stars in Soft and Biological Matter Symposium, University of Chicago, USA

Rohit Attri
- Received the Best Poster Award at Bengaluru India Nano – 2022
- Received the Best Poster and Oral Presentation Award at 16th JNC Research Conference on Chemistry of Materials 2022

Rahul Kumar
- Received the ICDD Grant-in-Aid Award from International Centre for Diffraction Data

Shubhanshi Mishra
- Received the Oral Presentation Prize in Chemical Science at ChemSci2023: Leaders in the Field Symposium, held at JNCASR

Tejaswini S. Rao
- Received the Best Student Talk Prize at JNCASR's In-House Symposium (IHS) 2022

EVOLUTIONARY AND INTEGRATIVE BIOLOGY UNIT

Medha Rao
- Received the Best Poster Award at the 4th Conference of the Indian Society of Evolutionary Biologists (ISEB4), held at Ahmedabad University during 9th–11th February 2023

Anvitha S.
- Received an Animal Behaviour Society Student Research Grant for work on the *"Impact of Drought on the Social Structure of Female Asian Elephants in Nagarahole and Bandipur National Parks, southern India"* on 30th March 2023

AWARDS AND ACHIEVEMENTS

MOLECULAR BIOLOGY AND GENETICS UNIT

Prerana Muralidhar
- Received the Best Talk Award at JNCASR's In-House Symposium 2022

Vanshika Sood
- Received the Best Poster Award at JNCASR's In-House Symposium 2022

NEW CHEMISTRY UNIT

Anshulata
- Received the Best Poster Award at JNCASR's In-House Symposium 2022

Paribesh Achharyya
- Received Prof. C. N. R. Rao Medal (for the best Ph.D. thesis in Physical Science), JNCASR

Yash Acharya
- Invited for poster presentation at the Gordon Research Conference seminar on Staphylococcal Diseases 2023, New Hampshire, USA
- Awarded Oral Presentation Prize at ChemSci2023: Leaders in the Field Symposium at JNCASR

Debabrata Bagchi
- Received Best Oral Presentation Award from the Royal Society of Chemistry

Arjun Cherevotan
- Selected for the International Climate Protection Fellowship by Humboldt Foundation

Animesh Das
- Received the Smt. and Sri. Bapu Narayanaswamy Prize (for the best M.S. thesis in Chemical and Materials Science), JNCASR

Paramesh Das
- Received the Best Poster Award at Indian Peptide Symposium (IPS-2023) at BITS Pilani, Goa

Risov Das
- Received the Best Thesis Award at KPIT, Pune

Subham Das
- Received the Best Poster Award at International Conference on Advanced Materials (ICAM 2023) held at Goa University

Darshana Deb
- Received the Best Poster Award from CSIR-NIIST

Geetika Dhanda
- Invited for oral presentation at the American Chemical Society Spring 2022 Meeting
- Invited for poster presentation at the Gordon Research Conference seminar on New Antibacterial Discovery and Development, 2022
- Invited for talk at the Gordon Research Conference seminar on New Antibacterial Discovery and Development, 2022

Anupama Ghata
- Received Dr. Indumati Rao Prize (for securing highest CGPA in the two-year M.Sc. in Chemistry), JNCASR

AWARDS AND ACHIEVEMENTS

Dr. Sreyan Ghosh
- Invited for Oral Presentation at the American Chemical Society Spring 2022 Meeting

Prasenjit Mandal
- Received the Best Poster Award at Perovskite Society of India Meet (PSIM-2023) held at IIT Roorkee

Sudip Mukherjee
- Selected for poster presentation at ACS Publications Symposium on Biological and Medicinal Chemistry 2023, Bonn, Germany

Suryapravo Mookerjee
- Received the Best Poster Teaser Prize at the In-House Symposium 2022, JNCASR

Dikshaa Padhi
- Received the SASTRA-Saroj Chandrasekhar Memorial Award on National Science Day on 28th February 2023

Satyajit Patra
- Received the Best Poster Award from Chemical Research Society of India

Dipanjana Patra
- Awarded the Best Poster Teaser Prize at the In-House Symposium 2022, JNCASR
- Invited for poster presentation at SMS 2022 International Conference, Athens, Greece

Biswajit Sahariah
- Received the Best Poster Award at National Conference on New Vistas in Chemistry, 2022, Bangalore University

Ashutosh Kumar Singh
- Received the Best Poster Teaser Award at JNCASR at the In-House Symposium and Faculty Meeting

NEUROSCIENCE UNIT

Rutvij Kaustubh Kulkarni
- Received Grants in Aid of Research (GIAR) – 2022 from Sigma Xi Society

Dr. Abhilash Lakshman
- Received Indian National Science Academy (INSA) Medal for Young Scientist 2022

Mansi Rathi
- Awarded the Best Poster Prize at the Indian Neurobehavior Conference 2022, held at Manipal Academy of Higher Education (MAHE) for her poster on "Exploring the ontogeny of adult social traits in *Drosophila melanogaster*"

Pragya Sharma
- Chosen for the Global Diversity Award 2022 from Society for Research on Biological Rhythms

THEORETICAL SCIENCES UNIT

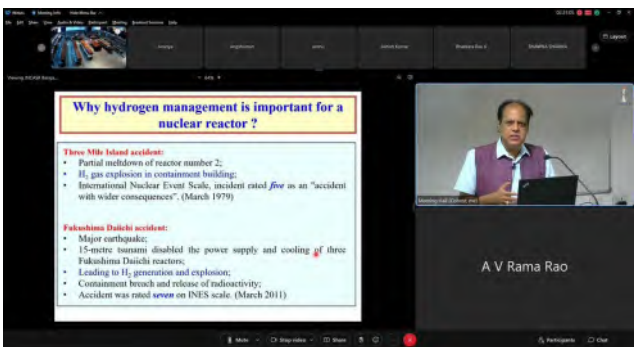
Raagya Arora
- Received the Ovshinsky Travel Award from the American Physical Society

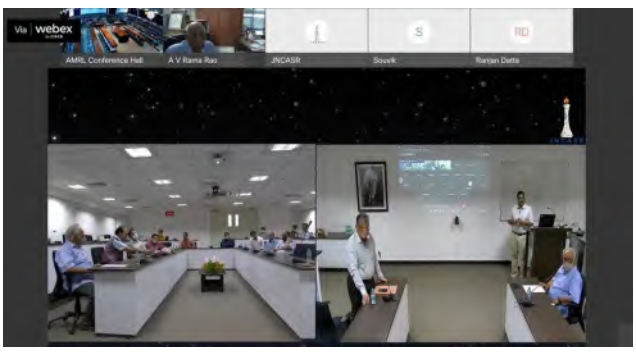
Himanshu Joshi Lakshman
- Story selected among the top 100 in AWSAR Competition 2022

MAJOR EVENTS AND CELEBRATIONS

ENDOWMENT LECTURES

A. V. RAMA RAO FOUNDATION LECTURE IN CHEMISTRY 2022





The A. V. Rama Rao Foundation Lecture in Chemistry 2022 was organised on 27th April 2022. The speaker of this lecture was Prof. A. K. Tyagi, Associate Director, Chemistry Group, Sr. Professor, Homi Bhabha

MAJOR EVENTS AND CELEBRATIONS

National Institute BARC, Mumbai, and the title of this talk was *"Transforming Research into Technologies: Self-reliance in Nuclear Sector"*. In addition, the prize lecture, titled *"Nanozymes for Biomedical Applications"*, was delivered by Prof. G. Mugesh from the Department of Inorganic and Physical Chemistry, Indian Institute of Science (IISc), Bengaluru.

C. N. R. RAO ORATION AWARD LECTURE 2022

The C. N. R. Rao Oration Award Lecture 2022 was organised on 16th August 2022, and the lecture was delivered by Prof. Santosh Ansumali from Engineering Mechanics Unit (EMU). Title of his lecture was *"Drik Ganita: Towards realistic simulation of Complex Systems"*.

DAE-RAJA RAMANNA LECTURE IN PHYSICS 2022

The DAE Raja Ramanna Lecture in Physics 2022 and the prize lecture were organised on 22nd September 2022 at JNCASR. The speaker of the main lecture was Prof. Amlan J. Pal, Director of the UGC-DAE Consortium for Scientific Research, Indore, and JC Bose National Fellow at the School of Physical Sciences, Indian Association for the Cultivation of Science, Kolkata, who spoke about *"Derivation of Band-Edges in Semiconductors and their Importance towards Optoelectronic Devices"*. The speaker of the prize lecture was Prof. Navkanta Bhat, Dean, Division of Interdisciplinary Sciences, Professor, Centre for Nano Science and Engineering (CeNSE), IISc, Bengaluru who spoke about *"Sensor Scaling for Intelligent and Smart Nanoelectronics"*.

INAUGURATIONS AND CELEBRATIONS

INTERNATIONAL YOGA DAY CELEBRATIONS

MAJOR EVENTS AND CELEBRATIONS

A series of events were organised in lieu of the International Yoga Day, which was celebrated at JNCASR with great enthusiasm. The first event was organised on 27th April 2022 with enthusiastic participation of employees, students, and researchers. Yoga Guru Sri Prasanna V. Raju gave an inspiring lecture on mental health and time management, while his students provided a demo of asanas.

Another lecture, titled *"Aging with wellness"*, by Yoga Guru Sri Prasanna V. Raju, was organised on 6th May 2022.

On 20th June 2022, a yoga competition was organised for three categories – Students/Postdoctoral Fellows/ R&D Staff, faculty members, and other staff. The competition was judged by Yoga Guru Bramarambha Patil. Top three performers from each category were given a token of appreciation.

On 21st June 2022, a lecture and yoga demonstration were performed by the team of volunteers and students led by Yoga Guru Sri Prasanna V. Raju at 7:30 AM at the Centre.

76TH INDEPENDENCE DAY CELEBRATIONS

With the hoisting of the national flag, the JNCASR community celebrated the 76th Independence Day in large numbers and made the "Azadi ka Amrit Mahotsav" celebration eventful at the Centre. Several events were organised by JNCASR Administration to mark the Azadi ka Amrit Mahotsav.

As a part of the "Har Ghar Tiranga" campaign under the aegis of Azadi Ka Amrit Mahotsav, the Centre hoisted the national flag at all the gates of its main campus and also on its other campuses and on a few prominent buildings from 13th to 15th August 2022 to mark 75 years of India's independence. Also, more than 150 flags were distributed to encourage hoisting of the national flag across residences. The main entrance and select buildings were decorated with tricolour lights.

- The sports committee organised a 5 km Freedom Run on 14th August 2022 in which more than 160 students, faculty, and staff members participated.
- An online essay competition on the theme *"Role & responsibilities of Science & Technology in nation building"* was organised.

On 15th August 2022, Prof. G. U. Kulkarni, President, JNCASR unfurled the national flag at the Centre in the presence of officials, students, and family members. It was followed by a speech by Prof. N. S. Vidhyadhiraja, Dean, Fellowships and Extension Programmes. The winners of the online essay competition and Freedom Run were felicitated during the occasion. It was followed by an enthralling performance of patriotic songs by students of the JNCASR Cultural Group.

MAJOR EVENTS AND CELEBRATIONS

INAUGURATION OF THE MAZUMDAR-SHAW LABORATORY FOR FRONTIER BIOLOGY

On 5th May 2022, the Mazumdar-Shaw Laboratory for Frontier Biology at JNCASR was inaugurated by Dr. Kiran Mazumdar-Shaw, Founder and Chairperson of Biocon, in the august presence of Bharat Ratna Prof. C. N. R. Rao, F.R.S., and Prof. G. U. Kulkarni, F.N.A., President, JNCASR. The inauguration programme was attended by the deans, faculty members, and officers of JNCASR along with employees of Biocon, and the team of architects.

The Laboratory aims at promoting research in newer areas of biology like synthetic biology, systems biology, nanobiotechnology, and biomaterials. The event was livestreamed on YouTube: https://youtu.be/Q9qW-VlJ81c

SPECIAL CAMPAIGN 2.0 FOR SWACHHATA AND DISPOSAL OF PENDING MATTERS

As part of the Special Campaign 2.0 for Swachhata and disposal of pending matters during 2nd to 31st October 2022 initiated by the Government of India, a series of rigorous cleanliness activities were undertaken. This included disposal of scrap/obsolete materials, leading to overall improved space management in offices at JNCASR.

MAJOR EVENTS AND CELEBRATIONS

RASHTRIYA EKTA DIWAS

On 31st October 2022, Rashtriya Ekta Diwas 2022 was observed at JNCASR to commemorate the birth anniversary of Sardar Vallabh Bhai Patel. Our officials paid homage to the Iron Man of India and participated in Rashtriya Ekta Diwas Pledge, which was administered by Joydeep Deb, Administrative Officer, JNCASR.

SWACHHTA PLEDGE

On 31st October 2022, Swachhta Pledge was administered JNCASR by Prof. N. S. Vidhyadhiraja, Dean, Fellowships and Extension Programmes in the presence of officials.

VIGILANCE AWARENESS WEEK

The Vigilance Awareness Week 2022 was observed at JNCASR with the Integrity Pledge on 31st October 2022. The pledge was administered by Vigilance Officer Prof. Kaustuv Sanyal in the presence of officials.

MAJOR EVENTS AND CELEBRATIONS

ANNUAL FACULTY MEETING, IN-HOUSE SYMPOSIUM, AND DEGREE AWARD CEREMONY

JNCASR has had a long tradition of celebrating the scientific research carried out in the Centre by organising an Annual Faculty Meeting (AFM) and In-House Symposium (IHS). The AFM and IHS this year was held on the 17th and 18th November 2022. The programme comprised talks by faculty members and students as well as poster teasers and presentations by students, postdocs, and R&D assistants.

Address of Prof. G. U. Kulkarni, President, JNCASR (left) and Prof. Umesh V. Waghmare, Dean Faculty Affairs (right) at the Annual Faculty Meeting on 17th November 2022.

Talks and Q&A sessions during the In-house Symposium on 17th and 18th November 2022.

Poster teasers and presentation session on 17th November 2022.

MAJOR EVENTS AND CELEBRATIONS

Prof. G. U. Kulkarni, President, JNCASR distributed degree certificates to the outgoing students during the annual Degree Award Ceremony on 18th November 2022.

CONSTITUTION DAY

Constitution Day (Samvidhan Diwas) was observed on 26th November 2022 at JNCASR to commemorate the day of adoption of the Constitution of India. As a part of the celebrations, reading of the Preamble to the Constitution of India was administered by Prof. N. S. Vidhyadhiraja, Dean, Fellowships and Extension Programmes, followed by a talk on *"The constitutional values and the fundamentals of the Constitution"*. This event was attended by faculty members, officers, staff, and students of the Centre.

An online essay competition on the theme *"Constitutional values & Fundamentals of the Indian Constitution"* was also conducted to mark this occasion. Large number of entries were received from all categories of employees and students and cash prizes were given to the winners.

BHARATIYA BHASHA UTSAV

As a part of the celebrations, the Centre organised the following:

1. A multilingual display/exhibition of books was organised at the Centre's Library, in which multilingual books published by the Centre on science popularisation, particularly for the school children, were kept on display.
2. The community members were requested/ encouraged to wear their ethnic dress on Sunday, 11th December 2022.
3. The community members were also requested to post a short writeup, not exceeding three lines on *"My Language My Signature"*.

MAJOR EVENTS AND CELEBRATIONS

74TH REPUBLIC DAY

The 74th Republic Day was celebrated at JNCASR with great pomp and éclat. Prof. G. U. Kulkarni, President, JNCASR unfurled the national flag, and a group of students sang the national anthem. More than 700 individuals participated, including faculty members, officers, students, and regular and contract staff.

ANNUAL MINI-MARATHON

JNCASR's Annual Mini-Marathon, a 5 km run was organised to celebrate International Women's Day on 5th March 2023.

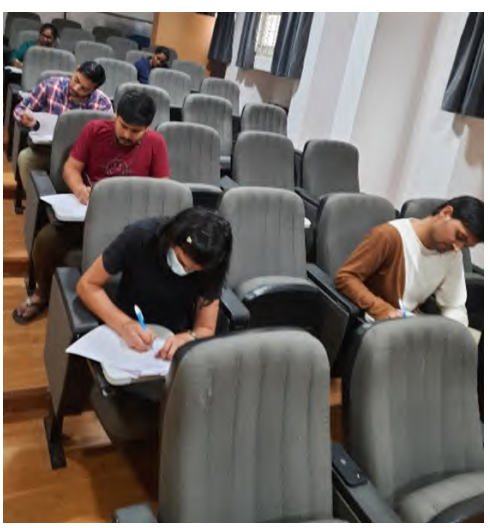
NATIONAL SCIENCE DAY 2023

National Science Day 2023 was organised at JNCASR on 28th February 2023, with the enthusiastic participation of Centre's researchers in addition to 130 school students and teachers from several schools in Bengaluru.

MAJOR EVENTS AND CELEBRATIONS

EVENT ORGANISED BY HINDI CELL

HINDI PAKHWADA CELEBRATION



Hindi Pakhwada Celebration was organised at JNCASR from 14th to 30th September 2022, and began with the circulation of Hon'ble Home Minister's Hindi Fortnight message on Hindi Diwas (14th September). Several events were organised to motivate employees to use Hindi for communication such as Hindi news reading, Hindi essay writing, and Hindi Shabd Gyan competitions, a lecture on official language policy, and OLIC meeting. A special talk on *"Policies on Official Language Implementation and how to work in Hindi smoothly"* was also delivered by Srinivas Rao, Asst. Manager (OL), BEL.

MAJOR EVENTS AND CELEBRATIONS

KEY EVENTS

VISIT OF MAX PLANCK SOCIETY AND GERMAN RESEARCH FOUNDATION DELEGATION

A delegation from the Max Planck Society (MPG) (four MPI directors and scouting officers) and the German Research Foundation (DFG) visited the centre on 13th March 2023. The purpose of the delegation was to meet partner groups, scout new partner groups, and collaborate. This meeting was chaired by Prof. G. U. Kulkarni, President JNCASR, who also presented an introductory remark. Presentations on overview of JNCASR, MPG, and DFG were made, followed by scientific presentations from MPG delegates and discussions.

REVIEW MEETING OF PARLIAMENTARY COMMITTEE ON OFFICIAL LANGUAGE

The Second Sub-Committee of the Committee of Parliament on Official Language interacted with officials of JNCASR and DST in Bengaluru on 26th August 2022 to review the implementation of the official language at the Centre.

MAJOR EVENTS AND CELEBRATIONS

ORGANISATION OF MEDICAL CAMPS

Dhanvantari, the JNCASR Health Centre, organised a series of Medical Camps from 16th to 19th January 2023 for diabetes, bone marrow density, and gynaecology-related screening. Faculty, students, staff, and their family members enthusiastically participated in these screening processes and utilised the facility.

PARTICIPATION IN SCIENCE EXHIBITIONS

Our research and various other activities were showcased in a series of exhibitions held in January. The Centre's exhibition stall was set up at the following exhibitions:

108TH INDIAN SCIENCE CONGRESS

Several dignitaries, students, and scientists visited our stall at 108th Indian Science Congress held from 3rd to 7th January 2023 at Rashtrasant Tukdoji Maharaj Nagpur University, Nagpur, Maharashtra.

NATIONAL YOUTH FESTIVAL AT DHARWAD, KARNATAKA

MAJOR EVENTS AND CELEBRATIONS

With the inauguration of our exhibition stall at the National Youth Festival 2023 by the Governor of Karnataka, several students and early career researchers visited our stall at the youth festival to know about our scientific and academic activities and achievements. The exhibition was held from 12th to 16th January 2023 at Hubli-Dharwad, Karnataka.

MEGA SCIENCE & TECHNOLOGY EXHIBITION AT INDIA INTERNATIONAL SCIENCE FESTIVAL 2022 DURING 21ST–24TH JANUARY 2023, MANIT, BHOPAL

Our exhibition stall at India International Science Festival (IISF) 2022 was visited by several dignitaries and students, including Dr. Srivari Chandrasekhar, Secretary, DST, and many others. We showcased our scientific activities and achievements at the exhibition.

INSTITUTIONAL AWARDS

JNCASR AWARDS OUTSTANDING SCIENCE TEACHER PRIZE FOR THE YEARS 2020 AND 2021

JNCASR has awarded Outstanding Science Teacher Prize instituted by the C. N. R. Rao Education Foundation, for the year 2020 and 2021 to the following awardees on 30th June 2022: M. Bheemappa from Govt. Girls High School, Maski Raichur District and Dr. Ravi Prakash Sharma from Vishnu Inter College, Bareilly, UP for 2020 and to Vidyadhar N. Yatagiri from Govt. High School Peerapur Tq. Muddebihal, Dist. Vijayapur for 2021.

MAJOR EVENTS AND CELEBRATIONS

NATIONAL PRIZES FOR RESEARCH IN ENVIRONMENTAL CHEMISTRY, INCLUDING CO_2 REDUCTION AND GREEN HYDROGEN AWARD LECTURES

The National Prizes for Research in Environmental Chemistry, including CO_2 reduction and Green Hydrogen Award 2021 were presented to Dr. Vivek Polshettiwar from TIFR Mumbai and Dr. Sebastian C. Peter from JNCASR on 21st September 2022 at a lecture programme held at JNCASR. On this occasion, Dr. Polshettiwar gave a lecture on *"Storing Sun Energy into Carbon Dioxide using Green Hydrogen"* and Dr. Sebastian C. Peter delivered a talk on *"Carbon and Water Recycling for Sustainable Energy: From Fundamental Chemistry to Green Technologies"*.

LECTURES, COLLOQUIA, AND WORKSHOPS

SCREENING OF THE LECTURE ON DEMOCRACY

The D. P. Kohli Memorial Lecture was screened at JNCASR on 1st April 2022. This lecture was organised by the Central Bureau of Investigation (CBI) and the speaker was the Hon'ble Justice N. V. Ramana. The title of this talk was *"Democracy: Role and Responsibilities of Investigative Agencies"*. This lecture was attended by faculty members, students, and various employees of the Centre.

LECTURE ON WORLD ENVIRONMENT DAY

As a part of the World Environment Day celebration, a special talk was organised at JNCASR titled *"Climate Change and Extremes over the Himalayas"* which was delivered by Prof. A. P. Dimri, Director, Indian Institute of Geomagnetism, Mumbai on 6th June 2022. The in-person lecture was also livestreamed on the YouTube channel of the Centre: https://youtu.be/A2rH29FaWvk

MAJOR EVENTS AND CELEBRATIONS

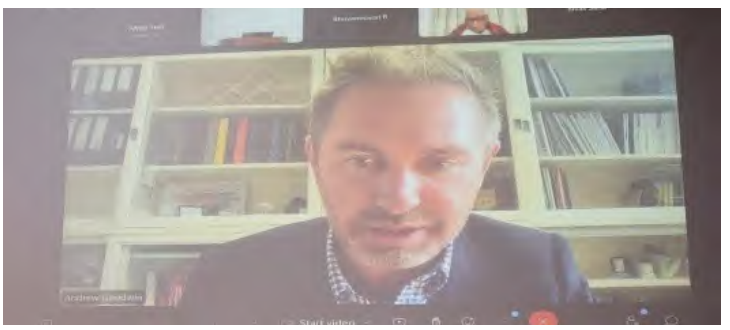
COLLOQUIUM LECTURE

A Colloquium by Prof. William A. Goddard III from California Institute of Technology, USA was organised by JNCASR on 13th October 2022. The title of his talk was *"Applications of theory and computation to batteries, to fuel cells, and to electrocatalytic CO_2 reduction, water splitting, and N_2 reduction"*.

GENOMICS WORKSHOP LECTURE

A genomics-based hands-on workshop on RNA-seq and ChIP-seq data analysis was organised by JNCASR in partnership with Clevergene Biocorp Pvt. Ltd. on 13th and 14th October 2022.

ANNUAL CHEMISTRY LECTURE



The Tenth Annual Chemistry Lecture was organised by New Chemistry Unit (NCU), JNCASR on 18th October 2022. The speaker of this lecture was Prof. Andrew Goodwin from University of Oxford, UK and the title of his talk was *"Disorder by Design"*.

12TH SHEIKH SAQR MATERIALS LECTURE

The 12th Sheikh Saqr Materials Lecture was organised by the International Centre for Materials Science (ICMS) on 6th December 2022 at JNCASR. The lecture was delivered by Prof. Bettina V. Lotsch from Max Planck Institute for Solid State Research, Stuttgart, Germany, who discussed *"Tackling the COF Trilemma: Design, Defects, and Disorder"*.

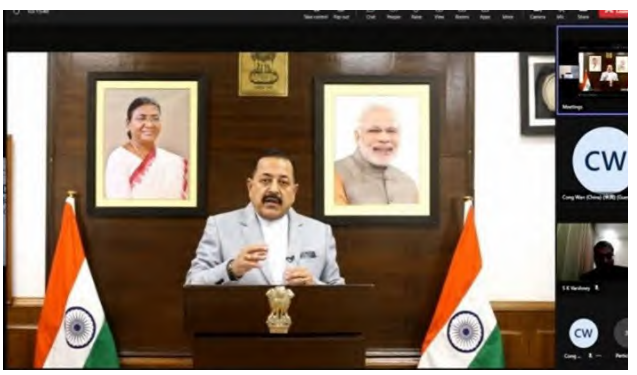
MAJOR EVENTS AND CELEBRATIONS

LEADERS IN THE FIELD SYMPOSIUM, CHEMSCI2023

The fourth edition of the Leaders in the Field Symposium, ChemSci2023 was organised by the JNCASR in association with the Royal Society of Chemistry (RSC) *Chemical Science* journal from 23rd to 25th January 2023. This in-person meeting at our campus aimed at providing a forum to the rapidly growing chemistry community in India, especially to the young and early career researchers. The 20 talks scheduled in this event included talks by the Associate Editors—Prof. Serena DeBeer and Prof. Steve Goldup and Executive Editor, Dr. May Copsey of *Chemical Science* journal.

2ND SCO YOUNG SCIENTIST CONCLAVE

This was organised by Department of Science and Technology, Government of India and hosted by JNCASR from 6th to 10th February 2023. This five-day event was inaugurated by Dr. Jitendra Singh, Hon'ble Minister of State (Independent Charge) for Science and Technology and Earth Sciences, Government of India on 6th February. Over 70 scientists participated from six SCO member states including India, Russia, Kazakhstan, Uzbekistan, China, and Tajikistan. They shared their current research on five thematic areas encompassing agriculture and food processing, artificial intelligence and big data processing, sustainable energy and energy storage, disease biology and healthcare, and environmental protection and natural resource management. In the valedictory session of the conclave, Dr. S. Chandrasekhar, Secretary, DST presented his valedictory address.



BIO-IMAGING WORKSHOP

This workshop was held from 6th to 8th February 2023. Imaging Facility at Molecular Biology and Genetics Unit/Neuroscience Unit (MBGU/NSU) organised this a three-day workshop which was supported by Zeiss, Evident/Olympus, Biotron Healthcare India, and Bitplane Imaris. The talks at this workshop focused on the basics of confocal, super resolution, multiphoton, and high content imaging and their applications. Hands-on demo was provided to the participants on image analysis using software Cell Path Finder, Zeiss Arivis, and Bitplane Imaris.

MAJOR EVENTS AND CELEBRATIONS

JNCASR SPECIAL COLLOQUIUM

Prof. Ravindra N. Bhatt (ECE, Princeton University, USA & Theoretical Physics, TIFR, Mumbai) presented a talk on *"The fascinating saga of composite fermion fermi surfaces"* on 17th February 2023.

SPECIAL LECTURE

Prof. Erick Carreira (ETH Zurich, Switzerland & Editor-in-Chief, *JACS*) presented a talk on *"Strategies and tactics in natural products as an engine for discovery"* on 20th February 2023.

DARWIN LECTURE

Prof. Vassiliki Betty Smocovitis (Departments of Biology and History University of Florida) presented the Darwin lecture on *"From Synthesis to Integration: G. Ledyard Stebbins, Developmental Genetics and the Path to an Integrative Biology (1959–1973)"* on 27th February 2023.

OTHER CONFERENCES, LECTURES, AND WORKSHOPS

- A workshop was held on *"Semiconductor Nanostructures and Applications"* in Nevill Mott hall towards the felicitation of Prof. S. M. Shivaprasad on 24th June 2022.
- The talk *"Self-assembly of Non-planar Scaffolds: Unraveling the Mutual Monomer Orientation in Supramolecular Polymers"* was delivered by Prof. Luis Sanchez, Universidad Complutense de Madrid on 29th July 2022.
- A conference on *"Current Directions in Statistical Physics"* was organised by Prof. Subir Kumar Das, JNCASR from 5th to 6th August 2022.
- The talk *"Role of histone acetylations in genome reregulate"* was given by Dr. Pradeepa Madapura, Blizard Institute, Queen Mary University of London on 22nd August 2022.
- The SAMat talk on *"Trap States in Semiconductor Quantum Dots: Friend or Foe"* by Prof. K. George Thomas, IISER Thiruvananthapuram, was organised on 16th September 2022.
- The EMBO conference on *"Molecular and physiological basis of behavioural/cognitive defects in neurodevelopmental disorders"* was organised by Dr. James P. C. Chelliah, JNCASR, from 31st October to 3rd November 2022.

In the year 2022–2023, the various units at JNCASR conducted 140+ events, some of which are highlighted below.

NEW CHEMISTRY UNIT

- Prof. Shiroh Futaki from Institute for Chemical Research, Kyoto University, Japan, presented a talk on *"Attenuated cationic lytic peptides for intracellular delivery"* on 20th February 2023.
- The NCU Tutorial Lecture titled *"Single-Molecule Spectroscopy"* by Prof. Jürgen Köhler, University of Bayreuth, Germany was organised on 30th September 2022.

MAJOR EVENTS AND CELEBRATIONS

NEUROSCIENCE UNIT

- Dr. Anindya Ganguly, University of California, USA presented a talk on *"To eat or not to eat: perspective from a fruit fly"* on 20th February 2023.
- Dr. Debanjan Dasgupta, Department of Neuroscience, University College London, UK presented a talk on *"Perception and encoding odour temporal dynamics in the mouse olfactory bulb"* on 21st February 2023.
- Dr. Achira Roy, DBT Ramalingaswamy Fellow at JNCASR presented a talk on *"Modelling a spectrum of early-onset human neurodevelopmental disorders – timing, mechanisms and potential therapies"* on 23rd February 2023.
- Dr. Sudeshna Das Chakraborty, Postdoctoral Fellow, European Neuroscience Institute, Göttingen, Germany presented a talk on *"Neuronal circuit mechanism underlying decision making: insights from fruit flies"* on 6th March 2023.
- Dr. Latika Nagpal, Research Associate, Howard Hughes Medical Institute, Chevy Chase, Maryland, U.S. presented a talk on *"Elucidating Redox Mechanisms Governing Neurodegenerative Diseases"* on 9th March 2023.
- Dr. Gaurav Das from National Centre for Cell Sciences (NCCS), Pune presented a talk on *"The food fly: neural circuits of feeding and emesis in Drosophila"* on 23rd March 2023.

MOLECULAR BIOLOGY AND GENETICS UNIT

- Prof. Douglas C. Wallace, Professor, Department of Pathology and Laboratory Medicine, University of Pennsylvania, USA, presented a talk on *"Mitochondrial Medicine in the Pandemic Era"* on 17th March 2023.

ACTIVITIES CHART

EDUCATION

Academic programmes

- Ph.D.
- Int. Ph.D.
- M.S.-Ph.D.
- M.S. (Research)
- M.S. (Engineering)
- M.Sc. Chemistry
- M.Sc. in Interdisciplinary Biosciences
- Post Graduate Diploma in Materials Science (P.G.D.M.S.)

LECTURES, OUTREACH, AND UNIT EVENTS

- 21 major lectures and conferences held during 2022–2023
- 23 outreach programmes organised by the Education Technology Unit during 2022–2023
- 140+ events organised by the various research units during 2022–2023

PUBLICATION OF MONOGRAPHS AND PROCEEDINGS

RESEARCH

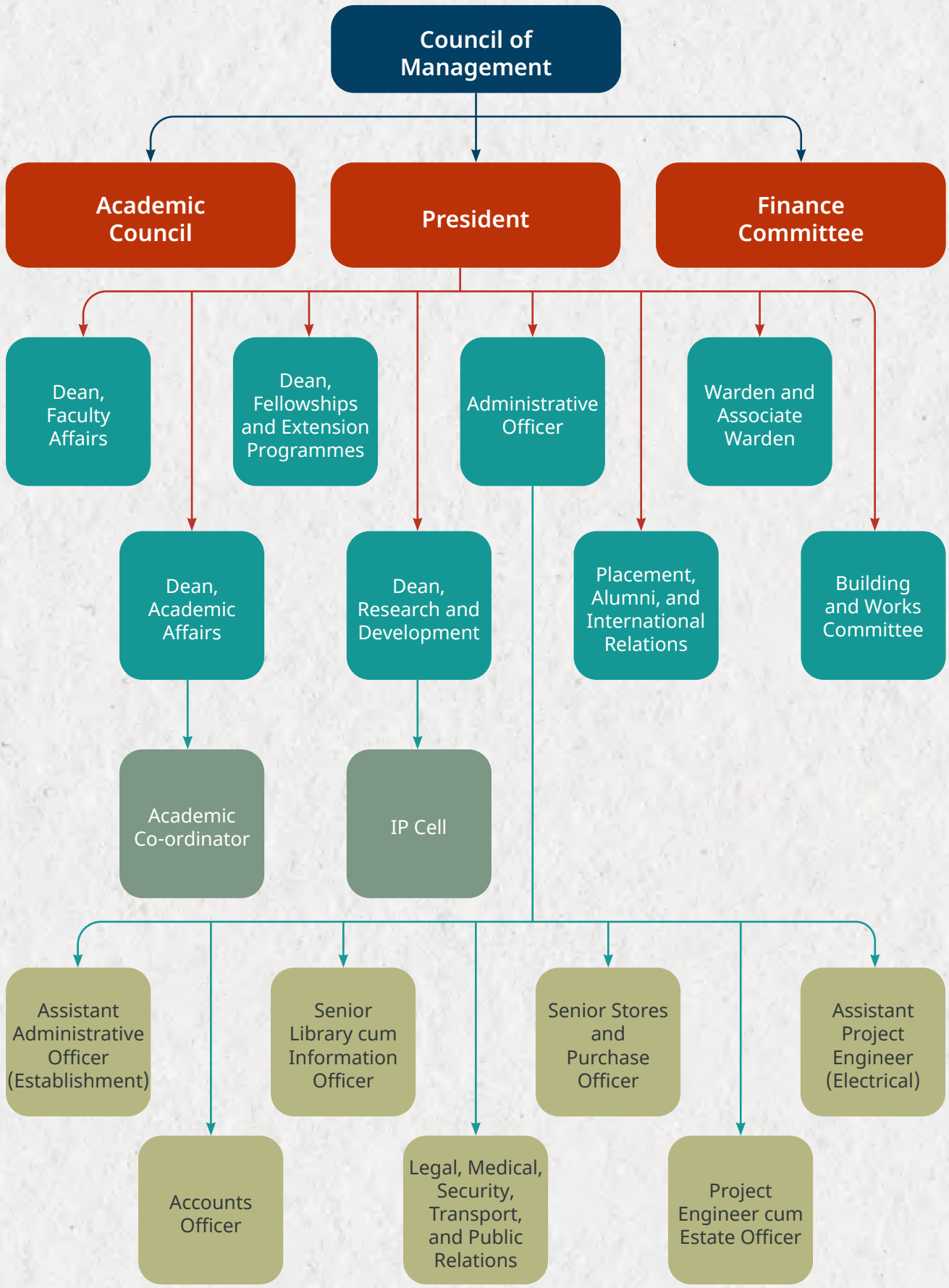
- Faculty members
- Units and laboratories

EXTENSION PROGRAMMES

Fellowships and extension programmes

- Graduate Research Internship Programme (GRIP)
- Summer Research Fellowship Programme (SRFP)
- Project Oriented Chemistry Education (POCE)
- Project Oriented Biology Education (POBE)
- Short/Long-Term Visiting Faculty Programme (LVFP)
- Short/Long-Term Visiting Student Programme (LVSP)
- Institutional Visits Programme (IVP)
- Student Buddy Programme (SBP)

ORGANISATIONAL CHART



COUNCIL OF MANAGEMENT

The Council of Management is involved with the administration and management of affairs and finances at JNCASR.

The members of Council of Management (2022–2026) 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

Dr. Srivari Chandrasekhar
Member (Ex-officio)
Secretary, DST

Vishvajit Sahay
Member (Ex-officio)
Additional Secretary and Financial Adviser, DST

Prof. M. Jagadesh Kumar
Member (UGC Nominee)
Chairman, UGC

Prof. Vinod K. Singh
Member (DST Nominee)
IIT, Kanpur

Prof. K. N. Ganesh
Member (DST Nominee)
Director, Indian Institutes of Science Education and Research (IISER), Tirupati

Prof. R. Murugavel
Member (UGC Nominee)
IIT, Mumbai

Prof. Raghavan Varadarajan
Member (IISc Nominee)
Professor, MBU, IISc

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

Prof. Umesh V. Waghmare
Member (Ex-officio)
Dean, Faculty Affairs, JNCASR

Prof. Eswaramoorthy M.
Member (Ex-officio)
Dean, Academic Affairs, JNCASR

Prof. Shobhana Narasimhan
Member
(Centre Nominee)
Professor, TSU, JNCASR

Joydeep Deb
Non-Member Secretary (Ex-officio)
Administrative Officer, JNCASR

COMMITTEES

FINANCE COMMITTEE

The Centre's Finance Committee examines financial proposals and provides recommendations to the Council of Management.

The members of the Finance Committee (2022–2026) are:

NAME AND DESIGNATION	POSITION
Prof. G. U. Kulkarni, President, JNCASR	**Chairperson (Ex-officio)**
Prof. K. N. Ganesh, Director, IISER, Tirupati	**Member**
Vishvajit Sahay, Additional Secretary and Financial Adviser, 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

The Academic Council is responsible for regulating course curriculums, admission procedures, examinations, etc. The main tasks of the Academic Council include planning, execution, and coordination of research and academic activities held at the Centre. The members meet at least twice a year to give their recommendations on all academic issues to the Council of Management.

The members of the Academic Council (June 2021–May 2023) are:

NAME AND DESIGNATION	POSITION
Prof. G. U. Kulkarni, President, JNCASR	**Member (Ex-officio)**
Prof. N. Ravishankar, IISc	**Member**
Prof. Ashok K. Ganguli, IIT, Delhi	**Member**
Prof. Anand K. Bachhawat, IISER, Mohali	**Member**
Prof. Vijay Chandru, Distinguished Technologist, IISc	**Member**
Prof. P. Seshu, IIT, Mumbai	**Member**
Prof. Leena Chandran Wadia, Professor & Head, VEC, TDU Vocational Education Programmes, Bengaluru	**Member**
Prof. Umesh V. Waghmare, Dean, Faculty Affairs, JNCASR	**Member (Ex- officio)**
Prof. Eswaramoorthy Muthusamy, Dean, Academic Affairs, JNCASR	**Member (Ex-officio)**
Prof. Sreenivas K. R., Dean, Research and Development, JNCASR	**Member (Ex-officio)**
Prof. N. S. Vidhyadhiraja, Dean, Fellowships and Extension Programmes, JNCASR	**Member (Ex-officio)**
Prof. T. Govindaraju, Chair, Education Technology Unit, JNCASR	**Member (Ex-officio)**
Prof. Shobhana Narasimhan, Faculty In-charge: Placement, Alumni & International Relations, JNCASR	**Member (Ex-officio)**

COMMITTEES

NAME AND DESIGNATION	POSITION
Prof. Ranjan Datta, Coordinator, Int. Ph.D. – Physical Science Programme, JNCASR	**Member (Ex-officio)**
Dr. Sheeba Vasu, Coordinator, Int. Ph.D. – Biological Science Programme, JNCASR	**Member (Ex-officio)**
Prof. Sebastian C. Peter, Coordinator, Int. Ph.D. – Chemical Science Programme, JNCASR	**Member (Ex-officio)**
Prof. Jayanta Haldar, Coordinator, M.Sc. – Chemical Science, JNCASR	**Member (Ex-officio)**
Joydeep Deb, Administrative Officer, JNCASR	**Member Secretary (Ex-officio)**
Dr. Princy P. Pereira, Academic Coordinator, JNCASR	**Controller of Examination (Ex-officio)**

The members of the General Body (Society) (2022–2026) are:

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, Director, IISER, Tirupati	**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**
Dr. Srivari Chandrasekhar, Secretary, DST	**Member**
Vishvajit Sahay, Additional Secretary and Financial Adviser, DST	**Member**
Prof. G. U. Kulkarni, President, JNCASR	**Member**
Prof. Raghavan Varadarajan, IISc	**Member**
Prof. Umesh V. Waghmare, Dean, Faculty Affairs, JNCASR	**Member**
Prof. Eswaramoorthy Muthusamy, Dean Academic Affairs, JNCASR	**Member**
Prof. Shobhana Narasimhan, Professor, Theoretical Sciences Unit, JNCASR	**Member**
Joydeep Deb, Administrative Officer, JNCASR	**Non-Member Secretary**

COMMITTEES

HONORARY PROFESSORS

Honorary Professors are invited at the Centre to conduct guest lectures and to guide students in their academics and research.

Honorary Professors for the period of 2021–2023 are:

NAME	ALTERNATIVE AFFILIATION
Prof. Gagandeep Kang, F.R.S.	**Professor of Microbiology, The Wellcome Trust Research Laboratory, Division of Gastrointestinal Sciences, Christian Medical College, Vellore**
Prof. T. V. Ramakrishnan, F.R.S.	**Emeritus Professor, Department of Physics Banaras Hindu University, Varanasi**
Prof. D. D. Sarma	**Honorary Professor, Solid State and Structural Chemistry Department, Indian Institute of Science (IISc), Bengaluru**
Prof. A. K. Sood, F.R.S.	**Principal Scientific Adviser to the Government of India**
Prof. Raghavendra Gadagkar, F.A.Sc., F.N.A., F.N.A.Sc., F.T.W.A.S.	**DST Year of Science Chair Professor, Centre for Ecological Sciences, IISc, Bengaluru**
Prof. V. Kumaran, F.A.Sc., F.N.A., F.N.A.E.	**Department of Chemical Engineering, IISc, Bengaluru**
Prof. Jaywant H. Arakeri, F.A.Sc., F.N.A.E.	**Department of Mechanical Engineering, IISc, Bengaluru**
Prof. P. Balaram, F.N.A., F.N.A.Sc., F.A.Sc.	**DST Year of Science Chair Professor, National Centre for Biological Sciences (NCBS), Bengaluru**
Prof. S. Sampath, F.N.A., F.N.A.Sc.	**Department of Inorganic and Physical Chemistry, IISc, Bengaluru**
Prof. Milan Kumar Sanyal, F.A.Sc., F.N.A., F.N.A.Sc., F.T.W.A.S.	**Emeritus Professor, Saha Institute of Nuclear Physics, Kolkata**
Dr. A. K. Tyagi, F.N.A.Sc., F.A.Sc., F.N.A.E.	**Director, Chemistry Group, Bhabha Atomic Research Centre (BARC), Mumbai**
Prof. Shubha Tole, F.A.Sc., F.N.A., F.N.A.Sc.	**Department of Biological Sciences, Tata Institute of Fundamental Research (TIFR), Mumbai**
Prof. Russel Foster, F.R.S.	**Professor of Circadian Neuroscience and Head of Department of Ophthalmology, University of Oxford**
Prof. Umesh Varshney, F.N.A., F.N.A.Sc., F.T.W.A.S.	**J N Tata Chair Professor, Department of Microbiology and Cell Biology, IISc, Bengaluru**

ENDOWED PROFESSORS

NAME	POSITION
Bharat Ratna Prof. C. N. R. Rao	**Linus Pauling Research Professor (ICMS, CPMU, NCU, SAMat)**
Prof. Hiriyakkanavar Ila	**Hindustan Lever Research Professor (NCU)**

ADMINISTRATION

POSITION	NAME OF THE MEMBER
President	**G. U. Kulkarni**, Ph.D., F.A.Sc., F.N.A.Sc, F.N.A.E., F.N.A.
Dean, Faculty Affairs	**Umesh V. Waghmare**, Ph.D., F.A.Sc, F.N.A.Sc, F.N.A.E., F.N.A.
Dean, Academic Affairs	**Eswaramoorthy Muthusamy**, Ph.D.
Dean, Fellowships and Extension Programmes	**N. S. Vidhyadhiraja**, Ph.D.
Dean, Research and Development	**Sreenivas K. R.**, Ph.D.
Warden and Student Counsellor	**Jayanta Haldar**, Ph.D.
Faculty In-charge, Sports Facility	**Sarit S. Agasti**, Ph.D.
Associate Warden	**Sheeba Vasu**, Ph.D.
Administrative Officer and Public Information Officer	**Joydeep Deb**, M.Sc. (Electronics), M.Sc. (Telecommunication), M.B.A. (HRM)
Assistant Administrative Officer (SG)	**C. S. Chitra**, B.Com.
Academic Coordinator	**Princy Jaison Pereira**, Ph.D.
Coordinator (FA, F&E, and R&D) (On Contract)	**Panneer K. Selvam**, M.A., M.B.A., L.L.B., Ph.D.
Accounts Officer	**Sampad Patra**, B.Com, P.G.D.C.A., M.B.A. (Finance)
Senior Stores and Purchase Officer	**K. Bhaskara Rao**, M.Sc.
Senior Library-cum-Information Officer	**Nabonita Guha**, M.L.I.S.
Senior Secretary to President	**A. Srinivasan**, B.A.
Junior Accounts Officer	**B. Venkatesulu**, B.Sc.
Assistant Public Information Officer	**Susheela G.**, B.Sc.
Project Engineer (On Contract)	**Mahadevan N.**, B.E., M.I.E.
Project Engineer Gr. II	**Nadiger Nagaraj**, D.C.E.
Assistant Project Engineer (Elec.)	**Sujeeth Kumar S.**, D.E.E.
Junior Project Engineer (Civil)	**Veeresha N. R.**, D.C.E.
Coordinator (Special Projects) (On Contract)	**A. N. Jayachandra**, B.Com, P.G. Diploma (Finance)
Coordinator (Security, Legal, and Campus Management) (On Contract)	**M. R. Chandrasekhar**, B.Sc., L.L.B.
Coordinator (PR) (On Contract)	**M. G. Narayana**, B.A.
Coordinator (Hindi) (On Contract)	**Ananda**, M.A., M.B.A.
Chief Medical Officer (On Contract)	**G. R. Naghabhushana**, M.B.B.S., F.C.C.P., F.C.G.P., P.G. Diploma in M&CHL
Medical Officers (On Contract)	**Kavitha Sridhar**, M.B.B.S.
	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)
	Chandralekha H. V., M.B.B.S.
Psychiatrist (On Contract)	**Elizebath Daniel**, M.A., M. Phil., Ph.D.
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**, Bachelor's degree in Physical Therapy
Consultant (Accounts and Finance) (On Contract)	**Raju B. Mahantshetti**, M.Com.
Section Officer (On Contract)	**Balraj A.**, M.B.A. (Finance)

APPOINTMENTS, PROMOTIONS, DEPUTATION, AND SUPERANNUATION

PROMOTIONS	
Prof. Sridhar Rajaram	Promoted as Professor, ICMS
Prof. Ranjani Viswanatha	Promoted as Professor, ICMS
Prof. Santosh Ansumali	Promoted as Professor, EMU
Prof. Sebastian C. Peter	Promoted as Professor, NCU
Prof. Kanishka Biswas	Promoted as Professor, NCU
Dr. Premkumar Senguttuvan	Promoted as Associate Professor, ICMS and NCU

DEPUTATION	
Prof. Maneesha S. Inamdar	On deputation to inStem, Bengaluru

SUPERANNUATION	
Prof. S. M. Shivaprasad	Superannuated

NEW APPOINTMENTS (On contract)	
Balraj A.	Section Officer
Dr. Geetha G. Nair	Advisor, Technical Matters
Vivek N. Kagali	Site Engineer
Rangaswamy L.	Electrical Supervisor
Dr. Rajalakshmi R.	Editorial Assistant
Ajesh Sinha	Personal Assistant/Office Secretary
Dr. Aruna Satyamurthy	Project Scientist III
Ananda	Coordinator (Hindi)
Raju B. Mahantshetti	Consultant (Accounts and Finance)

II.

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 eight 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) and M.S. (Engineering) programmes in the sciences and engineering, and Master of Science (M.Sc.) in Chemistry. Candidates with a B.Sc./equivalent, M.Sc./equivalent, B.E., B.Tech./equivalent, M.E., M.Tech./equivalent, or M.B.B.S./M.D. are eligible to apply for these degree programmes. 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.

Integrated Ph.D. programmes are offered in Physical Science, Chemical Science, and Biological Science, and admissions to these programmes are only for the August session.

All enrolled students are expected to take courses and actively participate in research. Research students receive a monthly fellowship as per the Government and Centre's norms. Upon the successful completion of coursework and thesis, students are awarded their relevant degrees.

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 the faculty and students can discuss their research. Further, students have access to world-class infrastructure and cutting-edge facilities.

RESEARCH ADMISSIONS

In the academic year 2022–2023, **83** students were enrolled in various degree programmes at the Centre:

Ph.D.	52
M.S. (Engineering)	01
Integrated Ph.D. in Biological Science	09
Integrated Ph.D. in Physical Science	02
Integrated Ph.D. in Chemical Science	06
M.Sc. Chemistry	08
Post Graduate Diploma in Materials Science (P.G.D.M.S.)	05

The student strength at JNCASR as of 31st March 2023: **331**

DEGREES AWARDED

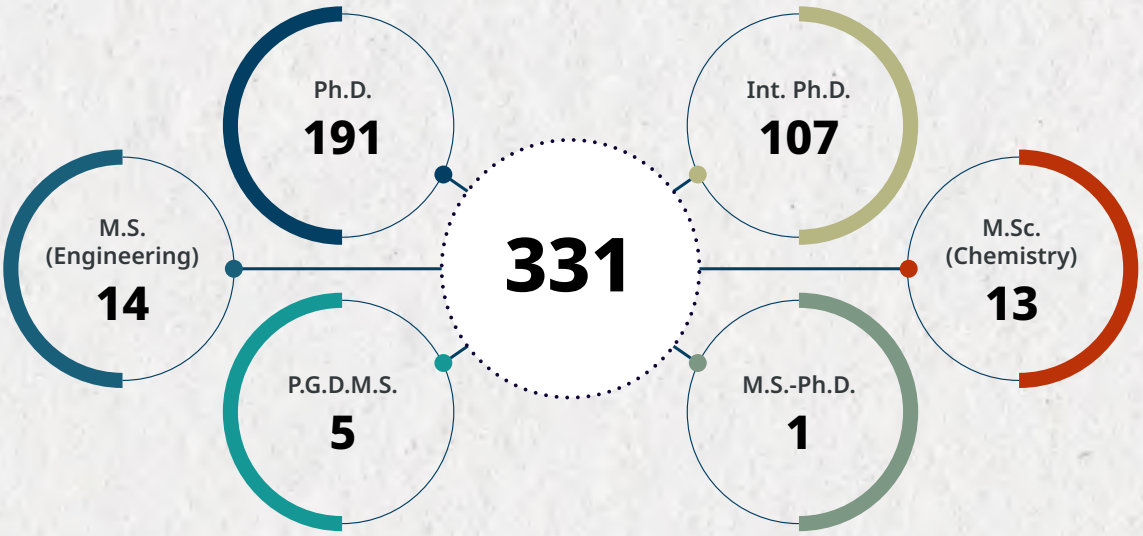
In the past year, the following number of degrees were awarded:

Ph.D.	51
Ph.D. (through Integrated Ph.D.)	05
Ph.D. (through M.S.–Ph.D.)	01
M.S. (Engineering)	00
M.S. (Biological Science)	05
M.S. (Materials Science)	05
M.S. (Chemical Science)	03
M.Sc. Chemistry	05
Post Graduate Diploma in Materials Science (P.G.D.M.S.)	02

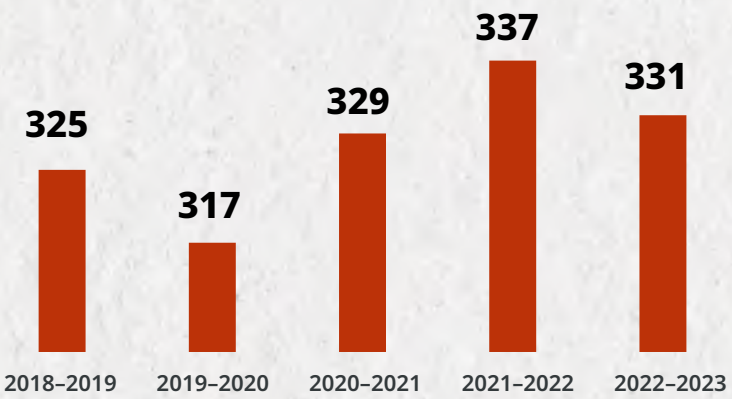
Total degrees awarded as of 31st March 2023: **77**

ACADEMIC PROGRAMMES

TOTAL STUDENT STRENGTH ACROSS DEGREE AND DIPLOMA PROGRAMMES 2022–2023



TOTAL STUDENT STRENGTH (PAST 5 YEARS)



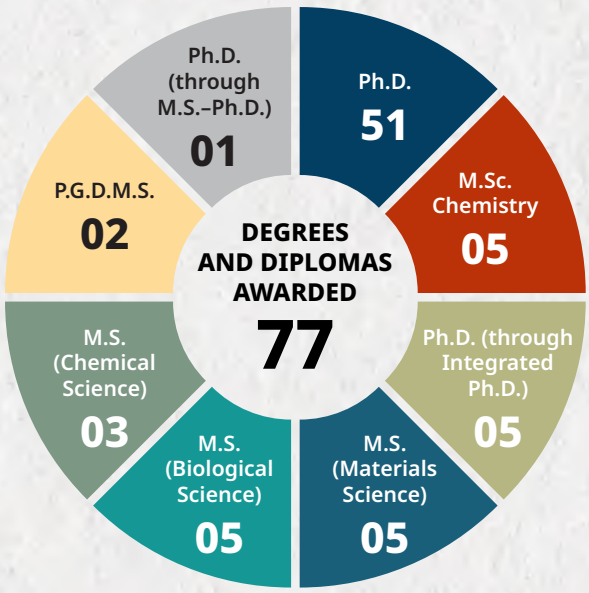
NEW ADMISSIONS IN 2022–2023

NEW ADMISSIONS (PAST 5 YEARS)

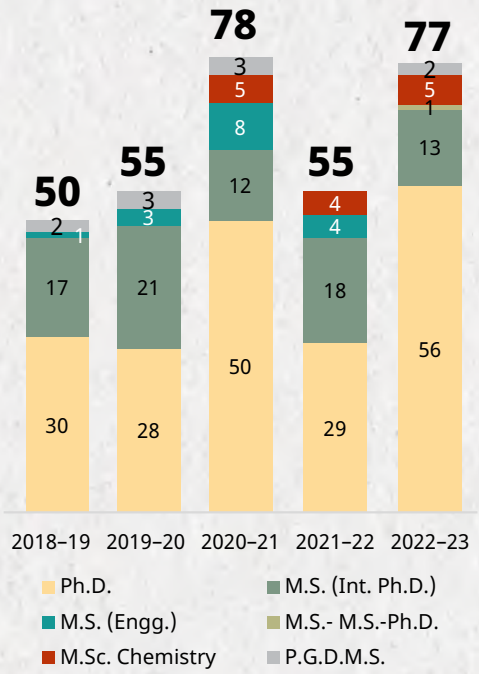
	Ph.D.	M.S. (Int. Ph.D.)	M.S. (Engg.)	M.S. of M.S.-Ph.D.	M.Sc. Chemistry	P.G.D.M.S.	Total
2022–2023	52	17	1	0	8	5	83
2021–2022	36	19	5	0	5	2	67
2020–2021	38	16	8	0	5	2	69
2019–2020	29	14	4	0	5	3	55
2018–2019	33	17	5	0	–	3	58

ACADEMIC PROGRAMMES

DEGREES AND DIPLOMAS AWARDED (2022–2023)



DEGREES AND DIPLOMAS AWARDED (PAST 5 YEARS)



UNIT-WISE CURRENT STUDENT STRENGTH AND DEGREES AWARDED IN 2022–2023

	TOTAL STUDENTS		NEW STUDENTS		DEGREES AWARDED	
CPMU	**77**		**17**		**17**	
	Ph.D.	45	Ph.D.	15	Ph.D.	11
	Int. Ph.D.	32	Int. Ph.D.	2	Ph.D. (through Int. Ph.D.)	1
					M.S. in Materials Science	5
EIBU	**15**		**1**		**3**	
	Ph.D.	13	Ph.D.	1	Ph.D.	2
	Int. Ph.D.	01			M.S. (through M.S.-Ph.D.)	1
	MS-Ph.D.	01				
EMU	**26**		**2**		**1**	
	Ph.D.	12	Ph.D.	1	Ph.D.	1
	M.S. (Engg.)	14	M.S. (Engg.)	1		

ACADEMIC PROGRAMMES

	TOTAL STUDENTS	NEW STUDENTS	DEGREES AWARDED
ICMS	**5**	**5**	**2**
	P.G.D.M.S. 05	P.G.D.M.S. 05	P.G.D.M.S. 02
MBGU	**66**	**19**	**15**
	Ph.D. 30	Ph.D. 10	Ph.D. 9
	Int. Ph.D. 36	Int. Ph.D. 9	Ph.D. (through Int. Ph.D.) 1
			M.S. in Biological Science 5
NCU	**101**	**28**	**27**
	Ph.D. 54	Ph.D. 14	Ph.D. 16
	Int. Ph.D. 34	Int. Ph.D. 6	Ph.D. (through Int. Ph.D.) 3
	M.Sc. Chemistry 13	M.Sc. Chemistry 8	M.S. in Chemical Science 3
			M.Sc. in Chemistry 5
NSU	**14**	**7**	**4**
	Ph.D. 10	Ph.D. 7	Ph.D. 4
	Int. Ph.D. 4		
TSU	**27**	**4**	**8**
	Ph.D. 27	Ph.D. 4	Ph.D. 8

MINIMUM SCORE TO APPLY FOR M.S.–Ph.D. AND INT. Ph.D.

M.S./Ph.D.

- Minimum score in the highest university examination in any area of science/ engineering
- Qualification in any one of the national exams with valid score/certificate

55%

Int. Ph.D. Programme

- Minimum score in Bachelor's degree in any area of science/engineering (or) B.E./B.Tech. degree (or) equivalent degree
- Qualification in JAM desirable

National tests to be eligible for admission to a Ph.D. programme:
GATE/JEST/GPAT/UGC-CSIR-NET-JRF/ICMR-JRF/DBT-JRF/INSPIRE

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

Ph.D. (Science and Engineering)	Years 1 & 2: Years 3, 4, & 5: Year 6:	₹31,000 ₹35,000 ₹15,000
M. S. (Engineering/ Research)	Year 1 & 2: Year 3 (first six months):	₹31,000 ₹13,000
Int. Ph.D.	Years 1 & 2: Years 3, 4, & 5: Year 6 & 7: Year 8:	₹19,000 ₹31,000 ₹35,000 ₹15,000
Diploma Programme	P.G.D.M.S.:	₹20,000

III.

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 (CPMU), Evolutionary and Integrative Biology Unit (EIBU), Engineering Mechanics Unit (EMU), Geodynamics Unit (GDU), 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 the year 2022–2023, 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 (CPMU)

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 come up with many ground-breaking discoveries and advances in the field of materials science and has collaborated with many national and international laboratories.

RESEARCH AREAS

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

RESEARCH HIGHLIGHTS

- Negative colossal magnetoresistance of the chalcogenide $MnSb_2Se_4$ was discovered
- The effect of surface functionality of elemental two-dimensional materials (2D) (such as Antimonene and Bismuthene) on their electronic and optical properties was investigated
- High-performance supercapacitors were produced using frosted glass as a template for growing electrodes
- A PCR-based Raman spectroscopic assay that can differentiate between different types of indels and single nucleotide polymorphisms was identified and developed
- Usefulness of superior features of patterned films in piezoelectric generators and passive daytime radiators was demonstrated

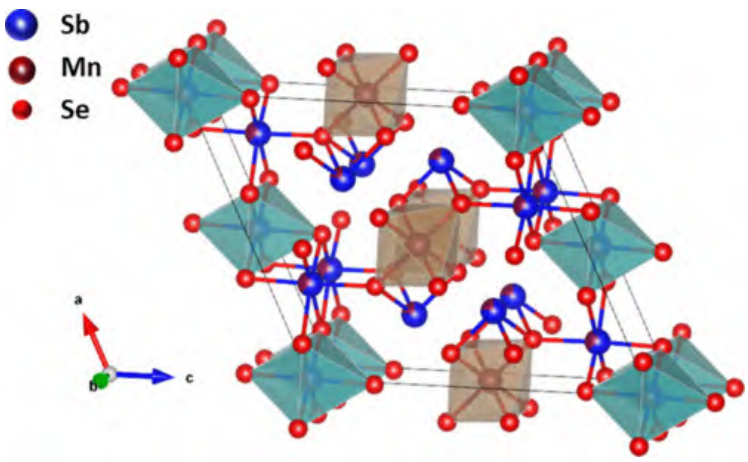
CPMU

- Different methods of synthesising mixed linker-based flexible metal–organic frameworks of different dimensions were reviewed, and their specific applications were highlighted
- Challenges associated with electrochemical nitrogen reduction in aqueous medium were evaluated and the different prospects for electrochemical NH_3 production via lithium-mediated N_2 reduction were presented
- Machine learning models to make shear viscosity estimations for fluids were studied
- Recent developments in host–guest chemistry in biology were explored
- The possibility of utilising a group-III expitaxial semiconducting nitride material with artificial synaptic devices was explored

RESEARCH ACTIVITIES AND ACHIEVEMENTS DURING 2022–2023

Prof. Sundaresan A. F.A.Sc.
Professor and Chair

The ground state of a magnetic material is often determined by the presence of antisite disorder. Our study investigated the effect of increased antisite disorder on the magnetic and electrical transport properties of a ternary chalcogenide material, $MnSb_2Se_4$. We measured its magnetic susceptibility and heat capacity and found an absence of long-range magnetic ordering. The nonequilibrium magnetic dynamics of the system at low temperatures were analysed using AC susceptibility for low-temperature regions and its evolution through metastable states was uncovered by the presence of magnetic memory effect and magnetic relaxation. Our team carried out data analysis using various dynamic scaling models and found that $MnSb_2Se_4$ exhibited a cluster glass state. We also observed a negative colossal magnetoresistance below the freezing temperatures which could be attributed to competing ferromagnetic and antiferromagnetic interactions induced by increased antisite disorder. In short, our study has led to the discovery that $MnSb_2Se_4$ is one of those rare chalcogenides that possess negative colossal magnetoresistance.



Crystal structure of $MnSb_2Se_4$. The cream colour indicates Mn(3) in the octahedra and green indicates Mn(4)

Reference: *Phys. Rev. B* 106(13): 134423. 2022. doi: 10.1103/PhysRevB.106.134423

Major talk during 2022–2023:

- 19th–23rd December 2022: Invited talk on *"Contrasting Magnetic and Multiferroic Properties in the Isostructural Polar magnets $LuMWO_6$ (M = Fe and Cr)"* at the IUMRS Conference, organised by IIT Jodhpur

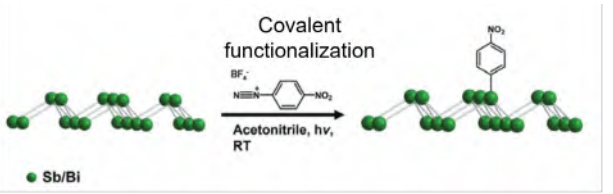
CPMU

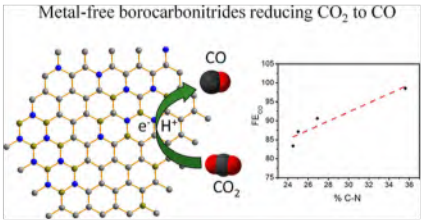
Bharat Ratna Prof. C. N. R. Rao D.Sc., F.R.S., Hon. F.R.S.C.

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

We have studied the effect of surface functionality of elemental two-dimensional materials (2D) (such as Antimonene and Bismuthene) on their electronic and optical properties. These materials possess a lone pair which can be effectively utilised to tune material properties *via* different functionalization strategies. Lewis acid functionalization leads to form Lewis acid-base adducts with the lone pair which affects the band structure, and the corresponding change was realized as the blue emission of few layered Sb and Bi. A similar distortion and blue shift were observed on covalent functionalization of Sb and Bi using p-nitrobenzene diazonium salt (Sb/Bi-C bonds). 2D Borocarbonitrides as metal-free electrocatalysts for the electrochemical reduction of CO_2 was also studied. By tuning the composition $B_xC_yN_z$ in boroncarbonitride, 98% faradaic efficiency for CO_2 conversion to CO was achieved.

2D $MoSe_2$ nanosheets were used to fabricate $MoSe_2$ membranes. These membranes showed 100% separation of dye molecules from dye/salt wastewater at a very high-water flux of 900 $Lm^{-2}h^{-1}bar^{-1}$ was achieved.





Top image: Covalent functionalisation of antimonene and bismuthene with Lewis acids
Middle image: Conversion of CO_2 to CO using 2D borocarbonitrides as metal-free electrocatalysts
Bottom image: $MoSe_2$ membranes fabricated using 2D $MoSe_2$ nanosheets

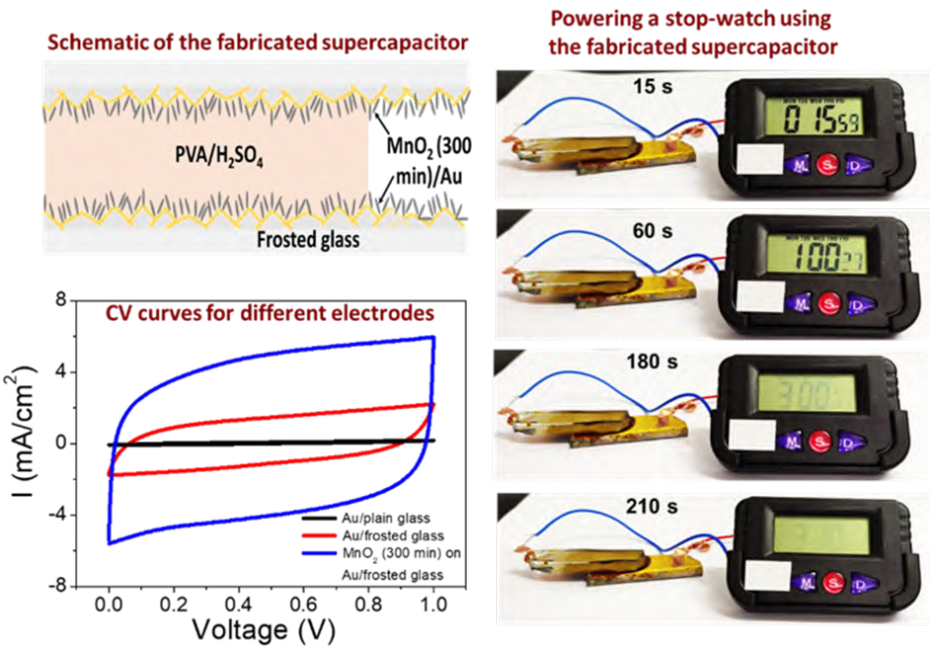
References:
Nanoscale. 14: 13834-13843. 2022. doi: 10.1039/D2NR03206F
Chem. Mater. 34(14): 6626–6635. 2022. doi: 10.1021/acs.chemmater.2c01591
Small. 18(38): 2203554. 2022. doi: 10.1002/smll.202203554
J. Colloid Interface Sci. 646: 980-990. 2023. doi: 10.1016/j.jcis.2023.05.087

Prof. G.U. Kulkarni F.A.Sc., F.N.A.Sc., F.N.A.E., F.N.A.

Professor, CPMU, and President, JNCASR

Supercapacitors made with electrodes of high surface area have emerged as potential candidates that can fill the gap between batteries and capacitors. Conventional methods used for fabrication are often very time-consuming and strenuous. Our team presented a facile method for the production of high-performance supercapacitors that involved using frosted glass as a template for growing electrodes. The micro- and nano-level roughness provided by the frosted substrates enabled the electrodes to host a much higher number of ions, which resulted in a capacitance one order higher than that of the plain surface. We electrodeposited MnO_2 nanostructures on the frosted surface, which increased the capacitance by 6.5 times. We used the material to assemble stacked supercapacitors using a polyvinyl alcohol/H_2SO_4 gel electrolyte. The devices exhibited excellent electrochemical properties, such as a high cyclic stability of up to 93% capacitance retention after 10,000 cycles, low self-discharge, high scan rate stability (100 $V.s^{-1}$), and low iR drop. Furthermore, the frosted glass can be used to imprint polydimethylsiloxane substrate surfaces to fabricate flexible and stretchable supercapacitors. Our work will pave the way for the facile and low-cost fabrication of supercapacitor electrodes.

CPMU



Schematic of the fabricated supercapacitor (top left). CV curves for different electrodes (bottom left), and performance of the capacitor at different time points (right)

Reference: *Energy Technol.* 10(10): 2200505. 2022. doi: 10.1002/ente.202200505

Events organised:

- 22nd March–15th April 2022: Crash course on *"Next Generation Solar Cells"*, co-organised with Prof. Mukundan Thelakkat as a part of SERB VAJRA project
- 14th May 2022: Outreach Programme titled *"Frontier Lectures in Contemporary Physics & Chemistry"*, co-organised with Prof. S. M. Shivaprasad, Director of Karnataka State Higher Education Academy (KHEA), Dharwad
- 9th–10th September 2022: Workshop on Frontier Areas in Materials Research, co-organised with Bulletin of Materials Science, Indian Academy of Sciences, Bengaluru and Himachal Pradesh University, Shimla
- 10th–30th September 2022: Crash course on *"Next Generation Batteries"*, co-organised with Prof. Mukundan Thelakkat as a part of SERB VAJRA project
- 6th–10th February 2023: Hosted 2nd Shanghai Cooperation Organisation (SCO) Young Scientist Conclave on behalf of DST, Govt. of India

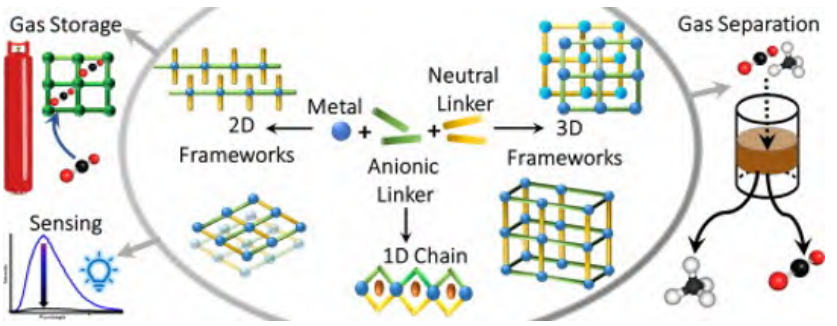
Major talks during 2022–2023:

- 8th April 2022: Invited talk at Frontier Symposium in Chemistry (FS-CHM 2022) on *"Au crystallites hosting non-cubic lattices"* at IISER Thiruvananthapuram
- 14th May 2022: Invited talk on *"Serendipitous inventions"* at the Outreach Programme for Frontier Lectures in Contemporary Physics and Chemistry at KHEA, Dharwad
- July 2022: Invited talk at Bengaluru India Nano Conference on *"Functional Glass for Smart Windows"*, organised by Karnataka Science and Technology Promotion Society (KSTePS)
- 18th August 2022: Invited talk on *"Supramolecular sensor and energy devices"* at the CHEM-THIRST 2022 Outreach Programme organised by NMKRV College for Women, Jayanagar, Bengaluru
- November 2022: S. V. Narasaiah Memorial lecture on *"Functional glass for Smart Windows"* at HHV, IISc
- 22nd Dec 2022: Invited talk on *"Functional glass for Smart Windows"* at IUMRS-ICA 2022, organised by MRSI, IIT Jodhpur
- 28th–30th December 2022: Invited talk at International Conference on Nanoscience and Photonics for Medical Applications (ICNPMA-2022) on *"Nanomaterial based devices for medical applications – Examples from our Laboratory"*, organised by Atomic & Molecular Physics, Manipal Academy of Higher Education

CPMU

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

The fascinating structural dynamism of metal–organic frameworks (MOFs) not only sets them apart from other porous materials but facilitates a wide range of applications. Structural dynamism in MOFs can be introduced by a host of external stimuli like pressure, temperature, or light. A rather interesting approach for inducing multi-functionality, such as interesting geometry and diverse functionalities in MOFs is the use of mixed linkers. 1D, 2D, and 3D MOFs can be fabricated using mixed linkers which can then be fine-tuned for specific applications like gas storage, separation, selective adsorption, drug delivery, or as novel optoelectronic or magnetic materials. In our review paper, we have documented different methods of synthesising mixed linker-based flexible MOFs of various dimensions and highlighted their specific applications. Our concise review will enable scientists to understand and be aware of the work that is already done in this field and help them design newer mixed linker-based flexible MOFs with properties tailored to the applications.



Graphical representation of the applications and synthesis methods of mixed linker-based flexible metal–organic frameworks (MOFs) in all three dimensions

Reference: *Coord. Chem. Rev.* 469: 214645. 2022. doi: 10.1016/j.ccr.2022.214645

Prof. Eswaramoorthy Muthusamy
Professor, CPMU; Associate Director, ICMS; and Dean, Academic Affairs

The Haber–Bosch process, the most widely used method of ammonia production, is a highly energy-intensive procedure. A global shift towards energy conversation has led to the rise of less intensive processes such as aqueous electrochemical nitrogen reduction (ENR) to ammonia (NH_3) under ambient conditions. Many metal, non-metal, and carbon-based materials along with metal-chalcogenides and metal-nitrides have been explored for their ENR activity. Unfortunately, NH_3 production through ENR is still at the microgram level. Furthermore, quantification of NH_3 at extremely low concentrations, one of the major challenges in this field, leads to reproducibility issues in electrocatalysis experiments. Our review highlighted in detail the challenges associated with ENR in aqueous medium. It also suggests the standardisation of protocols for quantifying the low concentrations of NH_3 to prevent false positives. Our paper also presents different prospects for electrochemical NH_3 production via lithium mediated N2 reduction.

Reference: *Chem. Rec.* 22(11): 2022. doi: 10.1002/tcr.202200139

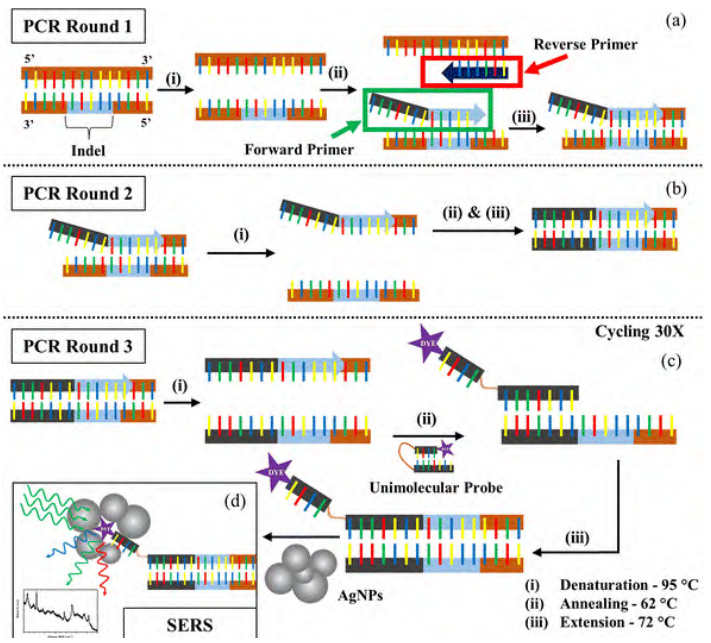
Event organised:
- 5th–9th December 2022: Winter School co-organised with Prof. Umesh V. Waghmare, TSU, JNCASR

Major talk during 2022–2023:
- 18th–22nd February 2023: Invited talk at the Fourteenth Annual International Workshop on Advanced Materials (IWAM 2023) Conference on *"Generation of new heterostructures for enhanced electrochemical water splitting"* organised by Ras Al Khaimah, UAE

CPMU

Prof. Chandrabhas Narayana F.A.Sc., F.N.A.Sc., F.R.S.C.
Professor (on deputation with RGCB)

Mutations like indels and single nucleotide polymorphisms (SNPs) can make crops susceptible to infections. Surface-enhanced Raman spectroscopy (SERS) has risen as a promising means for uncovering mutations owing to its ability to detect molecular vibrational signatures. In our study, we were able to identify and develop a PCR-based SERS assay that can differentiate between different types of indels and SNPs. Our assay was able to identify mutations in the tomato genome that cause infections by the tomato yellow leaf curl virus and root-knot nematodes, diseases that have disrupted the global agriculture industry. The developed tri-primer assay utilises mutation-specific forward primers and SERS probes tagged with FAM and Cy3 dyes. The unique Raman spectral features of these dyes enabled multiplexing, which led to the detection of not only the indel type but also the zygosity in a single experiment. The proposed technique was also able to differentiate between two different SNP-based alleles. Our study presented a mutation detection strategy that does not require quenchers and can facilitate multiplexing, which could be used as a powerful onsite and offsite screening tool very soon.



Schematic representation of the PCR-based SERS strategy

Reference: *RSC Adv.* 12: 35929-35937. 2022.
doi: 10.1039/d2ra06044b

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

The unique properties of patterned piezoelectric polymer films can have a wide range of electrical and optical applications. For our study, we adopted a cost-effective breath-figure technique to demonstrate large-area spontaneous pattern formation in relaxor terpolymer, poly (vinylidene difluoride-trifluoroethylene-chlorofluoroethelene) (P(VDF-TrFE-CFE)) films. The experimental parameters chosen for the study allowed us to tailor the hemispheroidal patterns and obtain pore dimensions ranging from a few ≈100 nm to ≈ 1 mm. Upon characterisation, we discovered that our prepared materials exhibited enhanced ferroelectric and piezoelectric responses owing to an increase in the charge accumulation region. The hemispheroidal patterned structures created refractive index contrast, which led to improved diffused reflection and thermal emittance. Additionally, the dominant amorphous phase of the patterned films resulted in higher photoluminescence yield in the presence of guest-dye molecules. Our study demonstrated that these superior features of patterned films can be of use in high-efficiency piezoelectric generators and passive daytime radiators.

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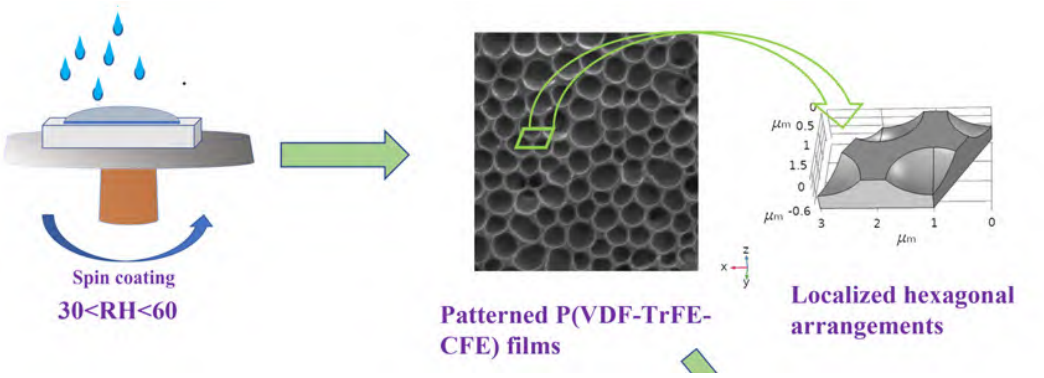


Relaxor terpolymer, poly (vinylidene difluoride-trifluoroethylene-chlorofluoroethelene) (P(VDF-TrFE-CFE)) films fabricated via a cost-effective breath-figure technique

Reference: *Macromol. Mater. Eng.* 307(11): 2200384. 2022. doi: 10.1002/mame.202200384

Event organised:

- 18th July 2022: Art Epstein Memorial Session at ICSM 2022 at Glasgow University, University of St. Andrews, Scotland, UK

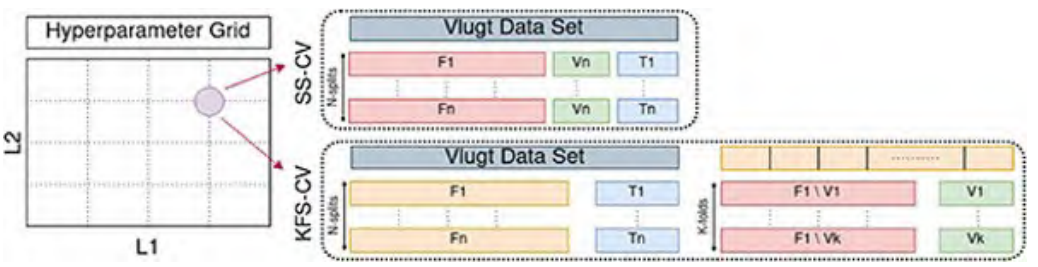
Major talks during 2022–2023:

- 18th July 2022: Invited talk on *"Artificial Retina"* at Organic Bioelectronic session ICSM 2022 organised by Glasgow University, University of St. Andrews, Scotland, UK
- 18th December 2022: Invited talk on *"Photovoltaic Energy"* at the 65th DAE Solid State Physics Symposium at BIT Ranchi
- 12th January 2023: Invited talk on *"Solution Processed PV and Imaging"* at Indo-German Meeting at SRM, TN, India
- 16th January 2023: Invited talk on *"Organic Electronics"* at National Symposium on Electronics for Self-Reliance at Central University, Hyderabad

Prof. Balasubramanian Sundaram F.A.Sc.

Professor

Calculating the shear viscosity of fluids via computational methods is an expensive affair. Recent advances in machine learning (ML) methods have shown some promise in enabling the estimation of viscosity in a relatively inexpensive manner. Unfortunately, ML methods have to overcome challenges, such as overfitting, in the case of viscosity since the dataset is often very small. We trained seven ML models to predict the shear viscosity of a Lennard–Jones fluid. They were trained to specifically address issues arising from a small data set and investigate the ones associated with model selection, performance estimation, and uncertainty quantification. We compared two cross-validation (CV) procedures for their ability to do both model selection and performance estimation and discovered that the k-fold CV-based procedure showed lower variance in error estimates. We discussed the role of performance metrics in training and evaluation and ranked the ML methods based on their metrics values. Furthermore, our team also estimated the uncertainty of individual predictions using two methods for uncertainty quantification—Gaussian process regression (GPR) and ensemble method. The procedures presented in our study led to the construction of robust ML models for small dataset viscosity estimations.



Schematic representation of the model selection and performance estimation procedures shuffle split cross-validation (SS-CV) and k-fold split cross-validation (KFS-CV), which were used in the study

Reference: *Mach. Learn. Sci. Technol*. 3: 045032. 2022. doi: 10.1088/2632-2153/acac01

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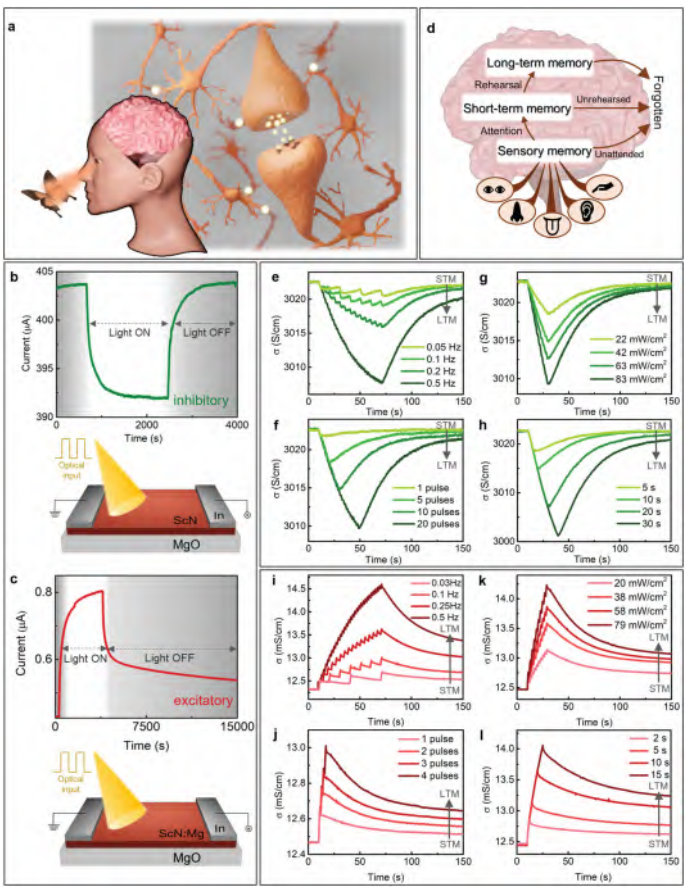
Dr. Sarit S. Agasti
Associate Professor (jointly with NCU)

The chemistry of biological systems at the molecular level never ceases to fascinate scientists, especially chemists. Many branches of chemistry have been built on inspirations drawn from the marvels of biological systems. One such field is supramolecular chemistry, a branch of synthetic chemistry that involves designing and synthesising simpler organic compounds that mimic the highly optimized self-assembly behaviour of naturally occurring molecules. Our review article showcases some of the recent developments in which host–guest chemistry was used to accomplish cutting-edge biological applications. The article also highlights research innovations that aim to solve important biological issues using host–guest chemistry. Through our focused cluster, we celebrated the extraordinary developments in the arena of host–guest chemistry in biology and shared our enthusiasm for what an exciting future the field holds.

Reference: *Bioconjugate Chem.* 33(12): 2235–2236. 2022. doi: 10.1021/acs.bioconjchem.2c00532

Dr. Bivas Saha
Faculty Fellow (jointly with ICMS)

Traditional computation based on von Neumann architecture is time and energy-intensive and falls short when it comes to solving unstructured, probabilistic, and real-time problems. A new brain-inspired neuromorphic computational architecture could be the key to dealing with these shortcomings. Optoelectronic artificial synaptic devices are gaining momentum in this field due to low power consumption, absence of resistance–capacitance delay, and high bandwidth. However, scalable, complementary metal–oxide–semiconductor (CMOS)-compatible materials that can emulate inhibitory and excitatory optoelectronic synaptic functionalities are barely reported. We presented epitaxial CMOS-compatible scandium nitride (ScN) optoelectronic artificial synaptic devices that can mimic biological synaptic activities. The inhibitory and excitatory synaptic plasticity was equated to the negative and positive persistent photoconductivity of undoped and magnesium-doped ScN. This property facilitated abilities such as learning–forgetting, frequency-selective optical filtering, Hebbian learning, and logic-gate operations. Our team also carried out temperature-dependent photoresponse and photo-Hall measurements which revealed that the scattering of photogenerated carriers from charged defect centres resulted in negative photoconductivity in undoped degenerate ScN.



a) Schematic of human visual system and the neural synapse. b) Negative photoconductivity in ScN thin film measured in the device geometry shown below. c) Positive photoconductivity in Mg-doped ScN thin film measured in the device geometry shown below. d) Atkinson–Shiffrin memory model proposing three main stages of memory in the human brain. e–h) Transition from short term memory (STM) to long term memory (LTM) in inhibitory ScN synapse. i–l) Transition from STM to LTM in excitatory Mg-doped ScN synapse.

Reference: *Adv. Electron. Mater.* 9(3): 2200975. 2022. doi: 10.1002/aelm.202200975

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Our work can expedite the possibility of utilising a group-III epitaxial semiconducting nitride material with biological synaptic activity-emulating abilities for practical neuromorphic applications.

Major talks during 2022–2023:

- 22nd February 2023: Invited Talk at the International Workshop on Advanced Materials (IWAM) event on *"Polaritonic Material Platform for Tunable Nanophotonic Devices"*, organised by IWAM, Ras Al Khaimah, UAE
- 2nd March 2023: Invited Talk on *"Phononic Bandgap and Phonon Anomalies in Epitaxial Nitride Thin Films and Heterostructures"* at the SPRUC Momentum-resolved Spectroscopy Conference at Spring-8, Japan
- 4th March 2023: Invited talk on *"Polaritonic Material Platform for Tunable Nanophotonic Devices"* at Advances in Low-dimensional Materials for Optoelectronic and Nano Devices (ALMOND 2023) organised by Institute of Physics, Bhubaneswar

UNIT MEMBERS

Faculty Members	
Professor and Chair	**Prof. Sundaresan A.**
Linus Pauling Research Professor; Honorary President, JNCASR; and Director, ICMS	**Bharat Ratna Prof. C. N. R. Rao**
Professor and President, JNCASR	**Prof. G. U. Kulkarni**
Professors	**Prof. Tapas Kumar Maji** **Prof. Eswaramoorthy Muthusamy (Associate Director, ICMS and Dean, Academic Affairs)** **Prof. Chandrabhas Narayana (on deputation with RGCB)** **Prof. K. S. Narayan** **Prof. Balasubramanian Sundaram**
Faculty Fellow	**Dr. Sarit S. Agasti (jointly with NCU)** **Dr. Bivas Saha (jointly with ICMS)**

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; Dean, Fellowships and Extension Programmes) • **Prof. Umesh V. Waghmare** (Professor, TSU; Dean, Faculty Affairs)

Research Students	
Ph.D.: 45	**Debendra Prasad Panda, Rahul Kumar, Souvik Banerjee, Purohit Sumukh Anil, C. S. Deepak, Abhijith Krishnan, Bhupesh Yadav, Tejaswini S. Rao, Kompella V. K. Srinath, Avula Venkata Siva Nikhil, Oishika Jash, Megha, Soumita Chakraborty, Momin Ahamed, Divya, Surishi Vashishth, Faruk Ahamed Rahimi, Rohan Jena, Anupam Dey, Navneet Singh (Mid-Year), Bidesh Biswas, Prasanna Das, Anjana Joseph, Suhas K. T., Soumen Pradhan, Simanta Kalita, Disha Brahma, Sourav Rudra, Athira M. P., 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, Mehak Loyal, Rishika Konar**

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Research Students	
Int. Ph.D.: 32	**Anaranya Ghorai, Sukanya Das, Anjali Gaur, Dipanjana Patra, Nijita Mathew, Abhishek Kumar, Niloyendu Roy, Pragya Arora, Uttam Tiwari, Dheemahi, Janaky S., Sarbajit Dutta, Shubhanshi Mishra, Deeksha Sharma, Sneha Raj V. P., Swaraj Servottam, Narendra Kumar, Shashank Chaturvedi, Raagya Arora, Surabhi Menon, Anirudha Mirmira, Gurshidali P., Aashish Kumar, Sohini Chatterjee, Brijesh, Sohom Das, Rahul Singh Rawat, Soumya Satpathi, Sakshi Verma, Utkarsh Singh, Chinmay S., Mayukh Saha**

Technical Staff	
Sr. Technical Officers	**Srinivas S., Sreenath V.**
Technical Assistant Trainee (On Contract)	**Arun Aravindakshan K. V.**

Administrative Staff	
Sr. Lab Assistants	**Anil Kumar J., Vasudeva B. S., Alla Srinivasa Rao**

Temporary Staff	
Secretarial Assistant Trainee	**Prema M. S.**
Glass Blower	**Nandha Kishore**
Workshop Assistant	**Raja Kumar D.**

Research Staff (On Contract)	
Research Associates	**Dr. Gurukrishna K., Dr. Manpreet Kaur, Dr. Pavitra Nityanand Shanbhag, Dr. Sanchita Karmakar, Dr. Tuhina Mondal, Dr. Abjijit Chatterjee, Dr. Bharath B., Dr. Sudarshan Behra, Dr. Parul Verma, Dr. Premkumar Yanda, Dr. Subhajit Laha, Dr. Pavitra V., Dr. Goutam Ghosh, Dr. Ganesha Krishna V. S., Dr. Sudhakar Chennu, Dr. Shivanandkumar Veesam, Dr. Prashant Kumar, Dr. Kamal Saravanan R., Dr. Indrajit Mondal, Dr. Rajashekar Pujar**
Research Associate (Provisional)	**Krishna Chand Maurya**
R&D Assistants	**Gulshan Khurana, Nagalambika G. Biradar, Shilauni Dadwal, Samiran Chakraborty, Anaranya Ghorai, Chirag Sarthi J., Daizy Kalita**
Research Associate-II	**Dr. Soumitra Barman**
Senior Research Fellows	**Dr. Srimayee Mukherji, Suchithra P., Ankit Kumar, Kompella V. K. Srinath, Nimish Dwarkanath**
SERB National Post Doctoral Fellows	**Dr. Sandip Biswas, Dr. Pradipkanti Devi Lairenjam**
Mectronic Lab Support	**Sunoj K. R.**
Junior Research Fellow	**Ganesh N.**

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UNIT AT A GLANCE

Honours/Fellowship/Memberships Received

Faculty members

Students

Faculty Achievements

Bharat Ratna Prof. C. N. R. Rao

- Received the SMC Lifetime Achievement Award from Society for Materials Chemistry
- Received D.Sc. *Honoris Causa* from The Assam Royal Global University
- Received Lifetime Achievement Award from Chirantan Rasayan Sanstha

Prof. G. U. Kulkarni

- Received the C. N. R. Rao Prize in Advanced Materials by MRSI
- Appointed as Adjunct Faculty at Manipal Academy of Higher Education for two years
- Honoured at the S. V. Narasaiah Memorial lecture at Hind High Vaccum
- Received the Chirantan Rasayan Sanstha Gold Medal

Prof. Chandrabhas Narayana

- Received Honorary Fellowship of the Indian Society of Analytical Scientists (ISAS)
- Received ISAS Raja Ramanna Award from Indian Society of Analytical Scientists
- Elected as Life Member, Chemical Research Society of India

Prof. K. S. Narayan

- Elected as the Chair of Working Group 16–Physics and Industry, International Union of Pure and Applied Physics (IUPAP)
- Received the Kaushal Kishore Memorial Lecture Prize 2023 from IPC, Indian Institute of Science

Dr. Sarit S. Agasti

- Awarded INSA Medal for Young Scientist 2022

Student Achievements

Pragya Arora (Int. Ph.D. student; research supervisor: Prof. Rajesh Ganapathy)

- Received the Best Poster Prize at the Gordon Conference on Granular Matter at Stonehill College, Easton, Massachusetts USA
- Invited speaker at the highly selective Rising Stars in Soft and Biological Matter Symposium, University of Chicago, USA

Rohit Attri (Ph.D. student; research supervisor: Prof. G. U. Kulkarni)

- Received the Best Poster Award at Bengaluru India Nano 2022
- Received the Best Poster and Oral Presentation Award at 16th JNC Research Conference on Chemistry of Materials 2022

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Rahul Kumar (Ph. D. student; research supervisor: Prof. Sundaresan A.)

- Received the ICDD Grant-in-Aid Award from International Centre for Diffraction Data

Shubhanshi Mishra (Int. Ph.D. student; research supervisor: Prof. G. U. Kulkarni)

- Received Oral Presentation Prize Award in Chemical Science at ChemSci2023: Leaders in the Field Symposium held at JNCASR

Tejaswini S. Rao (Ph. D. student; research supervisor: Prof. G. U. Kulkarni)

- Received the Best Student Talk Award at In-House Symposium (IHS) 2022, JNCASR

Total Publications

94 Peer reviewed articles indexed in Web of Science/Scopus

Sponsored Projects

New Projects

6

Grants Received During 2022–2023

₹ 62.95 lac

Ongoing Projects

20

Grants Received During 2022–2023

₹ 38.12 cr

Students Graduated During 2022–23

11 **Ph. D.**

- Abhijit Chatterjee
- Priyanka Jain
- Divya C.
- Rajendra Kumar
- Manodeep Mondal
- Shivaram B. Kubakaddi
- Sudarshan Behera
- Nimish D.
- Sanchita Karmakar
- Abdul Azeez H.
- Swarnamayee Mishra

CPMU

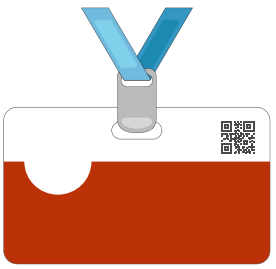
1 Ph.D. (through Int. Ph.D.)

- Pavitra Nityanand Shanbhag

5 M.S. in Materials Science

- Uttam Tiwari
- Dipanjana Patra
- Surabhi Menon
- Sohini Chatterjee
- Aashish Kumar

Students Admitted During 2022–2023



15 Ph. D.

- Souvik Mondal
- Sudip Ghosh
- Kamlesh Mishra
- Chandan Pramanik
- Debmalya Mukhopadhyay
- Mousona Pal
- Shubham Kumar Mehta
- Pritam Kumar
- Soumya Kanti Mondal
- Ujjwal Vidyarthi
- Dipayan Mandal
- Sudip Mahato
- Monika Yadav
- Mehak Loyal
- Rishika Konar

2 Int. Ph.D.

- Chinmay S.
- Mayukh Saha

77 Current Student Strength

EVOLUTIONARY AND INTEGRATIVE BIOLOGY UNIT (EIBU)

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 synthesize 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 social 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, behaviour, ecology, computation, physics, statistics, and mathematics.

We mostly do empirical research, both in the laboratory and in the field, using a combination of experimental tools from evolutionary quantitative genetics, molecular genetics, developmental biology, animal behaviour, and population biology. We also conduct theoretical research, largely through computer simulations of mathematical models of biological processes. Our unit is well-equipped for field studies and studies using a range of experimental and computational tools, with labs for the routine handling of large numbers of *Drosophila* populations and experiments in physiology, biochemistry, and molecular biology.

RESEARCH AREAS

- Asian elephant socioecology and behaviour
- Modelling in ecology and evolution

RESEARCH HIGHLIGHTS

- Experimental evidence suggests reduction in sexual selection due to smaller effective lifespan in *Drosophila* populations selected for rapid development and early reproduction
- Socioecological theory in the Asian elephant was explored in relation to food resource availability with between- and within-clan agonistic interactions

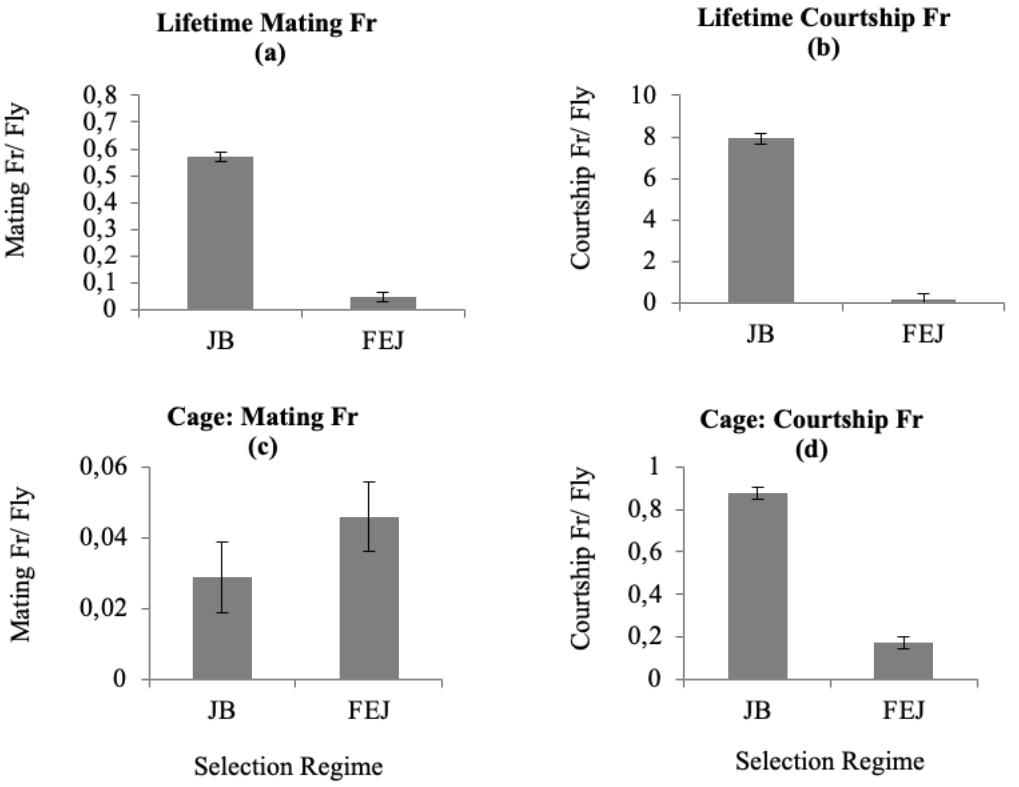
EIBU

RESEARCH ACTIVITIES AND ACHIEVEMENTS DURING 2022–2023

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

Professor and Chair

Sexual conflict, often manifested as an arms race between males and females trying to enhance their own reproductive success at some cost to the other, is of great evolutionary interest because it can maintain genetic variation in populations, prevent the independent optimisation of male and female traits, and promote speciation. Sexual selection, or variation in mating success, is known to affect the levels of sexual conflict. However, it is not so clear whether, and how, the regular evolution of life-histories also affects sexual selection. Here, we show that life-history evolution in fruit fly populations selected for traits not related to sexual conflict might, nevertheless, mediate the possible evolution of altered sexual conflict levels through effects on sexual selection. We examined *Drosophila melanogaster* populations selected for a short development time and early age at reproduction for changes in reproductive behaviour and traits that are proxies of sexual selection. We report a large reduction in reproductive competition experienced by the males of these populations, compared to ancestral populations that are not consciously selected for rapid development or early reproduction, potentially leading to reduced sexual selection. We show that rapidly developing and early reproducing populations have very low levels of mating in their lifetime (females are more or less monandrous), low courtship levels, shorter copulation duration, and longer time from eclosion to first mating, compared to the controls. These results are discussed in the context of the previously demonstrated reduction of inter-locus sexual conflict in these populations. We show that life-history strategies might have a large and significant impact on sexual selection, with each influencing the other and contributing to the complexities of adaptation.



a) Mean lifetime mating frequency, b) Mean lifetime courtship frequency, c) Mean mating frequency in the cage, d) Mean courtship frequency in the cage, averaged across the four replicate populations of the fruit fly.

Reference: *Beh. Ecol. Sociobiol.* 76: 52. 2022. doi: 10.1007/s00265-022-03158-w

EIBU

Events organised:

- 23rd–26th February 2023: Seventh Foundations of Biology Meeting on *"Evolution: an ongoing synthesis?",* supported by IASc, Bengaluru and co-organised with L.S. Shashidhara, Ashoka University, Sonipat and Sutirth Dey, IISER Pune
- 10th–12th March 2023: Speaker and Co-organiser at workshop on Public Policy x Evolution at Takshashila Institute, Bengaluru, with Shambhavi Naik from Takshashila Institute and the Indian Society of Evolutionary Biologists

Major talks during 2022–2023:

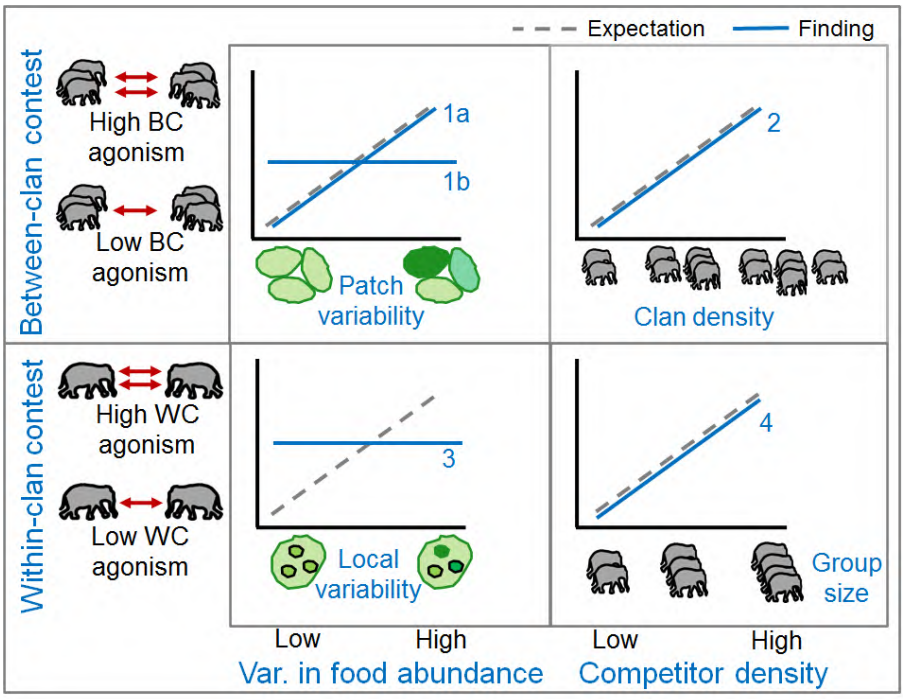
- 18th April 2022: Invited talk (hybrid mode) on *"Evolutionary biology: in the lab and beyond"* at Science Festival, Impulse-22, organised by Synapse—the Zoological Society of Miranda College, Delhi University
- 5th June 2022: Public Policy Online Course on *"How can biology illuminate public policy"* at Takshashila Institute, Bengaluru
- 6th December 2022: Invited Talk (online) on *"Atheism after Darwin"* for event titled *"Reason and faith: a quest to understand atheism and religion across the centuries"* at INSTUCEN, Mumbai
- 10th February 2023: Invited as a speaker at the ISEB4: Revolutionizing Darwinian synthesis International Conference on *"Crowded fruit fly cultures: more than just density"* organised by Indian Society of Evolutionary Biologists, Ahmedabad University
- 25th February 2023: Joint talk with Satybrata Nayak at the International Discussion Meeting on *"The role of genes in evolutionary explanation"* for the Seventh Foundations of Biology Meeting on *"Evolution: an ongoing synthesis?"* organised by Prof. Amitabh Joshi, L.S. Shashidhara, and Sutirth Dey from IASc, Bengaluru
- 2nd March 2023: National online talk on *"Experimental evolutionary biology"* at the Seventh Workshop on *"Trans-disciplinary Areas of Research and Teaching by Shanti Swarup Bhatnagar Awardees"* organised by Deen Dayal Upadhyay College, Delhi University
- 4th March 2023: Invited talk (hybrid mode) for National Webinar event—Partnership for Wildlife Conservation and Saving Wildlife on the topic *"Why evolution is central to both biology and our lives"* organised by Department of Zoology, St. Francis College for Women, Hyderabad, on the occasion of World Wildlife Day and the 60th anniversary of the department's founding
- 4th March 2023: Invited talk (hybrid mode) at the Growth of Biological Sciences International Conference on *"Evolutionary biology as 'nazariya' and 'kirdaar'"* organised by Faculty of Life Sciences, Punjabi University, Patiala
- 16th March 2023: Invited talk (hybrid mode) at National Online Meet on Evolutionary Biology organised by Department of Zoology, Hindu College, Delhi on the occasion of the 50th anniversary of the founding of the department, and the 125th anniversary of the founding of Hindu College
- 26th March 2023: Public lecture on *"What is natural selection, and why it is not the survival of the fittest"* at Kaapi with Kuriosity event organised by International Centre for Theoretical Sciences (ICTS-TIFR) and Jawaharlal Nehru Planetarium, Bengaluru

Dr. T. N. C. Vidya F.I.S.E.B.

Associate Professor

We reported on the first tests of socioecological theory in the Asian elephant, relating food resource availability with between- and within-clan agonistic interactions. We found the grassland created around the Kabini reservoir (between Nagarahole and Bandipur National Parks) had about three times as much grass abundance as forests on either side. In keeping with this being a small, resource-rich patch, we found between-clan dominance to be remarkably high, in contrast to that previously reported from the forest. The rate of agonism between females between clans was also higher than that within clans. The rate of between-clan encounters increased with the number of clans and the number of adult females. Despite fission–fusion dynamics, within-clan agonism was also fairly high, but not correlated with grass biomass, in contradiction to socioecological prediction. Within-clan agonism increased with group size, suggesting that the opposing effects of between- and within-clan agonism might govern group sizes.

EIBU



Effects of food distribution and competitor density on within-clan and between-clan agonistic contests, expectations, and findings

Reference: *bioRxiv.* 754515. 2022. doi: 10.1101/754515

UNIT MEMBERS

Faculty Members	
Professor and Chair	**Prof. Amitabh Joshi**
Associate Professor	**Dr. T. N. C. Vidya**

Research Students	
Ph.D.: 13	**Ankana Sanyal, Anuj Menon, Athira T. K., Bhawna Mittal, Bindya R. S., Chinmay Krishna Yadav Temura, Divya Choudhary, Jabili Chowdari, Medha Rao, Mohnish Singh, Pavitra Prakash, Satyabrata Nayak, Singh Viveka Jagdish**
Int. Ph.D.: 1	**Srikant Venkitachalam**
M.S.–Ph.D.: 1	**Anvitha S.**

Administrative Staff	
Helper	**Rajanna N.**

Temporary Staff	
Driver	**Pramoda Kumar G. S.**
Tracker	**Shankar**

Research Staff (On Contract)	
Research Associate (Provisional)	**Neha Pandey**
R&D Assistant	**Thanikodi M.**

EIBU

UNIT AT A GLANCE

Honours/Memberships Received

Faculty member

Students

Faculty Achievement

Dr. T. N. C. Vidya
• Elected as Member to the Board of Studies, Zoology, at St. Joseph's University, Bengaluru

Student Achievements

Medha Rao (Ph.D. student; research supervisor: Prof. Amitabh Joshi)
• Received the Best Poster Award at the 4th Conference of the Indian Society of Evolutionary Biologists (ISEB4), held at Ahmedabad University during 9th–11th February 2023

Anvitha S. (MS–Ph.D. student; research supervisor: Dr. T. N. C. Vidya)
• Received an Animal Behaviour Society Student Research Grant for work on the *"Impact of Drought on the Social Structure of Female Asian Elephants in Nagarahole and Bandipur National Parks, southern India"* on 30th March 2023

Total Publications

3 Peer reviewed articles indexed in Web of Science/Scopus

EIBU

Students Graduated During 2022–23

2 **Ph.D.**

- Neha Pandey
- Revathe T.

1 **M.S. (through M.S.–Ph.D.)**

- Anvitha S.

Student Admitted During 2022–2023

1 **Ph. D.**

- Bindya R. S.

15 **Current Student Strength**

ENGINEERING MECHANICS UNIT (EMU)

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 endeavours currently underway concern the study of both complex micro-structured fluids (suspensions and emulsions, granular materials, polymer solutions and melts, 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, massively parallel computations and theoretical analyses.

Research carried out 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 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 active matter
- Hydrodynamic stability, transition, and turbulence
- Nonlinear dynamics and bifurcation phenomena
- Interfacial phenomena
- Atmospheric and geophysical sciences
- Thermal sciences
- Aerodynamics and acoustics

RESEARCH HIGHLIGHTS

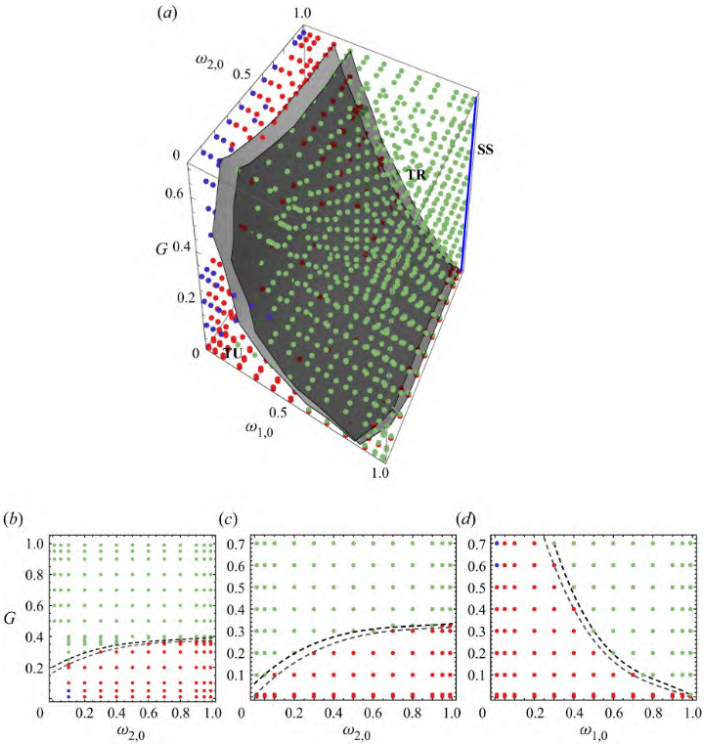
- Novel stretching-aligning regime was identified for deformable elastic particles subject to simple shear flow of an ambient Newtonian fluid
- Inertial transitions in a suspension Taylor–Couette flow were explored
- The essentially entropic lattice Boltzmann model was studied
- First analysis of inertial migration in an ambient quadratic flow was performed that shows equilibria other than the classical Segre–Silberberg positions
- Novel, purely elastic shear-driven instability in a viscoelastic film-flow configuration was demonstrated
- The relevance of generalised Fourier's law was demonstrated in the near-continuum limit of granular Poiseuille flow

EMU

RESEARCH ACTIVITIES AND ACHIEVEMENTS DURING 2022–2023

Prof. Ganesh Subramanian
Professor and Chair

The rheology of a suspension of rigid particles in a Newtonian fluid has been well-explored analytically, experimentally, and computationally. Many Newtonian fluids in nature and industrial settings consist of suspended particles that are deformable and impose shear flow. In our study, we investigated the shape dynamics of deformable elastic and viscoelastic particles in an ambient Newtonian fluid that is subjected to simple shear. The particles we studied were allowed to undergo large deformation and their elastic stress was calculated using the neo-Hookean constitutive relation. Our team presented a method for determining the shape dynamics of initially ellipsoidal particles, which was inspired by a previous method originally used to determine the shape at the steady state of an initially spherical particle. Our method recovered earlier results for the in-plane trembling and tumbling dynamics of initially prolate spheroids in simple shear flow that were determined by a different approach. Furthermore, the proposed method found a novel state wherein the particle extended indefinitely in time and asymptotically aligned with the flow axis. Our study is the first of many steps toward improving our understanding of the rheology and dynamics of suspensions of elastic and viscoelastic particles.



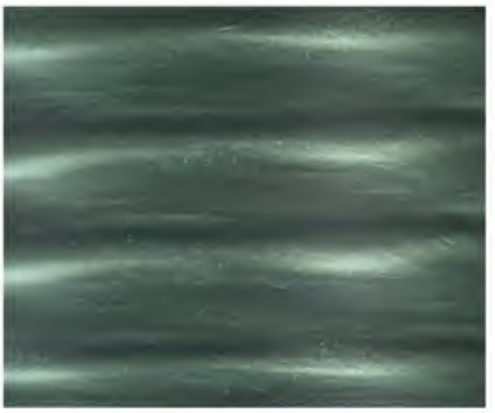
Graphical representation of tumbling (TU) and trembling (TR) dynamical states of a triaxial ellipsoid in simple shear flow

Reference: *J. Fluid Mech.* 949: A22. 2022. doi: 10.1017/jfm.2022.704

Prof. Meheboob Alam
Professor

We explored inertial transitions in a suspension Taylor–Couette flow via experiments in the counter-rotation regime up to a particle volume fraction of Φ = 30%. We found that the primary bifurcation from the circular Couette flow (CCF) yielded patterns similar to those in a particle-free Newtonian fluid and became supercritical at smaller rotation ratios (the ratio between outer and inner cylinder rotation rates, $\Omega = \omega_o/\omega_i \geq -0.5$, but turned hysteretic at large rotation ratios $|\Omega| = 1$. The bistability or the coexistence of wavy Taylor vortices (WTV) and modulated wavy vortices (MWV) states is demonstrated over a range of shear Reynolds number (Re_s) values spanning the secondary and tertiary bifurcation loci. We uncovered a novel sequence of transitions, TVF → MWV_1 → WTV → MWV, with another variant of modulated vortices (MWV_1, having a low-frequency mode which is dominant over the frequency of the wavy mode) that

EMU

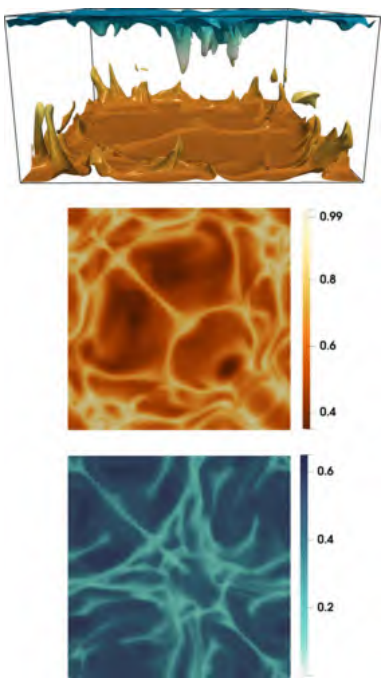


bifurcates into a single-frequency WTV state which subsequently gives birth to the standard MWV state (in which the wavy mode dominates over the low-frequency mode) characterised by two incommensurate frequencies. Finally, we showed that the effect of particle loading decreased the amplitude and increased the wavelength of wavy vortices, and the latter seems to be responsible for the decreased propagation frequencies of azimuthal waves with increasing ϕ.

Snapshot of a modulated wavy vortex (MWV_1) state in a pure fluid ($\Phi = 0$) TCF at a shear Reynolds number of $Re_s = 450$.

Reference: *J. Fluid Mech.* 944: A18. 2022. doi:10.1017/jfm.2022.483

Prof. Santosh Ansumali
Professor



The unconditional numerical stability by iteratively solving the nonlinear entropy evolution equation is guaranteed by the entropic lattice Boltzmann model. In our paper, we present a detailed description of the essentially entropic lattice Boltzmann model. We demonstrate that near equilibrium, this analytic solution reduces to the standard lattice Boltzmann model and along the way explain the construction of closed-form analytic solutions to equations. Our study deliberates on a few test cases to show that the analytic solution does not exhibit any significant deviation from the iterative solution. We also extended the analytical solution for the Ellipsoidal Statistical (ES)–Bhatnagar–Gross–Krook model to remove the limitation on the Prandtl number for heat transfer problems. Our proposed analytical solution simplifies entropic lattice Boltzmann models by removing the computational overhead and algorithmic complexity associated.

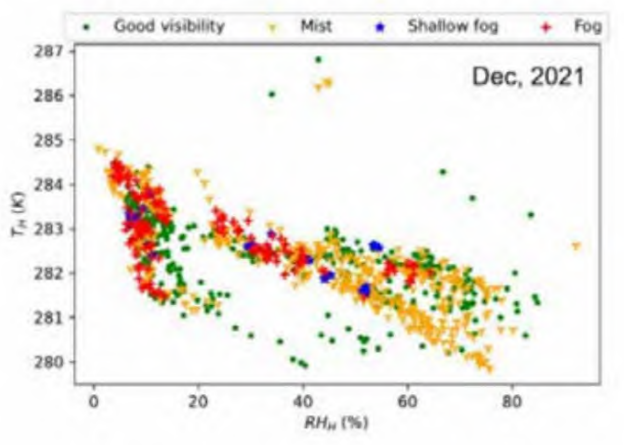
3D isotemperature contours of Rayleigh-Bènard convection at nondimensional temperatures 0.3 and 0.7. The mid and bottom figures visualise the temperature field at horizontal slices close to the two walls

Reference: *Phys. Rev. E* 106(5): 055307. 2022. doi: 10.1103/PhysRevE.106.055307

Prof. Sreenivas K. R.
Professor, Dean, Research and Development

Our team has been working to operationalise a major research facility for fog prediction next to the North runway at the Kempegowda International Airport, Bengaluru. The three components of the project are to develop a capability to predict the onset of radiation fog using (a) 3D scanning wind lidar; (b) microwave radiometer, to get the vertical profile of temperature, humidity, liquid water content up to 10-km height and the cloud base height at the site; and (c) 3-m height mast and soil temperature and heat flux probes. After calibration and initial field trial, we are receiving continuous data on the atmospheric condition prevailing over the airport region. Numerical simulations are being carried out using the WRF model, and comparisons are made between field observation of the fog and the numerical predictions. At present, we are getting 68% correct predictions for fog occurrence. Efforts are underway to improve this capability to reach a success rate of around 80%.

EMU



Correlation plot indicating the relation between condition for occurrence in terms of upper layer temperature and relative humidity

Dr. Diwakar Seyyanur Venkatesan

Faculty Fellow

One of our major focus areas is to understand multi-layer convection phenomena like mantle convection and liquid-encapsulated crystal growth. Our work, involving both theoretical and experimental approaches, has helped us understand the regimes of different oscillatory modes of convection, such as standing, traveling, and modulated traveling waves. In other work, in collaboration with Prof. Ranga Narayanan, University of Florida, USA, we have developed a novel instrument to measure interfacial tension. Correlating the interfacial tension and volume of a pendant droplet before its breakup, the instrument yields accurate estimates without requiring cumbersome image processing and curve fitting.

With a renewed interest in explicit methods for solving nonlinear partial differential equations, we have developed a new weighted scheme that considers an average of the convectional forward time-centred space scheme and the asynchronous delayed difference scheme. The method relaxes the stability constraints of explicit approaches, and in conjunction with isotropic spatial difference operators, helps in overcoming the curse of dimensionality. A novel immersed volume approach has been developed as a convenient way of handling finite-size particles in a fixed grid formulation. A volume-fraction-based localized forcing was invoked to mimic the effects of solids in the fluid domain. Deriving from interface reconstruction procedures of the volume of fluid method, the present approach efficiently interpolates velocities and their derivatives closer to the interfacial cells, yielding second-order accuracy.

UNIT MEMBERS

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

Research Students	
Ph.D.: 12	**K. Siddharth, Vybhav G. R., Mohammad Rafiuddin (upgradation to Ph.D.), Suryadev Pratap Singh, Subham Banerjee, Piyush Garg (upgradation to Ph.D.), Raksha Mahalinkam, Praveen Kumar K. (upgradation to Ph.D.), Shaurya Kaushal, Akshaysingh Bhawarsingh Shekhawat, Uttara S., Abhisek Ganguly**

EMU

Research Students	
M.S.(Engg.): 14	**Mayank Toprani, Adharsh S., Shashank R., Sangamesh Gudda (upgradation to Ph.D.), Biswadeep Roy, Ritwik Das, Akhilesh Srivastava (mid-year), Anomitra Saha, Ganesh Kumar B., Jishnu Goswami, Guruprasad S., Manoj Tanaji Tanagawade, Akash Bansal, Shounak Dey**

Research Staff (On Contract)	
Research Associates	**Dr. Harish N. Mirajkar, Dr. Partho Mukherjee, Dr. Abhijit Dhamanekar**
Research Associate-II	**Dr. Pavan Kumar Singeetham**
SERB National Postdoctoral Fellow	**Dr. Manojit Ghosh**
Senior Research Fellows	**Arunkumar V., Prateek Anand**
Junior Research Fellows	**Vybhav G. R., Soumyakanta Mishra, Piyush Garg**
R & D Assistant	**Ritwik Das**

UNIT AT A GLANCE

Honour Received

Faculty member

Faculty Achievement

Prof. Santosh Ansumali
• Received the prestigious IIT Bombay International Award for Excellence in Research in Engineering & Technology on 5th September 2022, for his significant and impactful contributions to engineering and technology

Total Publications

9 Peer reviewed articles indexed in Web of Science/Scopus

EMU

Sponsored Projects

Ongoing Projects

5

Grants Received During 2022–2023

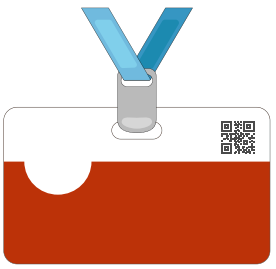
₹ 2.19 cr

Student Graduated During 2022–23

1 **Ph. D.**

- Arun Kumar Varanasi

Students Admitted During 2022–2023



1 **Ph. D.**

- Uttara S.

1 **M.S.(Engg.)**

- Shounak Dey

26 **Current Student Strength**

GEODYNAMICS UNIT (GDU)

At GDU, our research 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. We also conduct comprehensive investigations into natural hazards, including surface faulting, earthquakes, tsunamis, and landslides. To enhance our understanding of the complex relationship between global and regional climates and monsoon rainfall patterns, we employ advanced modelling techniques. These techniques leverage extensive geological proxy databases. Additionally, in collaboration with the Geological Survey of India in Bengaluru, we study selected urban lakes using environmental geochemistry to discern climatic variations and anthropogenic influences.

Expanding our scientific endeavours, we have initiated captivating natural analogue studies in collaboration with the Theoretical Science Unit of JNCASR and the Bhabha Atomic Research Centre in Mumbai. Our primary focus in 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 our research have significant potential 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 Himalaya and the Indian Peninsula
- Petrography and mineralogy and stable isotopes of speleothems
- Environmental geochemistry and geomagnetism of lake sediments
- Investigations into potential hazards in the tectonically active Himalaya and Western Ghats Mountains
- Establish the relationship between global and regional climates by utilizing regional atmospheric circulation models
- Study of structure, vibrational, and elastic properties of natural hydroxyapatites with carbonate and actinides substitutions

RESEARCH HIGHLIGHTS

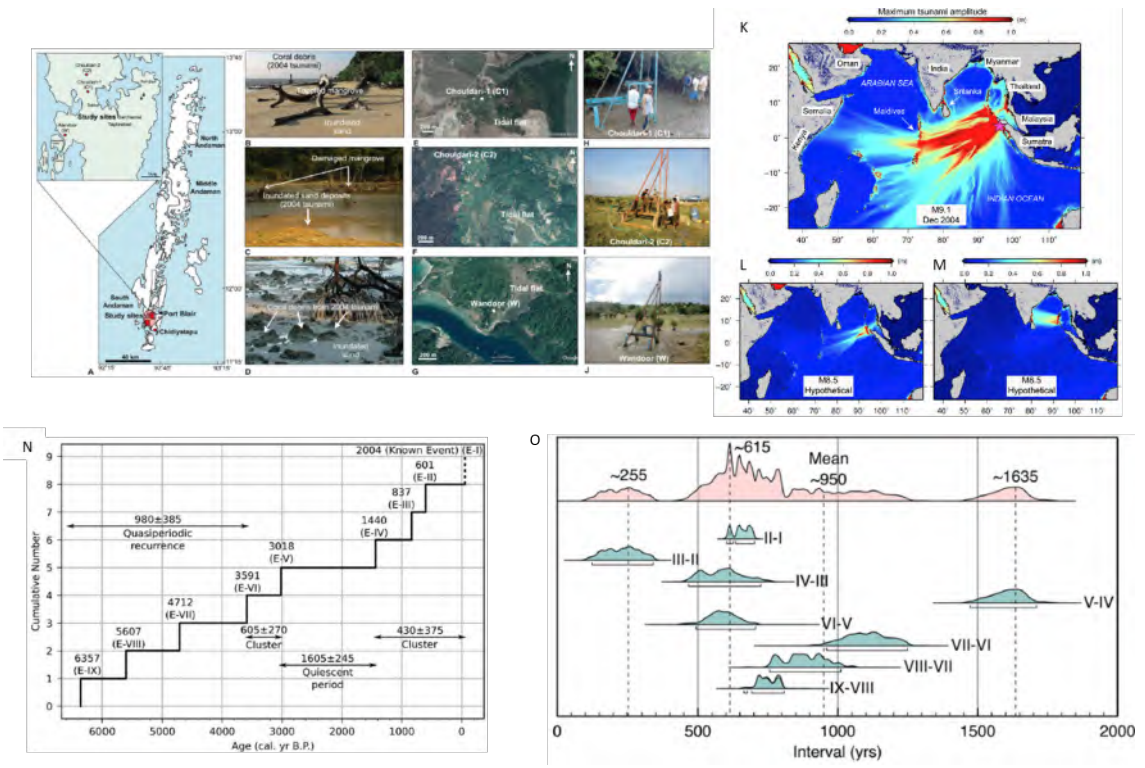
- Evidence of ancient tsunamis was discovered as a result of GDU's recent research near Port Blair in the South Andaman region
- A comparative study of sediment based biotic proxies (Pollen and δ^{13}Corg) and speleothem (δ^{18}O) records of (Indian Summer Monsoon) ISM system was conducted
- Another research endeavour was undertaken to explore the historical evolution of the Indian Summer Monsoon

RESEARCH ACTIVITIES AND ACHIEVEMENTS DURING 2022–2023

Dr. Jaishri Sanwal Bhatt

Research Associate III

We developed a comprehensive and long-term near-field template of tsunami deposition. This was achieved by conducting multiple analyses of sediment cores obtained from various sites near Port Blair and by comparing them with chronologically comparable tsunami litho-units from other areas affected by the 2004 tsunami along the Indian Ocean coast. Through detailed investigations of these sediment cores, we have identified nine out-of-sequence/tsunami sand sheets, including the 2004 tsunami, suggesting that the region has experienced multiple large-scale tsunami events over the past 6500 years. These deposits were identified as previous tsunami episodes based on their distinct sediment characteristics and microfossil content. We used the deposition from the 2004 event as a template for comparison to determine the dates of these deposits at different depths. These findings align chronologically with similar events observed in far-field locations across the Indian Ocean region. The study revealed a nonlinear pattern in the occurrence of causative earthquakes behind the tsunamis. An early phase of quasiperiodic recurrence was identified, transitioning into a distinct interval of temporally clustered events. This quasiperiodic regime emerged around the mid-Holocene, with an inter-event interval of approximately 980 ± 385 years, followed by a significant quiescent period of about 1605 ± 245 years. This pattern was then succeeded by a regime of temporally clustered events. Similar to subduction zones observed elsewhere, the temporal variability of tsunamigenic great earthquakes is believed to be influenced by long-term stress recycling processes within the subduction zones and transfer processes between the lower viscoelastic layer and the upper seismogenic crust, as supported by theoretical models. The long-term recurrence characteristics of earthquakes similar to the 2004 event along the Sumatra-Andaman subduction zone, as presented in this study, provide valuable data for testing assumptions and simulations in theoretical models.



Comprehensive and long-term near-field template of tsunami deposition from sites near Port Blair

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

GDU

Events organised:

- 6th June 2022: Co-organised talk on *"Climate change and extremes over the Himalaya"* for World Environment Day by Prof. A.P. Dimri, with Prof. Vidhyadhiraja (Professor, TSU and Coordinator of ETU, JNCASR)
- 29th September 2022: Organised talk by Prof. Binod Sreenivasan, Chair, Centre for Earth Sciences, Indian Institute of Science, Bengaluru on *"Discover the Magnetic Earth"* during the Science Outreach Programme held as part of the Prof Valdiya Memorial Lecture Series-2

Major talks during 2022–2023:

- 3rd April 2022: Invited talk on *"Discover karst and cave geology"* for Geologists Day organised by the Speleological Association of India
- 25th–28th April 2022: Invited talk on *"The Science of a Dynamic Planet: Geological Secrets"* for Science Outreach Programme, Uttarakhand, organised by Prof. C. N. R. Rao Education Foundation jointly with Himalayan Gram Vikas Samiti (HGVS), Gangolihat, Uttarakhand
- 14th June 2022: Invited talk on *"The Mighty Himalaya: Land, People, and Environment"* for World Environment Day, 2022, organised by Indian Women Scientists' Association (IWSA), South Indian Education Society's School of Business Studies (SIESSBS), and College of Management Studies (SIESCOMS)
- 2nd–4th November 2022: Invited talk on *"Evidence of long-lasting quiescence of great earthquakes in the Central Himalaya"* for The Himalaya-Karakorum-Tibet (HKT) workshop at Pokhara, Nepal
- 17th–18th November 2022: Invited talk on *"Evidence of the Quiet Before the Quake in the Central Himalaya: Are We Prepared for a strong tremor by a Great Earthquake?"* for an In-House Symposium (IHS) at JNCASR, Jakkur, Bengaluru
- 19th–21st January 2023: Invited talk on *"The Rocks"* for Science Outreach Programme organised by Prof. C. N. R. Rao Education Foundation jointly with School Prof. C. N. R. Rao Education Foundation jointly with School Chandan, Laxmeshwar District, Gadag, Karnataka
- 10th–12th February 2023: Invited talk on *"Science Outreach Activities in Rural Uttarakhand: A Unique Innovation by Prof. C. N. R. Rao Education Foundation"* for the Rural Science Congress under the Uttarakhand State Science and Technology Congress organised by the Uttarakhand State Council for Science and Technology (UCOST), Vigyan Dham, Jhajra, Dehradun, Uttarakhand
- 28th February 2023: Invited talk on *"The Rocks: Tangible Trace of The Earth's Past"* for National Science Day 2023, organised by ETU, JNCASR
- 27th–29th March 2023: Invited talk on *"Synergistic Impacts of Rapid Urbanisation Anthropogenic Landscape Transformations On Emerging Disaster Risks"* for the event titled *"Rapid Urbanisation and Disaster Risk Reduction"* organised by School of Earth & Environmental Sciences, Central University of Himachal Pradesh in collaboration with National Institute of Disaster Management, Ministry of Home Affairs, Government of India, New Delhi

UNIT MEMBER

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

Total Publications

3 Peer reviewed articles indexed in Web of Science/Scopus

INTERNATIONAL CENTRE FOR MATERIALS SCIENCE (ICMS)

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 the 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 Honourable Prime Minister of India, Dr. Manmohan Singh.

An important and unique activity of ICMS is to support research and international exchange programmes. ICMS is a constituent of the School of Advanced Materials (SAMat), JNCASR.

RESEARCH AREAS

- Aberration corrected high-resolution transmission electron microscopy
- Solid–state chemistry
- Epitaxial growth of semiconductors
- High-Resolution Electron Energy Loss Spectroscopy (HREELS)
- Experimental soft condensed matter physics

RESEARCH HIGHLIGHTS

- The effect of surface functionality of elemental two-dimensional materials (2D) (such as Antimonene and Bismuthene) on their electronic and optical properties was studied
- 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
- Melting on a sphere via a hexatic phase was demonstrated
- A new class of biodegradable aliphatic polymers was developed with potential applications in the biomedical industry
- Higher cycling stability for advanced alloy anodes was demonstrated by coupling diglyme-based electrolyte with a bismuth oxychloride anode in sodium-ion batteries (NIBs)
- Morphology-controlled Reststrahlen band and plasmon polaritons make GaN nanostructures attractive for infrared nanophotonics were demonstrated
- A model system of copper-doped cadmium selenide/cadmium sulfide quantum dots for in-depth understanding of the extended X-ray absorption fine structure spectra of the dopant and host atoms was developed
- Transition metal doping in CdS quantum dots was studied
- The possibility of utilising a group-III expitaxial semiconducting nitride material with artificial synaptic devices was explored
- 2D nanomaterials and magnetic and semiconducting halide perovskites were explored

ICMS

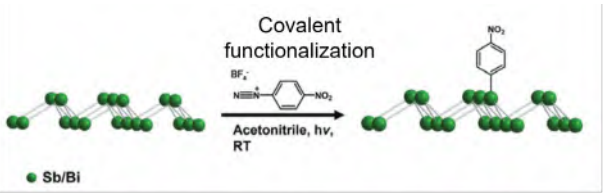
RESEARCH ACTIVITIES AND ACHIEVEMENTS DURING 2022–2023

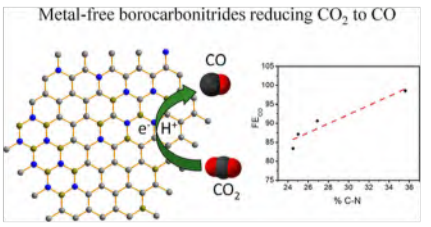
Bharat Ratna Prof. C. N. R. Rao D.Sc., F.R.S., Hon. F.R.S.C.

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

We have studied the effect of surface functionality of elemental two-dimensional materials (2D) (such as Antimonene and Bismuthene) on their electronic and optical properties. These materials possess a lone pair which can be effectively utilised to tune material properties *via* different functionalization strategies. Lewis acid functionalization leads to form Lewis acid-base adducts with the lone pair which affects the band structure, and the corresponding change was realized as the blue emission of few layered Sb and Bi. A similar distortion and blue shift were observed on covalent functionalization of Sb and Bi using p-nitrobenzene diazonium salt (Sb/Bi-C bonds). 2D Borocarbonitrides as metal-free electrocatalysts for the electrochemical reduction of CO_2 was also studied. By tuning the composition $B_xC_yN_z$ in boroncarbonitride, 98% faradaic efficiency for CO_2 conversion to CO was achieved.

2D $MoSe_2$ nanosheets were used to fabricate $MoSe_2$ membranes. These membranes showed 100% separation of dye molecules from dye/salt wastewater at a very high-water flux of 900 $Lm^{-2}h^{-1}bar^{-1}$ was achieved.





Top image: Covalent functionalisation of antimonene and bismuthene with Lewis acids
Middle image: Conversion of CO_2 to CO using 2D borocarbonitrides as metal-free electrocatalysts
Bottom image: $MoSe_2$ membranes fabricated using 2D $MoSe_2$ nanosheets

References:

Nanoscale. 14: 13834-13843. 2022. doi: 10.1039/D2NR03206F
Chem. Mater. 34(14): 6626–6635. 2022. doi: 10.1021/acs.chemmater.2c01591
Small. 18(38): 2203554. 2022. doi: 10.1002/smll.202203554
J. Colloid Interface Sci. 646: 980-990. 2023. doi: 10.1016/j.jcis.2023.05.087

Prof. Eswaramoorthy Muthusamy

Associate Director, ICMS; Professor, CPMU; and Dean, Academic Affairs

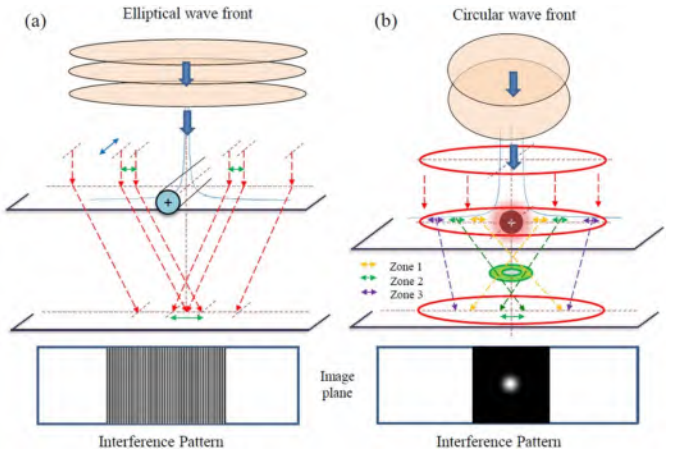
Please refer pg. 48 for research activities

Prof. Ranjan Datta

Professor

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.

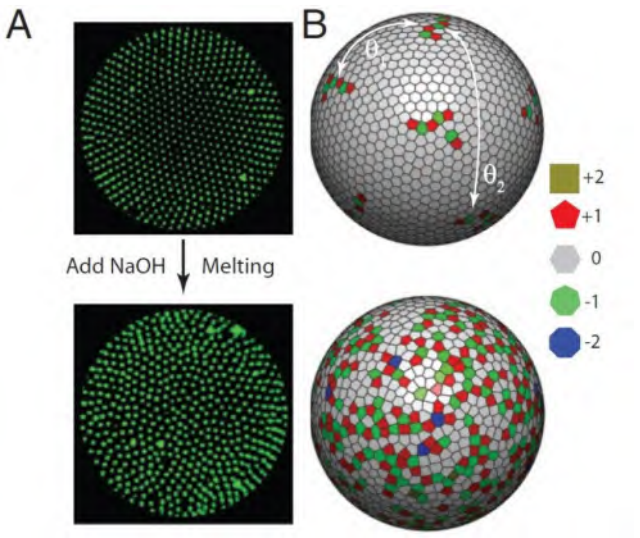


The interference pattern due to (a) unidirectional bi-prism and (b) atom as charge center

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

Prof. Rajesh Ganapathy
Professor

Unlike in three-dimensional flat space, melting in two dimensions is typically via the hexatic phase—a state with quasi–long-range orientational order but no translational order. However, crystals on curved surfaces harbor a finite number of defects, even in their ground state, to relieve the packing frustration imposed by curving space, and how melting proceeds is unknown. In fact, for crystals on a sphere, these defects are ordered, and melting involves the loss of both crystalline and defect order. Here we show that melting on a sphere is via the hexatic phase and, surprisingly, also unaffected by the presence of curvature-induced defects. Strikingly, defect order vanished in the hexatic window. Our findings can help understand phase transitions on curved surfaces.



Melting of crystalline and icosahedral defect order on a sphere

Reference: *PNAS.* 119: 32 e2206470119. 2022. doi: 10.1073/pnas.2206470119

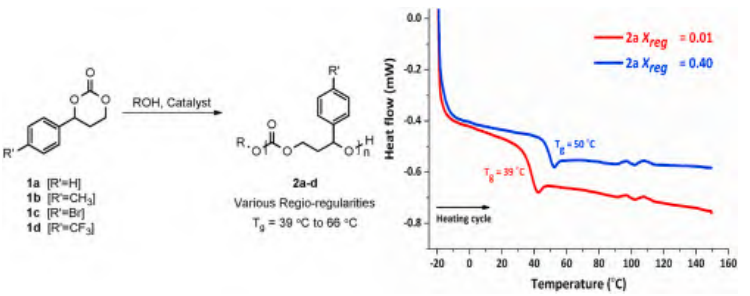
Major talks during 2022–2023:

- August 2022: Lecture on *"Intermediate-range order governs dynamics in dense colloidal liquids"* at the Current Directions in Statistical Physics Seminar at JNCASR
- December 2022: Invited talk on *"Colloidal heat engines in complex environments"* at the Experimental Applications of Stochastic Thermodynamics event organised by IIT Mumbai
- December 2022: Invited Seminar on *"Intermediate-range order governs dynamics in dense colloidal liquids"* at the Winter School on the Physics and Chemistry of Materials organised by JNCASR
- December 2022: Invited talk on *"Melting on a sphere"* at the Department of Atomic Energy, Solid State Physics Symposium organised by BITS-Mesra, Ranchi

ICMS

Prof. Sridhar Rajaram
Professor

During the past year, we worked on developing biodegradable polymers with potential applications in the biomedical industry. Most biodegradable polymers used in the bio-medical industry are polyesters which, during degradation, increase the pH, which often leads to burst release of cargo. Aromatic polycarbonates are an attractive alternative to such polyesters since they biodegrade without increasing pH. However, aromatic polycarbonates are made from bisphenol A, a suspected endocrine disruptor. On the other hand, aliphatic polycarbonates degrade into harmless material but have inferior mechanical properties compared to the former. We addressed this issue and developed a novel class of aliphatic polyesters consisting of aliphatic polycarbonate backbone, appended with aromatic side chains to enhance the stiffness of polymer chains. The polymerisation technique led to the formation of polymers with excellent regio-regularity, which is a rarity amongst aliphatic polymers. The results indicated that the glass transition temperature of these polymers was sensitive to regio-regularity as well as the substitution pattern of the pendant group. We also made diblock polymers to make more mechanically robust biodegradable polymers.

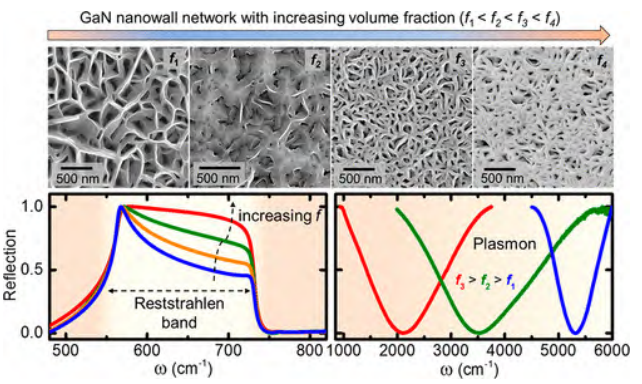


Chemical structures of the novel compounds developed in this study and their regio-regularity.

Reference: *Polymer* 227: 123803. 2021. doi: 10.1016/j.polymer.2021.123803

Prof. S. M. Shivaprasad
Professor (on lien; superannuated on 30th June 2022)

Gallium nitride (GaN) has emerged as one of the most famous semiconductors of the modern era due to its ultrabright and stable blue light emission. Its properties make it a promising candidate for light-emitting diodes, power electronics, and optoelectronic applications. Extending GaN's optical resonance from visible to mid- and far-infrared spectral ranges could open new avenues for its utilisation in many emerging technologies. We showed that hexagonal honeycomb-shaped GaN nanowall networks and vertically standing nanorods with the ability to exhibit morphology-dependent Reststrahlen band and plasmon polaritons could be harnessed for infrared nanophotonics. We found that phonon absorption inside the Reststrahlen band altered its shape from rectangular to right-trapezoidal due to surface-induced dipoles at the edges and asperities in molecular beam epitaxy-deposited nanostructures. Such polariton modes could provide a novel pathway to achieve far-infrared optical resonance in GaN. Furthermore, additional surface defects in nanostructures could lead to high carrier concentrations, resulting in tuneable mid-infrared plasmon polaritons with high-quality factors. Our study demonstrated that morphology-controlled Reststrahlen band and plasmon polaritons make GaN nanostructures attractive for infrared nanophotonics.



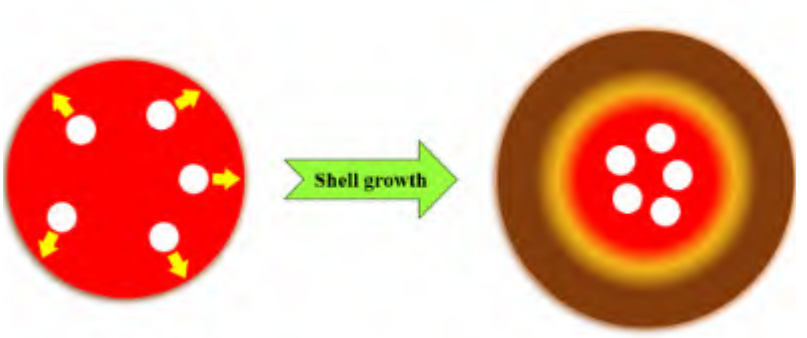
Scanning electric microscopy images of GAN nanowall synthesised in the study and the IR spectra reading showing Reststrahlen band and plasmon polaritons

Reference: *Nano Lett.* 22(13): 9606–13. 2022. doi: 10.1021/acs.nanolett.2c03748

ICMS

Prof. Ranjani Viswanatha SERB-POWER Fellow
Professor

Identifying the nature of the interface and the radial location of the dopant ion due to the diffusion within the lattice are the two biggest questions and challenges in the field of colloidal doped core/shell nanomaterials of different morphologies. We addressed these issues by obtaining an in-depth understanding of the extended X-ray absorption fine structure (EXAFS) spectra of the dopant and host atoms with the help of the Cu-doped cadmium selenide/cadmium sulfide (CdSe/CdS) quantum dots model system. Our findings suggested that the interface was not sharp and in agreement with the existing non-structural. We also carried out local structure analysis around the Cu dopant ion which confirmed that Cu drifts out from the core toward the outer region in the absence of the shell but then stops and stays mostly in the core after a sufficiently thick interfacial barrier of ~2 monolayers are formed. Our study emphasised and demonstrated the ability of EXAFS spectroscopy as a tool that can help us better understand the nature of interfaces in nanomaterials.



Graphical representation of Cu drifting out from the core towards the outer region in the absence of a shell

Reference: *J. Phys. Chem. Lett.* 13(47): 11036–11043. 2022. doi: 10.1021/acs.jpclett.2c02704

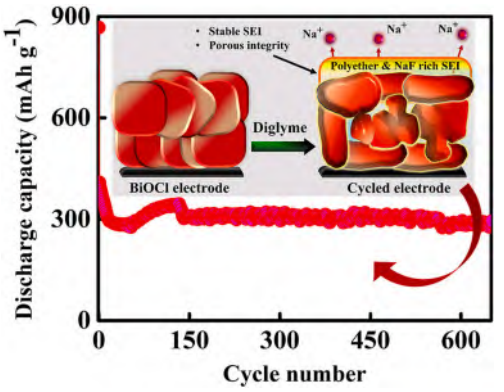
Event organised:
- 17th and 18th November 2022: Co-organised the Annual Faculty Meeting and In-House Symposium 2022 with Prof. Rajesh Ganapathy (CPMU, JNCASR), and Prof. Eswaramoorthy Muthusamy (CPMU, JNCASR)

Major talks of 2022–2023:
- Invited Talk on *"Cu doping in II-VI semiconductors"* at the National Conference on d–d Transitions
- 2022: Talk as Chair of the Indian delegation at the BRICS Photonics Second, Third, and Fourth Working Group Meeting Summit organised in Russia, China, and Brazil respectively
- August 2022: Invited talk on *"Nanomaterials: The Journey from Laboratory to Industry"* at Vigyan Utsav by KSCST 2022
- 3rd and 4th August 2022: Invited talk on *"Magneto-Optical Effects in Doped Nanocrystals"* at the National Conference on New Vistas in Chemistry, Bangalore University
- 6th December 2022: Invited talk on *"Study of Magneto-optical Effects for Nanophotonic Applications"* at the International Winter School, JNCASR
- 23rd January 2023: Invited talk on *"Diffusion, Magnetism and Excited State Dynamics: Periodic Overview"* at the ChemSci2023: Leaders in the Field Symposium 2023, JNCASR
- 20th–24th February 2023: Invited talk on *"Study of Magneto-optical Effects for Nanophotonic Applications"* at the ICAM-2023 Conference organised by Goa University
- 3rd March 2023: Invited talk on *"Understanding mechanism of Mn emission in Perovskite halides using Raman Spectroscopy and Magnetic Circular Dichroism"* at a conference organised by Perovskite Society of India, IIT Roorkee

ICMS

Dr. Premkumar Senguttuvan
Associate Professor (jointly with NCU)

The layered structure of two-dimensional bismuth oxychloride (BiOCl) facilitates ionic diffusion and higher specific capacities as an anode in rechargeable alkali-ion batteries. Despite its excellent electrochemical properties, the application of BiOCl is hindered by rapid capacity decay caused by particle pulverisation and unstable solid electrolyte interphase (SEI). We circumvented the problem by simply coupling BiOCl anode in Na-ion batteries (NIBs) with a diglyme-based electrolyte. Electrochemical analysis of our system exhibited higher cycling ability and reversible capacities greater than 295 mA h g^{-1} for up to 650 cycles at 100 mA g^{-1}. Our material also showed a great rate of performance and excellent durability. The post-mortem studies revealed that the formation of stable SEI and maintenance of electrode integrity were responsible for the excellent performance of the anode. Our study highlighted the importance of electrolyte engineering in stabilising the SEI and in the development of high-performance advanced alloy anodes for NIB application.

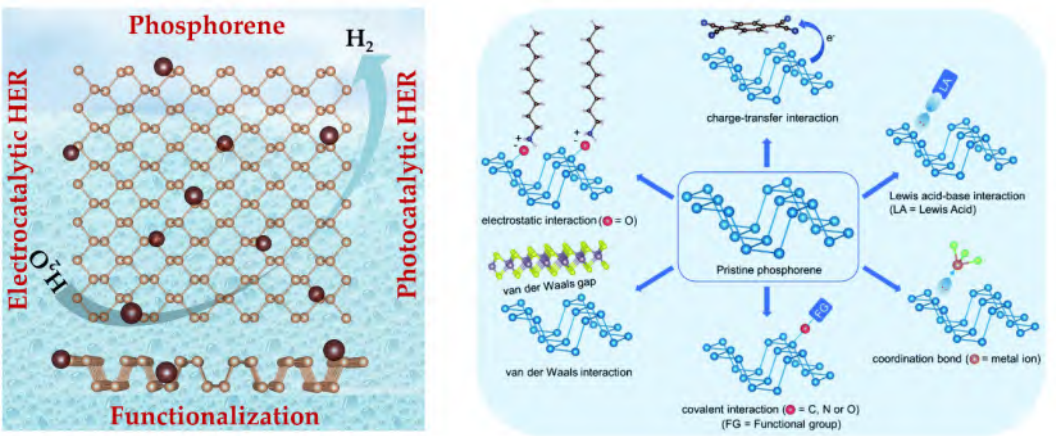


Cycle number vs discharge capacity for characterisation of higher cycling stability of BiOCl anode in NIBs

Reference: *J. Power Sources* 529: 231227. 2022. doi: 10.1016/j.jpowsour.2022.231227

Dr. Pratap Vishnoi
DST Ramanujan Fellow (jointly with NCU)

Chemically functionalised phosphorenes and their use in the water splitting reaction: Phosphorene, a 2D material composed of artificially synthesised layered black phosphorus, has garnered attention as a potential catalyst for the hydrogen evolution reaction (HER) via water splitting due to its high density of surface-active sites, high charge-carrier mobility, broad-spectrum light absorption, and tuneable bandgap. Unfortunately, pristine phosphorene only allows for the generation of trace amounts of H_2 due to its large positive change in the Gibbs free energy value, and poor ambient stability. We put forward a wide range of interactions that could be utilised for preparing modified/functionalised phosphorenes with enhanced HER properties. We also assessed the properties of phosphorene that could make it an ideal and efficient HER catalyst, and further discussed possible developments in electrocatalytic, photocatalytic, and photo-electrocatalytic means of producing H_2 using phosphorene-based materials.



Schematic representation of different interactions utilised for phosphorene functionalisation

Reference: *J. Mater. Chem. A.* 10: 19534-19551. 2022. doi: 10.1039/D2TA01932A (perspective)

ICMS

Major talks of 2022–2023:

- 31st August – 2nd September 2022: Invited talk at Crystal Engineering: From Molecule to Crystal [CE: FMC2022] Conference on *"Hybrid Halide Double Perovskites Beyond Main Group Metals"* organised jointly by University of Kashmir and IISER Kolkata at the Pahalgam Club & Convention Centre, Pahalgam, Kashmir, India
- 5th – 9th December 2022: Invited talk on *"Halide Double Perovskites of Open-Shell Transition Metals"* at the International Winter School 2022, organised by JNCASR and Ras Al Khaimah Center for Advanced Materials Ras Al Khaimah, UAE

Dr. Bivas Saha

Faculty Fellow (jointly with CPMU)

Please refer pg. 51 for research activities

UNIT MEMBERS

Faculty Members	
Linus Pauling Research Professor; Honorary President, JNCASR; and Director, ICMS	**Bharat Ratna Prof. C. N. R. Rao**
Associate Director (Professor, CPMU and Dean, Academic Affairs)	**Prof. Eswaramoorthy Muthusamy**
Professors	**Prof. Ranjan Datta** **Prof. Rajesh Ganapathy** **Prof. Sridhar Rajaram** **Prof. S. M. Shivaprasad** *(on lien; superannuated on 30th June 2022)* **Prof. Ranjani Viswanatha**
Associate Professor	**Dr. Premkumar Senguttuvan (jointly with NCU)**
Faculty Fellow	**Dr. Bivas Saha (jointly with CPMU)**
DST Ramanujan Fellow	**Dr. Pratap Vishnoi (jointly with NCU)**

Associate Faculty
• **Prof. Sundaresan A.** (Professor & Chair, CPMU) • **Prof. Kanishka Biswas** (Professor, NCU) • **Prof. G. U. Kulkarni** (Professor, CPMU; 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 Sundaram** (Professor, CPMU) • **Prof. Umesh V. Waghmare** (Professor, TSU; Dean, Faculty Affairs)

Diploma Students	
PGDMS: 5	**Poornima Baburaj, Parisha, Ananya A., Ankit Kumar, Sakil Mallick**

ICMS

Technical Staff	
Sr. Research Officer	**Dr. Jay Ghatak**
Technical Assistant (Inst)	**Mahesh J. I.**
Technical Assistant Trainees (On Contract)	**Ruther Tyson Lewis, Sachin Kumar**

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

Research Staff (On Contract)	
Research Associates	**Dr. M. S. Ramesh, Dr. Manodeep Mondal, Dr. Usha Manjunath Bhat, Dr. Mohd Monis Ayyub**
R & D Assistants	**Souren Mondal, Manjushri Anbarasu, Sneha Kobri, Mehak Loyal**
Senior Research Associate	**Dr. Chithaiah P.**
Project Scientist	**Ankur**
Research Scientist B	**Sanjit Kumar Parida**
SERB National Postdoctoral Fellow	**Dr. Nidhi Pandey**
Junior Research Fellow	**Alfred Rosario A.**

UNIT AT A GLANCE

Honours/Membership Received

Faculty members

Faculty Achievements

Bharat Ratna Prof C. N. R. Rao
• Received the SMC Lifetime Achievement Award from Society for Materials Chemistry • Lifetime Achievement Award from Chirantan Rasayan Sanstha • Received *Honoris Causa* from The Assam Royal Global University

ICMS

Dr. Premkumar Senguttuvan

- Elected as Member of JACS Au Early Career Advisory Board (ECAB) 2023
- Received the *Journal of Materials Chemistry A* Emerging Investigators 2023 Award

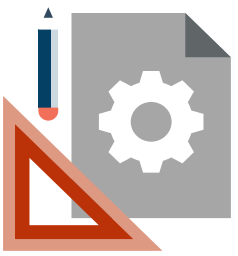
Dr. Pratap Vishnoi

- Received recognition as Emerging Investigator 2022 by the *Journal of Materials Chemistry*, Royal Society of Chemistry

Total Publications

51 Peer reviewed articles indexed in Web of Science/Scopus

Sponsored Projects



New Projects

3

Grants Received During 2022–2023

₹ 65.62 lac

Ongoing Projects

11

Grants Received During 2022–2023

₹ 25.03 cr

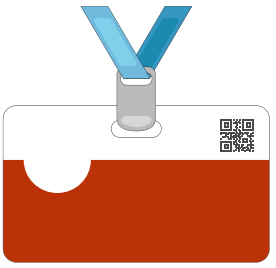
Student Graduated During 2022–23

2 **PGDMS**

- Chirag Sarthi J.
- Chiku Parida

ICMS

Students Admitted During 2022–2023



5 **PGDMS**

- Poornima Baburaj
- Parisha
- Ananya A.
- Ankit Kumar
- Sakil Mallick

5 **Current Student Strength**

MOLECULAR BIOLOGY AND GENETICS UNIT (MBGU)

Research in MBGU uses fundamental principles and advanced approaches to improve the understanding of concepts in biology as well as to provide solutions applicable to healthcare and medicine. Initiated in the area of infectious diseases, the unit has expanded to several current areas of cell and molecular biology, developmental genetics and biochemistry that assimilate inputs from physics, chemistry, materials science, and engineering.

Given the unique array of research areas that JNCASR has expertise in, biologists can easily traverse disciplines and have a worldwide network of collaborations.

Our research impacts the understanding and application of clinical and translational studies. Biological concepts and processes are unravelled by studying a wide variety of organisms including viruses, protozoans, fungi, *Drosophila*, and mouse, as well as human clinical samples. Research questions include understanding biomolecules at one end of the spectrum to studying human development and disease at the other. Facilities, funding, and training programs are geared to promote cross-disciplinary interactions.

With experience of several decades, the faculty holds key administrative and advisory positions at JNCASR, as well as nationally and internationally. The unit also has made the highest impact in contributions to science in the country, as evidenced by the large number of awards and honours bestowed on its members over the years, contributing actively to the recent excellent ranking of JNCASR as seventh in the Nature index normalized.

RESEARCH AREAS

- Unconventional protein secretion
- Organelle level mechanisms of EHT and early haematopoietic development
- Cancer and autophagy inhibition
- Molecular mechanisms responsible for severity of malaria infection and drug resistance
- *OCIAD1/2*- mediated regulation of mouse and human haematopoiesis
- Mechanisms of mitochondrial dynamics in blood progenitor homoeostasis and lineage bias
- Mitophagy and xenophagy
- Neurodegeneration and autophagy
- Molecular mechanism of T cell tolerance in the thymus
- Regulation of immune cell differentiation and function
- Role of organelle heterogeneity in HSC function and lineage differentiation
- Chromatin dynamics and transcription regulation
- Cellular and molecular basis of human genetic disorders
- Chromatin biology
- Cytoskeletal mechanisms of EMT and cell migration
- Role of endosomal sorting machinery in blood cell homeostasis
- Molecular enzymology and protein structure function analysis
- Crosstalk between nucleotide and energy metabolism in *Plasmodium*
- Cell cycle regulation, genome evolution, and histone variants in fungal pathogens
- Long noncoding RNA biology

MBGU

RESEARCH HIGHLIGHTS

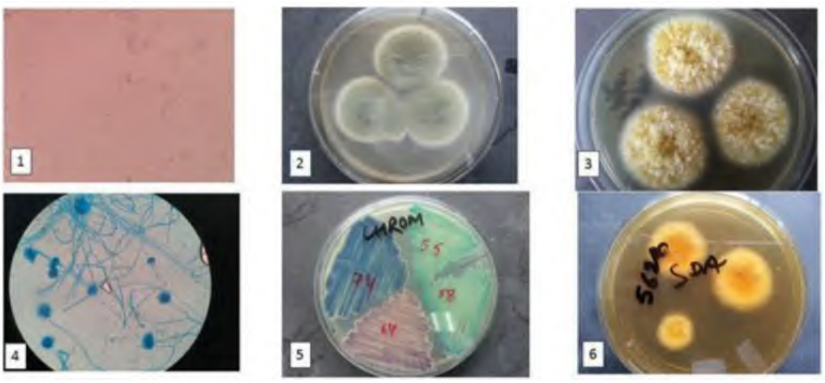
- Potential mechanisms responsible for chromosomal instability were identified
- Exome sequencing to collect initial data for idiopathic male infertility was performed
- Cell-intrinsic mechanisms regulating blood stem cell aging were studied in the context of aiding the reversal or slowing of aging
- The emergence of promoter-variant viral strains of HIV-1 subtype C was studied in the Indian population
- A semisynthetic derivative of garcinol, LTK-14A, to separate p300-catalysed butyrylation from acetylation during adipogenesis, was identified
- The synaptic dysfunction involved in Machado–Joseph Disease was studied using *Drosophila*
- Importance of DNA topoisomerases in immune cell development and function was highlighted based on a literature review of their immunological underpinnings
- A functional mechanism for detailing the role of *Methanocaldococcus jannaschii* GMP synthetase as a catalyst in biologically important reactions was discovered
- The molecular mechanism of regulation of *Sox8* by *Mrhl* lncRNA, mediated through chromatin looping, was studied in detail
- The finding that ART-induced ER stress could lead to increased expression of *P. Falciparum* autophagy proteins through induction of the UPR was established

RESEARCH ACTIVITIES AND ACHIEVEMENTS DURING 2022–2023

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

Professor and Chair

Chromosomal instability caused by cell division errors can often lead to antifungal drug resistance in fungal pathogens. Our study attempted to identify and characterise novel genome stability regulators in *Candida albicans (C. albicans)*, a human fungal pathogen. Our analysis of approximately 530 genes uncovered five genes which exhibited increased genomic instability upon overexpression. Two of these genes were linked to increased genomic instability primarily due to chromosome loss, whereas for the other three, instability was associated with non-chromosomal loss events. We found that the overexpression of a chromosomal stability (CSA) reported strain, CSA11, was associated with increased rate of erroneous chromosome segregation, leading to aneuploidy. Our study highlighted the important role of CSA11 for cell cycle progression and its role as a novel target for developing antifungals.



CSA11 overexpression results in chromosome missegregation leading to aneuploidies

Reference: *Med. Myc.* 60(1): 2022. doi: 10.1093/mmy/myac072.P331

MBGU

Events organised:

- 16th November 2022: MBGU Seminar by Prof. Frederic Berger on *"Organisation of chromatin landscape by histone variants"* at JNCASR
- 12th December 2022: MBGU Seminar by Prof. Joseph Heitman on *"RNAi-dependent epimutations evoke transient antifungal drug resistance"* at JNCASR
- 14th–18th December 2022: Co-organised 5th Conference on Chromosome Stablity with IISER Thiruvananthapuram at the IISER Thiruvananathapuram campus
- 21st December 2022: MBGU Seminar by Dr. Meetali Singh on *"Grand world of small RNAs: Navigating the balance between translation and small RNA biogenesis"* at JNCASR
- 7th February 2023: MBGU Seminar by Dr. Mainak Bose on *"Functional regulation of RNA-protein condensates in the Drosophila female germline"* at JNCASR
- 17th February 2023: MBGU Seminar by Dr. Paulomi B. Sanghavi on *"Intracellular Motors and Membranes During Pathogen Infection"* at JNCASR
- 2nd March 2023: MBGU Seminar by Dr. Varun Bhaskar on *"Studying the interplay of RNA metabolism and autophagy via disease factors implicated in C9-ALS/FTD"* at JNCASR

Major talks during 2022–2023:

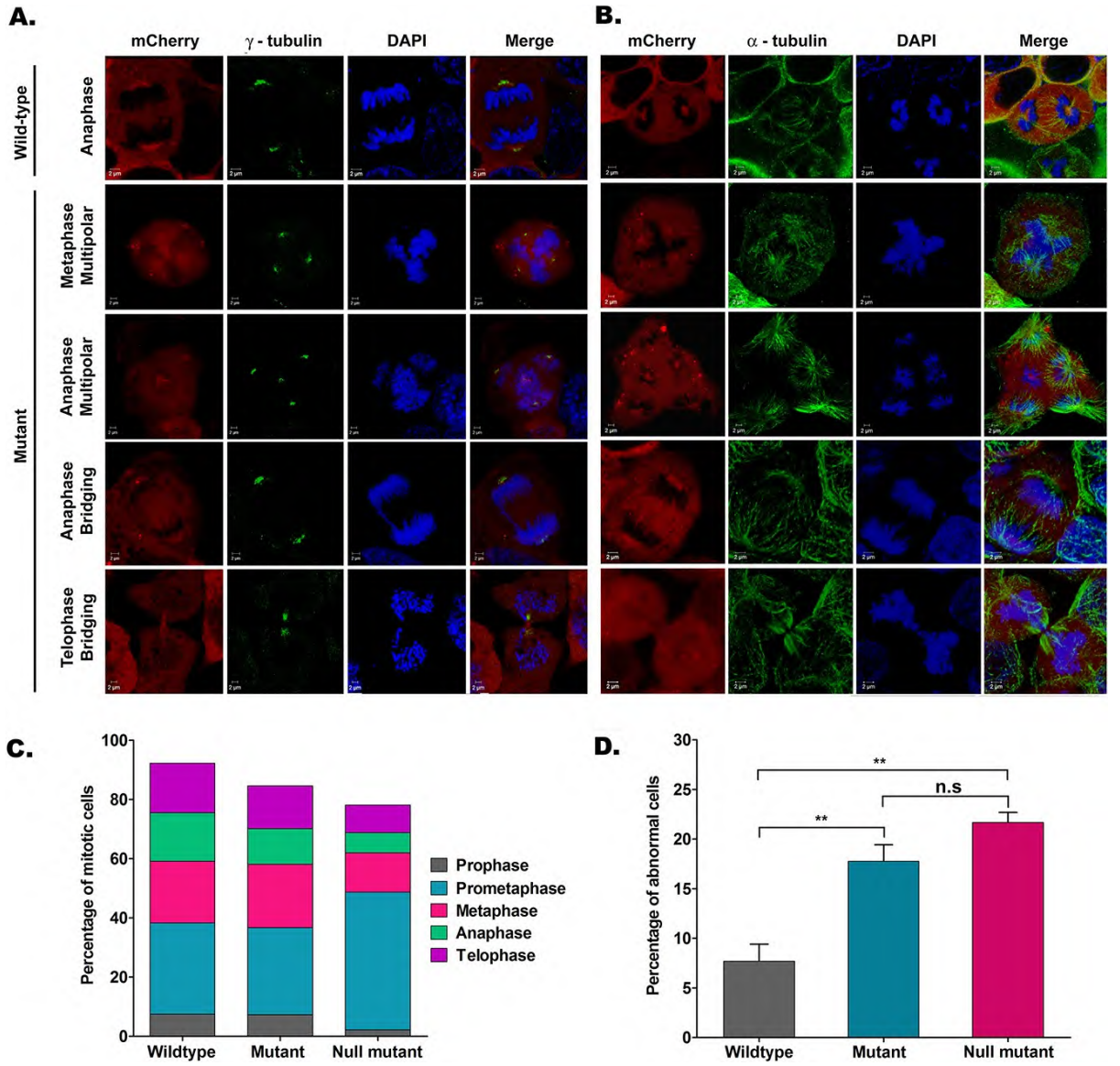
- 25th April 2022: Invited talk on *"Does centromere fragility drive speciation"* at the Guha Research Conference organised in Bheemtal
- 18th August 2022: Invited talk on *"A novel phylogenetically-restricted mitotic progression factor is essential for viability of the human pathogen Candida albicans"* at a Research Seminar organised by Temasek Life Sciences Laboratory, National University of Singapore
- 21st September 2022: Invited talk on *"Chromosomal stability and speciation in Malassezia clade"* at the ISHAM2022 Conference organised by the International Society for Human and Animal Mycology, New Delhi
- 11th January 2023: Invited talk on *"Mechanism of chromosome segregation in Cryptococcus neoformans"* at the 11th International Conference on Cryptococcus and Cryptococcosis organised by the University of Minnesota, Kampala, Uganda
- 29th January 2023: Invited talk on *"The Centromere Code Hypothesis"* at a seminar organised by the Indian Institute of Science, Kharagpur
- 24th February 2023: Invited talk on *"Discovery of a novel phylogenetically restricted mitotic progression factor in the human pathogen Candida albicans"* at the Yusuf Hamied Virtual Workshop organised by the Royal Society, UK
- 10th March 2023: Invited talk on *"Molecular innovations in rebuilding a cellular load bearning machine"* at the 12th International Conference on Yeast Biology in Mohali

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

Professor

Male infertility has a highly complex genetic landscape. While 15% of male infertility cases are attributed to known genetic factors, approximately 40% of male infertilities remain undiagnosed. Such cases are classified as idiopathic male infertility, a term used to address the unexplained reduction in the quality of semen. To collect the initial data, we performed exome sequencing on a discovery cohort of 47 men dealing with idiopathic infertility. We further replicated the study using Sequenom MassARRAY® based genotyping with 844 in the infertile group and 709 as controls. The results identified 8 novel candidate genes that could be associated with male infertility. Out of the new ones, we chose the candidate gene *CETN1* for our further sequencing in a separate cohort of 689 fertile and 840 infertile men. Biophysical analysis of the *CETN1* revealed that the variant p.Met72Thr led to cell death and the *CETN1*–5' UTR variant led to the loss of methylation sites, which are essential for normal development.

The eight novel candidate genes reported in our study can help improve clinical management and diagnostics for male infertility.



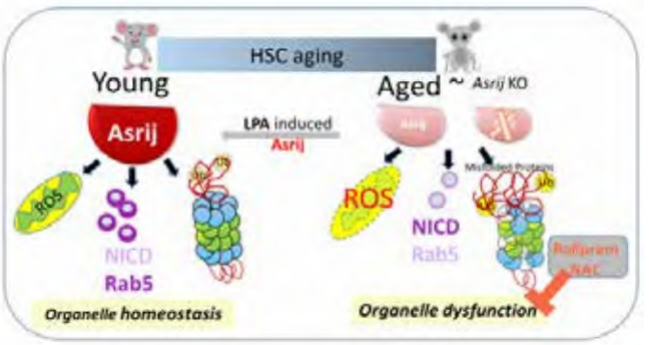
Centrin-1 Met72Thr causes multipolar spindles and aberrant mitosis

Reference: *Hum. Mol. Genet.* 32(4): 533–42. 2023. doi: 10.1093/hmg/ddac216

Prof. Maneesha S. Inamdar J.C. Bose National Fellow, F.A.Sc., F.N.A.Sc., F.I.A.Sc.
Professor (on deputation)

Aging of the blood system is defined by increased haematopoietic stem cells (HSCs) and myeloid-biased differentiation leading to a higher propensity for haematological malignancies. Unravelling cell-intrinsic mechanisms regulating HSC aging could aid the reversal or slowing of aging. Our study provided the first report that HSC aging is associated with *Asrij*-dependent simultaneous dysfunction in mitochondrial, endosomal, and proteasomal machineries. We also demonstrate that restoring organelle homeostasis by pharmacological intervention can maintain HSC stemness and lineage choice, thereby reversing phenotypes of premature aging in *Asrij* KO mice. After analysing our observations, we proposed that *Asrij* is a critical node in organelle control of HSC aging. Furthermore, the results also showed that lysophosphatidic acid-induced *Asrij* upregulation in aged WT mice rescued the mitochondrial and proteasome activity and restored HSC frequency. Our results highlighted a new role for *Asrij* in preventing HSC aging by regulating organelle homeostasis. These insights can be used to decipher organelle dynamics in HSC longevity.

MBGU

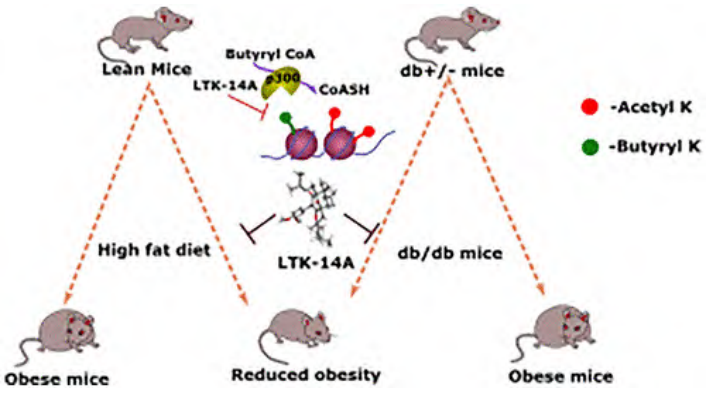


Scheme representing the newly discovered role of Asrij in preventing HSC aging by regulating organelle homeostasis

Reference: *Ag. Cell* 21: e13570. 2022. doi: 10.1111/acel.13570

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

The enzyme p300, often associated with acetyltransferase activity can also catalyse other acylation modifications whose physiological effects are yet to be discovered. Our study revealed that the level of histone butyrylation increased globally and locally in the promoters of pro-adipogenic genes during adipogenesis. To separate p300-catalysed butyrylation from acetylation during adipogenesis, we identified a semisynthetic derivative of garcinol, LTK-14A. This derivative specifically inhibited histone butyrylation without affecting the acetylation process. We also found that administering LTK-14A to high-fat diet-fed and genetically obese mice decreased their weight gain. The inhibition of H4K5 butyrylation in adipocytes and the liver could be partially responsible for reduced obesity in the mice. Our report, for the first time, not only causally linked histone butyrylation with adipogenesis but also presented a probable candidate for anti-obesity therapeutics.



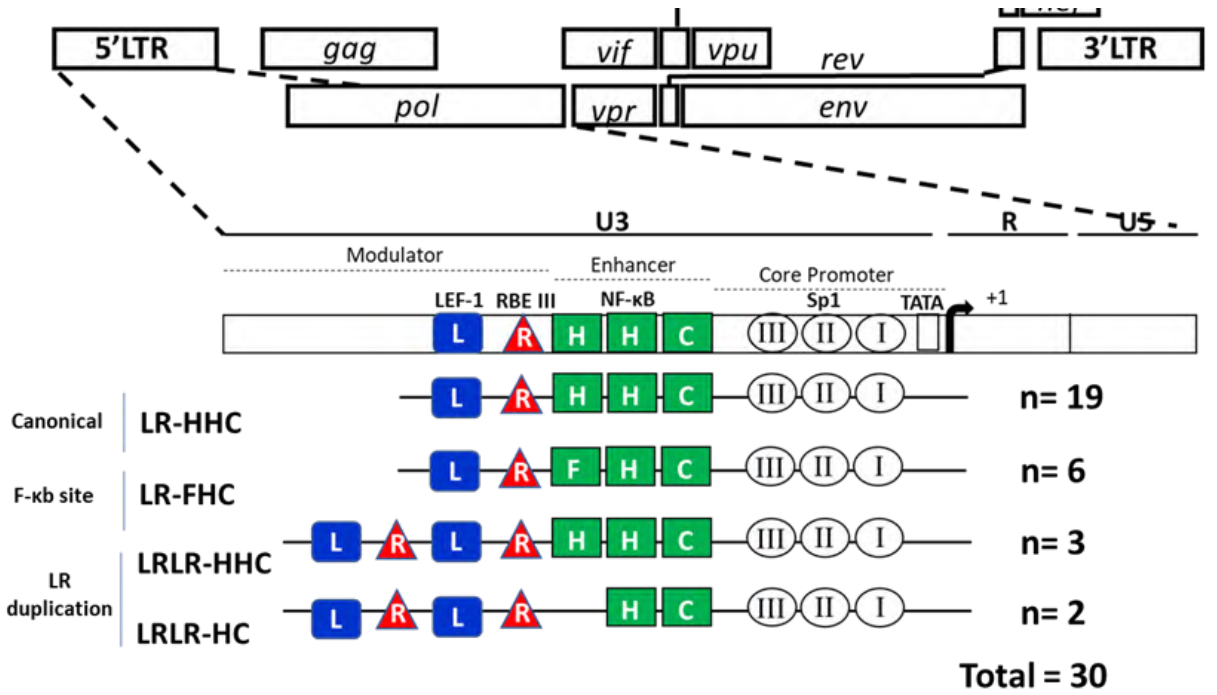
Schematic representation of changes in weight upon administration of LTK-14A to high-fat diet-fed and genetically obese db/db mice

Reference: *J. Med. Chem.* 65(18): 12273–91. 2022. doi: 10.1021/acs.jmedchem.2c00943

Prof. Ranga Udaykumar
Professor

In a multicentric, observational, and longitudinal clinical study of 30 ART-naïve subjects, we identified four different promoter variant strains of HIV-1 subtype C (HIV-1C) emerging in the Indian population. Unlike several previous studies, our work here focuses on the evolving viral regulatory elements, not the coding sequences. The emerging viral strains contain 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. The data shows that five of the 30 viral LTRs contain a duplication of the RBE III and LEF-1 motifs. Additionally, three of the four strains contain three NF-κB sites (LRLR-HHC), while the other two have only two (LRLR-HC). Further, the six other LTRs show an F- κB motif at one of the NF-κB sites. The 19 viral strains represent the wild-type LTR configuration (LR-HHC). The additional TFBS are genetically diverse and may blur the distinction between the modulatory region of the promoter and the viral

enhancer. Since a single promoter regulates viral gene expression and constitutes the master regulatory circuit with Tat, the acquisition of additional and variant copies of the TFBS may significantly impact viral latency and latent reservoir characteristics. Further studies are urgently warranted to understand how the diverse TFBS profiles of the viral promoter may modulate the characteristics of the latent reservoir, especially following the initiation of antiretroviral therapy.



Schematic representation the magnitude of TFBS variation in HIV-1C LTR

Events organised:

- 11th November 2022: Seminar on *"Human immunity to SARS-CoV-2 vaccination and infection"*
- 22nd December 2022: Seminar on *"RNA mimicry of INI1/SMARCB1 and its influence on HIV-1 replication, latency, reactivation and development of novel therapeutics"*
- 23rd December 2022: Seminar on *"A beta Chemokine modulates cellular ESCRT factors, HIV-1 budding and viral fitness"*
- 7th January 2023: Workshop on *"Ethics in scientific research"*
- 9th February 2023: Seminar on *"Migration coupled with recombination explains disparate HIV-1 anatomical compartmentalization signals"*

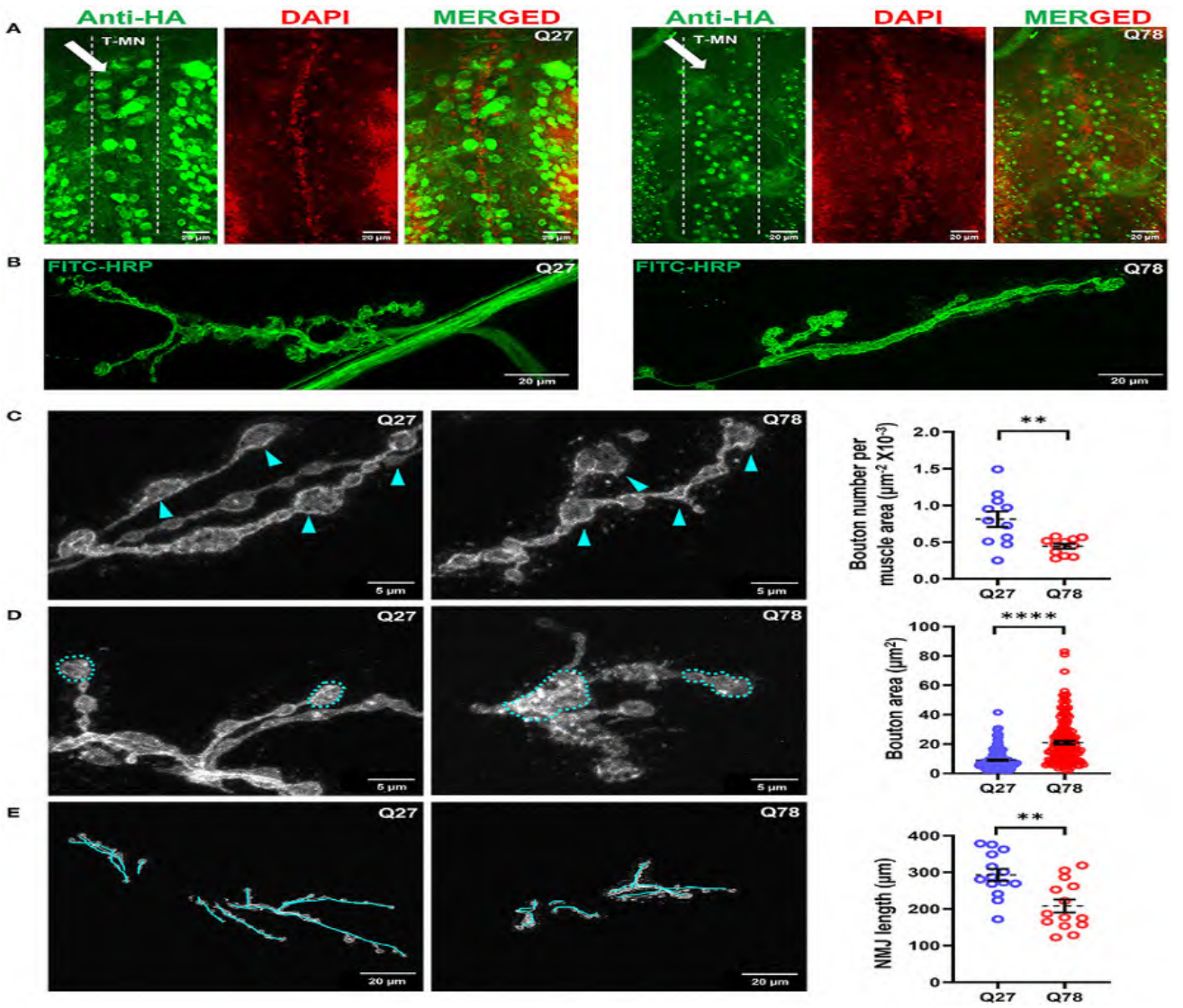
Major talks during 2022–2023:

- 18th November 2022: Invited talk on *"HIV- Please tell us how to kill you"* at In-House Symposium, JNCASR
- 15th December 2022: Invited talk at the International Conference on Virus Evolution, Infection, and Disease Control, on the topic *"HIV-1C transcriptional silence: catch me if you can"* organised by the Department of Biotechnology, SLS, Hyderabad
- 20th January 2023: Invited talk at the 9th Annual Research Symposium of the Centre for Biosystems Science and Engineering, on *"HIV-1 transcriptional silencing"* organised by IISc, Bengaluru

MBGU

Dr. Ravi Manjithaya
Associate Professor and Chair, NSU

The proper functioning of synapses is crucial to the smooth operation of neuronal networks in the brain. Dysfunction of synapses can often lead to the development of neurodegenerative disorders, such as synaptopathies. Glutamate, a major excitatory neurotransmitter found in the nervous system and *Drosophila* neuromuscular junctions, can provide a tractable platform for understanding the biology of synapses both in health and disease. Our study took advantage of the genetic amenability of the *Drosophila* to shed light on the pathogenesis of glutamatergic synapses in the rare, progressive neurodegenerative condition Machado–Joseph Disease. We, in collaboration with Dr. Sheeba Vasu's laboratory, found that defects in the synapses of motor neurons correlated with behavioural deficits observed in the larval as well as adult stages of flies. Our observations indicated that expression of 78 polyQ repeats of the mutant ataxin-3 protein in *Drosophila* motor neurons result in defects, such as impaired locomotion. The results also uncovered that overexpression of the autophagy-related protein Atg8a can significantly improve behavioural and functional defects. Our study demonstrates that a model for glutamatergic synapse dysfunction can aid in genetic and chemical biology screenings for the identification of potential therapeutic targets for synaptopathy.



Images of samples showing that Q78 expression leads to multiparametric changes in the morphology of neuromuscular junctions

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

MBGU

Event organised:

- 6th–10th February 2023: SCO Young Scientist Conclave, co-organised by DST, Govt. of India, and hosted by JNCASR

Major talks during 2022–2023:

- 1st April–15th May 2022: Public talk and tutorial in Kannada at PSYCHE, a free digital exhibition season on the complexities of the human mind
- 2nd May 2022: Webinar on *"Autophagy in health and disease"* at Vigyan Utsav on theme *"Future Technologies"*, organised by the Karnataka State Council for Science and Technology (KSCST)
- 20th January 2023: Talk on *"Autophagy: The PacMan inside of our cells"* at the outreach programme organised by Chandan School, Lakshmeshwar

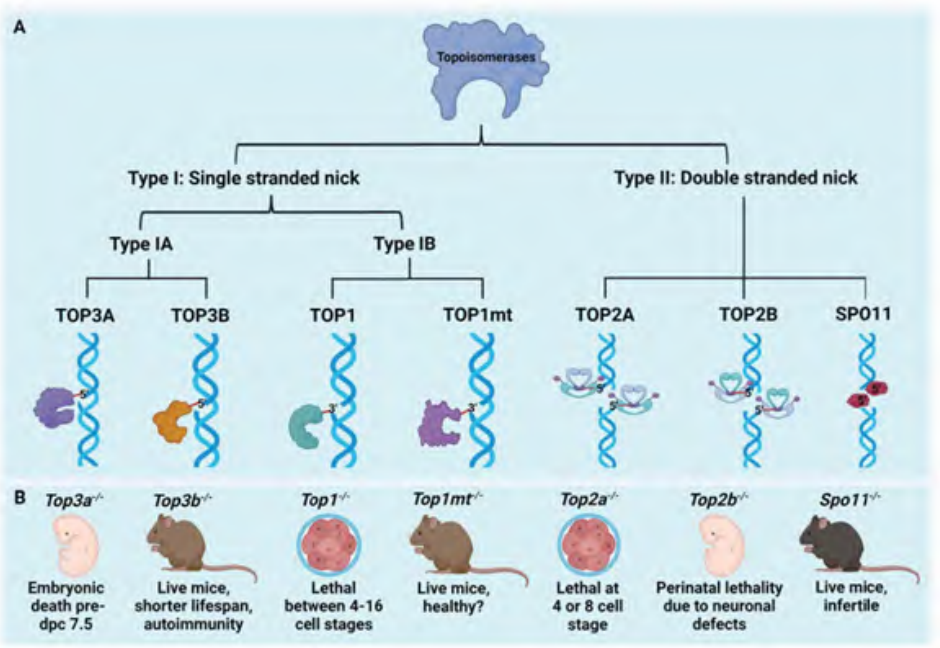
Dr. Kushagra Bansal

Faculty Fellow

DNA topoisomerases are complex enzymatic machines with extraordinary capacity to maintain DNA topology during the torsion-intensive steps of replication and transcription. The vital role of topoisomerases in immune homeostasis and dysfunction is beginning to emerge and they have been implicated in various immunological disorders such as autoimmunity, B cell immunodeficiencies, and sepsis. We reviewed the recent literature highlighting the contribution of topoisomerases in the development of immune cells, and further provided an overview of their importance in immune cell responses.

The research in our lab is also focused on immune regulation in cancer. Immunological tolerance mechanisms play a crucial role in the development and progression of cancer. There are many parallels in the development of tumour and the placenta during pregnancy. The immunological microenvironment at the maternal-foetal interface is very similar to that of tumour. Regulatory T cells, also known as Tregs, maintain immunological tolerance and prevent autoimmunity by accumulating at the maternal-foetal interface. We reviewed the existing literature on Tregs and highlighted the similarities and differences between Tregs in the case of pregnancy and cancer. We also put forward the challenges and scope of targeting Tregs for treating cancer during pregnancy.

We also reviewed the current knowledge on the interplay between DNA/RNA methylation and metabolic programs in cancer cells and summarised these findings in a book chapter.



The classification of DNA topoisomerases and the phenotype of mice models carrying genetic deletion of topoisomerases

Reference: *J. Immunol.* 210(2): 126–133. 2023. doi: 10.4049/jimmunol.2200650

MBGU

Events organised:

- 27th–29th April 2022: Single cell genomics workshop co-organised with Prof. Maneesha Inamdar, Prof. Anuranjan Anand, and 10X Genomics
- 14th–15th July 2022: Hands-on workshop on RNA-seq and ChIP-seq data analysis co-organised with Prof. Anuranjan Anand, Prof. Kaustuv Sanyal, and Clevergene Biocorp Pvt. Ltd.
- 13th–14th October 2022: Hands-on workshop on RNA-seq and ChIP-seq data analysis co-organised with Prof. Anuranjan Anand, Prof. Kaustuv Sanyal, and Clevergene Biocorp Pvt. Ltd.
- 11th–12th November 2022: MS based proteomics data analysis workshop co-organised with Prof. Hemalatha Balaram, and Prof. Kaustuv Sanyal
- 29th November–1st December 2022: Flow cytometry workshop on basics, multicolor experiments and data analysis, co-organised with Prof. Udaykumar Ranga, Dr. Narendra Nala, and BD Biosciences
- 6th–8th February 2023: Bio-Imaging workshop co-organised with Prof. Ravi Manjithaya and Ms. Suma B.S

Major talks during 2022–2023:

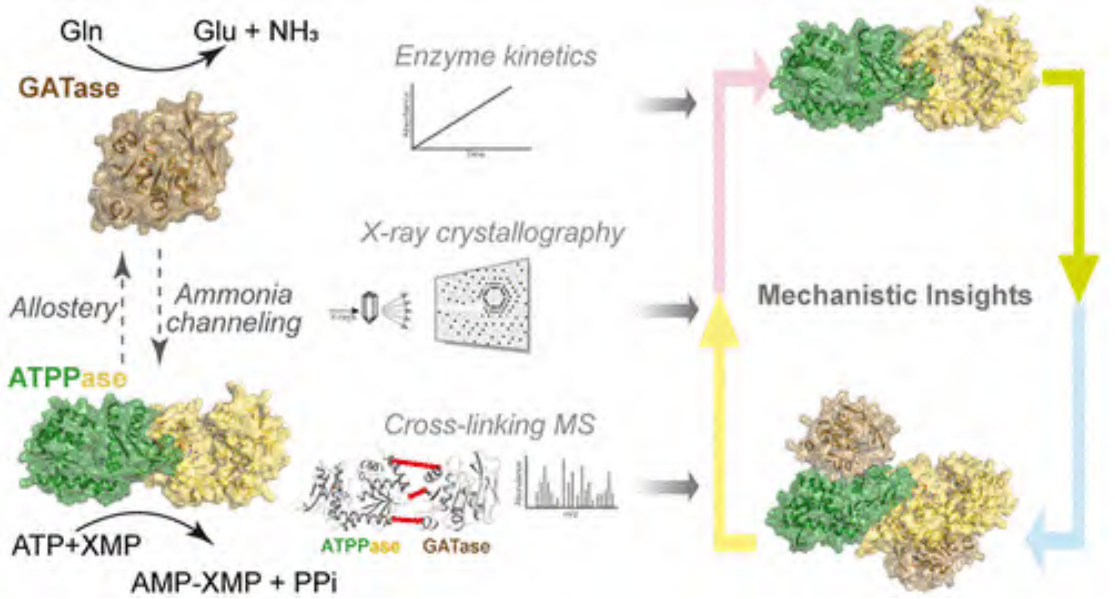
- 20th August 2022: Invited talk on *"Transcriptional regulation in the immune system"* at the 4th BioGroup-India Meeting organised by BioGroup India, and Dr. Sabari Sankar Thirupathy and Dr. N. Sadananda Singh of IISER Thiruvananthapuram
- 22nd August 2022: Invited talk on *"Transcriptional regulation in the immune system"* at the Biology Symposium organised by Prof. Chandrabhas Narayana on behalf of RGCB, Thiruvananthapuram
- 15th September 2022: Invited talk on *"Regulators of genome superstructure in the immune system"* at the 19th Horizons in Molecular Biology Symposium organised by Max Plank Institute, Gottingen, Germany
- 28th October 2022: Invited talk on *"Molecular Mechanisms in the Immune System"* at an online Refresher Course on Life Sciences organised by Dr. Parul Mishra and Dr. Nooruddin Khan from University of Hyderabad
- 4th November 2022: Invited talk on *"T cell tolerance"* at the online seminar Rhetor 3.0 organised by undergraduate students from the Proteus Biology Club of IISER Thiruvananthapuram
- 9th March 2023: Invited talk on *"Regulators of genome superstructure in the immune system"* at the Science Day Symposium organised by Dr. Udupi Ramagopal from Poornaprajna Institute of Scientific Research (PPISR), Bengaluru

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

Resident Honorary Professor

Guanosine 5'-monophosphate (GMP) synthetases are the enzymes that catalyse the conversion of xanthosine 5'-monophosphate (XMP) to GMP. They are composed of two different catalytic units: the glutamine amidotransferase (GATase) unit that hydrolyses the glutamine-generating ammonia, and the ATP pyrophosphatase (ATPase) unit that catalyses the formation of an AMP-XMP intermediate. In ammonia channelling enzymes, a tight complex interaction of the two subunits of *Methanocaldococcus jannaschii* GMP synthetase (MjGMPS) was observed. Unfortunately, the interaction is transient; hence, the underlying mechanism of allostery and substrate channelling is largely unclear. We presented a mechanistic model encompassing the various steps in the catalytic cycle of MjGMPS based on biochemical experiments, crystal structure, and cross-linking mass-spectrometry-guided integrative modelling. We analysed the pH dependence of enzyme kinetics and discovered that ammonia is tunnelled across the subunits, with the lifetime of the complex being ≤0.5 s. We also reported the crystal structure of the XMP-bound ATPase subunit and highlighted the role of conformationally dynamic loops in enabling catalysis. Our proposed strategy allowed us to visualize the subunit interactions that enable allostery under catalytic conditions. The results indicated that our study is a functional mechanism for detailing the role of MjGMPS as a catalyst in biologically important reactions.

MBGU



Schematic representation of the various steps in the catalytic cycle of Methanocaldococcus jannaschii GMP synthetase (MjGMPS)

Reference: *Biochem.* 61(18): 1988–2006. 2022. doi: 10.1021/acs.biochem.2c00151

Prof. M. R. S. Rao F.A.Sc., F.N.A.Sc., F.N.A., F.A.M.S., F.T.W.A.S.
Former President and SERB Year of Science Chair Professor

Sox8 is a developmentally important transcription factor that plays an important role in sex maintenance and fertility of adult mice. In the B-type spermatogonial cells, *Sox8* is regulated by the long noncoding RNAs (lncRNA) *Mrhl* in a p68-dependant manner under the control of the Wnt signaling pathway. The downregulation of Mrhl leads to the meiotic commitment of the spermatogonial cells in a *Sox8*-dependant manner. While the molecular players involved in the regulation of transcription at the *Sox8* promoter have been worked out, our current study points to the involvement of the architectural proteins CTCF and cohesin in mediating a chromatin loop that brings the *Sox8* promoter in contact with a silencer element present within the gene body in the presence of lncRNA *Mrhl* concomitant with transcriptional repression. Further, lncRNA Mrhl interacts with the *Sox8* locus through the formation of a DNA:DNA:RNA triplex, which is necessary for the recruitment of PRC2 to the locus. The downregulation of lncRNA *Mrhl* results in the promoter-silencer loop giving way to a promoter-enhancer loop. This active transcription-associated chromatin loop is mediated by YY1 and brings the promoter in contact with the enhancer present downstream of the gene.

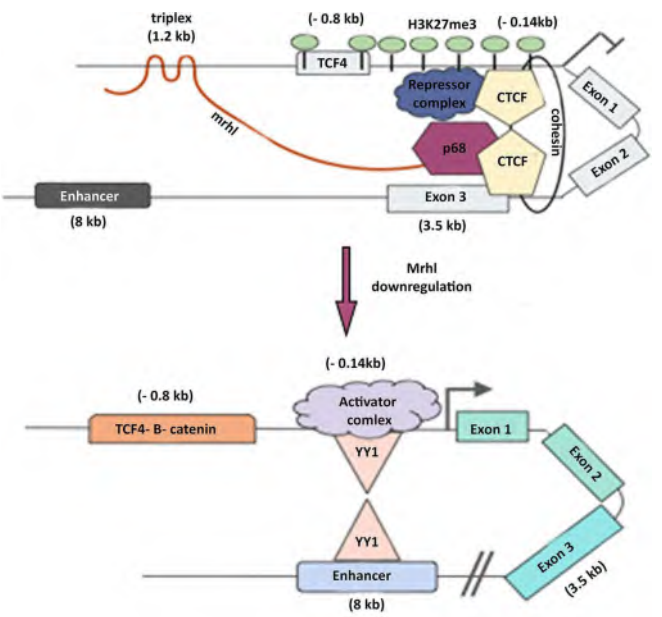


Figure summarizing the regulation of Sox8. Sox8 is maintained in the transcriptionally repressed state when Mrhl lncRNA is bound at the promoter

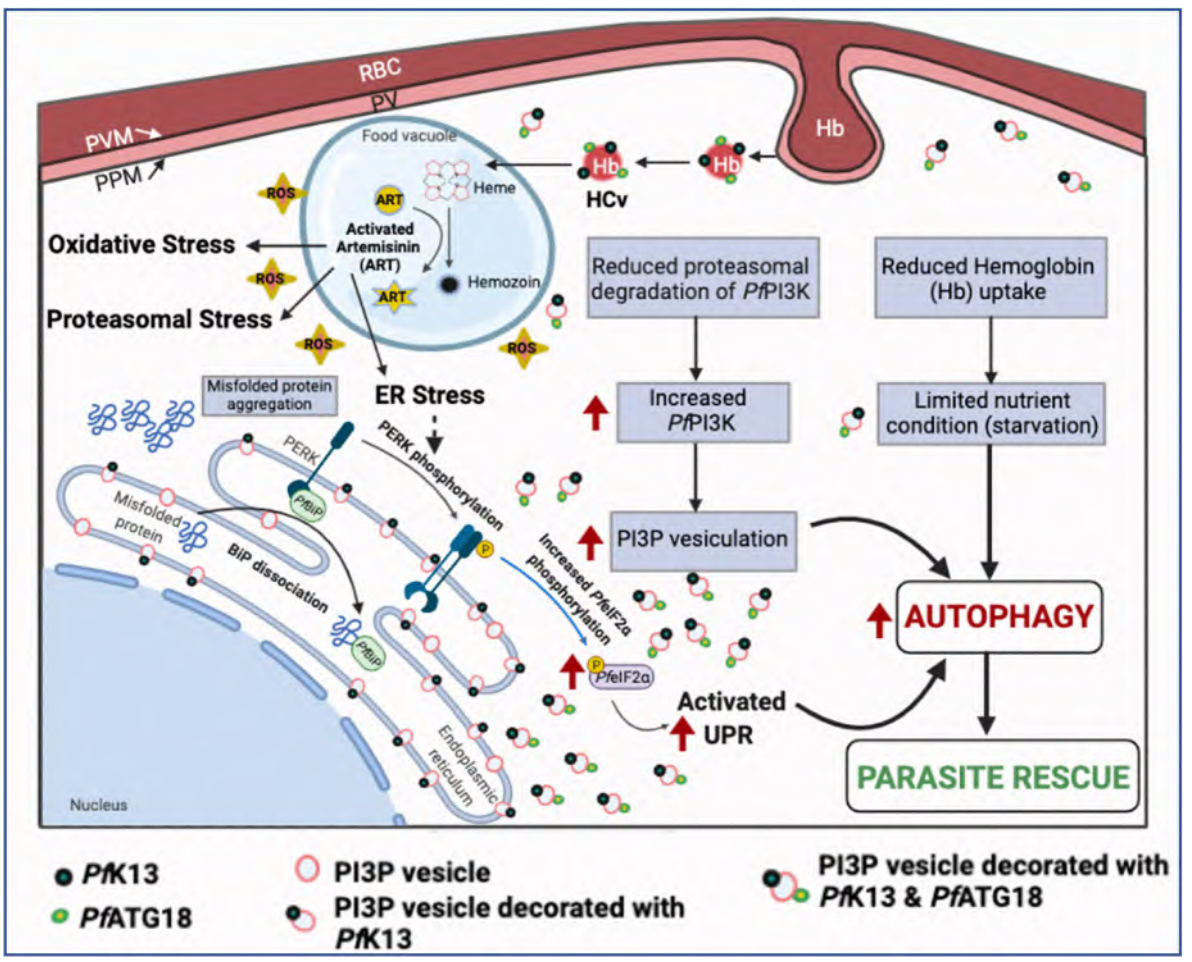
Reference: *Mol. Cell Biol.* 42(5): e00475-21. 2022. doi: 10.1128/mcb.00475-21

MBGU

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

DBT Distinguished Biotechnology Research Professor

Growing resistance to artemisinin (ART) has become a hurdle in the way of reducing malaria mortality and morbidity cases worldwide. Scientists have proposed three plausible proteostasis mechanisms of ART resistance: increased endoplasmic reticulum phosphatidylinositol-3-phosphate (ERPI3P) vesiculation, unfolded protein response (UPR), and oxidative stress. There is an urgent need to clearly understand the mechanisms of ART resistance as it is rapidly emerging in many parts of the world. Our research established that ART-induced ER stress could lead to increased expression of *P. falciparum* autophagy proteins through induction of the UPR. We also showed that ART-resistant *K13*^{C580Y} had higher basal expression levels of autophagy proteins when compared to its isogenic counterpart, and this effect was further magnified under starvation conditions. Analysis of *PfK13* mutations in 2,517 field isolates alongside our experimental studies with an ART-resistant *P. falciparum* strain established that parasite autophagy underpinned various mechanisms of ART resistance. The insights from our study can act as a launchpad for further exploration of ART resistance pathways and the development of antimalarials.



Schematic representation for role of autophagy in proteostasis mechanisms of ART resistance in P. falciparum

Reference: *MBio* 13(3): 2022. 2022. doi: 10.1128/mbio.00630-22

MBGU

UNIT MEMBERS

Faculty Members	
Professor and Chair	**Prof. Kaustuv Sanyal**
Professors	**Prof. Anuranjan Anand** **Prof. Maneesha S. Inamdar (on deputation)** **Prof. Tapas Kumar Kundu** **Prof. Ranga Udaykumar**
Associate Professor	**Dr. Ravi Manjithaya (Chair, NSU)**
Faculty Fellow	**Dr. Kushagra Bansal**
Resident Honorary Professor	**Prof. Hemalatha Balaram**
Former President and SERB Year of Science Chair Professor	**Prof. M. R. S. Rao**
DBT Distinguished Biotechnology Research Professor	**Prof. Namita Surolia**

Research Students	
Ph.D.: 30	**Preeti Jindal, Rajarshi Batabyal, Kamat Kajal Murli, Alice Sinha, Nazia, Resmi Ravi, 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, Pai Shruta Sandesh, Jay Lakshmi P.R., Rohini Bhatt, Supriya Varsha Bhagat, Anchal Gupta, Nabanita Das, Nidhi Ray, Riya Manna, Oiendrila Das**
Int. Ph.D.: 36	**Dongre Prathamesh Rajesh, Aishwarya Prakash, Yashashwinee Rai, Arpitha A. Suryavanshi, Chhavi Saini, Akash Kumar Singh, Polisetty V. S. Satya Dev, 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., Arghakusum Das, Deepam Bhattacharya, Ritoprova Sen, Souradip Mukherjee, Aman Sharma, Priyesh Singh Parihar, Joyee Bhattacharya, Kamakshi Tomar, Priyadarshini Ghosh, Titikhya Nath, Amrintendu Ganguly, K. V. Balakumaran, Pallavi Gupta, Utkarsh Pandey, Sarvleen Kaur, Soumyadeep Dey, Anuvab Gupta, Asima Mishra**

Technical Staff	
Technical Officer Grade II	**Suma B. S.**
Technical Assistant (Inst.)	**Mohan V.**
Lab Manager (On Contract)	**Bhuvana R.**
Project Technical Officer (On Contract)	**Kruthi H. T.**

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

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

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Temporary Staff	
Sr. Instructor (Biological Science)	**Dr. Ramesh G. R.**
Microscope Operator	**Keerthana J.**
Bioinformatician	**Maithili Balkrishna Sawant**
Trainee	**Sahana Ravi**
Lab Assistant	**Ganesh G. V.**

Research Staff (On Contract)	
Research Associates	**Dr. Dileep Pullepu, Dr. Praveen Wulligundam, Dr. Arindam Ray, Dr. Aditya Battacharya, Dr. Banishree Sahoo, Dr. U. D. Kumaresan, Dr. Aswathy Narayanan, Dr. Arun Panchapakesan, Dr. Priya Jaitly**
Research Associate-I	**Dr. Sumedha Swarnkar**
Research Associate-II	**Dr. Mamta Negi**
Research Associates (Provisional)	**Siddharth Singh, Priya Brahma**
SERB National Post Doctoral Fellow	**Dr. Karthikeyan R.**
DBT Research Associates-1	**Dr. Md. Hashim Reza, Dr. Sangeeta Dutta, Dr. Mukesh Kumar Chaurasia**
Senior Research Fellows	**Kajal M. Kamat, Preeti Jindal, Arpitha Suryavanshi, Asutosh B. R.**
Junior Research Fellows	**Resmi Ravi, Rishana Farin S., Masood Ahmad Khan, Nada R. S., Nidhi Ray, Narmathaa Palanisamy, Tanya Pareek, Nivedita Pandey, Vaishali S.**
R&D Assistants	**Aboli Shrikant Varunjikar, Vidhi Agarwal, Arufi Singh, Ananya Ray, Afzal Amanullah, Tejal R. Gujarathi, Yuvrajsinh Gohil, Nabanita Das, Anish D'silva, Gopika K. G., Dolly Parihar, Akash Kumar Singh, Sai Krishna A. V. S., Deepak Selvam, Deepika S.**
R&D Associate	**Joshi Aditya Pradeepbhai**
Project Assistants	**Satya Santoshi, Vishnu V. Ashok**

UNIT AT A GLANCE

Honours/Fellowship/Memberships Received

Faculty members

Students

Faculty Achievements

Prof. Kaustuv Sanyal
• Received the Sun Pharma Science Foundation Research Award 2022 under the category of 'Medical Sciences-Basic Research'

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Prof. Maneesha S. Inamdar

- Appointed as Director of inStem, NCBS Bengaluru, w.e.f. 19th August 2022

Prof. Tapas Kumar Kundu

- Distinguished Visiting Professor in the Bioscience and Bioengineering department, at IIT Bombay
- Selected for Sir M. Visvesvaraya Senior Scientist State Award for the year 2021 of Dept. of Electronics, IT, BT & S&T, Govt. of Karnataka, instituted by Karnataka State Council for Science & Technology
- Received the International Chemical Biology Society (ICBS) Global Lectureship Award 2022

Prof. Ranga Udaykumar

- Received the INSA Fellowship from the Indian National Science Academy

Dr. Kushagra Bansal

- Elected as Member, The American Association of Immunologists (AAI)

Student Achievements

Prerana Muralidhar (Ph.D. student; research supervisor: Dr. Kushagra Bansal)

- Received the Best Talk Award at JNCASR's In-House Symposium 2022

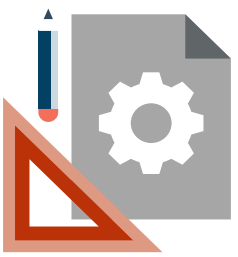
Vanshika Sood (Int. Ph.D. student; research supervisor: Dr. Kushagra Bansal)

- Received the Best Poster Award at JNCASR's In-House Symposium 2022

Total Publications

38 Peer reviewed articles indexed in Web of Science/Scopus

Sponsored Projects



New Projects

4

Grants Received During 2022–2023

₹ 1.2 cr

Ongoing Projects

21

Grants Received During 2022–2023

₹ 10.38 cr

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Student Graduated During 2022–23

9 **Ph.D.**

- Sambhavi Puri
- Moumita Basu
- Bhange Disha Ramesh
- Arun Panchapakesan
- Asutosh B. R.
- Aditya Bhattacharya
- Ananya Ray
- Shrilaxmi V. Joshi
- Wulligundam Praveen

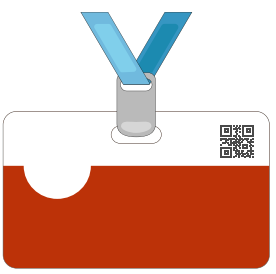
1 **Ph.D. (through Int. Ph.D.)**

- Pooja Barak

5 **M.S. in Biological Science**

- Harshit Arya
- Vanshika Sood
- Amrutha A. S.
- Arghakusum Das
- Jayendra Singh

Students Admitted During 2022–2023



10 **Ph.D.**

- Pratiksha P. Bhat
- Pai Shruta Sandesh
- Jay Lakshmi P.R.
- Rohini Bhatt
- Supriya Varsha Bhagat
- Anchal Gupta
- Nabanita Das
- Nidhi Ray
- Riya Manna
- Oiendrila Das

9 **Int. Ph.D.**

- Titikhya Nath
- Amrintendu Ganguly
- K. V. Balakumaran
- Utkarsh Pandey
- Pallavi Gupta
- Sarvleen Kaur
- Soumyadeep Dey
- Anuvab Gupta
- Asima Mishra

66 **Current Student Strength**

NEW CHEMISTRY UNIT (NCU)

NCU was created by JNCASR as part of the 11th Five-Year Plan. At NCU, we 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. Our projects usually involve the development of new strategies for the synthesis of solid-state materials that address contemporary energy and environmental concerns. At NCU, we synthesise a host of organic and inorganic multi-dimensional nanomaterials, intending to understand their electronic structure for their application in magnetic, optical, and electrical devices.

Renewable energy research, development of materials for thermoelectric, 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. We also look into the synthesis of peptide/protein-based materials and programmable DNA-based materials for biomaterial and therapeutic applications. For complete characterisation and analysis of the materials pursued in the laboratories, we have curated a wide range of advanced equipment.

At NCU, we 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, this group of researchers has 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

- Supramolecular chemistry and organic materials
- Circularly polarised luminescent (CPL) materials
- Semiconductor nanocrystals, nanoplasmonics, and their heterostructures
- Solid-state chemistry
- Chemical biology, medicinal chemistry, drug discovery, biomaterials, and antimicrobial resistance
- Organic phosphors
- Atomic layer deposition and pulsed laser deposition
- Thermoelectric materials
- Diagnostic therapy (theranostics)
- Carbon dioxide reduction
- Catalysis
- Silk-inspired and cyclic dipeptide (CDP)-based biomimetics and biomaterials
- Halide-based perovskites
- Molecular architectonics
- Water splitting/H_2 generation and fuel cell
- Understanding the $n \rightarrow \pi^*$ interaction
- Topological insulators
- Study of electronic and optical properties

NCU

RESEARCH HIGHLIGHTS

- A new strategy was developed for tailoring the entire excited state landscape of an organic molecule using tuneable through-space charge transfer interactions with appropriate donors
- Recent advancements in thermoelectric materials and devices were explored
- Cyclic dipeptide-based small molecules were found to modulate zinc-mediated liquid-liquid phase separation of tau
- Reliable fluorometric detection of SARS-CoV-2 was done by targeting the G-quadruplex through pH-triggered conformational polymorphism
- A biocompatible, biocide-loaded, injectable gellan–gelatin hydrogel was developed to tackle wound-associated infections and enhance wound
- Inorganic materials were designed and developed for CO_2 capture and reduction to value added chemicals (methanol, ethanol, DME, CH_4, olefines), catalysts for fuel cell and water splitting, electrodes for energy storage (batteries) and catalysts for important industrial organic reactions
- The ways in which various steric and stereoelectronic interactions can affect the conformational properties of N,N'-diacylhydrazines was demonstrated
- The effect of surface functionality of elemental two-dimensional materials (2D) (such as Antimonene and Bismuthene) on their electronic and optical properties was studied
- Incorporation of N,N'-diacylhydrazines in azapeptoid foldamer was demonstrated to stabilise trans amide bonds
- Strategic C-terminal modification of proline was shown to stabilise trans amide geometry by synergistic $n \rightarrow \pi^*$ and $nN \rightarrow \pi^*Ar$ interactions
- Domino synthesis of thiazole-fused six- and seven-membered nitrogen heterocycles via the intramolecular hetero-annulation of in-situ-generated 2-(het)aryl-4-amino-5-functionalised thiazoles was successfully executed

RESEARCH ACTIVITIES AND ACHIEVEMENTS DURING 2022–2023

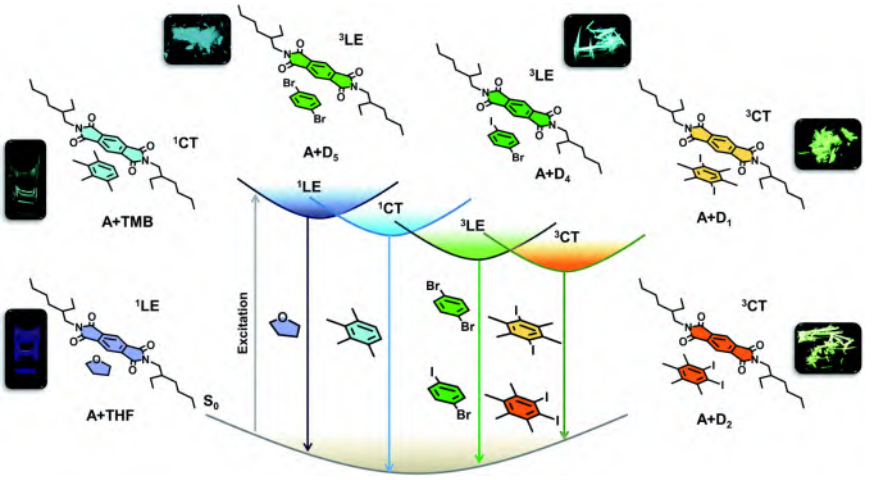
Prof. Subi Jacob George F.A.Sc.

Professor and Chair

In recent times, ambient triplet harvesting has garnered significant attention as a promising strategy for engineering the manifold of electronic excited states in organic molecules. In our study, we put forth a novel approach to tailor the entire excited state landscape of an organic molecule by harnessing tuneable 'through-space' charge transfer interactions with chosen donors. Although charge transfer (CT) donor–acceptor complexes have been extensively explored in the realm of soft organic materials, their luminescence properties have remained largely unexplored. Therefore, we investigated modulating the emission characteristics of a pyromellitic diimide derivative by complexation with suitable donors, targeting the selective harnessing of locally excited (LE) and CT singlet and triplet states.

Furthermore, our study unveiled an unprecedented ambient CT phosphorescence, exhibiting exceptional efficiency and a prolonged lifetime, through co-crystallization of the pyromellitic diimide with heavy-atom substituted and electron-rich aromatic donors. Through a comprehensive analysis encompassing spectroscopic investigations, theoretical studies, and meticulous single-crystal analyses, we elucidated the unparalleled influence of intermolecular donor–acceptor interactions in conferring distinctive optical properties. These findings have yielded invaluable insights that hold the potential to expand the current repertoire of molecular designs for triplet harvesting.

NCU



Schematic of the modular donor–acceptor co-assembly strategy to tune the excited state manifold of pyromellitic diimide phosphor

Reference: *Chem. Sci.* 13(34): 10011–19. 2022. doi: 10.1039/D2SC03343G

Events organised:

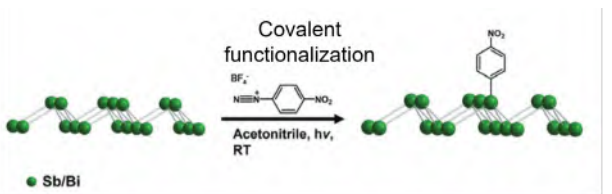
- 20th–22nd October 2022: Sixteenth JNC Research Conference on Chemistry of Materials at JNCASR, co-organised by Prof. K. George Thomas, IISER Thiruvananthapuram
- 23rd–25th January 2023: ChemSci2023: Leaders in the Field Symposium at JNCASR

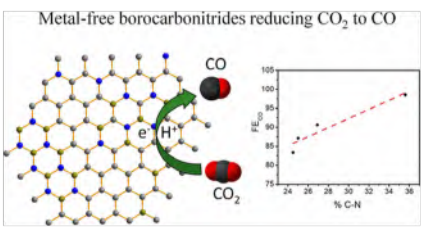
Bharat Ratna Prof. C. N. R. Rao D.Sc., F.R.S., Hon. F.R.S.C.

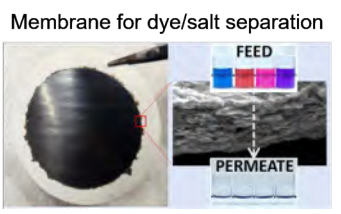
Linus Pauling Research Professor; Honorary President, JNCASR; and Director, ICMS

We have studied the effect of surface functionality of elemental two-dimensional materials (2D) (such as Antimonene and Bismuthene) on their electronic and optical properties. These materials possess a lone pair which can be effectively utilised to tune material properties *via* different functionalization strategies. Lewis acid functionalization leads to form Lewis acid-base adducts with the lone pair which affects the band structure, and the corresponding change was realized as the blue emission of few layered Sb and Bi. A similar distortion and blue shift were observed on covalent functionalization of Sb and Bi using p-nitrobenzene diazonium salt (Sb/Bi-C bonds). 2D Borocarbonitrides as metal-free electrocatalysts for the electrochemical reduction of CO_2 was also studied. By tuning the composition $B_xC_yN_z$ in boroncarbonitride, 98% faradaic efficiency for CO_2 conversion to CO was achieved.

2D $MoSe_2$ nanosheets were used to fabricate $MoSe_2$ membranes. These membranes showed 100% separation of dye molecules from dye/salt wastewater at a very high-water flux of 900 $Lm^{-2}h^{-1}bar^{-1}$ was achieved.







Top image: Covalent functionalisation of antimonene and bismuthene with Lewis acids
Middle image: Conversion of CO_2 to CO using 2D borocarbonitrides as metal-free electrocatalysts
Bottom image: $MoSe_2$ membranes fabricated using 2D $MoSe_2$ nanosheets

References:

Nanoscale. 14: 13834-13843. 2022. doi: 10.1039/D2NR03206F
Chem. Mater. 34(14): 6626–6635. 2022. doi: 10.1021/acs.chemmater.2c01591
Small. 18(38): 2203554. 2022. doi: 10.1002/smll.202203554
J. Colloid Interface Sci. 646: 980-990. 2023. doi: 10.1016/j.jcis.2023.05.087

NCU

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

Thermoelectric (TE) materials and devices are pivotal in delivering promising solutions to the global energy crisis as they can successfully convert waste heat into useful electrical energy. This realisation has compelled a new surge of interest in high performance, environmentally-friendly TE materials made from earth-abundant sources. Scientists are working on the development of novel materials that widen the utilisation of TE materials in power plants, households, automobiles, space technology, etc. In our editorial, we presented brief pioneering articles that offered remarkable advancement in the field of TE materials and devices. We introduced research endeavours where scientists developed new TE materials, demonstrated the design and integration of devices, studied the modulation of electrical transport, and tried to minimise thermal conductivity. We also highlighted papers that have reported novel flexible and thin-film type thermoelectric materials. Our report aims to provide readers with an effective path to acquire up-to-date perceptions of this rapidly advancing field of materials science.

Reference: *Appl. Phys. Lett.* 121(7): 070401. 2022. doi: 10.1063/5.0115322

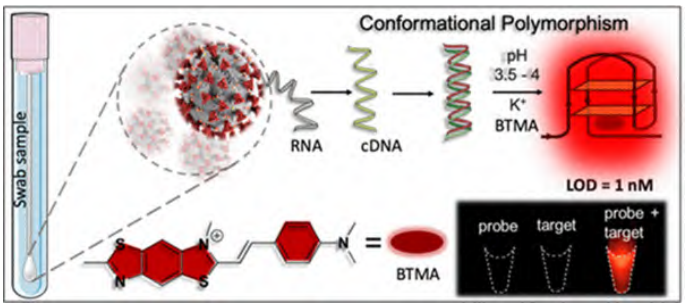
Event organised:
- 14th March 2023: Symposium at Oxford Instruments Young Nanoscientist Award Function

Major talks during 2022–2023:
- July 2022: Invited talk on *"Enhanced Atomic Ordering Leads to Ultra-High Thermoelectric Performance"* at Gordon Research Conference on Solid State Chemistry in New London, NH, USA
- October 2022: Invited talk on *"Glass-like Thermal Conductivity in a Single Crystal of Layered Metal Halides"* at Indo-French Laboratory of Solid-State Chemistry Workshop in IISC, India
- November 2022: Invited talk on *"Glass-like Thermal Conductivity in a Single Crystal of Layered Metal Halides"* at Indo-German SERB-DFG Week of the Young Researcher (WYR) on Synthetic Molecular Chemistry Conference in New Delhi, India
- December 2022: Invited talk on *"The Panoscopic Approach towards Ultra-high Performance Thermoelectrics"* for International Winter School 2022 on Frontiers in Materials Science at JNCASR
- February 2023: Invited talk on *"Antibonding Electronic States: Not Always a Devil for Chemists"* at the International Conference on Advanced Materials: Properties and Applications, Goa, India
- March 2023: Talk on *"Enhanced Atomic Ordering Leads to Ultra-High Thermoelectric Performance"* at the ACS SPRING 2023 Crossroads of Chemistry Conference, Indianapolis, USA

Prof. T. Govindaraju F.A.Sc., F.R.S.C.
Professor and Chair, Education Technology Unit

Unravelling unique molecular targets specific to viruses is challenging yet critical for diagnosing emerging viral diseases. Nucleic acids and proteins are the major targets in diagnostic assays of viral pathogens. Identification of novel sequences and conformations of nucleic acids as targets is desirable for developing diagnostic assays specific to a virus of interest. Here, we disclose the identification and characterisation of a highly conserved antiparallel G-quadruplex (GQ)-forming DNA sequence present within the SARS-CoV-2 genome. The two-quartet GQ with unique loop compositions formed a distinct recognition motif. Design, synthesis, and fine-tuning of structure–activity of a set of small molecules led to the identification of a benzobisthiazole-based fluorogenic probe that unambiguously recognizes the target SARS-CoV-2 GQ DNA. A robust, cost-effective assay was developed through thermal cycler PCR-based amplification of the antiparallel GQ-forming ORF1ab region of the SARS-CoV-2 genome and endpoint fluorescence detection with the probe. An exclusive pH window (3.5–4) helped trigger reliable conformational

polymorphism (RCP) involving DNA duplex to GQ transformation, which aided the development of a GQ-RCP platform for the diagnosis of SARS-CoV-2 clinical samples. This general strategy can be adapted for the development of specific diagnostic assays targeting different noncanonical nucleic acid sequences.



Schematic depicting the identification and characterisation of a sample for the diagnosis of SARS-CoV-2 clinical samples

Reference: *ACS Sens.* 7: 453-459. 2022. doi: 10.1021/acssensors.1c02113

Events organised:

- 19th–20th January 2023: Workshop at the Young Scientists Conference on the theme *"Contribution of Physics and Chemistry towards Medical Sciences and Global Health Care",* co-organised with Prof. V. Krishnan, JNCASR
- 13th March 2023: Speaker and co-ordinator of a Workshop conducted during the Max-Planck-Gesellschaft (MPG)-German Research Foundation (DFG) delegation visit at JNCASR

Prof. Jayanta Haldar F.R.S.C.

Professor and Warden and Student Counsellor

We work towards integrating interdisciplinary approaches involving medicinal chemistry, chemical biology, and biomaterial research to mitigate AMR, through therapeutic and biomaterial interventions. Our recent publication reported next-generation glycopeptides with multiple modes of action, including cell-division inhibition *(Chem. Sci. 2023)*. In another publication, we reported weak membrane-perturbing antibiotic-adjuvants to repurpose/reactivate antibiotics against superbugs *(ACS Infect. Dis. 2022)*. We have also reported novel synthetic membrane-targeting agents which destabilise the microbial membrane, leading to selective bacterial killing *(Adv. Therap. 2022; Chem. Sci. 2023)*.

On the biomaterials frontier, we have engineered polymeric hydrogels as well as injectable hydrogels for local delivery of a wide range of antimicrobials *(Adv. Healthc. Mater. 2022)*. Our hydrogels also healed wounds and sealed ruptured tissues in mice. We have also developed antimicrobial haemostatic sponges, which can arrest bleeding in liver injury and curb infections *(ACS Biomater. Sci. Eng. 2022)*. Recently, we have developed photo-crosslinkable antimicrobial coatings, which can kill bacteria, fungi, influenza, and SARS-CoV-2 *(ACS Appl. Mater. Interfaces 2022)*.

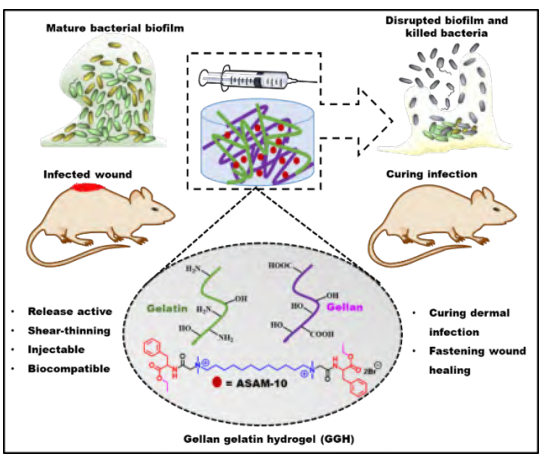


Illustration depicting the hydrogel with activity against bacteria and enhanced wound healing, including in murine in vivo models

Reference: *Biomater. Sci.* 11(3): 998–1012. 2022. doi: 10.1039/d2bm01582j

NCU

Event organised:

- 14th February 2023: NCU Seminar by Prof. Sangram Bagh on *"Building Computers with Genetically Engineered Cells, which can compute, solve mazes and add and subtract numbers"*

Major talks during 2022–2023:

- 14th–16th July 2022: Invited talk on *"Polymeric Biomaterials for Tackling Antimicrobial Resistance and Infection"* at the International e-Conference on Biopolymers organised by APA Bioforum
- 23rd July 2022: Guest Lecture on *"Innovative Functional Biomaterials for Tackling Antimicrobial Resistance and Infection"* at R. N. Tagore University, Bhopal
- 29th September 2022: Talks on *"Functional Biomaterials for Tackling Antimicrobial Resistance and Infection"* at the DBEB Departmental Seminar Series organised by IIT Delhi
- 18th October 2022: Invited talk on *"Pursuit of next-generation glycopeptides – Our journey with vancomycin"* at JNCASR on the occasion of New Chemistry Day
- 9th November 2022: Talk on *"Innovative Chemical Strategies for Tackling Antimicrobial Resistance and Infection"* at the Indo-Belgian Virtual Networking Meeting organised by JNCASR and ULB
- 15th–18th December 2022: Invited talk on *"Functional Biomaterials for Tackling Antimicrobial Resistance and Infection"* at the International Conference on Biomaterials, Regenerative Medicine and Devices, Bio-Remedi-2022 organised by IIT Guwahati, India
- 1st February 2023: Invited lecture on *"Biomaterial interventions to tackle bleeding and infection"* at the In-house SAMat Meet at JNCASR
- 15th February 2023: Talk on *"Innovative biomaterials and therapeutic interventions for tackling antimicrobial resistance and infection"* at the TATA Steel - JNCASR Meet held at JNCASR
- 17th–20th February 2023: Invited talk on *"Pursuit of next-generation glycopeptides – Our journey with vancomycin"* at the XXII Organic Chemistry Conference, organised by the National Organic Symposium Trust (NOST) in Aurangabad
- 1st March 2023: Invited lecture on *"Outwitting antibiotic resistance: A perpetual battle"* at NCBS, Bengaluru
- 3rd March 2023: Invited lecture on *"Smart biomaterials for tackling infection"* at M V J College of Engineering, Bengaluru
- 16th–18th March 2023: Invited Talk on *"Outwitting antibiotic resistance: A perpetual battle"* at Chemistry Meet: Kindling in Kaziranga, India, organised by Indian Association for Cultivation of Science (IACS), Kolkata
- 23rd March 2023: Invited talk on *"Outwitting antibiotic resistance: A perpetual battle"* at Amrita Pharmacon-2023, International Conference on Innovation in Antimicrobial Therapeutics, organised by Amrita University, Coimbatore

Prof. Sebastian C. Peter

Professor

The Solid-State Chemistry and Catalysis lab has expertise in designing new inorganic materials but not limited only to intermetallic. The materials synthesis is done using the chemical principles of solid-state chemistry using variety of methods such as high-temperature solid solid-state, colloidal, solvothermal, and the wet-impregnation method. We target and design the materials for electronic, magnetic and catalytic applications such as water splitting, CO_2 reduction to value added chemicals by different approaches such as electrochemistry, photochemistry and thermochemistry. The innovative strategies include dimensionally induced CO_2 to methanol (*Advanced Materials*, 2022), charge transfer induced CO_2 to ethylene (*JACS*, 2022), surface restructuring induced CO_2 to ethylene (*Angew Chem,* 2022), chemistry at the interface induced CO_2 to ethanol (*EES,* 2022), structural ordering controlled CO_2 to acetic acid (*EES Catalysis,* 2023), charge polarisation induced CO_2 to ethanol (*Advanced Materials,* 2022), etc. Discovery of new materials can lead to some unexpected properties. In this regards, exploratory synthesis is in the forefront, and we have developed a chiral intermetallic (*JACS,* 2022). Not only do we focus on value added products from CO_2 reduction, but we also try to understand the fundamental reaction dynamics for fuel cell reaction (oxygen/hydrogen evolution reaction). Vacancy filling controlled fuel cell electrodes (*JACS,* 2022) and morphology tuned H_2 evolution (*Advanced Materials,* 2022) are some examples.

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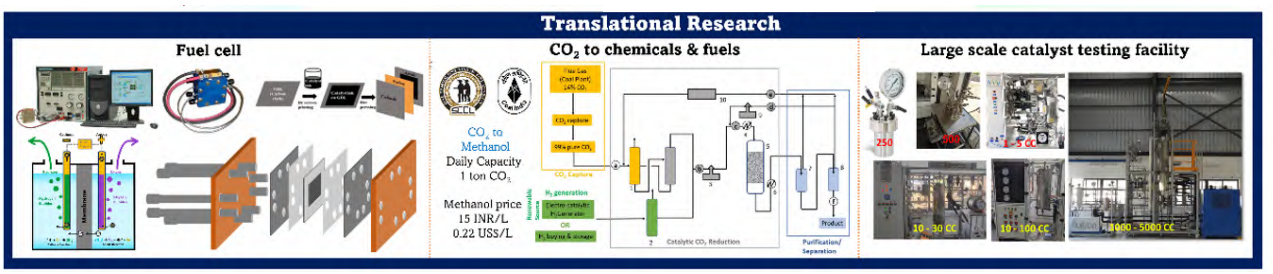


Translational research conducted by the The Solid-State Chemistry and Catalysis lab aids the design of materials for electronic, magnetic and catalytic applications

Reference:
J. Am. Chem. Soc. 144: 11859–11869. 2022. doi: 10.1021/jacs.2c04541
Adv. Mater. 34: 2202294-10. 2022. doi: 10.1002/adma.202202294
Adv. Mater. 34: 2109426-10. 2022. doi: 10.1002/adma.202109426
Adv. Mater. 35: 2205994-11. 2022. doi: 10.1002/adma.202205994
Energy Environ. Sci. 15: 1967-1976. 2022. doi: 10.1039/D1EE02976B
Ange. Chem. 135: e202216613-11. 2022. doi: 10.1002/ange.202216613

Major talks during 2022–2023:

- 22nd September 2022: Invited talk on *"Carbon and Water Recycling for Sustainable Energy: From Fundamental Chemistry to Green Technologies"* at Shell.ai Scientific Conference 22, Bengaluru
- 9th–11th November 2022: Invited talk on *"Design and Development of Nanomaterials for the conversion of CO_2 to Chemicals and Fuels: From Fundamental Chemistry to Green Technologies"* at Asia Nano Conference – 2022 organised by Shell in Busan, Korea
- 17th–19th November 2022: Invited talk on *"Carbon and Water Recycling for Sustainable Energy: From Fundamental Chemistry to Green Technologies"* at the International Conference on H_2 & CO_2 by ST&T Digital, Pune, organised by Prof. Satish Ogale
- 10th December 2022: Invited online talk on *"Career in India on CCU"* at SCI-ROI Global on Career in India organised by the US Student Association
- 20th December 2022: Invited talk on *"Carbon and Water Recycling for Sustainable Energy: From Fundamental Chemistry to Green Technologies"* at IUMRS ICA 2022, IIT Jodhpur, organised by MRSI
- 10th–11th January 2023: Talk on *"Carbon and Water Recycling for Sustainable Energy: From Fundamental Chemistry to Green Technologies"* at the Second International Conference on Sustainable Nanomaterials: Sustainable Application, NanoSa-2023 organised by ICT
- 21st–22nd February 2023: Talk on *"Carbon and Water Recycling for Sustainable Energy: From Fundamental Chemistry to Green Technologies"* at Indo-French Workshop on Clean and Sustainable Energy Technologies, (INFINITE) by CEFIRPA at Delhi
- 4th–5th March 2023: Talk on *"Carbon and Water Recycling for Sustainable Energy: From Fundamental Chemistry to Green Technologies"* at Emergent Materials for Energy and Environment (EMEE-23) Conference organised by IIT Roorkee

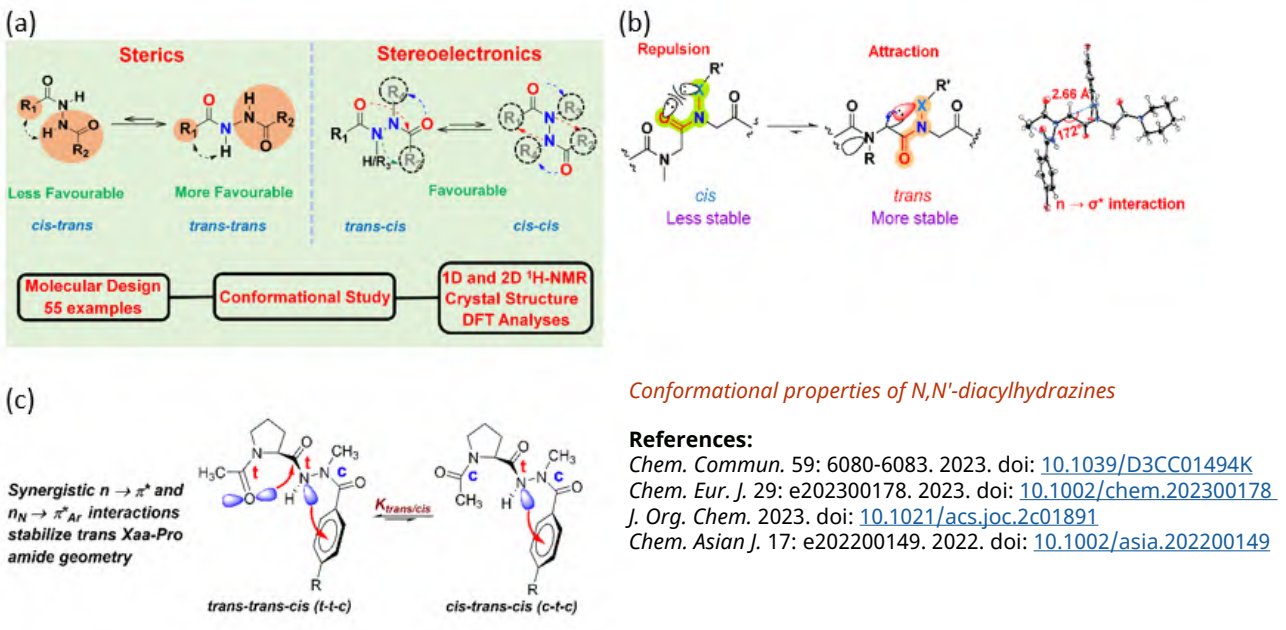
Dr. Bani Kanta Sarma
Faculty Fellow

N,N'-diacylhydrazines are an important class of molecules with diverse applications in chemistry and biology. By means of combined experimental and theoretical tools, we investigated the conformational properties of these molecules and observed that *N,N'*-diacylhydrazine prefer twisted trans-trans geometries when the substituents on the nitrogens are H-atoms (>90%). In contrast, *N*-alkylation and *N,N'*-dialkylation induces twisted trans-cis geometries. We further investigated the role of steric and stereoelectronic interactions on the stability of these conformers and provided a guideline for predicting the stable conformers of *N,N'*-diacylhydrazines just by examining their substituents (Figure-1a).

Subsequently, we demonstrated that *N,N'*-diacylhydrazines stabilises trans-amide bonds when they are

part of peptidomimetic foldamers, such as azapeptoids (Figure-1b). We discovered that the repulsion between the sidechain nitrogen lone pair and the backbone CO oxygen lone pairs destabilise cis amide geometries, whereas $n_N \rightarrow \sigma^*_{C\alpha-N}$ interactions between sidechain nitrogen lone pair and the orbital of the backbone C–N bond stabilise the trans amide geometries. Incorporation of azapeptoids as a guest in proline-rich short peptides has further been found to stabilize their PPII geometries.

We again observed that incorporation of *N,N'*-diacylhydrazine at C-terminus of proline, induces trans geometry of amide bond (Figure-1c), which can have consequences in the stability of polyproline-II and collagen helices.



Conformational properties of N,N'-diacylhydrazines

References:
Chem. Commun. 59: 6080-6083. 2023. doi: 10.1039/D3CC01494K
Chem. Eur. J. 29: e202300178. 2023. doi: 10.1002/chem.202300178
J. Org. Chem. 2023. doi: 10.1021/acs.joc.2c01891
Chem. Asian J. 17: e202200149. 2022. doi: 10.1002/asia.202200149

Major talk during 2022–2023:

- 23rd–25th Jan 2023: Invited talk at ChemSci2023: Leaders in the Field Symposium on *"Leveraging Local Interactions to Affect Global Structures of Peptides and Peptidomimetics"* at JNCASR, organised in association with the Royal Society of Chemistry's *Chemical Science* journal

Prof. Hiriyakkanavar Ila F.A.Sc.

Hindustan Lever Research Professor

We present a one-pot synthesis strategy for novel 2-(het) aryl-substituted thiazolo-fused six- and seven-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 one-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 two-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.

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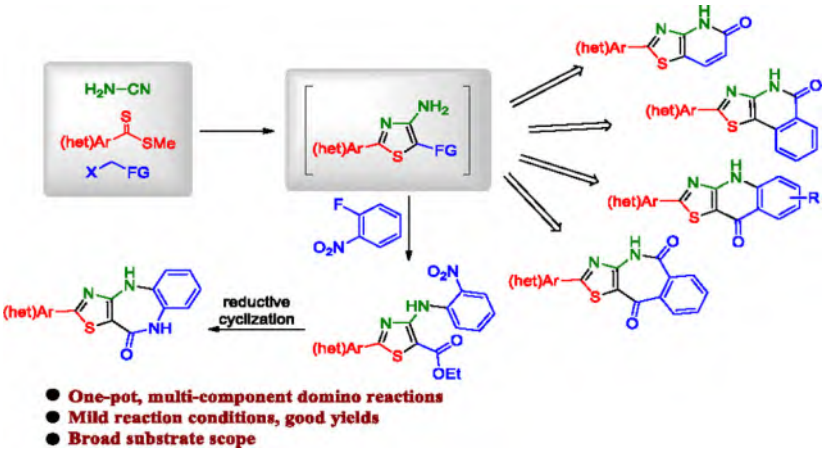

Schematic representation of one-pot synthesis of novel 2-(het)aryl-substituted thiazolo-fused six- and seven-membered heterocycles

Reference:
J. Org. Chem. 87(18): 12397–413. 2022.
doi: 10.1021/acs.joc.2c01673

Major talks during 2022–2023:

- July 2022: Talk as Session Chair at the CRSI Meeting organised by IISER Mohali
- Nov 2022: Keynote address on *"New Direction In Synthesis of Biologically Important Heterocycles"* at the International Conference in Recent Advances in Chemical Science organised by the Central University of Jammu
- 1st–4th Dec 2022: Keynote address on *"Novel routes to Synthesis Of Biologically Important Heterocycles"* at Contemporary Facets in Organic Synthesis CFOS -2022, organised by IIT Roorkee
- 26th–27th Dec 2022: Keynote address as Chief Guest titled *"New Strategies Towards Synthesis of Biologically Important Heterocycles"* at Chemical Science Symposia organised by Benaras Hindu University
- 2nd–4th February 2023: Talk as Conference Chair at the CRSI Meeting organised by JNU, Delhi
- 21st–23rd February 2023: Invited lecture on *"New Strategies towards Synthesis Of Biologically Important Heterocycles"* at Indo-German Conference organised by IIT Indore

Dr. Sarit S. Agasti
Associate Professor (jointly with CPMU)

Please see pg. 51 of CPMU for research activities

Dr. Premkumar Senguttuvan
Associate Professor (jointly with ICMS)

Please see pg. 77 of ICMS for research activities

Dr. Pratap Vishnoi
DST Ramanujan Fellow (jointly with ICMS)

Please see pg. 77 of ICMS for research activities

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UNIT MEMBERS

Faculty Members	
Professor and Chair	**Prof. Subi Jacob George**
Linus Pauling Research Professor; Honorary President, JNCASR; and Director, ICMS	**Bharat Ratna Prof. C. N. R. Rao**
Professors	**Prof. Kanishka Biswas** **Prof. T. Govindaraju (Chair, ETU)** **Prof. Jayanta Haldar (Warden and Student Counsellor)** **Prof. Sebastian C. Peter**
Associate Professors	**Dr. Sarit S. Agasti (jointly with CPMU)** **Dr. Premkumar Senguttuvan (jointly with ICMS)**
Faculty Fellow	**Dr. Bani Kanta Sarma**
DST Ramanujan Fellow	**Dr. Pratap Vishnoi (jointly with ICMS)**
Hindustan Lever Research Professor	**Prof. Hiriyakkanavar Ila**

Associate Faculty
• **Prof. Sundaresan A.** (Professor, Chair, CPMU) • **Prof. Tapas Kumar Maji** (Professor, CPMU) • **Prof. Eswaramoorthy Muthusamy** (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.: 54	**Acharya Yash Sanjay, Alka Chahal, Angshuman Das, Anju A. K., Animesh Bhui, Anustoop Das, Arindam Ghosh, Ashish Kumar, Anshulata, Bhaskar Kakoty, Biplab Patra, Bitan Ray, Debajit Kalita, Debashree Borah, Debattam Sarkar, Devender Goud G., Dikshaa Padhi, Devesh Chandra Binwal, Diku Raj Deka, Gauttam Dash, Hariharan M., Indrajit Haldar, Krithi K. Bhagavath, Madhu R., Mary Antony P., Milind Kumar Anand, Papiya Sadhu Keshavkrishna Mondal, Nandini Saha, Nilutpal Dutta, Paramesh Das, Piyasi Garai, Priyanka, Prasenjit Mandal, Rajib Dey, Robi Sankar Patra, Rohit, Rubu Rinya, Sabyasachi Mandal, Soumi Mondal, Subhajit Chakraborty, Subham Das, Subhankar Maity, Vaishali Taneja, Soumya Panja, Sushanta Show, Sumedha Gupta, Subhradeep Barman, Sayan Das, Saswata Bandyopadhyay, Samprete Bhattacharyya, Saurav Saha, Saikat Ghosh, Satyajit Patra**
Int. Ph.D.: 34	**Suchi Smita Biswas, Adrija Ghosh, Taraknath Das, Darshana Deb, Reetendra Singh, Aditi Saraswat, Geetika Dhanda, Sudip Mukherjee, Riddhimoy Pathak, Animesh Das, Akshay Saroha, Ivy Maria , Prabhat Thapliyal, Sayan Chakravarty, Surya Pravo Mookerjee, 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, Aishwarya Saha, Sovan Kundu, Saikat Das**
M.Sc Chemistry: 13	**K. Palani Ganesh, Arpita Panda, Jatin Chauhan, Ramjayakumar V., Kashish Kumar Taneja, Naren Ghandhi K. K., Debmalya Bhattacharya, Sudipa Aich, Subarna Panda, Mridul Krishna Sharma, Karushuda Anita, Subhajit Pal, Priyanka**

Technical Staff	
Technical Assistant (Inst.)	**Shivakumar K. M.**
Technical Assistant Trainees (On Contract)	**Dr. Samiran Misra, D. Kannan**
Technician (On Contract)	**Jagabandhu Sahoo**
Laboratory Assistant (On Contract)	**Savitha N.**

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Administrative Staff	
Office Executive (On Contract)	**Geetanjali Chakravorthy**
Scientific Administrative Assistant (On Contract)	**Ragina K. K.**

Temporary Staff	
Project Scientist III	**Dr. Aruna Satyamurthy**

Research Staff (On Contract)	
Research Associates	**Dr. Vasudhar Bhat S. V., Dr. Diptendu Patra, Dr. Khyati Anand, Dr. Kumar Saurabh, Dr. Payel Mondal, Dr. Risov Das, Dr. Debabrata Bagchi, Dr. Vinita Ahuja Ashok Kumar, Dr. Souvik Sarkar, Dr. Arka Som, Dr. Shagufi Naz Ansari, Dr. Kalpita Baruah, Dr. Jugal Kishore Rai Deka, Dr. Keshav Kumar, Dr. Jeevan Chakravarthy A. S., Dr. Madhulika Mazumder, Dr. Subham Ghosh, Dr. Paribesh Archaryya, Dr. Sushmita Chandra, Dr. Arjun C. H., Dr.Wagalgave Sopan Mahadev, Dr. Swadhin Garain, Dr. Prashurya Pritam Mudoi, Dr. Himani Singh, Dr. Shikha Agawal, Dr. Sujit Kumar Guchhait, Dr. Kumar Saurabh, Dr. Mohd Riyaz, Dr. Kousik Das, Dr. Sushmitha Chandrabhas, Dr. Subarna Das, Dr. Raju Laishram, Dr. Prabir Dutta, Dr. Riya Mukherjee , Dr. Abdul Ahad, Dr. Kartik Panda, Dr. Bharath Velaga, Dr. Sathyapal Churipard R., Dr. Biswajit Sahariah, Dr. Bhawna Pandey**
Research Associates (Provisional)	**Mujeeb Alam, Sreyan Ghosh, Ashutosh Kumar Singh, Saptarshi Chakraborty, Prayasee Baruah, Deepika Gupta, Madhu R.**
SERB (TARE) Fellows	**Dr. Srinatha N., Dr. Manjunatha S. O., Dr. B. N. Ramesh, Dr. Ashly P. C.**
Dr. D. S. Kothari Postdoctoral Fellow	**Dr. Veenu Mishra**
SERB National Postdoctoral Fellows	**Dr. Suresh R., Dr. Soumik Dinda, Dr. Deepa Bhatt, Dr. Pratibha Kumari, Dr. Jayita Pradhan**
Senior Research Fellows	**Rajarshi Batabyal, Sucheta Biswas**
Junior Research Fellows	**Aparna R. Nair, Anjana S., Anu P., Madhurima Sarkar, Manami Banerjee , Saurav K. V., Rashmi Devaru Hegde, Vinayak Narayanmurthy Vernekar, Amit Tevatia, Anish Yadav, Sreshtha Ganguly, Pooja Rani, Mohammed Jasil P.**
R & D Assistants	**Anupama Ghata, Subhajit Das, Logia Jolly, Mohamed Nabeel Mattath, Subham Sarkar , Preeti Jindal, Saurav Ajit Kulkarni, Hasem Ansari, Bhawna, Archana K., Vijay B. B.**
Project Associates I	**Sanjay Sajeev, Gouri Ramadas Nayanar**
Senior Project Associate	**Bishnubasu Giri**

UNIT AT A GLANCE

Honours/Fellowships/Memberships Received

Faculty members

Students and Postdoctoral Fellow

NCU

Faculty Achievements

Bharat Ratna Prof. C. N. R. Rao

- Received the SMC Lifetime Achievement Award from Society for Materials Chemistry
- Received *Honoris Causa* from The Assam Royal Global University
- Received Lifetime Achievement Award from Chirantan Rasayan Sanstha

Prof. Kanishka Biswas

- Elected as Editorial Advisory Board Member of *Journal of Materiomics,* Elsevier
- Elected as Editorial Advisory Board Member, *Materials Lab*

Prof. T. Govindaraju

- Elected as the Fellow of Indian Academy of Sciences 2023
- Received the Sun Pharma Science Foundation Research Award under the category of pharmaceutical science
- Received the National Technology Award 2023 (Translational Research) from DST-Technology Development Board, Govt. of India
- Elected as Editorial Advisory Board member, *Journal of Peptide Science*, European Peptide Society and Wiley Publication
- Received the Bhagyatara Award 2022 from Punjab University

Prof. Jayanta Haldar

- Selected as the Guest Editor of a special issue of Royal Society of Chemistry's (RSC's) *Medicinal Chemistry* on antimicrobial resistance

Prof. Sebastian C. Peter

- Received the National Prize 2021 for Research on Environmental Chemistry, including CO_2 Reduction and Green Hydrogen (instituted by the C. N. R. Rao Education Foundation) on 21st September 2022
- Received the Society for Materials Chemistry Bronze Medal 2022
- Received the National Award for Technology Start-Ups from the Technology Development Board, DST, for developing a pilot plant to convert CO_2 to methanol through the start-up he founded, M/s Breathe Applied Sciences Pvt. Ltd.
- Received the prestigious J.C. Bose Diamond Jubilee Scientist Award from National Academy of Science, India in 2022
- Elected as a Fellow of the Royal Society of Chemistry
- Elected as Fellow of International Association of Advanced Materials 2022
- Competition Winner at MaterialNEXT 4.0 by TATA Steel

Dr. Sarit S. Agasti

- Awarded INSA Medal for Young Scientist 2022

Dr. Premkumar Senguttuvan

- Elected as Member of JACS Au Early Career Advisory Board (ECAB) 2023
- Received the *Journal of Materials Chemistry A* Emerging Investigators 2023 Award

Dr. Pratap Vishnoi

- Received recognition as Emerging Investigator 2022 by the *Journal of Materials Chemistry A*, Royal Society of Chemistry

Prof. Hiriyakkanavar Ila

- Featured in the book titled *"Vigyan Vidushi – 75 Women Trailblazers of Indian Science"* released by DST Vigyan Prasar

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Students and Postdoctoral Fellow Achievements

Anshulata (Ph.D. student; research supervisor: Dr. Bani Kanta Sarma)

- Received the Best Poster Award at the In-House Symposium, 2022, JNCASR

Paribesh Achharyya (Ph.D. student; research supervisor: Prof. Kanishka Biswas)

- Received Prof. C. N. R. Rao Medal (for the best Ph.D. thesis in Physical Science), JNCASR

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

- Received Oral Poster Presentation Award at the ChemSci2023 Leaders in the Field Symposium, RSC and JNCASR
- Invited for poster presentation at the Gordon Research Conference seminar on Staphylococcal Diseases 2023, New Hampshire, USA

Debabrata Bagchi (Ph.D. student; research supervisor: Prof. Sebastian C. Peter)

- Received the Best Oral Presentation Award from Royal Society of Chemistry

Arjun Cherevotan (Ph.D. student; research supervisor: Prof. Sebastian C. Peter)

- Selected for the International Climate Protection Fellowship by Humboldt Foundation

Animesh Das (Int. Ph.D. student; research supervisor: Prof. Kanishka Biswas)

- Received the Smt. and Sri. Bapu Narayanaswamy Prize (for the Best M.S. thesis in Chemical and Materials Science), JNCASR

Paramesh Das (Ph.D. student; research supervisor: Dr. Bani Kanta Sarma)

- Received the Best Poster Award at 9th Indian Peptide Symposium (IPS-2023), at BITS Pilani, Goa

Risov Das (Ph.D. student; research supervisor: Prof. Sebastian C. Peter)

- Received the Best Thesis Award at KPIT, Pune

Subham Das (Ph.D. student; research supervisor: Prof. Ranjani Viswanatha)

- Received the Best Poster Award at International Conference on Advanced Materials (ICAM-2023) held at Goa University

Darshana Deb (Int. Ph.D. student; research Supervisor: Prof. Subi Jacob George)

- Received the Best Poster Award from CSIR-NIIST

Geetika Dhanda (Int. Ph.D. student; research supervisor: Prof. Jayanta Haldar)

- Invited for oral presentation at the American Chemical Society Spring 2022 Meeting
- Invited for poster presentation at the Gordon Research Conference seminar on New Antibacterial Discovery and Development, 2022
- Invited for talk at the Gordon Research Conference seminar on New Antibacterial Discovery and Development, 2022

Anupama Ghata (M.Sc. student; research supervisor: Prof. Kanishka Biswas)

- Received Dr. Indumati Rao Prize (for securing the highest CGPA in the two-year M.Sc. in Chemistry), JNCASR

Dr. Sreyan Ghosh (Research Associate (Provisional); research supervisor: Prof. Jayanta Haldar)

- Invited for oral presentation at the American Chemical Society Spring 2022 Meeting

NCU

Prasenjit Mandal (Ph.D. student; research supervisor: Prof. Ranjani Viswanatha)

- Received the Best Poster Award at Perovskite Society of India Meet (PSIM-2023) held at IIT, Roorkee

Suryapravo Mookerjee (Int. Ph.D. student; research supervisor: Dr. Bani Kanta Sarma)

- Received the Best Poster Teaser at the In-House Symposium, 2022, JNCASR

Sudip Mukherjee (Int. Ph.D. student; research supervisor: Prof. Jayanta Haldar)

- Invited for poster presentation at ACS Symposium by ACS Publications Symposium 2023 Biological and Medicinal Chemistry, Bonn, Germany

Dikshaa Padhi (Ph.D. student; research supervisor: Prof. T. Govindaraju)

- Received the SASTRA – Prof. Saroj Chandrasekhar Memorial Award on National Science Day on 28th February 2023

Dipanjana Patra (Int.Ph.D. student; research supervisor: Prof. Jayanta Haldar)

- Received the Best Teaser at In-House Symposium 2022, JNCASR
- Invited for poster presentation at the SMS 2022 International Conference, Athens, Greece

Satyajit Patra (Ph.D. student; research supervisor: Prof. Subi Jacob George)

- Received the Best Poster Award at Chemical Research Society of India

Biswajit Sahariah (Post Doc student; research supervisor: Dr. Bani Kanta Sarma)

- Received the Best Poster Award at National Conference on New Vistas in Chemistry, 2022, Bangalore University

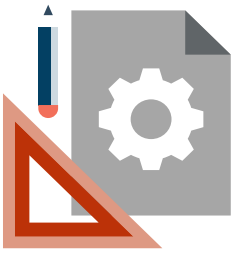
Ashutosh Kumar Singh (Ph.D. student; research supervisor: Prof. Sebastian C. Peter)

- Received the Best Poster Teaser Award at JNCASR at In-House Symposium and Faculty meeting

Total Publications

99 Peer reviewed articles indexed in Web of Science/Scopus

Sponsored Projects



New Projects

7

Grants Received During 2022–2023

₹ 54.27 lac

Ongoing Projects

28

Grants Received During 2022–2023

₹ 120 cr

NCU

Student Graduated During 2022–23

16 Ph.D.

- Brinta Bhattacharjee
- Debasis Ghosh
- Arjun C. H.
- Mohd Monis Ayyub
- Paribesh Acharyya
- Anusha S. Avadhani
- Souvik Sarkar
- Payel Mondal
- Swadhin Garain
- Debabrata Bagchi
- Risov Das
- Ahuja Vinita Ashokkumar
- Ramesh M. S.
- Biswanath Maity
- Yogendra Kumar
- Sumon Pratihar

3 Ph.D. (through Int. Ph.D.)

- Manaswee Barua
- Sushmita Chandra
- Madhulika Mazumder

5 M.Sc. in Chemistry

- Daizy Kalita
- Anupama Ghata
- Dharshini Raghavan
- Kulkarni Saurav Ajit
- Chahat

3 M.S. in Chemical Science

- Mohd. Arif
- Tarak Nath Das
- Animesh Das

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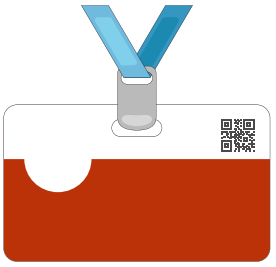
Students Admitted During 2022–2023



14 **Ph.D.**

- 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

6 **Int. Ph.D.**

- Sayan Goswami
- Priyanshi Bahuguna
- Aishwarya Saha
- Sovan Kundu
- Saikat Das
- Brundha A.

8 **M.Sc. in Chemistry**

- Naren Ghandhi K. K.
- Debmalya Bhattacharya
- Sudipa Aich
- Subarna Panda
- Mridul Krishna Sharma
- Karushuda Anita
- Subhajit Pal
- Priyanka

101 **Current Student Strength**

NEUROSCIENCE UNIT (NSU)

The field of neuroscience is the academic pursuit of studies of the nervous system and its role in modulating behaviours and physiological processes in organisms. At NSU, researchers work on understanding the unique molecular and biophysical properties of neuronal cells and their partners, as well as emergent properties of neuronal networks. The fundamental theme of this unit is to study the various aspects of nervous systems.

Currently, the research interests of the Unit include the study of synaptic function and its relationship with intellectual disability, neurogenetics of behaviour in *Drosophila*, molecular and cellular mechanisms of human brain/mind disorders, biomaterials for interfacing sensory organs with soft analogue devices, and molecular neuro-oncology. 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.

In the coming years, NSU intends to expand its activities in the broad areas of computational neuroscience, cellular neuroscience, and mammalian developmental neurobiology. The unit is also looking to build highly advanced imaging technologies to investigate not only synaptic function and morphology but also neuronal circuit function, which will have biomedical implications.

RESEARCH AREAS

- Developmental neurobiology
- Understanding autism spectrum disorder using *Syngap1* heterozygous mutant mice as a model
- Dysregulated autophagy in neurodegenerative diseases
- The circadian neuronal circuit as a model to understand cellular players in neurodegeneration
- Developmental and translational neuroscience, deciphering mechanisms and potential therapies for brain malformations, hydrocephalus, and epilepsy
- Cerebellar development and disorders using clinically relevant mouse models
- Neuronal circuitry underlying locomotor activity rhythms
- Sleep circuits of fruitflies
- Clock evolution under semi-natural conditions
- Chronotype evolution or the evolution of ‘owl’ and ‘lark’ phenotypes
- Research in chronobiology and behavioural neurogenetics
- Plasticity of circadian waveforms

RESEARCH HIGHLIGHTS

- The synaptic dysfunction involved in Machado–Joseph Disease was studied using *Drosophila*
- Basic causes for epilepsy and those that contribute to the development of epilepsy along with neurodevelopmental disorders was studied
- Circadian health restoration in fly models of neurodegeneration via heat shock and autophagy pathways was demonstrated
- Mechanistic role of *NF1* in cortical malformations using mouse models was investigated

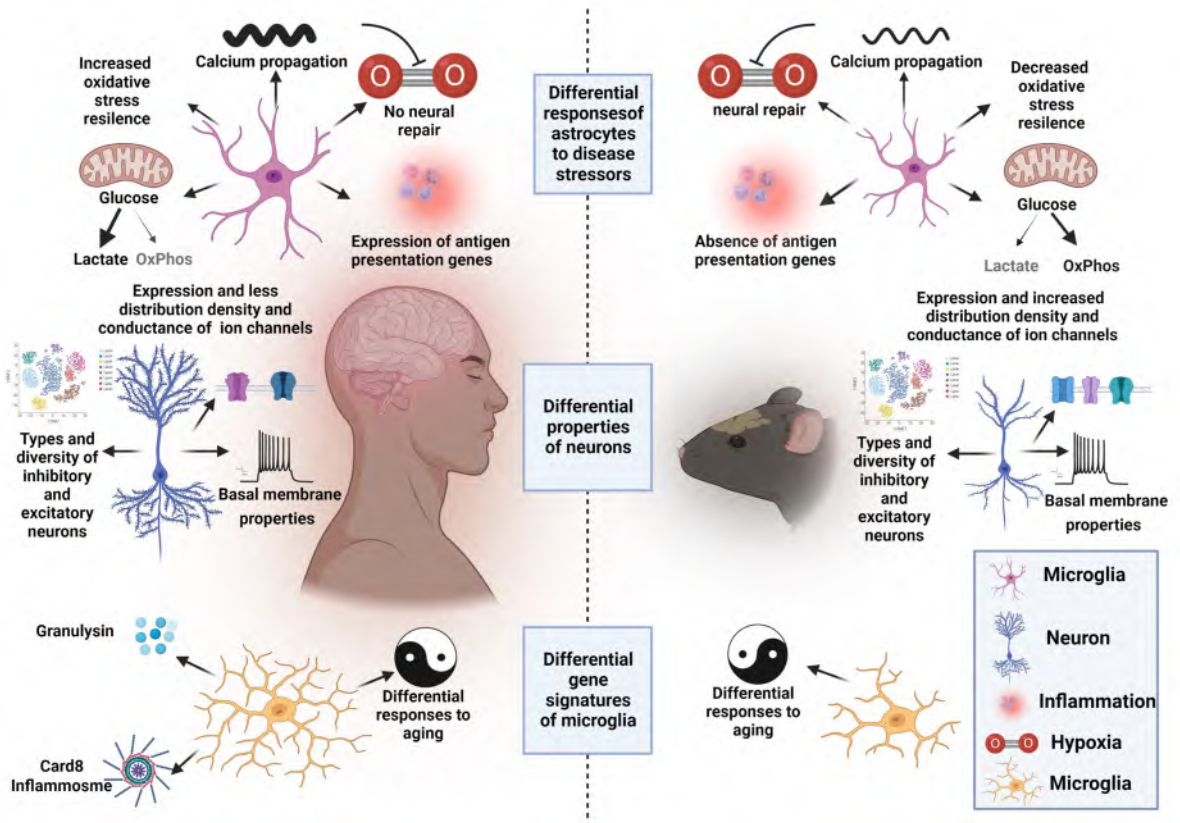
RESEARCH ACTIVITIES AND ACHIEVEMENTS DURING 2022–2023

Dr. Ravi Manjithaya
Associate Professor and Chair

Please refer to pg. 88 for research profile

Dr. James P. C. Chelliah
Associate Professor

Epilepsy is known as a heterogeneous group of brain-related diseases. The development of epilepsy along with other neurodevelopmental disorders (NDDs) is known to occur as a result of pathological mechanisms that involve disruptions in the excitation and inhibition balance. Our study attempts to describe the basic causes for epilepsy and those that contribute to the development of epilepsy along with NDDs. We comprehensively study some of the key neurodevelopmental genes (such as *MeCP2, SYNGAP1, FMR1, SHANK1-3,* and *TSC1*) and highlight the main electrophysiological and behavioural deficits for epilepsy. We also discuss the recent developments in the field of epilepsy management and provide a brief overview of the challenges and loopholes in identification and testing of species-specific epilepsy models.



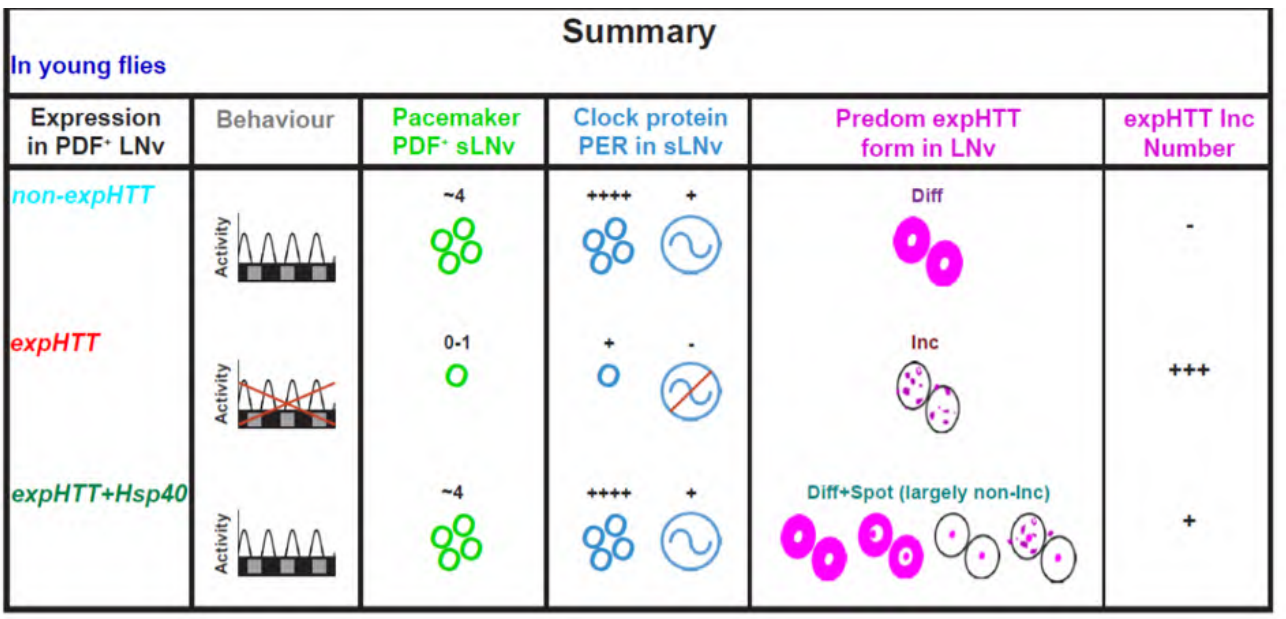
Species-specific differences in the intrinsic properties of astrocytes, neurons, and microglia

Reference: *Int. J. Mol.* Sci. 23(18): 10807. 2022. doi: 10.3390/ijms231810807

NSU

Dr. Sheeba Vasu
Associate Professor and Associate Warden

Many neurodegenerative conditions are associated with disrupted sleep-wake patterns. Our studies have been using fly models of neurodegeneration—specifically Huntington's Disease—to find ways to slow down the progression of this debilitating motor condition. In two independent studies, we have demonstrated that upregulation of heat shock pathway or autophagy pathway in the circadian circuit can help mitigate the toxic effects of the pathogenic protein. Our approach has been to target the expression of mutated versions of the human gene in circadian pacemaker neurons to create a circadian model of neurodegeneration. In this background we have upregulated heat shock genes *(HSP)* or autophagy genes (*Atg*) and show that these methods can significantly reduce the extent of arrhythmicity that was seen previously. We show that the expression of *HSPs* can alter the type of cellular aggregates within the cell that presumably renders them to be less toxic.



Summary representation of effect of co-expressing Hsp40 with expHTT

Reference: *Dis. Model. Mech.* 15(6): dmm049447. 2022.
doi: 10.1242/dmm.049447

Event organised:

- December 2022: Indian Neurobehaviour Conference INC 2022, co-organised with Pavan Agarwal (MAHE) and Gaurav Das (NCCS, Pune), held at Manipal Academy of Higher Education (MAHE), Manipal

Major talks during 2022–2023:

- April 2022: Talks on *"The tick-tock of our biological clocks"* and *"The many mysteries of sleep"* at the Science Outreach Programme 2022, organised by HGVS and C. N. R. Rao Education Foundation
- 17th May 2022: Introductory talk as Symposium Chair on *"Rhythms in the time of COVID-19"* for SRBR 2022 – Biannual Meeting of the Society for Research on Biological Rhythms organised by the Society for Research on Biological Rhythms
- 30th May 2022: Invited talk on *"A Drosophila Circadian Model of Huntington's Disease"* for a symposium associated with World HD Day, titled "*Huntington's disease: from bedside to bench and back*", organised by NIMHANS-TIGS
- 21st Dec 2022: Invited talk on *"Neuronal circuits that modulate rhythmic locomotion under thermal cues"*, at the Indian Neurobehaviour Conference 2022, organised by MAHE, Manipal Academy of Higher Education

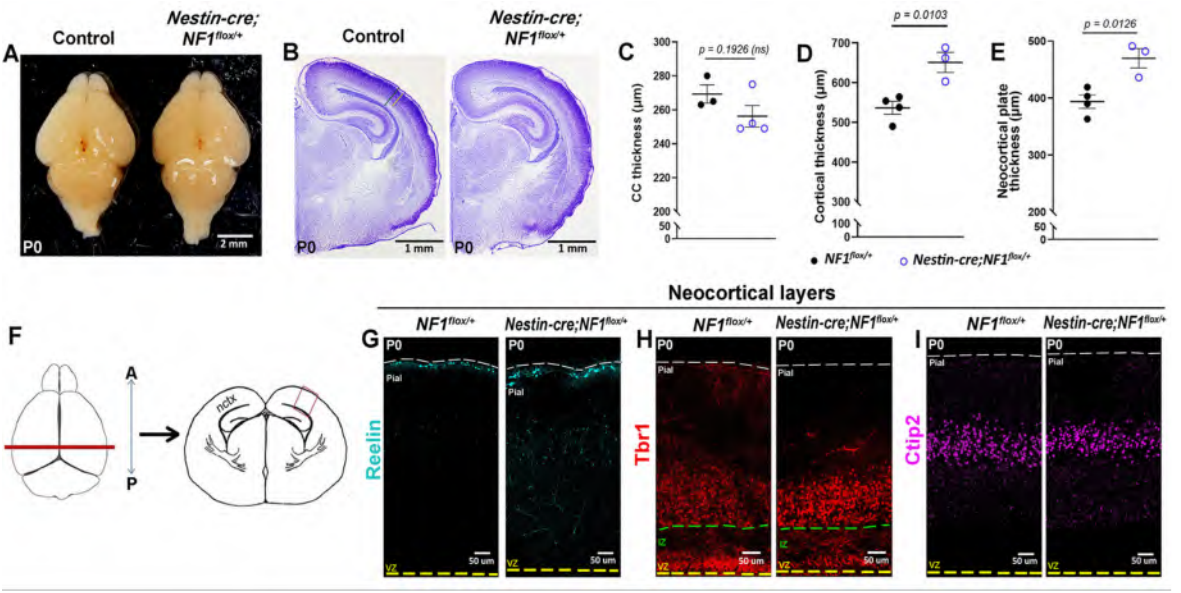
NSU

- 9th Jan 2023: Invited talks on *"Genetic basis of circadian clocks – discovery to current understanding"* and *"Lessons from model organisms on neuronal organisation of circadian clocks"* at the Indian School in Chronobiology and Chronomedicine, organised by Indian Society for Chronomedicine

Dr. Achira Roy
DBT Ramalingaswami Fellow

Malformations of cortical development (MCD) is an early-onset spectrum of neurodevelopmental disorders affecting paediatric population. These, including brain growth anomalies, epilepsy, hydrocephalus, etc., are often difficult to treat due to unavailability of drug and/or surgery failure. Investigating the underlying mechanisms is thus critical for identifying small-molecule targets for non-invasive therapeutic strategies. *Neurofibromin 1* (*NF1*) is a critical regulator of two key signalling pathways, namely, PI3K-AKT-MTOR and RAS-ERK-MAPK, which are instrumental in the process of brain development. Absence of *NF1* has been reported to cause MCD in humans. However, cellular and molecular mechanisms underlying this spectrum are not well elucidated. Ongoing work in our lab addresses this with the help of conditional loss-of-function mouse model of *NF1*. Current findings showed that monoallelic *NF1* loss causes mild phenotypes in mouse neocortical development. Interestingly, these phenotypes are *"cre-specific"*, suggesting a critical period of mutation onset influencing the phenotypic severity.

Our publication on epilepsy and preclinical drug assays was highlighted as a science story, titled *"New study offers hope for children suffering from intractable epilepsy"*, at the DST website, in February 2023. https://dst.gov.in/new-study-offers-hope-children-suffering-intractable-epilepsy



Embryonic deletion of one allele of NF1 in early neural progenitors of mouse brain results in a significant increase in cortical thickness and in subtle abnormalities in the neuronal localization at different layers of neocortex

Reference: *Currently unpublished but has recently been submitted as part of the first M.S. Thesis report from the lab, by Vishal R Lolam, Int. Ph.D. (Biological Science, 2020).*

Event organised:

- 8th July 2022: Talk at JNCASR on *"Do stars shape our behavior? Diversity of form and function within astrocyte populations: relevance to behavior and brain disorders"*, by Dr. Swanand Marathe, DST-Inspire Faculty Fellow, Centre for Neurosciences, IISc

Major talks during 2022–2023:

- 27th August 2022: Talk on *"Brain development and disorders - a beginning towards bridging gaps"* at the Seminar on MBGU-NSU Day 2022, JNCASR

NSU

- 23rd February 2023: Talk on *"Modelling a spectrum of early-onset human neurodevelopmental disorders – timing, mechanisms, and potential therapies"* at the NSU Seminar, JNCASR

UNIT MEMBERS

Faculty Members	
Associate Professor and Chair	**Dr. Ravi Manjithaya**
Associate Professors	**Dr. James P. C. Chelliah** **Dr. Sheeba Vasu (Associate Warden)**
DBT Ramalingaswami Fellow	**Dr. Achira Roy**

Associate Faculty
• **Prof. Anuranjan Anand** (Professor, MBGU) • **Prof. K. S. Narayan** (Professor, CPMU) • **Prof. Tapas Kumar Kundu** (Professor, MBGU) • **Prof. M. R. S. Rao** (Former President, Honorary Professor, and SERB Year of Science Chair Professor)

Research Students	
Ph.D.: 10	**Rituparna Sahu, Reena, Lipali Priyadarshini, Surajit Dawn, Rahul Dubey, Anjali Sharma, Debopriya Choudhury, Yashwini Dewan, Nilpawan Roy Choudhury, Mansi Rathi**
Int. Ph.D.: 4	**Sharma Pragya Niraj, Ankit Sharma, Kulkarni Rutvij Kaustubh, Vishal Rajesh Lolam**

Administrative Staff	
Sr. Helper	**Samuel S.**

Research Staff (On Contract)	
Research Associate	**Dr. Roshan Fatima Begum**
R & D Assistants	**N. S. Neeta, Sushmitha S. P., Sushma S. Rao**
Project Assistant	**Neeharika Reddy M. N.**

UNIT AT A GLANCE

Honours/Memberships Received

Faculty members | Students | Alumnus

NSU

Faculty Achievements

Dr. Sheeba Vasu

- Elected as Member of Education Committee by the Society for Biological Rhythms Research
- Elected as Member of Editorial Board of *Journal of Biological Rhythms* by the Society for Biological Rhythms Research
- Elected as Vice-President of Indian Society for Chronobiology

Dr. Achira Roy

- Received international research donation towards studying rare neurodevelopmental disorders by M-CM Network, New York, USA in June 2022

Student and Alumnus Achievements

Rutvij Kaustubh Kulkarni (Ph.D. student; research supervisor: Dr. Sheeba Vasu)

- Received Grants in Aid of Research (GIAR) – 2022 from Sigma Xi Society

Dr. Abhilash Lakshman (Alumnus (Ph.D.); research supervisor: Dr. Sheeba Vasu)

- Received Indian National Science Academy (INSA) Medal for Young Scientist 2022

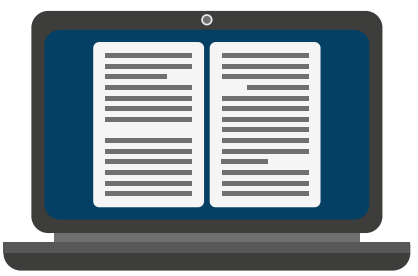
Mansi Rathi (Ph.D. student; research supervisor: Dr. Sheeba Vasu)

- Awarded the Best Poster Prize at the Indian Neurobehavior Conference 2022, held at Manipal Academy of Higher Education (MAHE) for her poster on "Exploring the ontogeny of adult social traits in *Drosophila melanogaster*"

Pragya Sharma (Ph.D. student; research supervisor: Dr. Sheeba Vasu)

- Chosen for Global Diversity Award 2022 from Society for Research on Biological Rhythms

Total Publications



14 Peer reviewed articles indexed in Web of Science/Scopus

NSU

Sponsored Projects

Ongoing Projects

4

Grants Received During 2022–2023

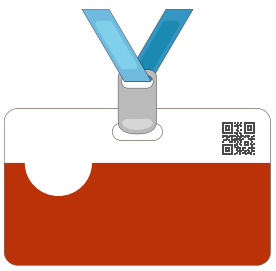
₹ 1.49 cr

Students Graduated During 2022–2023

4 **Ph.D.**

- Iyer Aishwarya Ramakrishnan
- Arijit Ghosh
- Chitrang Dani
- Aishwariya Iyengar

Students Admitted During 2022–2023



7 **Ph.D.**

- Rituparna Sahu
- Reena
- Lipali Priyadarshini
- Surajit Dawn
- Rahul Dubey
- Anjali Sharma
- Debopriya Choudhury

14 **Current Student Strength**

THEORETICAL SCIENCES UNIT (TSU)

The Theoretical Sciences Unit at JNCASR seeks to address, explain, and understand the rich diversity found in the physical world. Our aim is to predict new phenomena and design innovative materials, with an interdisciplinary approach that incorporates techniques and theories from physics, chemistry, and biology. We are inspired by two complementary approaches to the study of matter and life: the search for universality and the exploration and explanation of diversity.

Our 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. We 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. Our research is highly interdisciplinary, foraying into theoretical physics, chemistry, mathematics, and evolutionary biology. As such, we welcome students and researchers from diverse academic backgrounds, including chemistry, physics, engineering, and computer science.

RESEARCH AREAS

- Evolutionary biology
- Quantum many-body systems
- Computational nanoscience
- Statistical physics of disordered systems
- Statistical physics of phase transitions in living and non-living matters

RESEARCH HIGHLIGHTS

- The role of roughening transition in coarsening dynamics during ferromagnetic ordering from paramagnetic to ferromagnetic transitions was investigated
- Site frequency spectrum in populations with varying population size and selection coefficient over time was studied
- Half-Heusler (HH) compounds, TiRhBi and TiCoBi, were theoretically studied to find that TiRhBi had a much lower lattice thermal conductivity (κ_l) than TiCoBi at 1000 K due to the weaker bond formation capability of diffused Rh 4d-electrons
- Low-temperature dynamics in glass-forming liquids was identified as an approach to bridge the gap between past computer simulations and actual phenomena
- A convincing qualitative explanation of recent experiments demonstrating a tuneable Kondo effect in spin-orbit coupled quantum dot systems was provided
- The anomalous functional properties in rock salt chalcogenides were attributed to the emergence of metavalent bonding
- Operator theory and applications covering a broad spectrum of various aspects were researched

- The source of ubiquitous extended dumbbell shaped features seen in scanning tunnelling microscopy (STM) images of black phosphorus surfaces was identified by comparing simulated STM images, based on density functional theory (DFT) calculations, with experimental STM images at multiple bias voltages
- Quantum probability (and more recently) applications to statistical theory of machine learning were studied

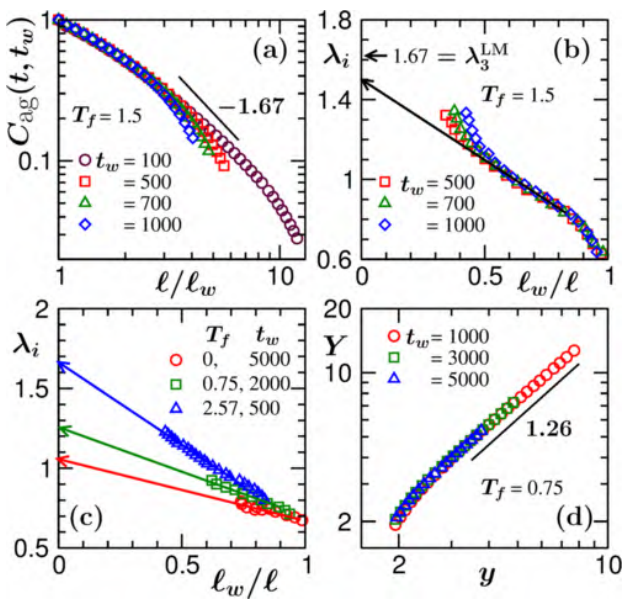
RESEARCH ACTIVITIES AND ACHIEVEMENTS DURING 2022–2023

Prof. Subir Kumar Das

Professor and Chair

Over last several decades, interest in understanding kinetics of phase transitions has been immense. There exists huge literature addressing issues concerning kinetics of paramagnetic to ferromagnetic transitions. Typically, studies are carried out by quenching a disordered system to the ordered region by sudden change in temperature. For many systems, within the ordered region of the phase diagram there exists a transition point, referred to as the roughening transition.

Across this, the interface between two coexisting phases can undergo change such that the width can vary with the system size. Influence of this fact on the kinetics has not previously been estimated. In our recent study, we have investigated various aspects of kinetics, namely structure, growth, and aging, by varying the quench temperature around the roughening transition point.



Demonstration of how the aging exponent is estimated from the order-parameter autocorrelation function, during ferromagnetic ordering [(a), (b), (d)]. We have also shown how this quantity depends upon temperature [(d)]

Reference: *Phys. Rev. E* 105(4): 044142. 2022. doi: 10.1103/PhysRevE.105.044142

Events organised:

- 5th and 6th August 2022: Conference on *"Current Directions in Statistical Physics"*
- 6th January 2023: Seminar on *"The waves within us: hydrodynamics of passive and active filaments"* by Dr. Brato Chakrabarti, Flatiron Institute, New York
- 9th January 2023: Seminar on *"Supersymmetry on the lattice: Geometry, flat bands, and topology"* by Dr. Krishanu Roy Chowdhury, Max Planck Institute for the Physics of Complex Systems, Germany
- 11th January 2023: Seminar on *"Emergent phenomena in solids and how multipoles help in understanding them"* by Dr. Sayantika Bhowal, ETH Zurich, Switzerland
- 20th January 2023: Seminar on *"Dynamics and Rheology of Glassy Active Matter"* by Dr. Rituparno Mandal, Institute for Theoretical Physics, University of Goettingen, Germany

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- 20th January 2023: Seminar on *"Elucidating the Formation Mechanism of Zeolites"* by Dr. Debdas Dhabal, Department of Chemistry, University of Utah, USA
- 24th January 2023: Seminar on *"Machine Learning for Molecular Simulation"* by Dr. Saientan Bag, University of Darmstadt, Germany
- 27th January 2023: Seminar on *"Statistical thermodynamics of deformation in crystalline solids: A defect-rich perspective"* by Dr. Saswati Ganguly, University of Konstanz, Germany
- 30th January 2023: Seminar on *"Vegetation pattern formation in dryland ecosystems in response to climate change"* by Dr. Bidesh Kumar Bera, BIDR, Israel
- 6th February 2023: Seminar on *"Shape morphing of chemically active elastic sheets, and tissues"* by Dr. Raj Kumar Manna, Postdoctoral Associate, Syracuse University, USA
- 7th February 2023: Seminar on *"Link representation of entanglement entropy"* by Dr. Sudipto Singha Roy, Postdoctoral Fellow, INO-CNR BEC Center Dipartimento di Fisica, Università di Trento, Italy
- 10th February 2023: Seminar on *"Fluctuation Driven Systems: from Glassy Dynamics of Associating Polymers to Deformations of Liquid Crystalline Polymers"* by Dr. Ashesh Ghosh, Postdoctoral Fellow, Stanford University, USA
- 21st February 2023: Seminar on *"Towards large-scale ground-state and time-dependent density functional theory at quantum accuracy."* by Dr. Bikash Kanungo, Research Scientist, Department of Mechanical Engineering, University of Michigan, USA
- 1st March 2023: Seminar on *"Developing adaptable systems using patterns"* by Dr. S. Ganga Prasath, Postdoctoral Fellow, Harvard University, USA

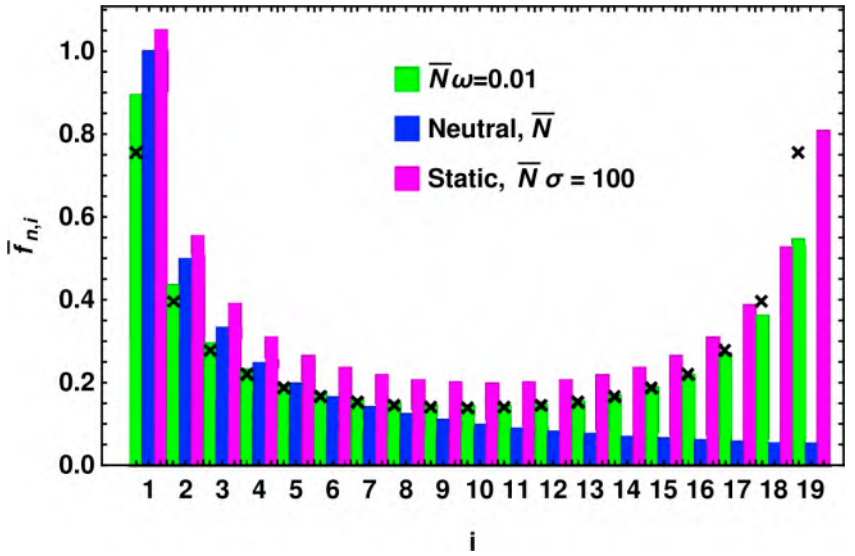
Major talks during 2022–2023:

- 1st July 2022: Invited Bio-Bridge Chalk talk on *"Phase transitions: Some simple pictures and their possible (i)rrelevance (?) in biological systems"* at the MBGU Seminar, JNCASR
- 5th August 2022: Invited talk on *"Mpemba Efffect in Magnetic Systems"* at the Discussion Meeting on Current Directions in Statistical Physics, JNCASR
- 6th August 2022: Talk on *"Finite-size Scaling in Dynamics of Error Reduction in Machine Learning"* with Tejas Dhamecha, partially during his invited talk at the Discussion meeting on Current Directions in Statistical Physics, JNCASR
- 10th August 2022: Invited talk on *"Mpemba Effect: From milk to magnets"* at the SAMat Meeting, JNCASR
- 13th October 2022: Invited seminar on *"Mpemba Effect: From milk to magnets"* at Department of Physics, Rajabazar Science College, Kolkata
- 24th November 2022: Invited lecture on *"Pattern Formation in Nature"* at the Workshop on Professional Scientific Development Programme, St. Xavier's College, Kolkata
- 15th February 2023: Invited lecture in memory of Neelangshu Saha on *"Stories from the Beautiful World of Active Matter"* at Spectrum, Department of Physics, St. Xavier's College, Kolkata
- 6th March 2023: Invited Physics seminar on *"From milk to magnets: An overview of the not so well-known Mpemba effect"* at IISER Thiruvananthapuram

Prof. Kavita Jain
Professor

The site frequency spectrum (SFS) is an important statistic that summarizes the molecular variation in a population and is used to estimate population-genetic parameters and detect natural selection. We studied the SFS in a randomly mating, diploid population in which both the population size and selection coefficient varied periodically with time using a diffusion theory approach. This was then used to derive simple analytical expressions for the time-averaged SFS in slowly and rapidly changing environments.

TSU



Site frequency spectrum (SFS) plot for a randomly mating, diploid population using a diffusion theory approach

Reference: *Theor. Popul. Biol.* 146: 46–60. 2022. doi: 10.1016/j.tpb.2022.07.001

Events organised:

- 6th May 2022: Seminar on *"Understanding the control process for non-equilibrium systems using scaling theory"* by Dr. Priyanka, University of Illinois, Urbana-Champaign, USA
- 13th June–15th July 2022: Speaker and Organiser at conference on *"Towards an Integrative View of Adaptation"* at KITP Santa Barbara, USA
- 6th January 2023: Seminar on *"Ruggedness and accessibility in fitness landscapes of drug resistance"* by Dr. Suman Das, Institute of Biophysics, University of Cologne, Germany
- 1st–3rd February 2023: Annual Indian Statistical Physics Community Meeting at ICTS, Bengaluru
- 20th–24th February 2023: Preparatory School on Population Genetics and Evolution at ICTS, Bengaluru

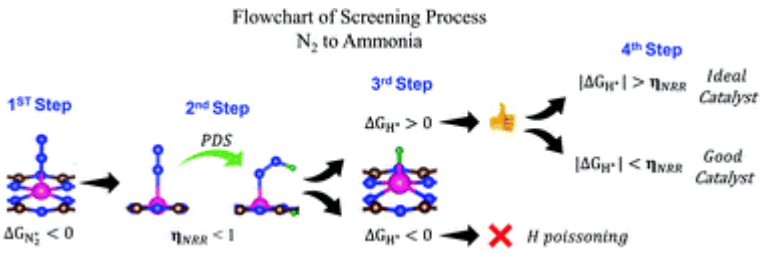
Major talks during 2022–2023:

- 22nd July 2022: Invited talk at the Indian Physics Association Colloquium, University of Delhi
- 5th–6th August 2022: Seminar on *"Current Directions in Statistical Physics"* at JNCASR
- 11th–22nd October 2022: Invited talk on *"Statistical Biological Physics: From Single Molecule to Cell"* at ICTS, Bengaluru
- 22nd November 2022: Invited talk at the SMBE Everywhere Global Symposium at NCBS, Bengaluru
- 19th–23rd December 2022: Invited talk on *"Statistical Physics of Complex Systems"* at ICTS, Bengaluru
- 1st–3rd February 2023: Invited talk at Indian Statistical Physics Community Meeting at ICTS, Bengaluru
- 9th–11th February 2023: Invited talk at 4th Annual Conference of ISEB at Ahmedabad University
- 13th March 2023: Invited talk on *"Honouring the Past and Embracing the Future: Centenary Celebration"* at Delhi University
- 16th–18th March 2023: Invited talk on *"Steady State Phenomena in Soft Matter, Active and Biological Systems"* at the SNBNCBS Conference, Kolkata
- 27th–29th March 2023: Invited talk at 45th Indian Biophysical Society Meeting at NCBS, Bengaluru
- 31st March–1st April 2023: Invited talk at the Aditi Simha Memorial Symposium on Soft Matter Physics organised by IIT Madras

TSU

Prof. Shobhana Narasimhan F.A.Sc., F.N.A.Sc., F.A.A.A.S., I.H.M.
Professor

The work performed in the group continues to use first principles density functional theory calculations to interpret experimental data on materials, and to design novel nanomaterials targeted for specific applications. Examples of work done in the previous year include a joint experimental (STM) and DFT study where the source of ubiquitous large-length-scale dumbbell-shaped features imaged by STM on black phosphorus were identified, using DFT, as arising from Sn substitutional defects in the second phosphorus sublayer. A second time of defect was identified as a Sn interstitial. This type of defect can be switched to a more stable configuration (P adatom + substitutional Sn) by application of a voltage pulse using the STM tip. DFT calculations show that this switches the system from a non-magnetic to magnetic configuration. The work emphasizes that for an unambiguous identification it is important to compare experimental and theoretical STM images at multiple bias voltages. In other work (done in collaboration with the group of Ranjit Thapa at SRM University), we have theoretically investigated possible single atom catalysts for the electrochemical nitrogen reduction reaction (eNRR), which offers the possibility of ammonia synthesis under mild conditions. We presented a systematic approach toward screening single-atom catalysts (SACs) for the eNRR, including a graphical construction that allows for easy identification of the best SAC.



Systematic approach towards screening single atom catalysts (SACs) for the electrochemical nitrogen reduction reaction

Reference: *Chem. Sci.* 13(34): 10003–10. 2022. doi: 10.1039/d2sc02625b

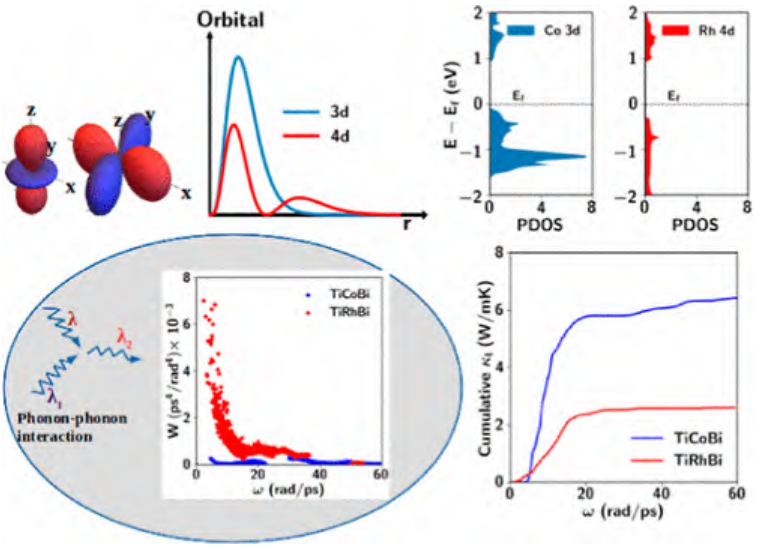
Event organised:

- 21st September 2022: Seminar on *"Machine learning in materials science"*, co-organised with Prof. Roberto Car, Princeton University, USA

Prof. Swapan K. Pati F.A.Sc., F.N.A.Sc., F.N.A., F.T.W.A.S.
Professor

Half-Heusler (HH) compounds are high-temperature thermoelectric materials with a high-power factor upon appropriate doping. However, the efficiency and ZT values are still low due to their high lattice thermal conductivity, κ_l. To develop newer efficient materials, it is essential to understand the thermal transport properties such as HH and microelectronic devices in general. We theoretically studied HH compounds, TiRhBi and TiCoBi, with the density functional theory and Boltzmann transport theory for κ_l calculation. We found that TiRhBi had a much lower κ_l (2.6 W/mK) than TiCoBi (6.4 W/mK) at 1000 K due to the weaker bond formation capability of diffused Rh 4d-electrons compared to the corresponding narrow band of 3d-electrons of Co in TiCoBi. Furthermore, the diffused Rh 4d-electrons near the valence band maximum participated in the nonbonding and antibonding types of overlap which led to an extremely weaker bond strength of TiRhBi. The COHP analysis supported the occurrence of the aforementioned phenomenon.

Our study discussed in detail several intermediate quantities such as COOP/COHP, heat capacity, phonon entropy, group velocity, Grüneisen parameter, and anharmonic scattering rates in order to explain the κ_l magnitudes.



Graphical representation of theoretically study of HH compounds, TiRhBi and TiCoBi, with the density functional theory and Boltzmann transport theory for κ_l calculation

Reference: *ACS Appl. Energy Mater.* 5(11): 13590–99. 2022.
doi: 10.1021/acsaem.2c02304

Event organised:

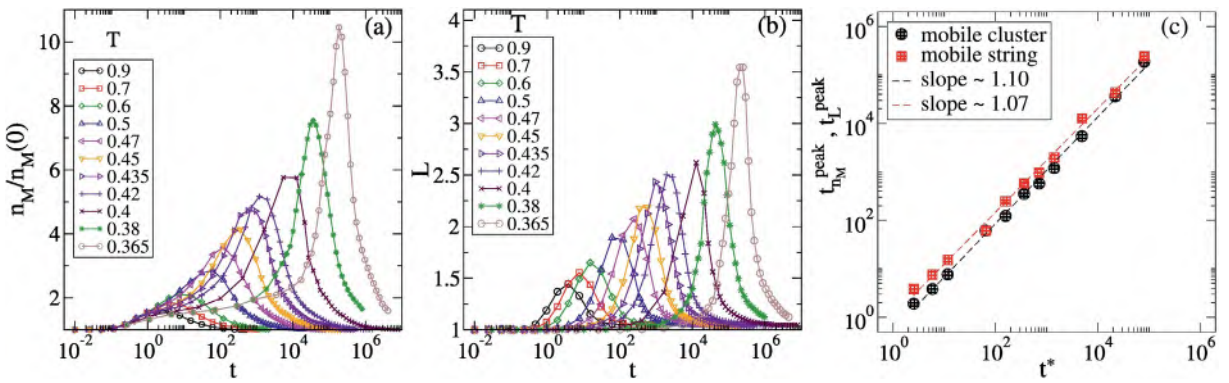
- 13th September 2022: Seminar on *"The Magnetization processes of the exact dimer ground state of the maple leaf model: interactions, correlated hopping, and bound states"* by Dr. Pratyay Ghosh, Universität Würzburg, Germany

Prof. Srikanth Sastry F.A.Sc., F.N.A.Sc., F.N.A.

Professor

Glass-forming liquids are broadly classified as being fragile or strong, depending on the deviation from Arrhenius behaviour of their relaxation times. In liquids like water and silica a fragile to strong crossover is observed or inferred. More recently a similar phenomenon has also been spotted in metallic glasses and phase change alloys. This led to an expectation that such a crossover is more widely realised among glass formers.

We investigated computationally, the well-studied Kob–Andersen model, accessing temperatures well below the mode coupling temperature TMCT. We discovered that relaxation times exhibited a crossover in dynamics around TMCT. We also discussed whether it showed any characteristics of the fragile to strong crossover. The results revealed that several aspects of dynamical heterogeneity exhibited behaviour mirroring the dynamical crossover, whereas thermodynamic quantities do not. Our work illustrated that exploring the nature of dynamics below the mode coupling crossover was feasible computationally. It also highlighted that exploration of such low-temperature dynamics should help bridge the gap between the temperature range computer simulations have been able to access in the past.



The average size of mobile clusters and strings, shown in (a) and (b), exhibit maxima at characteristic time scales $t_{n_M}^{peak}$ and t_L^{peak} respectively

Reference: *Non Cryst. Solids.* 14: 100098. 2022. doi: 10.1016/j.nocx.2022.100098

TSU

Events organised:

- 4th April 2022: Seminar on *"Fluctuations and Rheology of Granular Flows near the Jamming Transition"* by Dr. Ishan Srivastava, Lawrence Berkeley National Laboratory, USA
- 17th May 2022: Seminar on *"Exploring Rugged Energy Landscapes of Chemical Reactions"* by Prof. Nisanth N. Nair, Department of Chemistry, Indian Institute of Technology, Kanpur
- 27th May 2022: Seminar on *"Emergent electromagnetism in Jammed granular solids"* by Prof. Subhro Bhattacharjee, ICTS, Bengaluru
- 22nd July 2022: Seminar on *"Learning the Dynamics of Disordered Systems with Graph Neural Networks"* by Prof. N. M. Anoop Krishnan, Indian Institute of Technology, Delhi
- 8th August 2022: Seminar on *"Social distancing in colloidal crystals"* by Dr. Dwaipayan Chakrabarti, University of Birmingham, UK
- 16th August 2022: TSU@25 Seminar on *"Modeling the Recycling of Polymer Waste"* by Prof. Sanat K. Kumar, Department of Chemical Engineering, Columbia University, New York, USA
- 17th August 2022: Seminar on *"Uncovering distinct contributions to the stress relaxation in dense packings of soft spheres"* by Dr. Vinutha H. A., Institute for Soft Matter Synthesis and Metrology, Georgetown University, USA
- 26th September 2022: Seminar on *"Identifying structural signature of dynamical heterogeneity via the local softness parameter"* by Dr. Sarika Maitra Bhattacharyya, Polymer Science and Engineering Division, CSIR-National Chemical Laboratory, Pune
- 2nd November 2022: Seminar on *"Lifetime of actin-dependent protein nanocluster: Is the plasma membrane a soft glassy material?"* by Dr. Sumantra Sarkar, IISc, Bengaluru
- 2nd November 2022: Seminar on *"Unusual Properties of Athermal Persistent Active Matter"* by Prof. Chandan Dasgupta, IISc and ICTS, Bengaluru

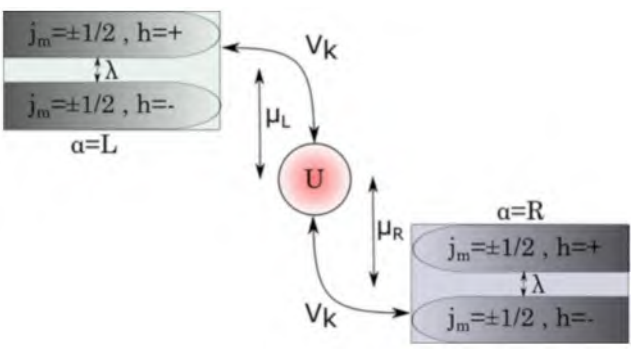
Major talk during 2022–2023:

- 8th March 2023: Invited talk on *"Computer Simulation of Fatigue Failure in Amorphous Solids"* at the APS March Meeting organised by , American Physical Society (APS), USA

Prof. N. S. Vidhyadhiraja

Professor and Dean, Fellowships and Extension Programmes

We study the steady-state dc transport characteristics of a system comprised of an interacting quantum dot, modelled as an Anderson impurity, coupled to two metallic noninteracting leads with Rashba spin-orbit coupling (SOC), using an interpolative perturbative approach (IPA). The single- particle spectra, current, and differential conductance are obtained in weak- and strong-coupling regimes over a wide range of SOC and bias values. Extensive benchmarking of the IPA validates the method in the linear as well as nonlinear response regime. The universal, zero-bias ($V_{sd} = 0$) peak with a width proportional to the Kondo scale (T_K) and two nonuniversal finite-bias peaks around $V_{sd} = \pm U$ in the zero-temperature differential conductance show a clear separation with increasing U or increasing SOC. In the strong-coupling regime, increasing temperature induces melting of the zero-bias peak, leading to a crossover from a three-peak conductance to a two-peak conductance.



Schematic of the correlated quantum dot connected to two leads, split further by spin-orbit coupling into chiral bands, subject to a voltage bias, $V_{sd} = \mu_L - \mu_R$

Reference: *Phys. Rev. B.* 107: 085107. 2023. doi: 10.1103/PhysRevB.107.085107

Recent experiments find the emergence of a two-peak structure by increasing SOC at a fixed temperature. Our results appear to provide a qualitative explanation of these observations as a SOC tuned crossover from

weak/intermediate to strong coupling, and a simultaneous crossover from low-T/T_K to high-T/T_K ratio.We also reproduce the experimentally observed temperature dependence of the zero-bias conductance.

Events organised:

- 14th–16th November 2022: Mini-Workshop on *"Quantum Computing"* at JNCASR
- 19th–21st January 2023: Science Outreach Programme, co-organised with Mr. Eswar, School Chandan, Laxmeshwar, Hubballi

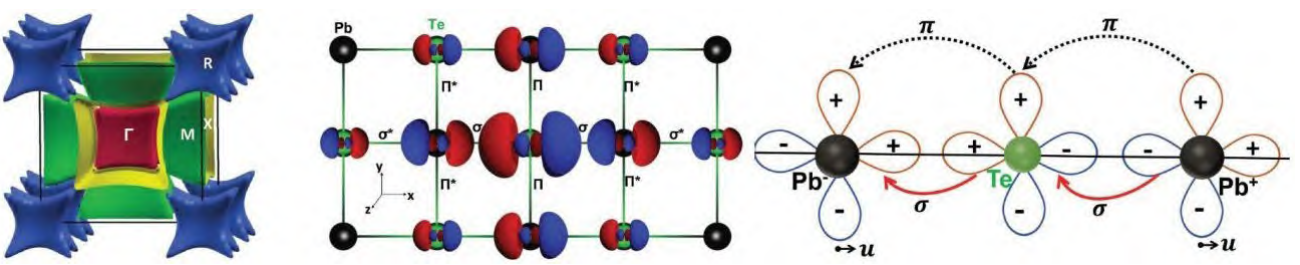
Major talks during 2022–2023:

- 12th–14th October 2022: Invited talk on *"Steady-state dc transport through an Anderson impurity coupled to leads with spin-orbit coupling"* at the Emergent phenomena in Quantum MATerials (E-QMAT) Conference organised by Prof. Tulika Maitra, IIT Roorkee
- 9th December 2022: Invited talk on *"Quantum entanglement and teleportation"* at the Introduction to Nobel Prizes–2022 in Physics event organised by Visvesvaraya Industrial & Technological Museum, Bengaluru
- 13th–17th February 2023: Invited talk on *"The physics of quantum computing: Superposition and Entanglement"* at the Faculty Development Programme on *"Quantum Computing, Tools, and its Applications"* organised by Dr. Savtiha Hiremath, Dayanand Sagar University, Bengaluru

Prof. Umesh V. Waghmare F.A.Sc., F.N.A.Sc., F.N.A., F.N.A.E.

Professor and Dean, Faculty Affairs

A distinct type of metavalent bonding (MVB) is recently proposed to explain an unusual combination of anomalous functional properties of group IV chalcogenide crystals, whose electronic mechanisms and origin remain controversial. Through theoretical analysis of evolution of bonding along continuous paths in structural and chemical composition space, emergence of MVB in rock salt chalcogenides is demonstrated as a consequence of weakly broken symmetry of parent simple-cubic crystals of Group V metalloids. High electronic degeneracy at the nested Fermi surface of parent metal drives spontaneous breaking of its translational symmetry with structural and chemical fields, which open up a small energy gap and mediate strong coupling between conduction and valence bands making metavalent crystals highly polarizable, conductive, and sensitive to bond-lengths. Stronger symmetry-breaking structural and chemical fields, however, transform them discontinuously to covalent and ionic semiconducting states. MVB involves bonding-antibonding pairwise interactions alternating along linear chains of at least five atoms, which facilitate long-range electron transfer in response to polar fields causing unusual properties. The precise picture of MVB predicts anomalous second-order Raman scattering as an addition to set off their unusual properties and will guide in design of new metavalent materials with improved thermoelectric, ferroelectric and nontrivial electronic topological properties. Our work uncovers the fundamental picture of how these materials are uniquely positioned to host interesting combination of phenomena like ferroelectricity, electronic topology, and high thermoelectric performance.



Nested Fermi surface of the parent metallic state drives instability to metavalent bonding that involves bonding and anti-bonding interactions in alternating bonds, and long-range charge transfer is responsible for high polarizability

Reference: *Adv. Mater.* 35: 2208724. 2023. doi: 10.1002/adma.202208724

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Events organised:

- 5th–9th December 2022: International Winter School on Frontiers of Materials, co-organised with Prof. Eswaramoorthy Muthusamy at JNCASR
- 12th–14th December 2022: School on Computer Simulations of Materials for Energy and Environment, co-organised with Sir Richard Catlow of University College London at JNCASR

Major talks during 2022–2023:

- 18th December 2022: Invited talk on *"Metavalent Bonding Origins of Unusual Properties of Group IV Chalcogenides"* at DAE Solid State Physics Symposium organised by BARC and DAE at BITS Mesra
- 19th December 2022: Invited talk on *"Metavalent Bonding Origins of Unusual Properties of Group IV Chalcogenides"* at IUMRS ICA Meeting, organised by IUMRS and MRSI at IIT Jodhpur
- 25th January 2023: Seminar on *"Instabilities and Functional Properties of Crystals"* at the Institute Colloquium of IISER Tirupati

Prof. K. B. Sinha F.A.Sc., F.N.A., F.T.W.A.S.

INSA Senior Scientist

For a commuting d-tuple of operators $\boldsymbol{T}$ defined on a complex separable Hilbert space $\mathcal{H}$, let $[[\boldsymbol{T}^*, \boldsymbol{T}]]$ be the $d \times d$ block operator $(([T_j^*, T_i]))$ of the commutators $[T_j^*, T_i] := T_j^* T_i - T_i T_j^*$. We defined the determinant of $[[\boldsymbol{T}^*, \boldsymbol{T}]]$ by symmetrizing the products in the Laplace formula for the determinant of a scalar matrix. We proved that the determinant of $[[\boldsymbol{T}^*, \boldsymbol{T}]]$ equals the generalized commutator of the $2d$-tuple of operators, $(T_1, T_1^*, \ldots, T_d, T_d^*)$ introduced earlier by Helton and Howe. We then applied the Amitsur–Levitzki theorem to conclude that for any commuting d-tuple of d-normal operators, the determinant of $[\boldsymbol{T}^*, \boldsymbol{T}]]$ must be o. In addition, we showed that if the d-tuple $\boldsymbol{T}$ was cyclic, the determinant of $[[\boldsymbol{T}^*, \boldsymbol{T}]]$ was non-negative and the compression of a fixed set of words in T_j^* and T_i—to a nested sequence of finite dimensional subspaces increasing to $\mathcal{H}$—did not grow very rapidly, then the trace of the determinant of the operator $[[\boldsymbol{T}^*, \boldsymbol{T}]]$ was finite. We also provided an upper bound for the trace. This upper bound was found to be sharp for a class of commuting d-tuples. Finally, we made a conjecture of what might be a sharp bound in much greater generality and verified it in many examples.

Reference: *Integr. Equ. Oper. Theory.* 94: 16. 2022. doi: 10.1007/s00020-022-02693-5

Major talks during 2022–2023:

- 24th–26th November 2022: Talk on *"Operator Theory and Complex Geometry"*, IISER, Kolkata
- 8th–14th January 2023: Scientific organiser of the 43rd International Conference on Quantum Probability, and Infinite Dimensional Analysis (QP-43), organised by Yeosu, Republic of Korea

UNIT MEMBERS

Faculty Members	
Professor and Chair	**Prof. Subir Kumar Das**
Professors	**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**

TSU

Research Students	
Ph.D.: 27	**Bidhan Chandra Garain, Supriti Dutta, Alok Kumar Dixit (ERP), Ankit Kumar, Anita Gemmy Francis, Arijit Sinha, Bhuvaneswari R., Arpan Das, Ritam Chakraborty, Vinayak M. Kulkarni (Mid-Year), Sujan K. K., Soumik Ghosh, Purnendu Pathak, Varghese Babu, Khandare Pushkar Gopalrao, Krishna Kanhaiya Tiwari, Himanshu Joshi, Sayantan Maity, Lakshita, Mayank Sharma, Sayan Paul, Swarnendu Maity, Debargha Sarkar, Garima Ahuja, Md Wasim Akram, Raghav T. S., Sougata Saha**

Temporary Staff	
Secretarial Assistant	**Bhumika S.**

Research Staff (On Contract)	
Research Associates	**Dr. Pallavi Sarkar, Dr. Arabinda Bera, Dr. Koyendrila Debnath, Dr. Nayana Devaraj, Dr. Shivakumar Athani, Dr. Tanay Paul, Dr. Arpita Sen, Dr. Jishnu N. Nampoothiri, Dr. Gour Jana, Dr. Sonu Prasad Keshri, Dr. Arpita Paul**
Research Associates-III	**Dr. Shazia Janwari, Dr. Matukumilli V. D. Prasad**
Research Associate (Provisional)	**Malay Ranjan Biswal**
SERB National Postdoctoral Fellow	**Dr. Durgesh Kumar Sharma**
R&D Assistants	**Anirudha Mirmira, Varghese Babu, Mohit Chaudhary, Monoj Adhikari**
Researchers	**Koyal Das, Nalina V., Pallabi Das**
Project Assistant	**Sougata Saha**

UNIT AT A GLANCE

Honours/Fellowships/Memberships Received

Faculty members

Students

Faculty Achievements

Prof. Kavita Jain
• Appointed as Associate Editor, *Journal of Evolutionary Biology*

Prof. Shobhana Narasimhan
• Elected as a Fellow of the American Physical Society

Prof. Srikanth Sastry
• Elected as a Fellow of the American Physical Society

TSU

Student Achievements:

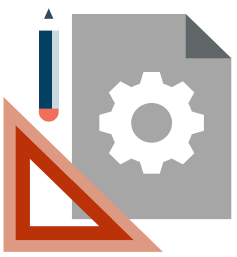
Raagya Arora (Int. Ph.D. student; research supervisor: Prof Umesh V. Waghmare)
• Received the Ovshinsky Travel Award from the American Physical Society

Himanshu Joshi Lakshman (Ph.D. student; research supervisor: Prof. Kavita Jain)
• Story got selected in the top 100 in AWSAR Competition 2022

Total Publications

70 Peer reviewed articles indexed in Web of Science/Scopus

Sponsored Projects



New Projects

2

Grants Received During 2022–2023

₹ 32.84 lac

Ongoing Projects

16

Grants Received During 2022–2023

₹ 6.84 cr

Students Graduated During 2022–2023

8 **Ph.D.**

- Monoj Adhikari
- Yagyik Goswami
- Koyel Das
- Pallabi Das
- Malay Ranjan Biswal
- Arabinda Bera
- Sachin Kaushik
- Pallavi Sarkar

TSU

Students Admitted During 2022–2023

4 **Ph.D.**

- Garima Ahuja
- Md Wasim Akram
- Raghav T. S.
- Sougata Saha

27 **Current Student Strength**

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 conducted the following activities from 1st April 2022 to 31st March 2023:

THE THIRD C. N. R. RAO ANNUAL MATERIALS LECTURE (OFFLINE)

Speaker: Prof. Ram Seshadri, University of California, Santa Barbara

Title: Chemistry and Design in Magnetic and Battery Materials

Date: 7th February 2023

SCHOOL OF ADVANCED MATERIALS (SAMat)

AWARD LECTURES OF THE NATIONAL PRIZES FOR RESEARCH IN NVIRONMENTAL CHEMISTRY, INCLUDING CO_2 REDUCTION AND GREEN HYDROGEN WAS HELD ON 21ST SEPTEMBER 2022

Speaker 1: Prof. Vivek Polshettiwar, TIFR Mumbai

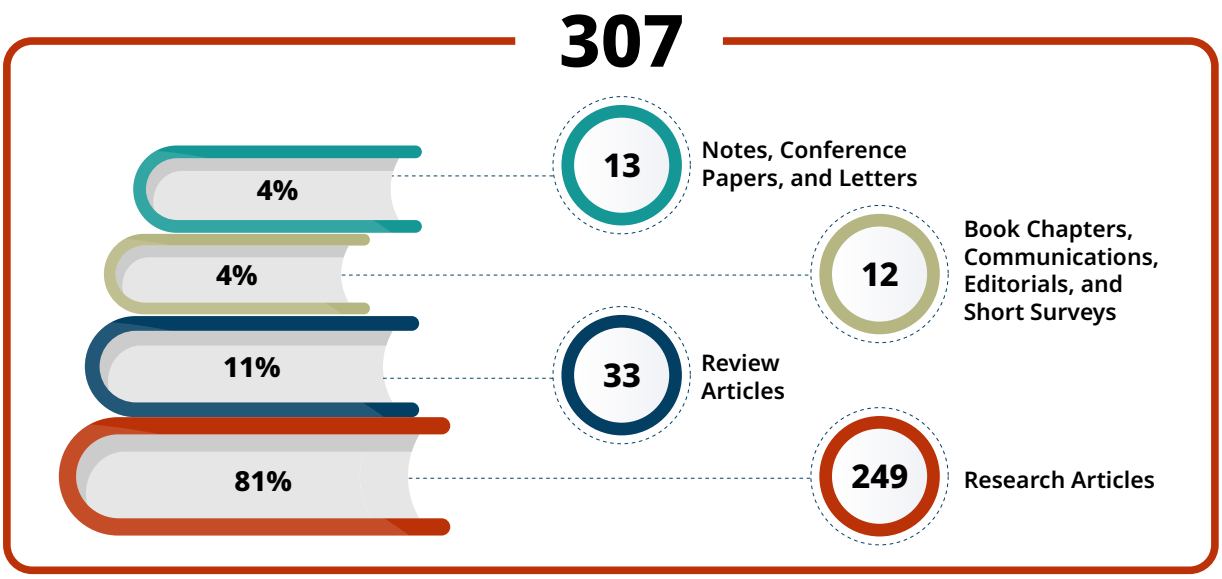
Title: Storing Sun Energy into Carbon Dioxide using Green Hydrogen

Speaker 2: Prof. Sebastian C. Peter, New Chemistry Unit, JNCASR

Title: Carbon and Water Recycling for Sustainable Energy: From Fundamental Chemistry to Green Technologies

FACULTY PUBLICATIONS

TOTAL NUMBER OF PUBLICATIONS IN 2022



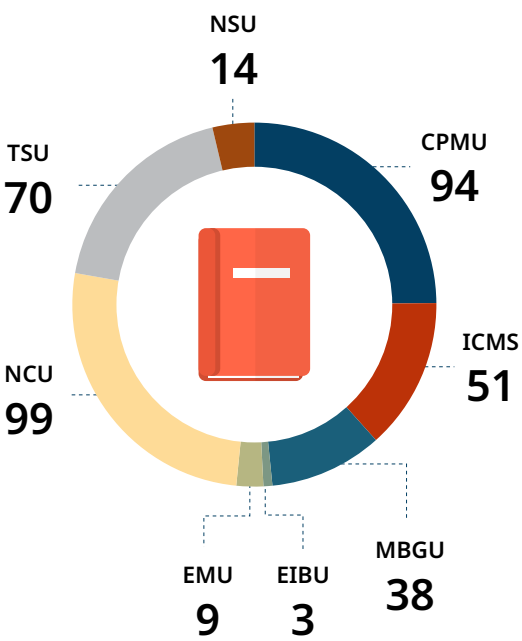
TOTAL PUBLICATIONS IN IMPACT FACTOR JOURNALS

292

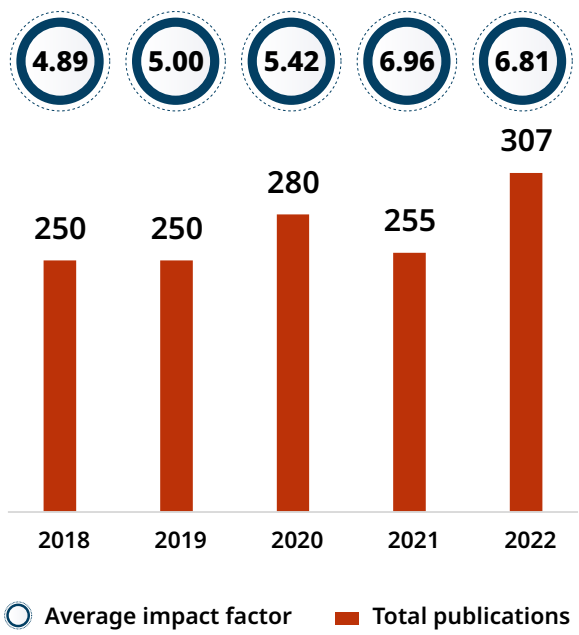
AVERAGE IMPACT FACTOR

6.81

UNIT-WISE PUBLICATIONS

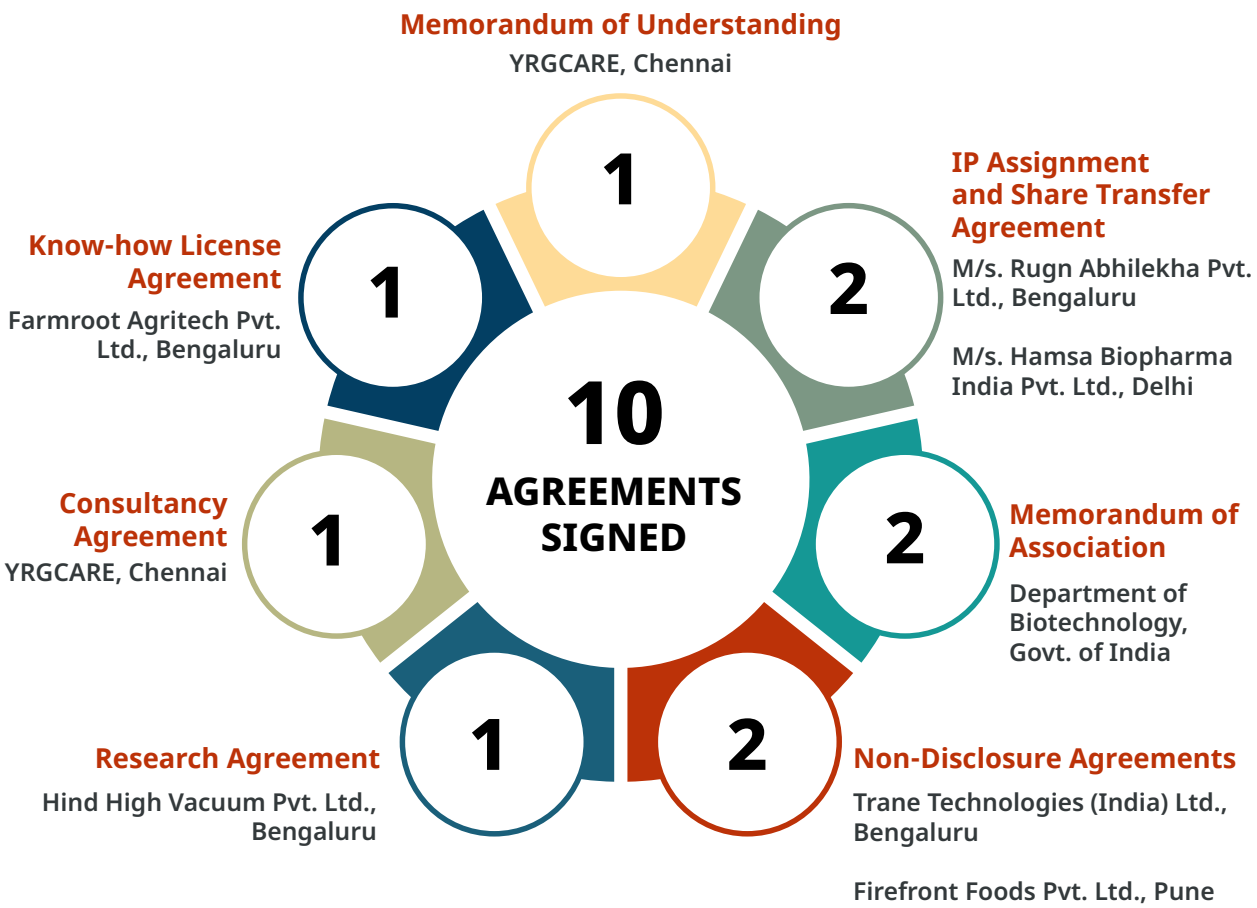


KEY INFORMATION YEAR-WISE



RESEARCH AND DEVELOPMENT ACTIVITIES

OVERVIEW OF RESEARCH AND DEVELOPMENT ACTIVITIES (2022–2023)



Patent Applications Filed

India	PCT
5	7

Patents Granted

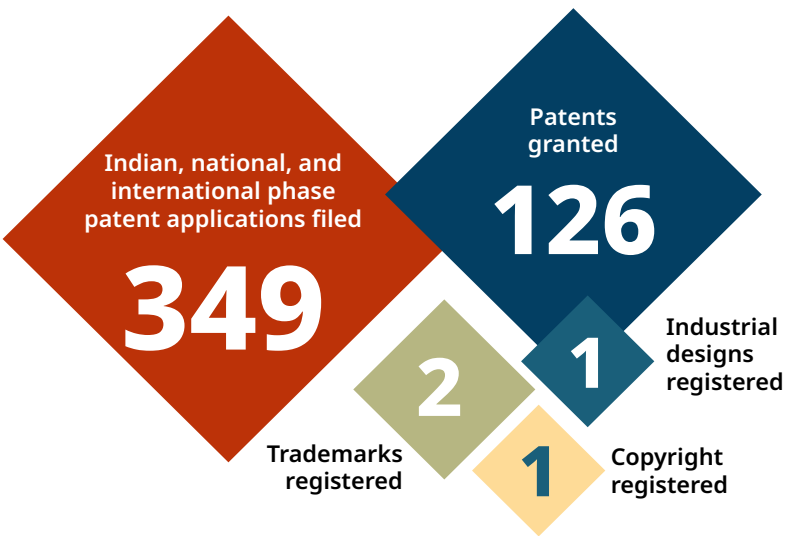
India	Singapore
5	2

INTELLECTUAL PROPERTY

IP 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 realise 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.

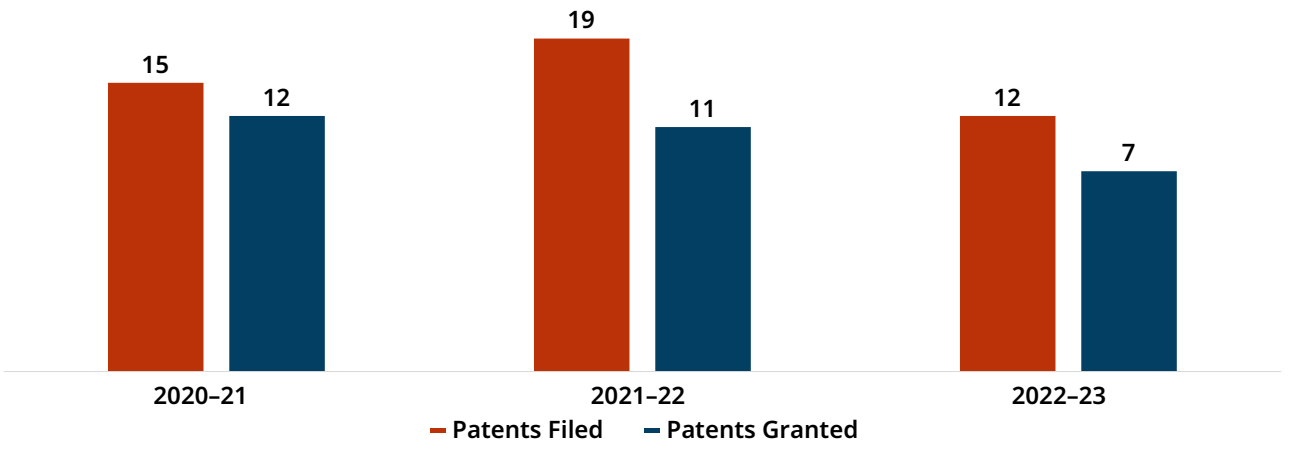
TOTAL IPAs OVER THE YEARS UNTIL MARCH 2023



The Centre has so far filed 349 *(India-124, PCT-72, ARIPO-2, Australia-7, Brazil-3, Canada-10, China-7, Europe-30, Hong Kong-2, Israel-1, Japan-10, Korea-3, OAPI-2, Singapore-4, S. Africa-5, S. Korea-3, USA-63, and Vietnam-1)* national phase (i.e. foreign countries) and international phase (i.e. PCT) patent applications under Patent Cooperation Treaty and obtained 126 *(India-46, ARIPO-2, Australia-3, Brazil-2, Canada-1, China-5, Europe-13, Japan-5, Korea-2, OAPI-2, Singapore-2, S. Africa-4, S. Korea-1, and USA-38)* patent grants.

During 2022–2023, 12 patent applications were filed (India-5 and PCT-7) for inventions meeting territorial patentability criteria. The Centre has also obtained 7 (India-5 and Singapore-2) patent grants.

PATENTS FILED AND GRANTED (PAST 3 YEARS)



INTELLECTUAL PROPERTY

PATENT APPLICATIONS FILED (APRIL 2022–MARCH 2023)

INDIAN PATENT APPLICATIONS

Title of the Invention	Inventors	Unit	Territory	Application No.	Date of Filing
Switchable Optical Device and Method of Controlling Operation of a Switchable Optical Device	G. U. Kulkarni, Indrajit Mondal, Ashutosh Kumar Singh	CPMU	India	202241029617	23rd May 2022
Confidential	Jayanta Haldar, Rajib Dey	NCU	India (Prov.)	202241047460	20th August 2022
Confidential	T. Govindaraju, Madhu Ramesh	NCU	India (Prov.)	202241047794	22nd August 2022
Confidential	Diwakar Seyyanur Venkatesan, Abhijit Krishna Dhamanekar, Arunachalam Naryanaperumal	EMU	India (Prov.)	202241048057	23rd August 2022
Confidential	Sebastian C. Peter, Devender Goud	NCU	India (Prov.)	202241052295	13th September 2022

INTERNATIONAL PHASE PATENT APPLICATIONS FILED

Title of the Invention	Inventors	Unit	Territory	Application No.	Date of Filing
Soluble Analogues of 6Bio Thereof and Implementation Thereof	James P. C. Chelliah, Ravi Manjithaya, Sridhar Rajaram, Vijaya Verma, Kavita Sharma, Suresh Santhi Natesan	NSU + MBGU + ICMS	PCT	PCT/IN2022/050408	29th April 2022
Indirubin Compounds and Methods Thereof	James P. C. Chelliah, Ravi Manjithaya, Sridhar Rajaram, Vijaya Verma, Kavita Sharma, Suresh Santhi Natesan	NSU + MBGU + ICMS	PCT	PCT/IN2022/050409	29th April 2022
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	NCU	PCT	PCT/IN2022/050515	2nd June 2022
A Catalyst, Its Application in Production of Hydrogen	Sebastian C. Peter, Soumi Mondal	NCU	PCT	PCT/IN2022/050741	17th August 2022

INTELLECTUAL PROPERTY

Title of the Invention	Inventors	Unit	Territory	Application No.	Date of Filing
A Catalyst for Thermochemical Reduction of CO_2	Sebastian C. Peter, Jithu Raj, Arjun C. H.	NCU	PCT	PCT/IN2023/050037	13th January 2023
Pd based catalyst and Implementations Thereof	Sebastian C. Peter, Soumi Mondal	NCU	PCT	PCT/IN2023/050152	15th February 2023
Amyloid and Associated Pathology Modulators and Methods Thereof	T. Govindaraju, Madhu Ramesh, Chenikkayala Balachandra	NCU	PCT	PCT/IN2023/050201	3rd March 2023

PATENTS GRANTED (APRIL 2022–MARCH 2023)

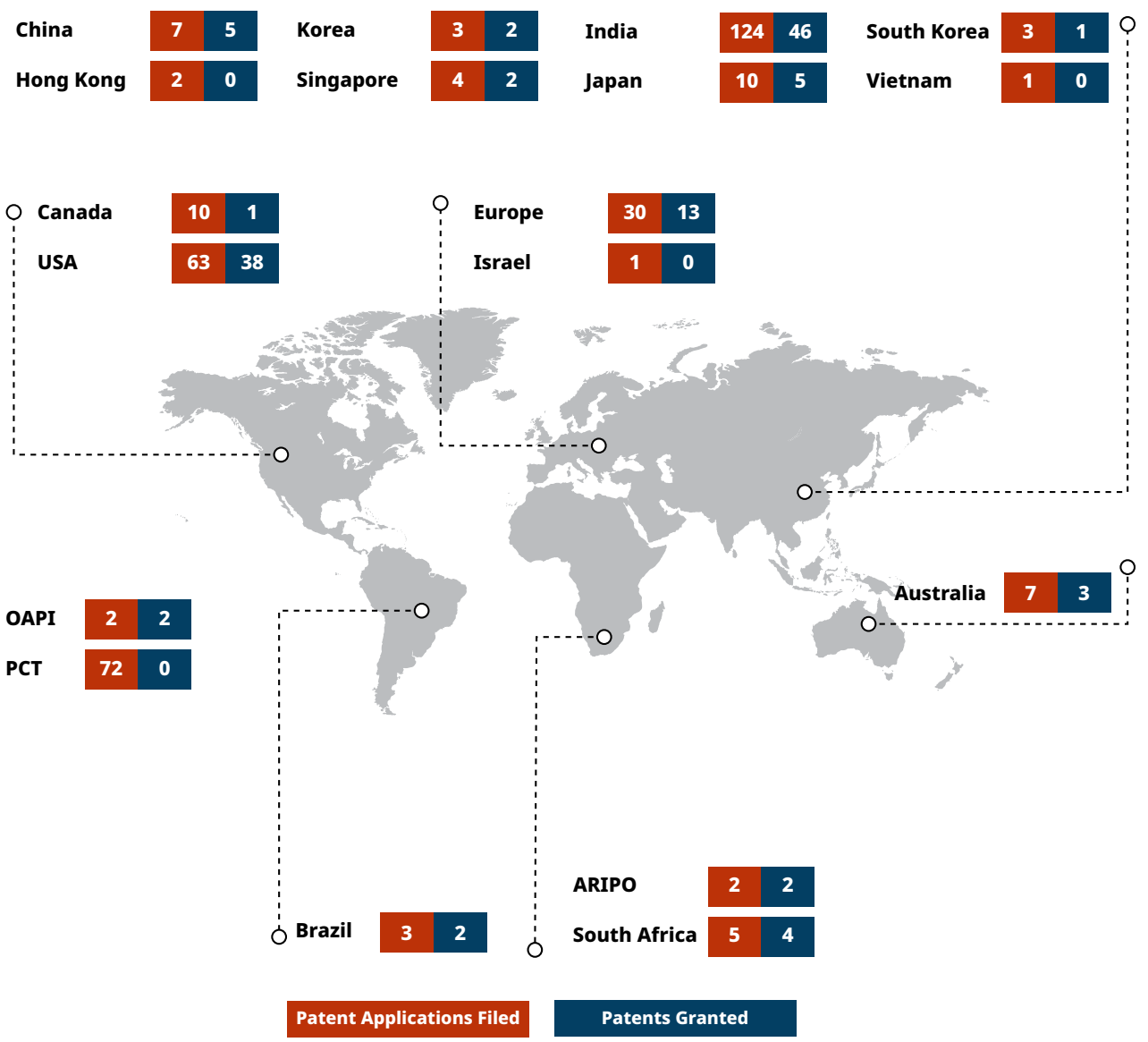
Title of the Invention	Inventors	Unit	Territory	Patent Number	Granted on
Composition Substrates and Methods Thereof	G. U. Kulkarni, Kunala Durga Mallikarjuna Rao, Ritu Gupta, Boya Radha, Shanmugam Kiruthika	CPMU	India	402365	28th July 2022
Compounds as DNA Probes, Methods and Applications Thereof	T. Govindaraju, Nagarjun Narayanaswamy	NCU	Singapore	11201801522R	26th August 2022
A Compound and Pharmaceutical Composition Thereof	T. Govindaraju, Nagarjun Narayanaswamy	NCU	Singapore	11201801523S	9th September 2022
Small-molecular adjuvants to repurpose existing antibiotics against multidrug-resistant bacterial infections	Jayanta Haldar, Geetika Dhanda	NCU	India	408041	29th September 2022
Luminescent Conjugates Microporous Polymer with Lewis Acidic 'Boron' Sites on the Pore Surface: Ratiometric Sensing and Capture of F-Ions	Tapas Kumar Maji, Swapan K. Pati, Venkata Suresh M., Arkamita Bandyopadhyay	CPMU & TSU	India	407937	29th September 2022
Turbostratic Graphite and Process of Preparing the Same	G. U. Kulkarni, Umesha Mogera	CPMU	India	410284	28th October 2022
Method of Enhancing Heat Transfer In Devices By Dispersing Heating or Radiation Absorbing-Emitting Elements and Devices Thereof	Sreenivas K. R., Jaywant Hanumappa Arakeri, Suhas Bannur	EMU	India	422077	16th February 2023

INTELLECTUAL PROPERTY

TECHNOLOGIES TRANSFERRED

Title of the Invention	Name of the Principal Inventor	Licensee	Effective Date
Oxyjani - Oxygen Concentrator	Diwakar Seyyanur Venkatesan	M/s. Rugn Abhilekha Pvt. Ltd., Bengaluru	4th April 2022
Controlled Release Dispensers for Delivery of Semiochemicals	Eswaramoorthy Muthusamy	M/s. Farmroot Agritech Pvt. Ltd., Bengaluru	18th January 2023

TERRITORY-WISE DISTRIBUTION OF INTELLECTUAL PROPERTY (SINCE INCEPTION TILL 31ST MARCH 2023)



AGREEMENTS SIGNED IN 2022–2023

NON-DISCLOSURE

- **Prof. Tapas Kumar Maji** from CPMU, entered into a **Non-Disclosure Agreement** with **Trane Technologies (India) Ltd., Bengaluru**, for a period of 2 years from 3rd October 2022.
  The title of the NDA is: *To exchange or have exchanged confidential information for the purpose of discussing and/or exploring a potential business transaction and/or relationship to JNCASR's metal organic framework (MOF) for Trane Technologies' applications.*

- **Prof. Eswaramoorthy Muthusamy** and **Prof. Tapas Kumar Kundu** entered into a **Non-Disclosure Agreement** with **Firefront Foods Pvt. Ltd., Pune**, for a period of 3 years from 19th December 2022. Firefront Foods Pvt. Ltd., Pune, will also be funding the project.
  The title of the NDA is: *Collaborative research in the development of healthy product using "CSP- Glucose based Carbon Nano sphere".*

MEMORANDUMS

- **Dr. Ravi Manjithaya** from MBGU, entered into a **Memorandum of Association**, for a project titled: *"A Comprehensive Study to Understand the Dysregulation of Mitophagy in Mitochondrial Diseases"*, funded by the **Department of Biotechnology (DBT)**, Govt. of India. The grant agreement is valid for a period of 3 years from 24th June 2022.

- **Prof. Namita Surolia** from MBGU, entered into a **Memorandum of Association**, for a project titled: *"Role and Regulation of stress-induced Autophagy in proteostratesis mechanisms underlying artemisinin resistance"*, funded by the **Department of Biotechnology (DBT)**. The grant agreement is valid for a period of 3 years from 14th August 2022. The agreement was signed on 14th September 2022.

- **Prof. Ranga Udaykumar** from MBGU, signed a **Memorandum of Understanding** with **YRGCARE, Chennai,** for a collaborative project titled: *"Infectious diseases, including HIV-AIDS, Tuberculosis, and emerging viral infections and non-communicable diseases and neurologic disorders"*. The agreement is valid for a period 2 years from 1st March 2023. The project will be funded by YRGCARE, Chennai.

OTHERS

- **Prof. T. Govindaraju** from NCU signed an **IP Assignment and Share Transfer Agreement** with **M/s. Hamsa Biopharma India Pvt. Ltd., Delhi** on 10th May 2022. Under the agreement, M/s. Hamsa Biopharma will develop the potential molecule named 'TGR63' for the treatment of dementia. The research undertaken by Prof. T. Govindaraju and his team could lead to the development of a potential drug candidate to halt or cure the leading cause of dementia (70–80% cases) worldwide.

In the image (left to right): Bharat Ratna Prof. C. N. R. Rao, Kris Gopalakrishnan, and Prof. G. U. Kulkarni, President, JNCASR along with representatives of M/s. Hamsa Biopharma India Pvt. Ltd.

AGREEMENTS SIGNED

- **Dr. Diwakar Seyyanur Venkatesan** from EMU signed an **IP Assignment and Share Transfer Agreement** with **M/s. Rugn Abhilekha Pvt. Ltd., Bengaluru**. The project is titled: *Oxyjani-oxygen Concentrator* and is valid for a period of 5 years from 4th April 2022. The project will be funded by M/s. Rugn Abhilekha Pvt. Ltd., Bengaluru. *OxyJani*, based on the principles of Pressure Swing Adsorption Technology can provide sustained healthcare solutions in nursing homes, Tier III/Tier IV towns for ICU, and other medical uses. Besides, it has the potential to occupy a niche in the market in terms of sizing.

In the image: Representatives of M/s. Rugh Abhileka exchanging agreement with Joydeep Deb, Administrative Officer, JNCASR in presence of Bhrarat Ratna Prof. C. N. R. Rao, Kris Gopalakrishnan and Prof. G. U. Kulkarni, President, JNCASR.

- **Prof. G. U. Kulkarni** from CPMU, signed a **Research Agreement** with **Hind High Vacuum Pvt. Ltd., Bengaluru**, that is valid for a period of 3 years from 10th August 2022. The project is titled, *"Scalable coating of metal oxides on hybrid transparent electrodes and fabrication of smart window devices"*.

- **Prof. Ranga Udaykumar** from MBGU, signed a **Consultancy Agreement** with YRGCARE, Chennai, *to provide consultancy services*. The agreement is valid for 1 year from 15th November 2022.

- **Prof. Eswaramoorthy Muthusamy** from CPMU and ICMS, entered into a **Know-how License Agreement**, with **Farmroot Agritech Pvt. Ltd., Bengaluru**. The agreement is valid for a period of 10 years from 18th January 2023. The project is funded by Farmroot Agritech Pvt. Ltd., Bengaluru.

MEMBERS OF R&D OFFICE

Dean, R&D: **Prof. Sreenivas K. R.**

Coordinator, R&D and Fellowships and Extension: **Dr. K. Panneer Selvam**

Office Executives: **Kavyashree H. C., Kavitha B. P.**

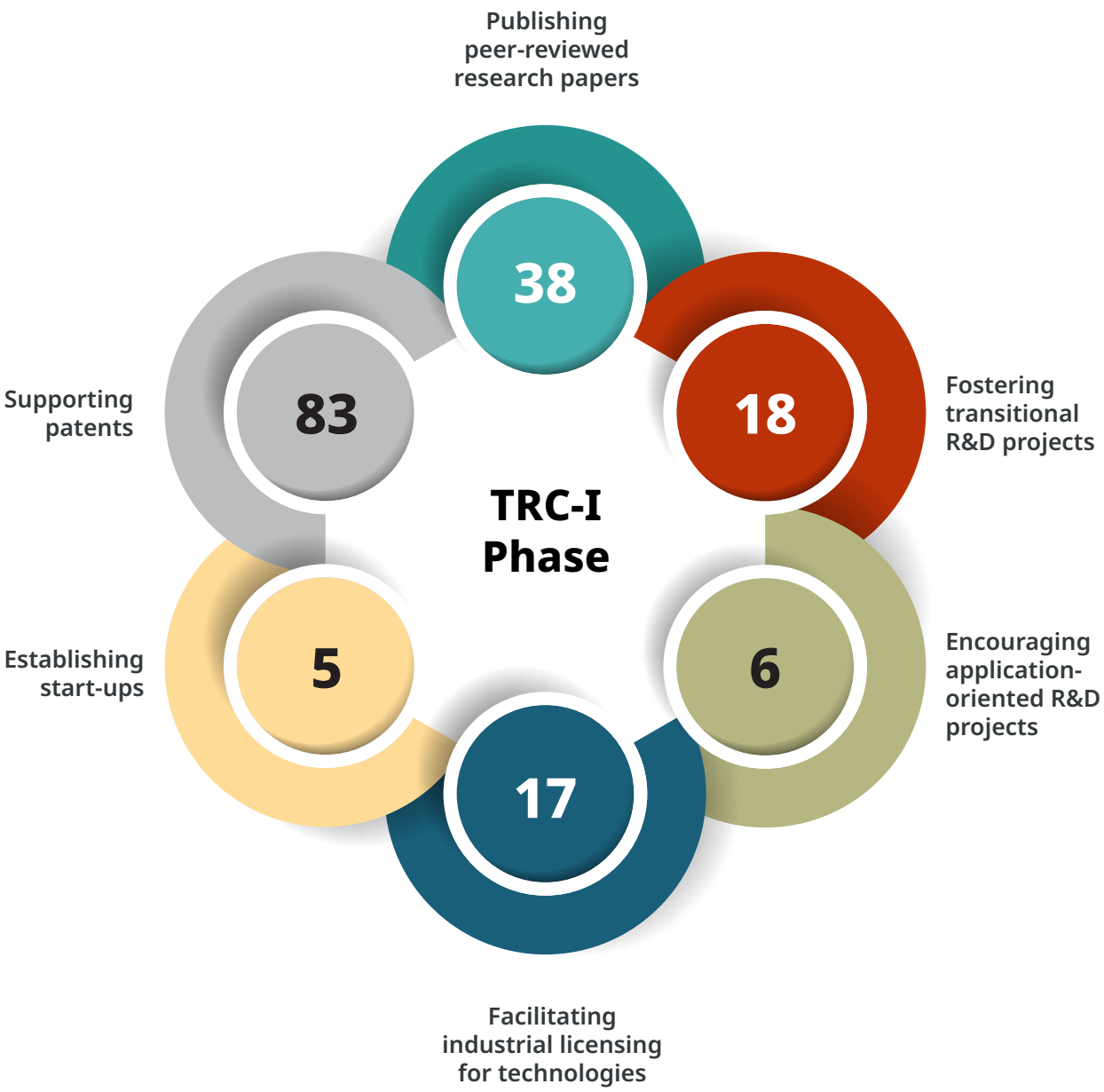
Sr. Lab Helper: **Varadaiah K.**

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 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 challenges of healthcare, climate change, energy scarcity, and resource management.

TRC-I Phase (2016–2021)

During the TRC-1 Phase, the programme supported various R&D activities at the Centre, primarily:



TECHNICAL RESEARCH CENTRE

TRC-II Phase (2022–27)

The Centre received its 1st installment of grants for carrying out translational research projects under the TRC-II phase. At present, the following ten projects are being carried out:

- PCR-based detection of clinically relevant fungal species
- Multielectrode patterns on soft substrates as brain interface for recording and stimulation
- Development of high-performance electrocatalysts for green hydrogen production
- Novel analogues of 6-BIO as modulators of autophagy for the treatment of neurodevelopmental disorders and neurodegenerative diseases
- Developing MOFs and related nanocomposites for water storage and prototype for dehumidification and atmospheric water harvesting
- Synthesis and device fabrication of high-performance p- and n-type rock salt metal telluride thermoelectric materials
- Noncanonical nucleic acid targeted diagnostic platform for tuberculosis
- Antimicrobial and hemostatic sponge: point of care technology to tackle infection and hemorrhage for traumatic injuries
- Development of stable and energy-efficient electrically rechargeable Zn-air battery prototype
- Ultra-multiplexed disease diagnosis via exchangeable fluorophore labels

Visit of R&D Teams

The following R&D Teams visited the Centre for a discussion meeting for possible collaborative research projects/funding:

- Ola Battery Innovation Center, Bengaluru, on 23rd June 2022
- Syngene, Bengaluru, on 6th July 2022
- Sun Pharma Advanced Research Company Ltd. (SPARC), Mumbai, on 7th September 2022
- L'Oréal R&D Team, Mumbai, on 19th January 2023
- TATA Steel, UK Ltd., on 15th February 2023
- The French National Centre for Scientific Research (CNRS), Paris, on 20th February 2023
- Central Silk Technological Research Institute, Bengaluru, on 14th March 2023

MEDIA REPORTS

JNCASR, in association with the Department of Science and Technology (DST) Media Cell, releases news of the latest achievements of the Centre's faculty members. Following a pre-defined process for press release publication and distribution, the DST Media Cell works towards maximizing the coverage of these science-related stories in national and regional print and digital media. Social media posts by DST and JNCASR further enhance the coverage of these press releases. Here is a compilation of these science stories, with information on their coverage by various news media and promotion via social media during the year 2022–2023.

INAUGURATION OF MAZUMDAR-SHAW LABORATORY FOR FRONTIER BIOLOGY

On 5th May 2022, the Mazumdar-Shaw Laboratory for Frontier Biology at JNCASR was inaugurated by Dr. Kiran Mazumdar-Shaw, Founder and Chairperson of Biocon, in the august presence of Bharat Ratna Prof. C. N. R. Rao, F.R.S., and Prof. G. U. Kulkarni, F.N.A., President, JNCASR. The ceremony was attended by Deans, faculty members, and officers of JNCASR along with employees of Biocon, and the team of architects. The Laboratory aims at promoting research in newer areas of biology like synthetic biology, systems biology, nanobiotechnology, and biomaterials.

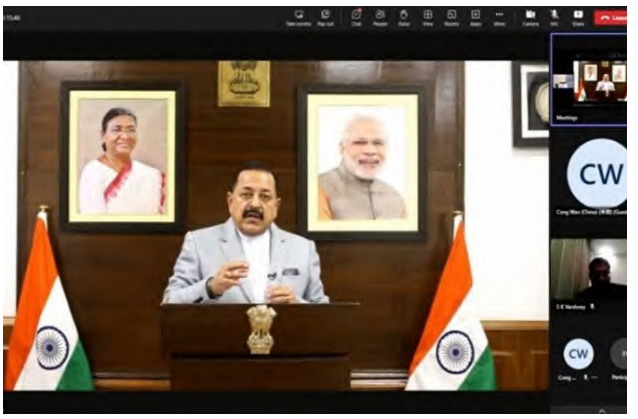
- YouTube recording: https://youtu.be/Q9qW-VlJ81c
- Tweet by @jncasr, 5th May 2022. https://twitter.com/jncasr/status/1522201138581614592

JNCASR RECENTLY HOSTED THE 2ND SCO YOUNG SCIENTIST CONCLAVE

The DST, Government of India, organised the 2nd SCO Young Scientist Conclave at JNCASR from 6th–10th February 2023. This 5-day event was inaugurated by Dr. Jitendra Singh, Hon'ble Minister of State (Independent Charge) for Science and Technology and Earth Sciences, Government of India. Over 70 scientists participated from the SCO member countries (India, Russia, Kazakhstan, Uzbekistan, China, and Tajikistan) and shared their current research on five thematic areas (agriculture and food processing; artificial intelligence and big data processing; sustainable energy and energy storage; disease biology and healthcare; and environmental protection and natural resource management). Dr. S. Chandrasekhar, Secretary, DST, presented the valedictory address.

MEDIA REPORTS

- *Press Information Bureau*, 7th February 2023. https://bit.ly/43H4DUx
- Department of Science and Technology. https://bit.ly/42ukHrc
- *The Hindu* (Bengaluru Edition in Print), 6th February 2023. https://bit.ly/3qybaSD



TWO JNCASR SCIENTISTS RECEIVED THE SUN PHARMA SCIENCE FOUNDATION RESEARCH AWARD

JNCASR scientists Prof. Kaustuv Sanyal of the MBGU, and Prof. T. Govindaraju, of the NCU, received the Sun Pharma Science Foundation Research Award under the categories of Medical Science – Basic Research and Pharmaceutical Science, respectively.

- Tweet by @SunPharma_Live, 14th December 2022. https://twitter.com/SunPharma_Live/status/1602980344579641344

MEDIA REPORTS

JNCASR TRANSFERS O_2 GENERATOR TECH TO ITS OWN STARTUP

JNCASR organised a programme for signing and exchange of IP Transfer Agreements between JNCASR and two industries, for two of its research endeavours. The first IP transfer agreement was for a molecule that could be a potential drug candidate to halt or cure the leading cause of dementia. The agreement was entered into with M/s. Hamsa Biopharma India Pvt. Ltd., a company based in Delhi, to further develop the drug based on a license agreement.

The other IP was transferred to M/s. Rugh Abhilekha Pvt. Ltd. for a device "Oxyjani", a robust, mobile group oxygen concentrator that can be used in remote settings and rapidly deployable during emergencies in any location. Oxyjani was developed by Dr. S. V. Diwakar, Dr. Meher K. Prakash and Prof. Santosh Ansumali from JNCASR, and collaborators, Prof. Arvind Rajendran from the University of Alberta, USA, and Arun Kumar from Eiwave Digitech with the help of Ritwik Das, M.S. student and Dr. Abhijit Dhamanekar, Postdoctoral Fellow from JNCASR.

Seen here (left image) Bharat Ratna Prof. C. N. R. Rao, Krish Gopalakrishnan and Prof. G. U. Kulkarni, President, JNCASR along with representatives of M/s. Hamsa Biopharma India Pvt. Ltd. and (right image) are representatives of M/s. Rugh Abhileka exchanging agreement with Joydeep Deb, Administrative Officer, JNCASR in presence of Bharat Ratna Prof. C. N. R. Rao, Krish Gopalakrishnan, and Prof. G. U. Kulkarni, President, JNCASR.

Times of India, 13th May 2022. https://t.co/BEOKAAyk3k

MEDIA REPORTS

RESEARCH NEWS

UNDERSTANDING THE BASIS OF SEXUAL CONFLICT VIA EXPERIMENTAL EVOLUTION

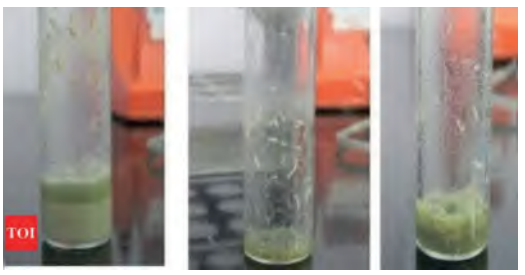
Prof. Amitabh Joshi's laboratory has demonstrated that reduced sexual selection in *Drosophila Melanogaster* populations can arise due to direct selection acting on mating-related behaviours and mate choices, and as a by-product of the evolution of a life history involving rapid development to adulthood and relatively early reproduction. The study, published in *Behavioural Ecology and Sociobiology* (10.1007/s00265–022–03158–w), illustrates the power of experimental evolution in addressing fundamental evolution related questions.

The fruitfly populations in the study are housed as adults in Plexiglass cages
Image credits: Prof. Amitabh Joshi and Avani Mittal, JNCASR

- Ministry of Science and Technology, 24th March 2022. https://rb.gy/fh0tpi
- *The Times of India,* 26th April 2022. https://rb.gy/2fgqn0
- Tweet by @jncasr, 26th April 2022. https://twitter.com/jncasr/status/1518923977527545858
- Tweet by @IndiaDST, 26th April 2022. https://twitter.com/IndiaDST/status/1518908785880104960

UNDERSTANDING ADAPTIVE EVOLUTIONARY TRAJECTORIES USING FRUIT FLIES SUBJECTED TO LARVAL CROWDING

Prof. Amitabh Joshi and his team found that insect populations that experience chronic larval crowding evolve to give rise to larger and faster hatching eggs, which may be important for the competitive ability of a larva. This study, published in the *Journal of Genetics* (10.1007/s12041–021–01355–6), provides a strong basis for understanding the subtle changes in adaptive evolutionary trajectories even under fairly similar selection regimes.



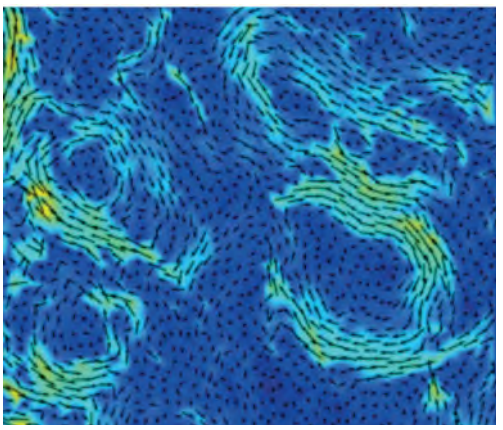
Different combinations of egg number & food amount used in study populations
Image credits: S. Venkitachalam, S. Das, A. Deep, and Prof. Amitabh Joshi, JNCASR

- *The Times of India,* 29th April 2022. https://rb.gy/uvi1wv
- Ministry of Science and Technology, https://rb.gy/v8meri
- Tweet by @jncasr, 26th April 2022. https://twitter.com/IndiaDST/status/1519963234379640833
- Tweet by@IndiaDST, 26th April 2022. https://twitter.com/IndiaDST/status/1519963234379640833

MEDIA REPORTS

MECHANISM THAT HELPS ACTIVE SYSTEMS ESCAPE TRANSFORMATION TO GLASS CAN AID STUDY OF CANCEROUS METASTASIS

Prof. Rajesh Ganapathy and his student from JNCASR, and Prof. Ajay. K. Sood from IISc, found that patterns can form in the presence of active elongated particles, helping the particles to keep moving and preventing the system from turning glassy. These findings also have implications for understanding fundamental biological processes, including cancerous metastasis. This research has been published in *Physical Review Letter*s (10.1103/PhysRevLett.128.178002).

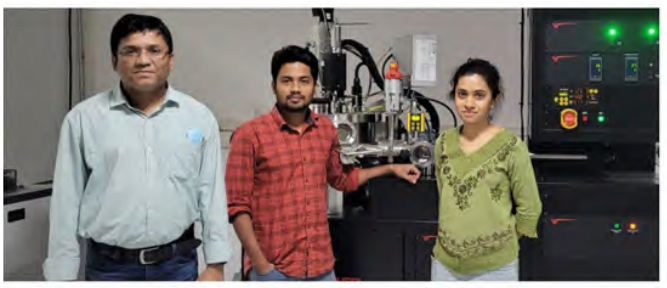


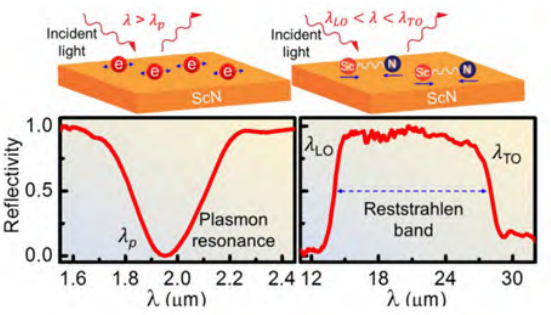
Velocity maps showing large-scale swirling motion (cyan colour regions streaks)
Image credits: Pragya Arora, Ajay Kumar Sood, and Prof. Rajesh Ganapathy, JNCASR

- Department of Science and Technology, 28th April 2022. https://rb.gy/95gmuu
- *The Indian Express*, 24th May 2022. https://rb.gy/duemrt
- Tweet by @jncasr, 19th May 2022. https://twitter.com/jncasr/status/1527177933882028032
- Tweet by @IndiaDST, 19th May 2022. https://twitter.com/IndiaDST/status/1527157869350899712

DISCOVERY OF A NOVEL MATERIAL THAT CONVERTS INFRARED LIGHT TO RENEWABLE ENERGY

Dr. Bivas Saha's team from JNCASR, along with their collaborators from IISc Bengaluru and University of Sydney, Australia, discovered a novel material that can emit, detect, and modulate infrared light with high efficiency. This makes it useful for application in harvesting solar and thermal energy and in optical communication devices. This discovery was published in *ACS Nano Letters* (10.1021/acs.nanolett.2c00912).





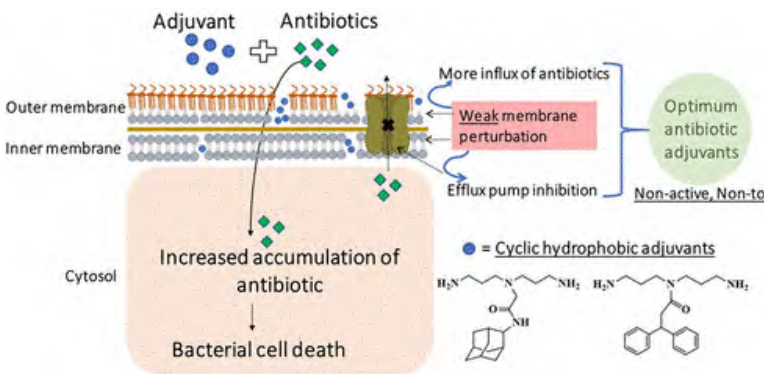
Left: Dr. Saha and his team at JNCASR.
Right: High-quality tunable short-wavelength infrared (IR) plasmon–polariton and long-wavelength IR phonon–polariton was demonstrated in complementary metal-oxide-semiconductor compatible group III–V polar semiconducting scandium nitride (ScN) thin films.
Image credits: https://doi.org/10.1021/acs.nanolett.2c00912

MEDIA REPORTS

- *Press Information Bureau.* 5th July 2022. https://bit.ly/3FXDUs5
- *Vigyan Samachar,* DST. 5th July 2022. https://bit.ly/3aWCrXv
- *The Tribune.* 5th July 2022. https://bit.ly/3PN0ua1
- *Khabar Infra.* 7th July 2022. https://bit.ly/3ooPhRe
- Tweet by @jncasr, 9th July 2022. https://twitter.com/jncasr/status/1545559805313822720
- Tweet by @IndiaDST, 9th July 2022. https://twitter.com/IndiaDST/status/1544551217678143489

A NEW STRATEGY TO COUNTER MULTIDRUG-RESISTANT BACTERIA

Prof. Jayanta Haldar and Geetika Dhanda, his Ph.D. student, developed a new cyclic hydrophobic moiety in a triamine containing compound, which, in combination with existing antibiotics, can weakly perturb the bacterial membrane. This novel strategy can not only counter antibiotic resistance in bacteria but also help revive the efficacy of obsolete antibiotics. (10.1021/acsinfecdis.2c00092)



The unique concept of "weakly perturbing the membrane" by incorporating cyclic hydrophobic moieties in a chemical design with free amine groups serves as a breakthrough for nontoxic membrane-perturbing adjuvants and has the potential to revitalize the effect of obsolete antibiotics to treat complicated Gram-negative bacterial infections.
Image credits: https://doi.org/10.1021/acsinfecdis.2c00092

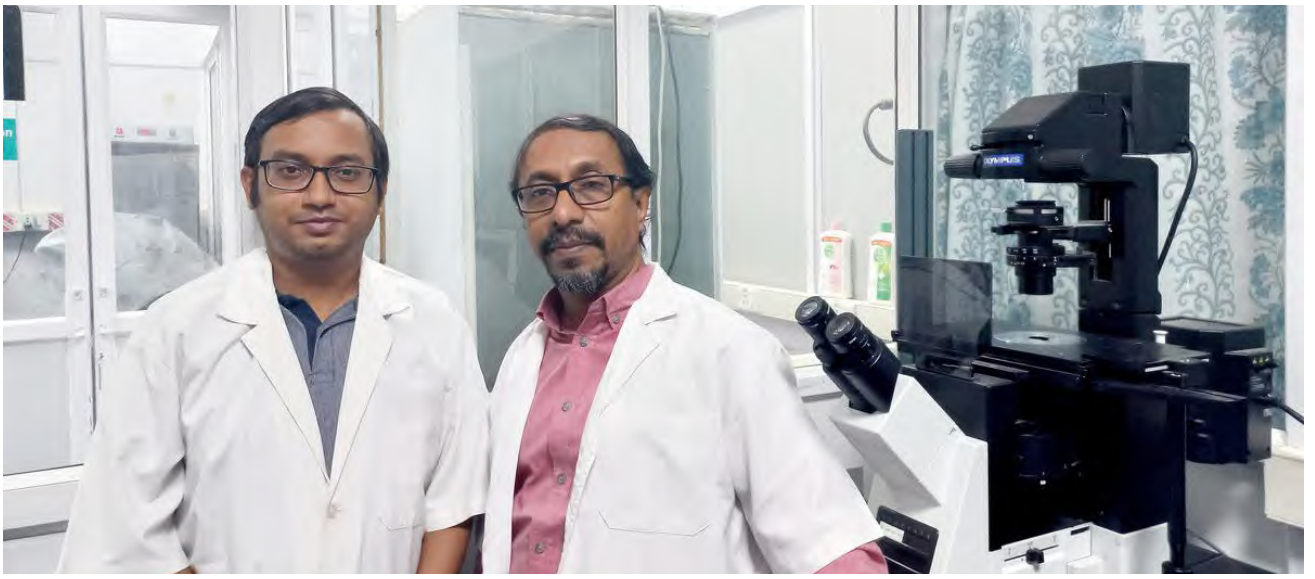
- *Press Information Bureau,* 21st July 2022. https://bit.ly/3I7TJim
- *Vigyan Samachar,* DST, 21st July 2022. https://bit.ly/3PMdzjX
- TheHealthSite.com. 22nd July 2022. https://bit.ly/3aUYOMQ
- Tweet by @jncasr, 21st July 2022. https://twitter.com/jncasr/status/1550361323741278208
- Tweet by @PIBIndia, 21st July 2022. https://twitter.com/PIB_India/status/1550057952325038080
- Tweet by @IndiaDST, 22nd July 2022. https://twitter.com/IndiaDST/status/1550355321876774912

JNCASR'S NOVEL MOLECULE PREVENTS OBESITY IN MICE

Obesity is a common lifestyle-related health problem that has no available drug yet for treatment. Prof. Tapas Kumar Kundu and his team at JNCASR discovered that histone butyrylation underlies fat accumulation and subsequent obesity development. Further investigation led to the identification of a novel molecule LTK-14A, a p300-specific butyrylation inhibitor that could attenuate weight gain in a mouse model of obesity. This molecule is a highly promising candidate for the treatment of obesity. (10.1021/acs.jmedchem.2c00943)

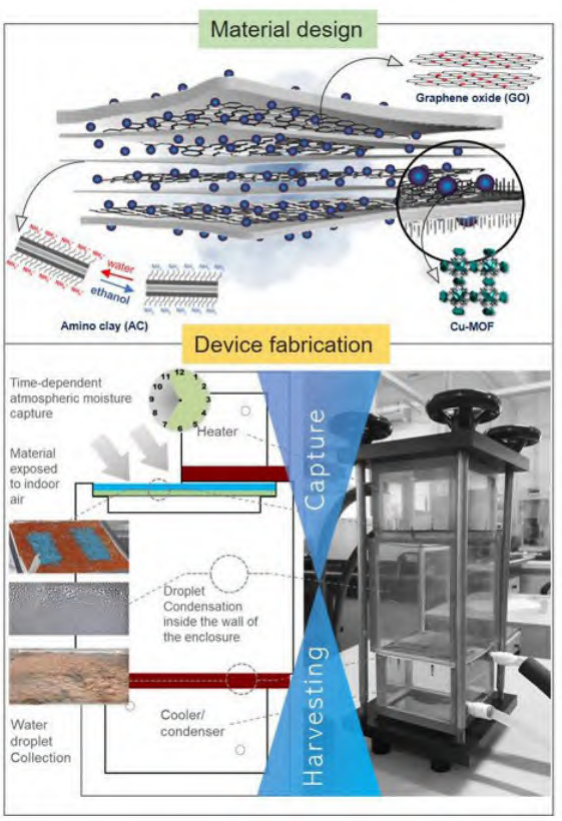
- *The Hindu,* 10th September 2022. https://bit.ly/3CeDwDQ

MEDIA REPORTS



Prof. Tapas Kumar Kundu with his student Aditya Bhattacharya
Image credits: Prof. Tapas Kumar Kundu

JNCASR SCIENTISTS DEVISE AN EFFICIENT WATER HARVESTING SYSTEM



The schematic of material preparation and prototype developed by JNCASR team
Image credits: https://onlinelibrary.wiley.com/doi/full/10.1002/adfm.202203093

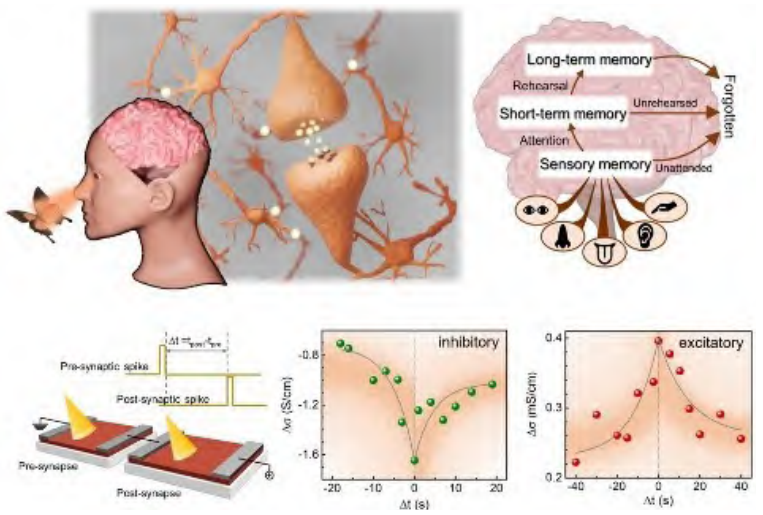
Prof. Tapas Kumar Maji and his team recently devised a series of binary (aminopropyl functionalized magnesium phyllosilicate or aminoclay, and CuBTC) and ternary (aminoclay, graphene oxide, and CuBTC) MOF nanocomposites that can efficiently harvest water from the air in all locations, including the indoor atmosphere. This work has been reported in *Advanced Functional Materials* (10.1002/adfm.202203093).

- *Vigyan Samachar,* DST. https://bit.ly/3Wud4yQ
- Tweet by @jncasr, 30th August 2023. https://twitter.com/jncasr/status/1564586248316284928
- Tweet by @IndiaDST, 30th August 2023. https://twitter.com/IndiaDST/status/1564577167333539841

MEDIA REPORTS

ARTIFICIAL SYNAPSE DEVELOPED FOR BRAIN-LIKE COMPUTING WITH INDUSTRY-COMPATIBLE NITRIDE SEMICONDUCTORS

Scientists at JNCASR have used scandium nitride (ScN), a semiconducting material with supreme stability and complementary metal-oxide semiconductor (CMOS) compatibility, to develop brain-like computing. This invention can provide a new material for stable, CMOS-compatible optoelectronic synaptic functionalities at a relatively lower energy cost & hence has the potential to be translated into an industrial product. The research was published in *Advanced Electronic Materials* (10.1002/aelm.202200975).



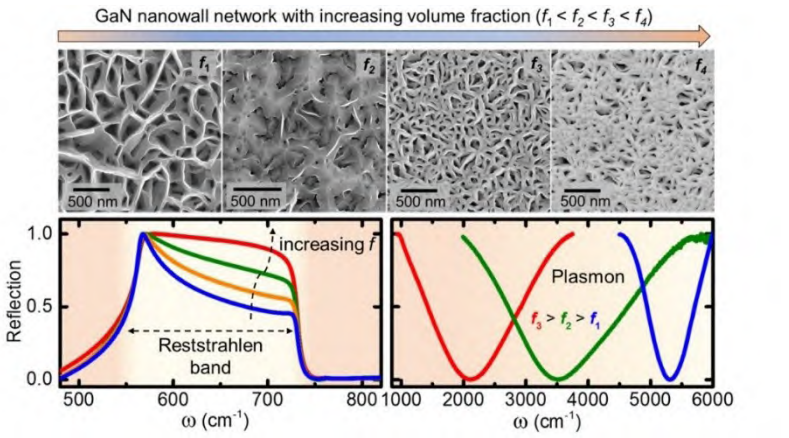
a) Schematic of human visual system and the neural synapse. b) Negative photoconductivity in ScN thin film measured in the device geometry shown below. c) Positive photoconductivity in Mg-doped ScN thin film is measured in the device geometry shown below. d) Atkinson–Shiffrin memory model proposing three main stages of memory in the human brain. e–h) Transition from short-term to long-term memory in inhibitory ScN synapse as a function of frequency, number, intensity, and duration of optical pulses. i–l) Transition from short-term to long-term memory in excitatory Mg-doped ScN synapse as a function of frequency, number, intensity, and duration of optical pulses.
Image credits: https://onlinelibrary.wiley.com/doi/10.1002/aelm.202200975

- Department of Science and Technology. https://bit.ly/43PtepN
- Tweets by @IndiaDST. 25th January 2023.
  https://twitter.com/IndiaDST/status/1618107925624651779
  https://twitter.com/IndiaDST/status/1618107929562841089
- *The Times of India*. 23rd January 2023. https://bit.ly/3WVWTuV

NEW ARTIFICIAL NANOSTRUCTURES FOR INFRARED ABSORPTION TECHNOLOGIES CAN BE USEFUL IN DEFENSE, IMAGING & SENSING

Dr. Bivas Saha and his research team from JNCASR have shown for the first-time infrared light emission and absorption with GaN nanostructures. GaN, a widely used material for blue light emission, is one of the most advanced semiconductors. Though visible and ultraviolet light applications of GaN have already been realized, with LEDs and laser diodes commercially available, utilization of GaN for IR light harvesting, or for the development of GaN-based IR optical elements is lacking. Dr. Saha says that this work will greatly benefit in addressing the demand for IR sources and detectors for energy, security, imaging, and other applications. The research was published in *ACS Nano Letters* (10.1021/acs.nanolett.2c03748).

MEDIA REPORTS

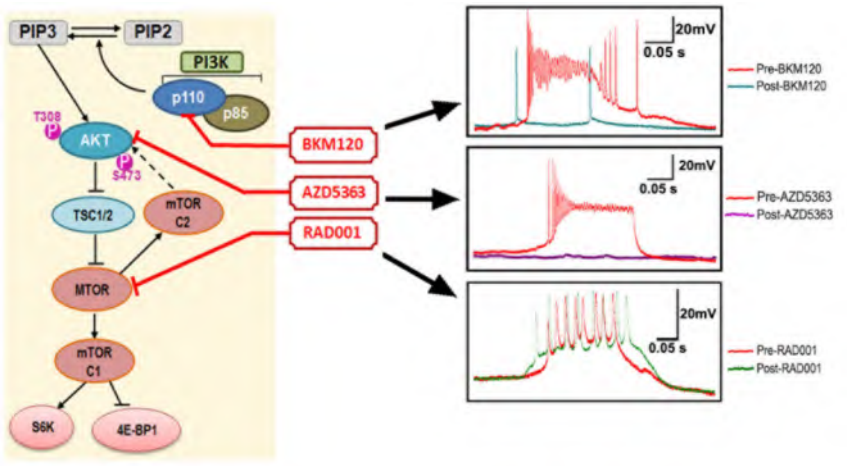


Analysis results of the infrared absorption and emission from GaN nanostructures.
Image credits: https://pubs.acs.org/doi/10.1021/acs.nanolett.2c03748

- Department of Science and Technology. https://bit.ly/3oHO1g8
- Tweet by @IndiaDST, 26th December 2022. https://twitter.com/IndiaDST/status/1607258772132749314

NEW STUDY OFFERS HOPE FOR CHILDREN SUFFERING FROM INTRACTABLE EPILEPSY

Scientists from JNCASR, led by Dr. Achira Roy, in collaboration with scientists at Seattle Children's Research Institute, Seattle, USA, focused on other mutations of PI3K-AKT-MTOR pathway and identified acute mechanisms that are MTOR-independent, with the help of preclinical drug assays. The team found that acute inhibition of PI3K or AKT, but not MTOR activity, suppresses the intrinsic hyperactivity of the mutant neurons. These acute mechanisms are distinct from those causing neuronal hyperactivity in other AKT/MTOR epileptic models and define parameters to facilitate the development of new molecularly rational therapeutic interventions for different types of intractable epilepsy. (10.3389/fnmol.2021.772847)



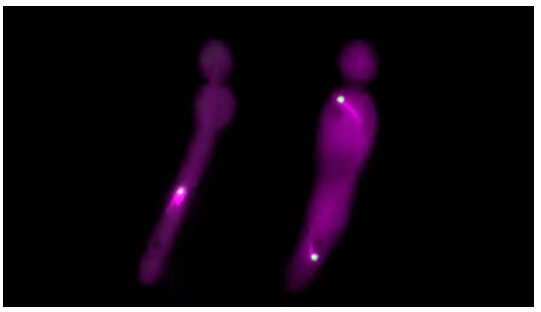
Acute inhibition of PI3K (by BKM120) or AKT (by AZD5363), but not MTOR activity (by rapamycin analogue RAD001), preclinically suppresses the intrinsic hyperactivity of the epileptic neurons in Pik3ca mutant mouse brain.
Image credits: https://www.frontiersin.org/articles/10.3389/fnmol.2021.772847/full

- Department of Science and Technology. https://bit.ly/3MYzYdY
- Tweet by @jncasr, 23rd February 2023. https://twitter.com/jncasr/status/1628662206991839232
- Tweet by @IndiaDST, 23rd February 2023. https://twitter.com/IndiaDST/status/1628658735269969920

MEDIA REPORTS

STUDY IDENTIFIES GENE THAT COULD HELP FIGHT LETHAL INFECTION CANDIDIASIS

A team of our researchers has identified a gene that probably holds the key to preventing the fungal infection Candidiasis that often affects intensive-care unit (ICU) patients, cancer patients, and patients receiving immunosuppressive therapy. In the new study, which was conducted by Prof. Kaustuv Sanyal's group at JNCASR in collaboration with Christophe d'Enfert's group at Institut Pasteur, Paris, France, the researchers carried out a large-scale screening to identify regulators of chromosome stability in the fungus which is also a clinically relevant fungal model system. They discovered that Csa6 was a critical regulator of cell cycle progression. The scientists have published a report on their findings in the scientific journal *Nature Communications.* (10.1038/s41467-022-31980-3)

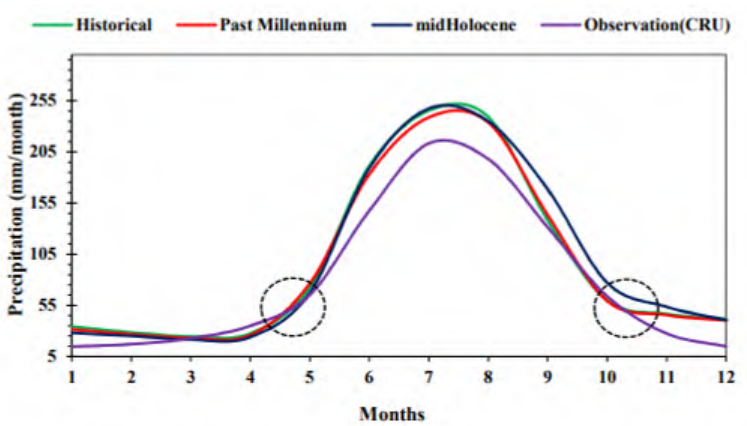


Contrasting aberrant mitotic spindle structures upon Csa6 overexpression (left) and depletion (right) in Candida albicans cells with an elongated bud.

- *LiveMint,* 25th August 2022. https://bit.ly/3X9FfEt
- *Vigyan Prasar,* 7th September 2022. https://bit.ly/3ChVGEW
- Tweets by @IndiaScienceWire, 8th September 2022. https://twitter.com/indianscinews/status/1567822958265249795
- Tweet by @jncasr, 8th September 2022. https://twitter.com/jncasr/status/1564123115168616453
- Tweet by @IndiaDST to 25th August 2022. https://twitter.com/IndiaDST/status/1562740318508040196

CAN CAVES HELP US UNDERSTAND CLIMATE CHANGE BETTER?

Dr. Jaishri Sanwal Bhatt, DST Scientist at the Geodynamics Unit, has been studying caves in the Himalayan region for signs of climate change, history of old earthquakes, and applications of these studies in the field of nuclear energy. In this interview with Lounge, Bhatt elaborates on what makes caves ideal ecosystems for forecasting changes in climate.



Mean annual precipitation cycle over (67–98°E, 7–38°N) for CRU (observational) Indian subcontinent region summarised by Dr. Bhatt in her study.

- *LiveMint* Lounge, 8th July 2022. https://bit.ly/3CfocH9
- Tweet by @jncasr, 7th July 2022. https://twitter.com/jncasr/status/1534104934639370240

IV.

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 conducted by the Office of Fellowships and Extension Programmes and the Education Technology Unit, 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 2022–2023 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 fellowships and extension (F&E) 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 a 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. The programme was suspended in March 2020 owing to the COVID-19 pandemic and reopened in September 2021, but 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 two months to receive training in their areas of interest, including the life sciences, chemical science, physical science, 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. The programme was suspended in March 2020 owing to the COVID-19 pandemic and reopened in September 2021. During 2022–2023, 77 students carried out project work under this programme. Since its inception, 2,522 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 ten meritorious students pursuing Bachelor's degree in chemistry are selected from across the country. In this three-year programme, students visit JNCASR during semester breaks after completing their first year of B.Sc. They learn through structured lecture programmes conducted 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. The programme was suspended in March 2020 owing to the COVID-19 pandemic and reopened in September 2021. Four students carried out project work under this programme during 2022–2023. Since its inception in 2004, about 140 students have benefited from this programme.

FELLOWSHIPS AND EXTENSION PROGRAMMES

PROJECT-ORIENTED BIOLOGY EDUCATION (POBE)

Like POCE, POBE selects ten meritorious students every year, pursuing first-year B.Sc. in the life sciences from colleges across the country. On successfully completing the programme, they are awarded a diploma in biology. The programme was suspended in March 2020 owing to the COVID-19 pandemic and reopened in September 2021. Three students carried out project work under this programme during 2022–2023. Since its inception in 2006, 103 students have benefited from this programme.

VISITING FELLOWSHIPS PROGRAMME

Scope:
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.

Research Areas:

- Life sciences (including molecular and developmental biology, chronobiology, genetics, ecology, behaviour, and neurobiology)
- Materials science (including nanoscience)
- Chemical science (including chemical biology, interfaces of chemical science with materials, solid-state chemistry, theoretical/computational chemistry, inorganic, and physical and organic chemistry)
- Physical science (including experimental and theoretical condensed-matter and materials physics, statistical physics, organic electronics, and experimental nanobiotechnology)
- Engineering sciences (including fluid dynamics, nonlinear dynamics, thermal, and chemical engineering)
- Atmospheric sciences

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. During 2022–2023, 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. The programme was suspended in March 2020 owing to the COVID-19 pandemic and reopened in September 2021. During 2022–2023, 350 students visited the Centre and its research facilities. Since its inception in 2019, 1,126 students and teachers from 31 different schools/colleges have participated in this programme.

FELLOWSHIPS AND EXTENSION PROGRAMMES

POPULAR LECTURE PROGRAMME (PLP) AT JAWAHAR NAVODAYA VIDYALAYA, JODHPUR

On an invitation from Shri H.P. Bairwa, Principal, Jawahar Navodaya Vidyalaya (JNV), Jodhpur, Prof. G. U. Kulkarni, visited JNV, Jodhpur as a part of Popular Lecture Programme (PLP) and addressed the students of Class X–XI on 23rd July 2022 (Saturday). A motivational lecture titled "Pursuing Science as Career" was delivered. Around 150 students from Class X–XII of the Vidyalaya, apart from science teachers, participated. Students expressed deep interest in the lecture and a few of them, who were very keen on pursuing Science as their career, desired to know how science can shape their lives and science education can impact society's growth. JNV organised this lecture as a part of the DST Vigyan Jyoti Program along with Dr. Ritu Gupta, Coordinator, Vigyan Jyoti Programs.

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 one year, depending on the requirement for the award of the degree. During 2022–2023, 31 final-year students pursuing UG/PG programmes in Engineering/Sciences carried out their project work under this programme. Since its inception in 2021, 44 students from different colleges have benefited from this programme.

SHORT/LONG-TERM VISITING STUDENTS PROGRAMME (SVSP/LVSP)

With a view to supporting students pursuing various academic programmes starting from undergraduate to Ph.D. to carry out research project work pertaining to their course of study, the Centre introduced the Short-term Visiting Students Programme (SVSP) and Long-term Visiting Students Programme (LVSP) in 2022. Since its inception in September 2022, 16 students from different colleges have benefited from this programme.

MAJOR EVENTS ORGANISED BY FELLOWSHIPS AND EXTENSION OFFICE

DEPARTMENT OF BIOTECHNOLOGY (DBT)–INDIA SCIENCE AND RESEARCH FELLOWSHIP (ISRF)–INDIAN NATIONAL SCIENCE ACADEMY (INSA) SCHEME

Under the DBT–ISRF–INSA Scheme, Dr. Deval Prasad, Assistant Professor, Department of Chemistry, Tribhuvan University, Kathmandu, Nepal, carried out the research project titled: *"A study of thermoelectric behaviour of polyaniline coated titanium oxide nanoparticles"* under the mentorship of Prof. Kanishka Biswas, NCU for a period of five months from 1st November 2022 to 31st March 2023.

FELLOWSHIPS AND EXTENSION PROGRAMMES

SERB-TEACHERS ASSOCIATESHIP FOR RESEARCH EXCELLENCE (TARE) SCHEME

Dr. Uttara Chakraborty, Assistant Professor, Manipal Institute of Regenerative Medicine (MIRM), Bengaluru, reported on 3rd January 2023 to carry out research project work titled: *"Studying Host-Pathogen Interactions of Human Mesenchymal Stem Cells and their roles in Immunomodulation Autophagy"* under the mentorship of Dr. Ravi Manjithaya, MBGU.

OUTREACH PROGRAMMES IN ASSOCIATION WITH KHEA, DHARWAD

JNCASR has set a goal to spread awareness about science and technology among the students of remote places in India, where the upcoming youth generation remains unaware of present career opportunities in the science and technology field. In this direction, JNCASR in association with Karnataka State Higher Education Academy (KHEA), Dharwad organised a one-day outreach programme at Dharwad titled: *"Frontier Lectures in Contemporary Physics and Chemistry"* on 14th May 2022. The programme was attended by 77 participants comprising students/scholars/faculty members from Karnataka University, Dharwad; KLE Technological University, Dharwad; SDM College of Engineering and Technology, Dharwad; and KSCD, Dharwad. The lectures were delivered by Prof. G. U. Kulkarni, President, JNCASR; Prof. S. M. Shivaprasad, Director, KHEA, Dharwad; Prof. B. L. V. Prasad, Director, CeNS; Prof. Ritu Gupta, IIT-J; Dr. M. G. Sreenivasan, HHV Pvt. Ltd., Bengaluru; and Dr. Ashutosh Singh, CeNS.

SCIENCE AND ENGINEERING RESEARCH BOARD (SERB)–VISITING ADVANCED JOINT RESEARCH (VAJRA) FACULTY SCHEME

Under the SERB–VAJRA Faculty Scheme, Prof. Mukundan T. from Bayreuth University, Germany, joined as Adjunct Faculty at the Centre's Chemistry and Physics of Materials Unit (CPMU). He worked with Prof. G. U. Kulkarni, the lead Indian collaborator, in the research project titled: *"Towards affordable semi-transparent solar cells based on solution-processed semiconductors and hybrid TCEs"* from 1st February 2022 to 31st January 2023 (in two spells). He offered a crash certificate course on "Next Generation Solar Cells" from 22nd March to 15th April 2022 and "Next Generation Batteries" from 10th to 30th September 2022.

MEMBERS OF F&E OFFICE

Dean, Fellowships and Extension Programmes **Prof. N. S. Vidhyadhiraja**

Coordinator (FA, Fellowships and Extension, and R&D) (On Contract): **Dr. Panneer Selvam K.**

Sr. Administrative Assistant Grade I: **Bannaiah R.**

FELLOWSHIPS AND EXTENSION PROGRAMMES

INCEPTION YEAR	PROGRAMME	PARTICIPATION TILL DATE
1991	SUMMER RESEARCH FELLOWSHIP PROGRAMME (SRFP)	**2,522** Students
2004	PROJECT-ORIENTED CHEMISTRY EDUCATION (POCE)	**140** Students from colleges across India
2006	PROJECT-ORIENTED BIOLOGY EDUCATION (POBE)	**103** Students from colleges across India
2006	VISITING FELLOWSHIPS PROGRAMME	**113** Research scientists and faculty members
2015	STUDENT BUDDY PROGRAMME	**434** Students; **33** Teachers
2019	INSTITUTIONAL VISITS	**1,126** Students and teachers
2021	GRADUATE RESEARCH INTERNSHIP PROGRAMME (GRIP)	**44** Students from colleges across India
2022	SHORT/LONG-TERM VISITING STUDENTS PROGRAMME (SVSP/LVSP)	**16** Students from colleges across India

EDUCATION TECHNOLOGY UNIT

The Education Technology Unit (ETU), in collaboration with C. N. R. Rao Hall of Science, conducted 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:

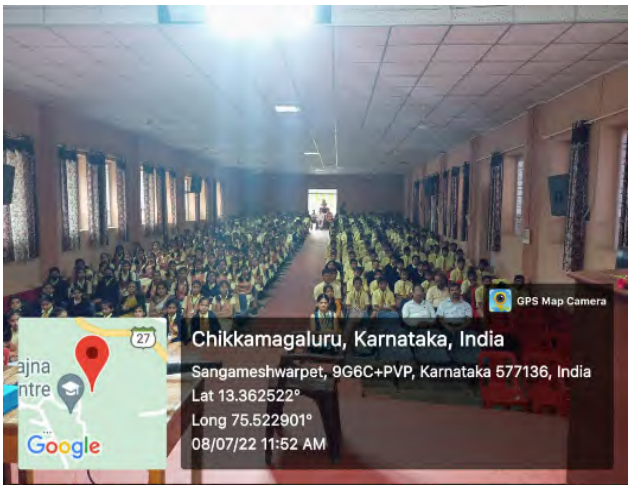
SCIENCE OUTREACH PROGRAMMES

A 4-day science outreach programme was organised from 25th to 28th April 2022 at the C. N. R. Rao Hall of Science, HGVS, Gangolihat. A total of 307 participants attended the programme, which included 235 students from classes 9 and 12, and 72 teachers from the Himalayan Gram Vikas Samiti, Ganglolihat, and Uttarakhand Gurukula Academy, Logaghat, Uttarakhand. Prof. Umesh V. Waghmare, Prof. N. S. Vidhyadhiraja, Dr. Ravi Manjithaya, Dr. Sheeba Vasu, Dr. Jaishri Sanwal Bhatt, Dr. Pratap Vishnoi, A. N. Jayachandra, and Vinayak Pattar from JNCASR were involved in facilitating the programme.

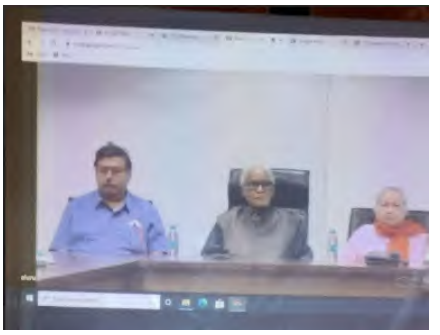
A half-day science outreach programme was conducted on 7th July 2022 for 139 students from classes 11 and 12 as well as 55 teachers from Poornaprjna P.U. College, Udupi, Karnataka, at their campus. The resource persons from JNCASR included Prof. N. S. Vidhyadhiraja, Vinayak Pattar, and Dhimahi.

EDUCATION TECHNOLOGY UNIT

On 8th July 2022, another half-day science outreach programme was facilitated at Poornaprjna P.U. College, Sangameshwarapete, Chikmagalur, Karnataka, by Prof. N. S. Vidhyadhiraja from JNCASR. A total of 270 participants attended the programme, which included 252 students from classes 11 and 12 and 18 teachers.



A 3-day science outreach programme was conducted from 7th to 9th October 2022 for 250 students from classes 10, 11, and 12, and 13 teachers at Himalayan Gram Vikas Samiti, Gangolihat. This was a hybrid mode programme for students from Jawahar Navodaya Vidyalaya and Kendriya Vidyalay (central school) Govt. Girls Inter College, Champavat, Uttarakhand. Prof. Umesh V. Waghmare, Prof. Ranga Udaykumar, Prof. N. S. Vidhyadhiraja, Dr. Sheeba Vasu, Dr. Pratap Vishnoi, and Vinayak Pattar from JNCASR facilitated the programme in association with Himalayan Gram Vikas Samiti and other resource persons.



EDUCATION TECHNOLOGY UNIT

On 10th November 2022, Vinayak Pattar from the ETU at JNCASR facilitated a one-day science outreach programme for 37 students of classes 11 and 12, and 3 teachers from various colleges near Sagara, Shivamogga District. It was held at the ETU, Hall of Science.

A 3-day science outreach programme was conducted on 19th, 20th, and 21st January 2023 for 330 participants from around 12 schools in the Dharwad, Gadag, and Koppal districts. 30 teachers and 300 students from classes 10, 11, and 12 attended the programme that was held at the C. N. R. Rao Hall of Science, School Chandan, Laxmeshwar (Gadag District). It was facilitated by Bharat Ratna Prof. C. N. R. Rao, Dr. Indumati Rao, Prof. S. M. Shivaprasad, Prof. G. U. Kulkarni, Prof. Ranga Udaykumar, Prof. Eswaramoorthy Muthusamy, Prof. T. Govindaraju, Prof. N. S. Vidhyadhiraja, Dr. Sheeba Vasu, Dr. Ravi Manjithaya, and Dr. Pratap Vishnoi from JNCASR.

TEACHER'S PROGRAMMES

A one-day teachers orientation programme was held on 2nd June 2022 for 185 teachers of class 10 at the Hall of Science in JNCASR. Teachers from 5 schools/colleges, Parikrma Learning Center, Bengaluru, attended along with Parikrma Humanity Foundation (NGO). The programme was facilitated by resource persons from Parikrma and Vinayak Pattar of JNCASR.

EDUCATION TECHNOLOGY UNIT

On 30th June 2022, the 2020 and 2021 Prizes for Outstanding Science Teachers Award programme was held in hybrid mode. 700 students from classes 9, 11, and 12, and 50 teachers from schools and colleges from different parts of Karnataka participated in the event. It was facilitated by Prof. S. M. Shivaprasad, Dr. Jaishri Sanwal Bhatt, Dr. Pratap Vishnoi, and Vinayak Pattar of JNCASR.

Vinayak Pattar from the ETU at JNCASR facilitated an outreach programme for teachers, titled, 'Fun with Science', for 20 teachers from SJB Institute of Technology and Ambedkar College of Engineering, Bengaluru. The programme comprised of lectures and was held on 16th November 2022 at the ETU, Hall of Science.

EDUCATION TECHNOLOGY UNIT

On 12th December 2022, a one-day interactive lecture programme for teachers was conducted in hybrid mode for High School, PUC, B.Sc., and B.Ed. teachers across Karnataka. The event saw 100 participants attend in person and 300 online attendees. It was facilitated by Dr. Gururaj Karajagi from ACT, and Prof. N. S. Vidhyadhiraja and Vinayak Pattar of JNCASR.

SCIENCE AND COMMUNITY

On 25th June 2022, an event for the 'Popularisation of science in Rural Highschools', was held at KLE College in Ankali, Karnataka, and was attended by 625 students of classes 10, 11, 12, and B.Sc., along with 50 teachers, all from 10 high schools in and around Chikkodi, Belagavi District, Karnataka. The one-day event was facilitated by Vinayak Pattar from ETU, JNCASR.

A 3-day residential enrichment science workshop was conducted at the Sagar Science Forum by Prof. S. M. Shivaprasad, Dr. Jaishri Sanwal Bhatt, Prof. N. S. Vidhyadhiraja, Dr. Pratap Vishnoi, and Vinayak Pattar from JNCASR. Fifty B.Sc. final year students and 5 teachers from Sagar, Shivamogga District, Karnataka, attended the event. The programme was conducted in association with Sagar Science Forum, Sagar, Shivamogga, and sponsored by the C. N. R. Rao Education Foundation and held from 1st to 3rd July 2022.

EDUCATION TECHNOLOGY UNIT

A 4-day science camp was conducted at Sagar Science Forum, Sagar, Shivamogga District. It saw the participation of 58 students from classes 11 and 12 and 2 teachers. The camp, held from 1st to 3rd October 2022, was facilitated by Prof. N. S. Vidhyadhiraja and Vinayak Pattar from JNCASR, and others.

SCIENCE LEARNING

Two hundred and fifty students of classes 11 and 12 and 70 teachers from Adamaru in rural Udupi, Karnataka, attended a half-day programme on 'Learning Science through Experiments' on 7th July 2022. The programme, facilitated by Prof. N. S. Vidhyadhiraja, Vinayak Pattar, and Dhimahi from JNCASR was held at the Poornaprajna PU College in Adamaru, Udupi.

On 9th September 2022, the 'Learning Chemistry Through Experiments' programme was conducted via hybrid mode, by Dr. Pratap Vishnoi and Vinayak Pattar of JNCASR. One hundred and forty-nine participants from VVS and Sardar Patel PU College, Bengaluru, attended the one-day event, which saw the participation of 145 students of classes 11 and 12, and 4 teachers.

One-thousand five-hundred and eighty participants from 28 schools/colleges in the Shivamogga District attended the Vijnyanotsava "Hongiranotsava" (Learning Science through Experiments) Programme at the Hongirana PU College, Amatekoppa, Sagara, Karnataka. The one-day event, facilitated by Vinayak Pattar of ETU, JNCASR, saw participation of 1,490 students belonging to high school and PUC and 90 teachers, and was held on 2nd December 2022.

EDUCATION TECHNOLOGY UNIT

INTERACTIVE LECTURES

On 20th September 2022, a one-day interactive lecture programme in biology called “Learn Science with Fun”, was facilitated by Dr. Nishikant K. Subhedar in hybrid mode. 6 teachers and 250 students of classes 11 and 12 from Nagachetan PU College, Yelahanka, MPL Sastry PU College, Rajajinagar, JNV Bengaluru Urban and Rural, and Pragati Girls PU College, Vijayapura (Devanahalli), Karnataka, attended the event.

EDUCATION TECHNOLOGY UNIT

An interactive lecture programme in earth science titled "Earth's Dynamic Magnetic Field Geological Wonders" was held on 29th September 2022, via hybrid mode for students and teachers from Govt. PU College, Bagalur, Nisarga PU College, Nelagadarnahalli, and Jain University, all in Karnataka. Prof. Binod Sreenivasan from IISc and Dr. Jaishri Sanwal Bhatt from JNCASR facilitated the one-day event, which was attended by 130 students from classes 11, 12, and B.Sc., and 6 teachers.

On 4th November 2022, an interactive lecture programme in chemistry and physics was facilitated by Dr. Pratap Vishnoi and Vinayak Pattar of JNCASR at the ETU, Hall of Science. The one-day programme was attended by 131 students of classes 10, 11 and 12, and 7 teachers from Sri Vidhya Bharati School, Vijayanagar, and Axillum PU College, K. R. Puram, Bengaluru.

An interactive lecture programme in biology, titled, "Learn Science with Fun", was held on 5th January 2023 in hybrid mode for 8,340 participants all over India, under JNV's 'Vigyan Jyoti Programme'. The event was facilitated by Prof. Raghavendra Gadagkar from IISc Bengaluru and Vinayak Pattar of JNCASR. 200 teachers and 140 students of classes 10, 11, and 12 attended the event in person and 8,000 students attended online.

EDUCATION TECHNOLOGY UNIT

An interactive lecture programme in science, titled “The Brain” & “Learn Science with Fun” was held on 16th February 2023, at the ETU, Hall of Science for 60 students of class 10 and 4 teachers from Channenahalli, Bengaluru. Prof. T. Govindaraju and Vinayak Pattar from JNCASR were the resource persons for the event.

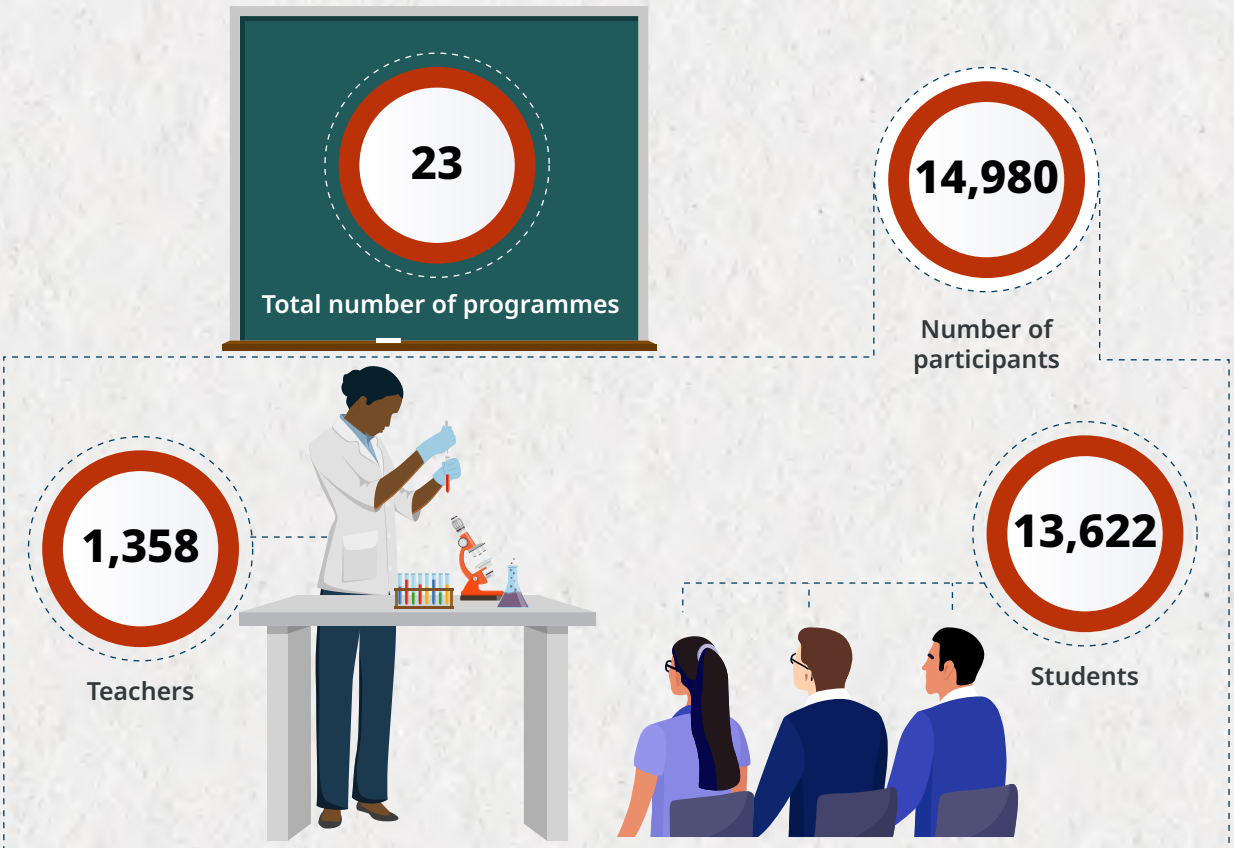
CELEBRATING SCIENCE

The Parikrma Festival of Science was conducted from 22nd to 24th February 2023, at the ETU, Hall of Science in association with the Parikrama Humanity Foundation (NGO). The 3-day event saw participation from 250 students of classes 7, 9, and 10, and 60 teachers from schools/colleges in and around Bengaluru. Resource persons from Parikrma and A. N. Jayachandra of JNCASR facilitated the event.

National Science Day 2023 was celebrated on 28th February 2023, at the ETU, Hall of Science and the resource persons for the event were Prof. T. Govindaraju, Dr. Jaishri Sanwal Bhatt, and Vinayak Pattar of JNCASR. 130 students of class 10 from Delhi Public School, Yelahanka, Bengaluru, and diploma students from Government Tool Room & Training Centre, Tumkur, Karnataka, along with 8 teachers, participated in the one-day event.

EDUCATION TECHNOLOGY UNIT

OUTREACH (APRIL 2022 TO MARCH 2023)



OUR OUTREACH

Uttarakhand	Rest of India

Karnataka

Chikkodi	Chikmagalur	Koppal
Sagar	Bengaluru Urban and Rural	Tumkur
Udupi Urban and Rural	Dharwad	Shivamogga
Adamaru	Gadag	

MEMBERS OF ETU

Chair, ETU: **Prof. T. Govindaraju**

Honorary Co-ordinator, ETU, Multimedia Group: **Dr. (Mrs.) Indumati Rao**

Assistant Co-ordinator: **Vinayak Pattar**

Honorary Assistant, ETU, Multimedia Group: **Sanjay S. R. Rao**

Former Chair: **Prof. V. Krishnan**

V.

ALUMNI AND PLACEMENTS

An alumni association plays a critical role in a student's life for getting career guidance and post-graduation 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 2022–2023.

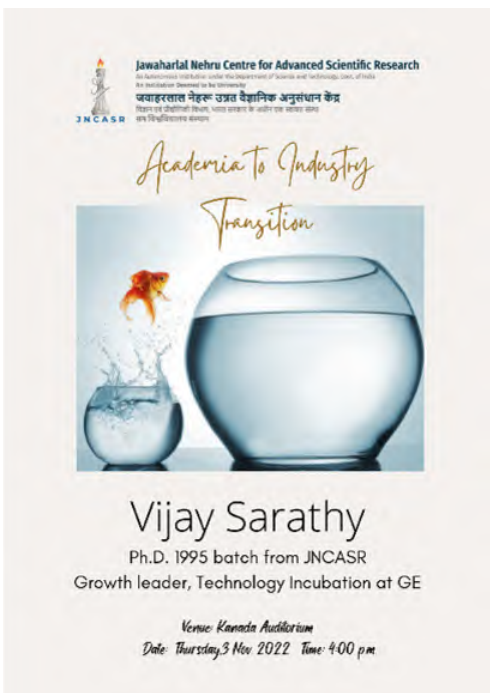
PLACEMENT, ALUMNI, AND INTERNATIONAL RELATIONS (PAIRs)

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. Prof. Shobhana Narasimhan, Professor, Theoretical Sciences Unit (TSU) is the Faculty In-Charge of PAIRs.

PAIRs organised its first event *"How to Launch Your Career"* on 5th October 2021. This interactive hybrid event, with guest speakers Prof. Manish Jain of the Indian Institute of Science, and Prof. Pushpalatha Murthy of Michigan Technological University, guided students on how to prepare CVs and resumes for academic and industrial positions, and how to prepare for online job interviews. The AMRL Conference Hall was full for this event, and in addition, there was significant online participation.

Event 1. An Interactive Discussion on "HOW TO LAUNCH YOUR CAREER" by Prof. Pushpalatha Murthy, Prof. Manish Jain, and Prof. Shobhana Narasimhan

In a second event, held on 3rd November 2022, Dr. Vijaya Sarathy, an alumnus of the first Int. Ph.D. batch of JNCASR, spoke on *"Academia to Industry Transition"*. The speaker is presently working as a Growth Leader, Tech Incubation at GE. Around 120 students participated in this event.



Event 2. "Academia to Industry Transition" by Dr. Vijaya Sarathy, alumnus of the first Int. Ph.D. batch of JNCASR

PLACEMENT, ALUMNI, AND INTERNATIONAL RELATIONS (PAIRs)

The third event was organised on 7th February 2023, where a hybrid talk on *"Making Clear and Informative Figures for Scientific Publishing"* was delivered by Prof. Ram Seshadri, University of California, Santa Barbara. Prof. Seshadri gave advice on how to improve the quality of scientific publishing with clear informative figures, graphical representations, and formatting styles, in order to more effectively communicate one's research findings and improve the likelihood of acceptance of research papers in high-impact journals. Around 125 students participated in this event.

Event 3: A talk on "Making Clear and Informative Figures for Scientific Publishing" by Prof. Ram Seshadri, University of California, Santa Barbara.

The feedback from students on the above three events has been extremely positive, and many more such events are being planned.

Meanwhile, an extensive exercise to create an alumni database is being undertaken to connect with around 700 alumni of JNCASR. Creating the alumni database is the first step to involving the alumni in the Centre's activities in the future. The updating of the alumni database on the Centre's website is in progress and a new webpage for the Placement and Alumni Office is at the developmental stage.

Efforts are also underway to encourage industries to come forward and invite students for industry internships.

The PAIRs Office will continue to make efforts to foster and promote close relations between the Centre and its Alumni.

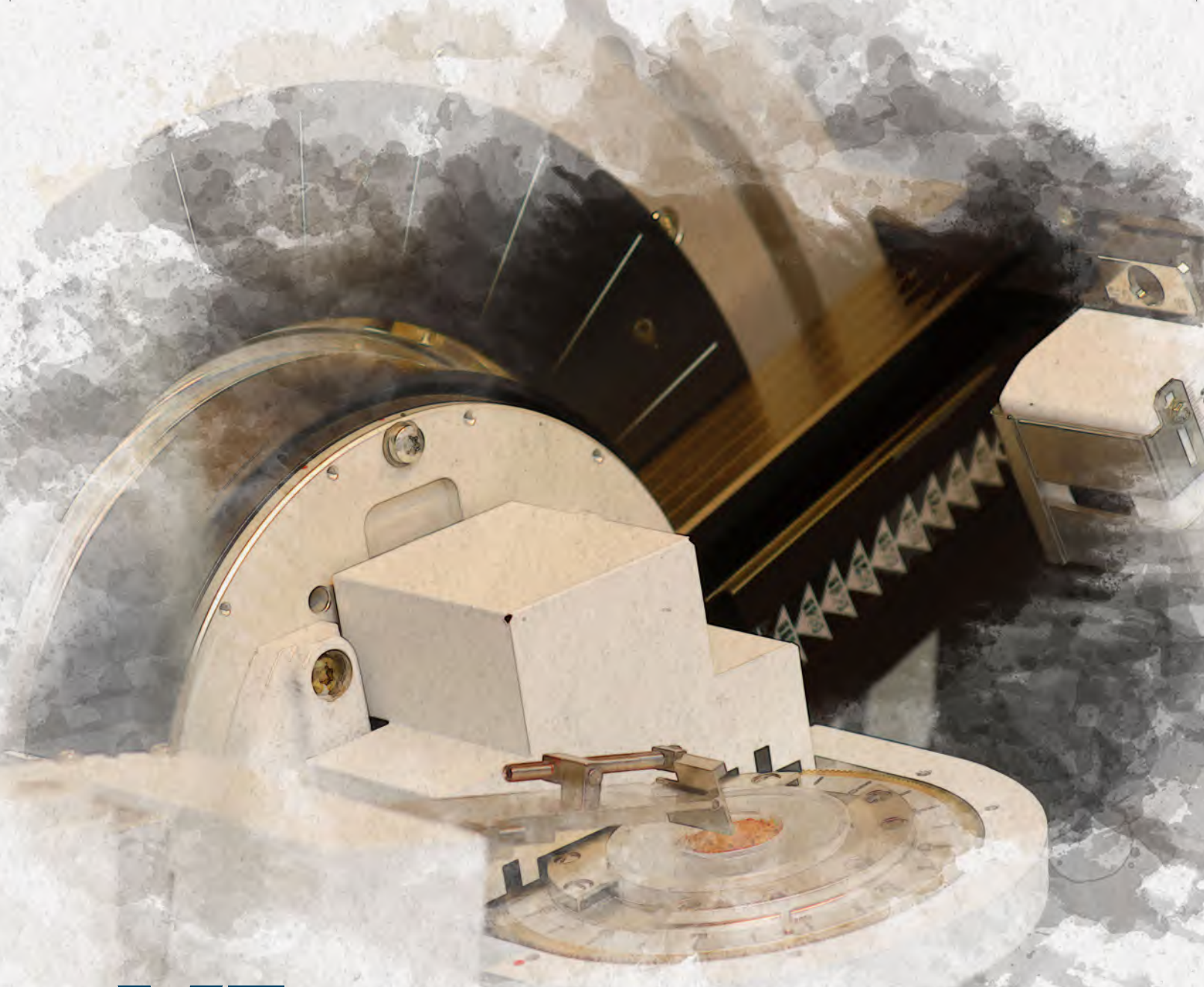
MEMBERS OF THE OFFICE

Faculty In-charge, PAIRS: **Prof. Shobhana Narasimhan**

Academic Coordinator: **Dr. Princy J. Pereira**

Sr. Library cum Information Assistant Gr. I: **Dr. Nandakumari E.**

Sr. Personal Assistant: **Shashi Karthikeyan**



VI.

FUNDING

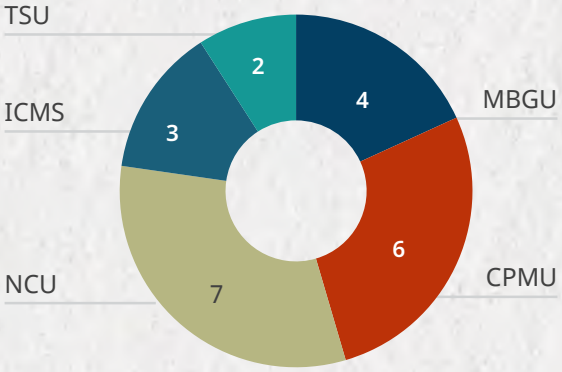
Along with an exceptional research workforce, JNCASR is also home to a top-notch research infrastructure, which enables high-quality research. But the establishment and maintenance of such infrastructure are possible only with funding.

JNCASR receives its funds from various top science funders at the national and international levels, from government agencies, as well as corporate funders. The support of these renowned funding agencies is a marker of the high-quality research at JNCASR.

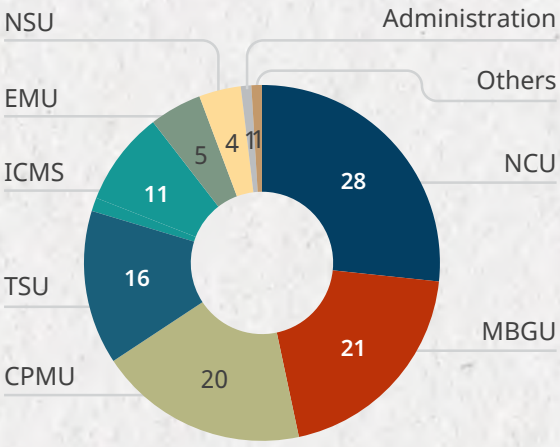
The following section outlines the details of the funding procured by JNCASR in the financial year 2022–2023 for ongoing and new projects.

SPONSORED PROJECTS

NEW PROJECTS 2022–2023

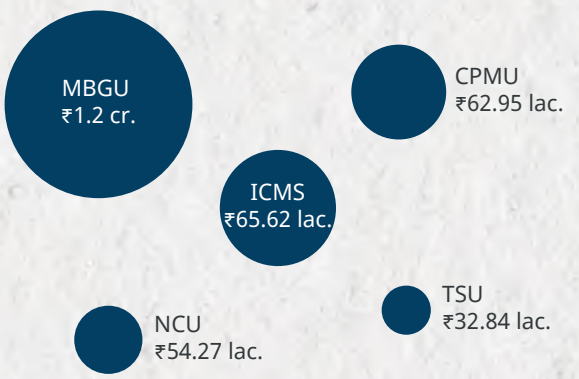


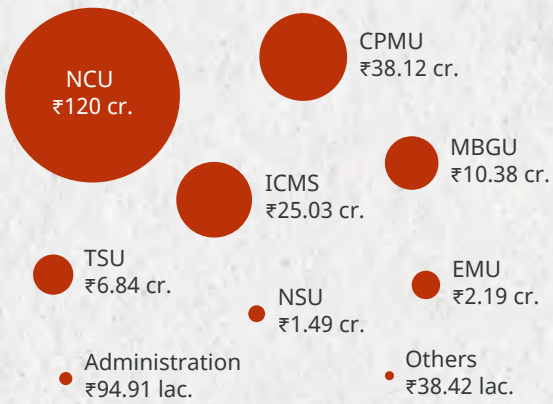
ONGOING PROJECTS 2022–2023



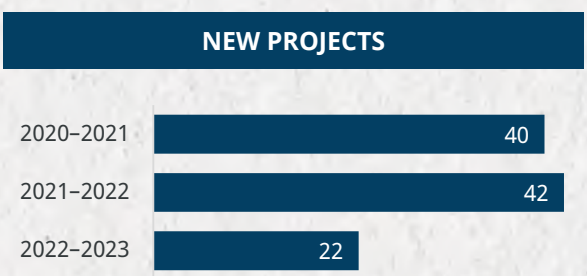
GRANTS RECEIVED BY UNITS (2022–2023)

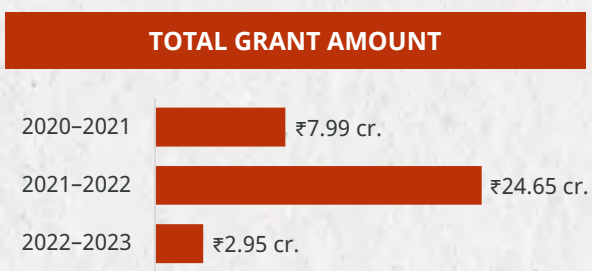
NEW SPONSORED PROJECTS	TOTAL GRANT RECEIVED FOR NEW PROJECTS	ONGOING SPONSORED PROJECTS	TOTAL GRANT RECEIVED FOR ONGOING PROJECTS
22	₹2.95 cr.	105	₹204.7 cr.





GRANTS RECEIVED FOR NEW PROJECTS (PAST 3 YEARS)





SPONSORED PROJECTS

NUMBER OF NEW PROJECTS PER FUNDING PARTNER 2022–2023

- 8 Sheikh Saqr Laboratory
- 5 Science and Engineering Research Board (SERB)
- 2 Indian Council of Medical Research (ICMR)
- 1 Biotechnology Industry Research Assistance Council (BIRAC)
- 1 Department of Atomic Energy (DAE) – Board of Research in Nuclear Sciences
- 1 Department of Science and Technology (DST), Govt. of India
- 1 Instruments R&D Establishment
- 1 National Institute of Pharmaceutical Education and Research, Kolkata
- 1 SERB – TARE

NUMBER OF ONGOING PROJECTS PER FUNDING PARTNER 2022–2023

- 33 SERB
- 15 DST, Government of India
- 9 Department of Biotechnology (DBT), Government of India
- 8 SERB – J. C. Bose Fellowship
- 4 Shell India Markets Pvt. Ltd.
- 3 DAE – Board of Research in Nuclear Sciences
- 3 Indian Institute of Science
- 3 SERB – TARE
- 2 DBT/Wellcome Trust India Alliance
- 2 ICMR
- 2 Indo-French Centre for the Promotion of Advanced Research
- 2 Indo-Korea Science and Technology Center
- 1 Asian Office of Aerospace Research and Development
- 1 Bangalore International Airport Ltd.
- 1 BIRAC
- 1 Central Mine Planning and Design Institute Ltd.
- 1 Cookson India Pvt. Ltd.
- 1 European Union
- 1 Gennova Biopharmaceuticals Ltd.
- 1 Hamsa Biopharma India Pvt. Ltd.
- 1 Human Spaceflight Centre – ISRO
- 1 Indian National Science Academy
- 1 Instruments R&D Establishment
- 1 National Institute of Pharmaceutical Education and Research, Kolkata
- 1 Public Health of England
- 1 Regional Center for Biotechnology
- 1 Renalyx Health Systems Pvt. Ltd.
- 1 Sankhyasutra Labs Pvt. Ltd.
- 1 Sheikh Saqr Laboratory
- 1 Tata Steel Ltd.
- 1 The World Academy of Sciences

VII.

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 for the entire JNCASR community.

This section outlines the major developments in these facilities and services.

LIBRARY

The JNCASR library is well-stocked, with 9,957 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 2022–2023, 122 books were newly added and 108 new patrons were registered, increasing the current number of patrons to 517. The total expenditure this year was ₹2,66,973 for procuring books and ₹75,62,030 for journals.

LIST OF USER ORIENTATION PROGRAMMES ORGANISED

1. Webinar on ***"Managing research credit in a collaborative world"*** conducted by Clarivate Analytics (Web of Science) on 26th April 2022
2. Webinar on ***"Art of Accurate Referencing in Academic Works"*** organised by ProQuest (Clarivate Analytics) on 10th May 2022
3. Webinar on ***"Powering drug discovery via research intelligence"*** conducted by Clarivate analytics (Web of Science) on 17th May 2022
4. Webinar on ***"Successful Submission to High Impact Factor journals"*** organised by National Knowledge Resource Consortium (NKRC) and Wiley on 27th July 2022
5. Online training session on ***"SciFinder^n Discovery Platform"*** conducted by Chemical Abstract Services (CAS) on 25th August 2022
6. Webinar on ***"How to avoid journal rejection"*** organised by National Knowledge Resource Consortium (NKRC) and Taylor & Francis on 6th September 2022

STAFF MEMBERS OF THE LIBRARY

Senior Library cum Information Officer: **Nabonita Guha**

Senior Library cum Information Assistant Grade I: **Dr. Nandakumari E., Nagesh Hadimani**

Junior Administrative Assistant: **Shubha S.**

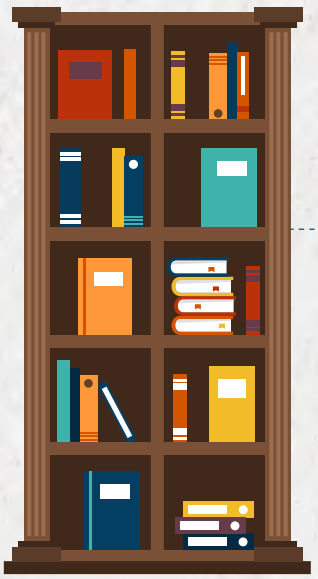
Senior Helper: **Rajeeva J.**

Library Trainees: **Shruti Kude, Manjunath B.**

LIBRARY

OVERVIEW OF LIBRARY RESOURCES AND SERVICES

RESOURCES



122
New books added

9,957
Total books in collection

149
Number of journal subscriptions

4,000+
Number of resources supported by NKRC

SERVICES

3,362
Total books circulated

787
Books renewed

1,244
Books issued

1,331
Books returned

108
New patrons

517
Total number of patrons

77
Article requests fulfilled

6
User orientation programmes organised

COMPUTER LABORATORY (COMPLAB)

Since its inception, the CompLab team in JNCASR has strived hard to modernise the existing network, security, and email system. The group constantly brings in novel technology to benefit the members of JNCASR.

NEW IMPLEMENTATIONS

CLOUD SERVER

We have recently migrated our on-premises servers to Microsoft Azure with additional security. It will provide access to the necessary servers whenever any major issue occurs on campus.

ANTI-VIRUS ON THE CAMPUS

We have implemented AI-based anti-virus throughout the campus to enhance internet and system security.

MOBILE SIGNAL BOOSTER

A major inconvenience experienced by JNCASR members is the lack of mobile signals on campus. Hence, CompLab has contacted the appropriate vendor to install mobile signal boosters for a major network provider, which should be operational from April 2023.

UPGRADES

NETWORK

JNCASR will offer up to 1 Gbps internet connection from April 2023, and the intranet speed will be up to 10 Gbps.

EMAIL

One of the major changes implemented last year was migrating successfully from the outdated Zimbra to the professional email client, Microsoft Outlook, which includes Microsoft products such as Teams, OneDrive (5 TB storage per email account), Word, PowerPoint, and Excel; these can be accessed via common sign-in credentials allowing easy sharing of information. Several new policies have been implemented to ensure the email facility's proper functioning and prevent spam. Further, the Outlook desktop/mobile app provides a single platform to access multiple email IDs independently at any given time, easing the user's workload.

FIREWALL

We have recently upgraded to the latest OS and implemented new rules to enhance security. Further, we have updated our SSL certificate for secure VPN connections.

COMPUTER LABORATORY (COMPLAB)

ENHANCED SECURITY FOR SYSTEM AND NETWORK

We have frequently communicated with JNCASR members 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 conducted network and internet security audits to fix any loopholes in the system.

CENTRALISED SOFTWARE LICENSE FOR STUDENTS AND FACULTY MEMBERS

We have a free campus license policy where all students and faculty members are given access to Mathematica, GraphPad, Origin, MATLAB, Intel Parallel Studio, and Microsoft Office 365 licenses that support up to 5 device installations per user and provide 5 TB of cloud storage for each user.

COMPLAB OFFERINGS

MEMBERS OF COMPLAB

Head, CompLab: **Dr. James P. C. Chelliah**

Onsite Engineers: **Chandan N., Vinoth P., Madasamy S., Yallappa, Indu Prakash**

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 four doctors, including one Chief Medical Officer and three Medical Officers, a physiotherapist, and two in-house clinical psychologists attending outpatients, four nurses who work round the clock in shifts, and two lab 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. The new physiotherapy unit has been shifted to the OPD Block downstairs, replacing the old lift. 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, labs, 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.

A health screening camp for all staff, including temporary staff, and a cancer screening camp for women aged above 40 years was conducted in the month of January 2023.

Dhanvantari also conducts annual orientation programs 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 those for COVID-19.

DHANVANTARI (JNCASR HEALTH CENTRE)

MEMBERS OF DHANVANTARI

Chief Medical Officer (On Contract):
Dr. G. R. Nagabhushana, M.B.B.S., F.C.C.P., F.C.G.P., P.G. Diploma in M&CHL

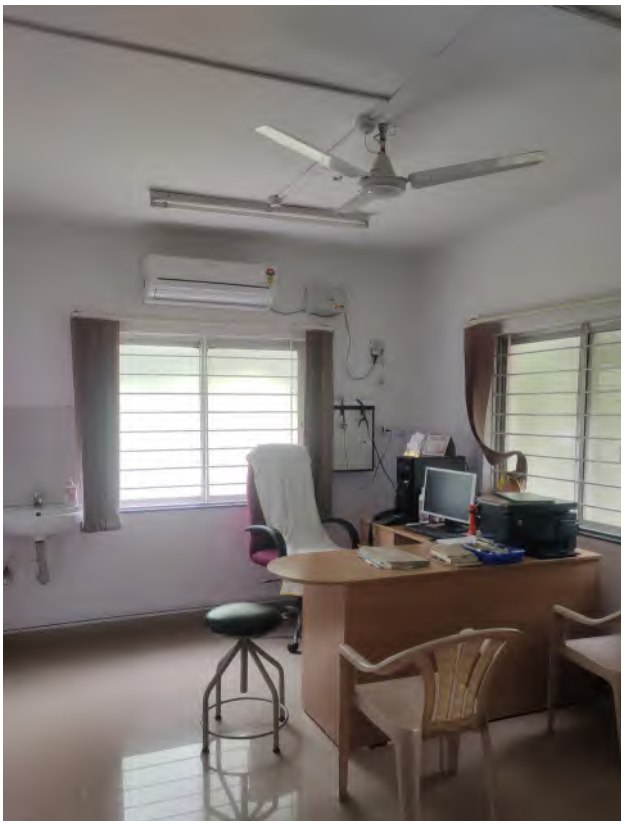
Medical Officers (On Contract):
Dr. Kavitha Sridhar, M.B.B.S.
Dr. Senthamarai S. Manoharan, M.B.B.S., P.G.D.M.L.S., Diploma in Preventive and Promotive Health Care, Diploma in Counseling Skills, P.G.D.H.H.M., M.B.A. (HA)
Dr. Chandralekha H. V., M.B.B.S.

Psychiatrist (On Contract):
Dr. Elizebath Daniel, M.A., M. Phil., Ph.D.

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

Sr. Helper:
Linga Murthy H.



DAY CARE FACILITY

An independent day care facility with a play area for the children of our staff members started operating in June 2010 on 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, children's lockers, two rooms, a kitchen, and two washrooms. It also has a small 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.

In 2022, the day care facility was augmented with the construction of an additional room. Prof. G. U. Kulkarni, President, JNCASR, inaugurated the facility on 10th March 2022, in the presence of the staff and committee members of the day care facility. The facility was then reopened, by following COVID–19 guidelines, and was initially functioning in a limited capacity with existing children. Following the success of this reopening, it was decided to open the facility at full capacity in mid-April 2022. After the reopening, a new committee was formed.

The facility is a safe space for children where they can play and learn through stimulating activities supervised by experienced staff members who consider the individual personalities and needs of each child. The facility organises dance classes, art sessions, and extracurricular activities like fancy dress events. The facility also celebrates festivals, such as Diwali, Christmas, Makar Sankranti, Holi, Krishna Janmashtami, and Ramanavami, and conducts special days, such as Colours Day, Children's Day, Halloween Day, and Independence Day, to enrich the children's engagement. The day care facility currently consists of three staff members, one in-charge, and two caregivers to look after the needs of 10 children.

This facility has been utilised by faculty members, research associates, R&D personnels, officers, and permanent employees. Limited seats have been available for children of outsourced employees as well from April 2022.

DAY CARE FACILITY

MEMBERS OF DAY CARE

Chairperson: **Prof. Ranjani Viswanatha**

Helper: **Sujatha**

CAMPUS INFRASTRUCTURE

New infrastructural facilities and developmental activities undertaken during the period 2022–2023 are:

ON-GOING PROJECTS

PRE-FAB INNOVATION AND DEVELOPMENT LABORATORY BLOCK OF JNCASR AT ARKAVATHI CAMPUS

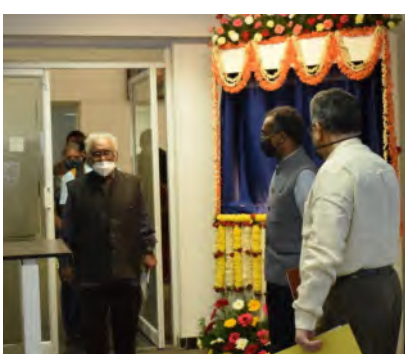
JNCASR has been allotted one acre of land on the Arkavathi campus of CENS. M/s Mindspace Architects designed the Laboratory block Phase-I to have 9 labs, a meeting room, classroom, library, pantry, and lounge facilities. The foundation stone was laid by the Hon'ble Vice President of India Shri M. Venkaiah Naidu on 16th August 2021.

The two-storey building with a plinth area of 18,500 sq. ft., and tender cost ₹5,60,28,126 was completed on 30th June 2022. A part of the building is already functional, and interior works are under process.

CONSTRUCTION OF SAMat BUILDING AT JNCASR JAKKUR CAMPUS

As proposed by the International Review Committee, the Lab facility building called School of Advanced Materials (SAMat) is being developed in front of the CCMS block. The three-storey building, having a plinth area of 22,000 sq. ft and a tender cost of ₹5,90,38,426, will house 11 labs and a conference room. The foundation stone was laid by Dr. S. Chandrasekhar, Secretary, DST, Government of India on 4th March 2022.

The frame structure of two floors has been completed, and the entire building is expected to be completed by September 2023.



CAMPUS INFRASTRUCTURE

CONSTRUCTION OF ADDITIONAL SPACE FOR ANIMAL HOUSE ANNEX BUILDING AT JNCASR CAMPUS

Additional laboratory space was required for the existing animal facility to set up new facilities. Accordingly, a plan has been prepared with office and storage space on the ground floor and laboratory and headroom on the first floor. The plinth area of the building is 2,800 sq. ft., and the tender cost is ₹91,59,644. The construction of the building is in its final stages.

CONSTRUCTION OF STORMWATER DRAINS (SWD) BY BBMP AUTHORITY IN JAKKUR CAMPUS

The BBMP authority has recently taken up SWD construction work in the campus [(1) from the backside of New Dining Hall to Rachenahalli Tank, (2) from Nano building to STP]. The construction of the SWD is expected to significantly reduce the risk of flooding in the campus and it will be completed within the estimated timeframe and budget. The SWD will serve as an important asset to the campus and help protect the local environment.

CAMPUS INFRASTRUCTURE

PROPOSED WORKS

CONSTRUCTION OF SPORTS BUILDING AT JNCASR JAKKUR CAMPUS

To encourage sports and well-being, construction of a sports building in the campus has been proposed for students and faculty. The building is envisaged to provide facilities like a gymnasium, squash court, board games, table tennis, billiards, snooker, volleyball, and basketball. It will be a three-storey building, with a plinth area of 21,300 sq. ft. and an estimated budget cost of ₹696 lac.

The DPR has been sent to KPWD for technical scrutiny as required by DST. The tendering process will start immediately after clearance from DST.

DESIGN OF MASTER PLAN AND DETAILED PROJECT REPORT FOR JNCASR CHAMUNDI CAMPUS AT CHOKKANAHALLI

JNCASR has laboratories and office space in the present campus at Jakkur on 27 acres 14 guntas of land. The total built-up area in Jakkur is about 53,500 sq. m. The Karnataka government granted 10 acres of land in 2008 for future expansion of the Centre's activities. The land is in Chokkanahalli area, 5 km away from the main campus. Presently, one laboratory block has been set up. As per inputs from the management, the proposed campus will accommodate research facilities, an administrative block, a hostel, service block quarters, and other buildings for infrastructural support and required basic amenities.

As per the guidelines of the DST, the master plan and DPR for the proposed campus need to be prepared by KPWD/CPWD architects, for further processing at the ministry. The preliminary estimate suggests a plinth area of 33,675 sq. ft. and approximate cost of ₹90 crores. The preparation of the master plan and DPR is currently under process.

MEMBERS OF THE ESTATE OFFICE

Project Engineer (On Contract): **Mahadevan N.**

Project Engineer Grade I (Civil): **Nadiger Nagaraj**

Jr. Project Engineer (Civil): **Veeresha N. R.**

Assistant Project Engineer (Electrical): **Sujeeth Kumar S.**

Sr. Mechanic (Electrical): **Srinivasan V. S.**

Helper Grade I: **Shamsundar, Krishnaiah M. N.**

Helper: **Krishna Murthy**

Coordinator (Electrical Support Services) (On Contract): **Basavaraju H. A.**

Coordinator (Electrical Installation and Maintenance) (On Contract): **Ramaiah M.**

Site Engineer: **Vivek N. Kagali**

Electrical Supervisor: **L. Rangaswamy**

RESEARCH FACILITIES

JNCASR strives to provide its researchers with state-of-the-art technologies, facilities, equipment, and software to facilitate high-quality research. Some of the latest additions to the list are:

CHEMISTRY AND PHYSICS OF MATERIALS UNIT (CPMU)

Compact ARC Melting Furnace; Multi-Channel System; CPU-GPU Server; Energy Dispersive Spectroscopy; Accessories for Waters Mass Spectrometer & Fraction Collector; Keithley Single Value High Performance Power Supplies; Thermal Core Smart Sensor Camera; Photochemical Reactor – released as rheometer; Edwards Mild Steel Vacuum Pump; Magneto-Optical Kerr Effect Setup from Holmarc; Automated HPLC with Gel Permeation Chromatography; Switch Multiplexer; High Performance Liquid Chromatography with Ultraviolet Detector; ION Beam Sputtering; Electrochemical Test Station; Upgradation of Keyence Microscope; UV Visible Spectrometer; ION Source; Multichannel LED with Controller; Source Meter; Upgradation of ATS-500 Magnetron Sputtering System; Light Source Xenon; Upgradation of SQUID-VSM Magnetometer; Upgradation of DSC System – Q 2000; Upgradation of Micro Raman Spectrometer; Photoreactor for Batch and Flow Reactions with Multiple Wavelength; Automatic Contact Angle Meter; Gas Line Connection for DST-AMT lab at Arkavathi Campus, JNCASR; SS Fixed & Flexible Vacuum Jacketed Hose

ENGINEERING MECHANICS UNIT (EMU)

Workstation; Compute Node; Double Pulse Laser System

INTERNATIONAL CENTRE FOR MATERIALS SCIENCE (ICMS)

Sony Smart Television 43” Ultra HD; UHV Magnetron Sputter Gun; Upgradation of ION Chromatography; Electrochemical Workstation; Glove Box; Modular Compact Rheometer Head; Freeze Dryer; Optical Modules; Liquid Phase TEM Holder - Through GTE; Upgradation of Existing FLS 920; Upgradation of Existing Battery Cycler; Optional Software Module for Leica Confocal SP8

MOLECULAR BIOLOGY AND GENETICS UNIT (MBGU)

Upgradation of Existing Olympus Microscope; Stackable Bacterio Logical Shaker Incubator; PCR System; Accessories for Zeiss LSM 880 Airy Scan system; Olympus Stereo Fluorescence Microscope (Part of SERB procurement); Camera for Microscope; High-Speed Cell Sorter; Upgradation of Server; BIOFLEX ROTORS; Ultra Low-Temperature Laboratory Deep Freezer; CO_2 Incubator & Bio Safety Cabinet; Fusion 355 UV Laser Upright 3 PMI Trigon; 30 KVA & 15 KVA UPS System with Accessories

RESEARCH FACILITIES

NEW CHEMISTRY UNIT (NCU)

Scanning Electrochemical Microscope; Oil Free Air Compressor; NMR Accessories; Carbolite Gero High-Temperature Laboratory Chamber Furnace; Tecan Spark Fusion Multimode Reader; IR Furnace with Accessories; Buchi LCD Rotary Evaporator; Julabo Movable with wheels Recirculating Chiller; Rotary Evaporator; Upgradation of JASCO CD Spectropolarimeter; Waters Autosampler; Upgradation of NMR; Vacuum Spray Pyrolysis Automated Equipment; Spectrometer with External Light Source and Software; Photochemical Reactor; Automated Cell Counter; Electrochemical Workstation; Leica Microscope; Ultraviolet Spectrophotometer; Accessories to NMR; Modular Compact Rheometer; Upgradation of FLS 1000 Spectrometer; Gas Line Connection for NCU Old Building

NEUROSCIENCE UNIT (NSU)

Sledge Microtome; Upright Microscope, Accessories and Colour Camera; Leica Microscope; Platform Camera

THEORETICAL SCIENCES UNIT (TSU)

Dell Workstation; Server (5 nos.); Q-Chem Unlimited Core License

COMPUTER LAB (COMPLAB)

30 KVA & 15 KVA UPS System with Accessories; Network Cabling Work - As per Annexure; Network Audit - As per Annexure; 1 Gbps Internet License Line Connectivity; Managed Cloud Services; Academic Campus User ICSD DVD; Coral Draw Graphics Suite; Overleaf Standard License; COMSOL; Cortex XDR Prevent

CENTRE-WIDE FACILITY

Audio System with Accessories; Upgradation of Keithley 4200 SCS to 4200A SCS (3 nos.); Addressable Fire Detection and Alarm System; Hand Held Radio Sets; Audio Visual System with Accessories; Accessories for Zeiss LSM 880 Airy Scan system

ELECTRICALS

Vacuum Circuit Breaker

VIII.

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
Bengaluru

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 2023, the Income & Expenditure 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 on March 31, 2023, 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.

Emphasis of Matter

We draw attention to Note No. 2 of B. NOTES TO ACCOUNTS of Schedule 25 to the financial statements, referring to Schedule No.7 and 11 to the financial statements, which states that the balances of Loans and Advances & Current Liabilities are subject to confirmation by the parties and reconciliation by the parties.

C S PRASHANTH

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PAN : AABFM8893Q GSTIN : 29AABFM8893Q1Z5

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.

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Mallya & Mallya Bangalore Chartered Accountants

- 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

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Mallya & Mallya Bangalore Chartered Accountants

CA CS Prashanth
Partner
Membership No: 218355
UDIN: 23218355BGPJEK4841

Place: Bengaluru
Date: 24-07-2023

JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH
BALANCE SHEET AS AT 31ST MARCH 2023

Amount in Rs.

Description	Schedule No.	Current year 2022-23	Previous year 2021-22
Liabilities			
Capital/Centre's Development Fund	1	99,68,74,624	93,96,88,488
Reserves & surplus	2	2,48,84,22,788	2,32,42,31,402
Earmarked and endowment funds	3	98,54,07,388	1,00,10,46,838
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	5,12,22,920	15,07,63,387
Total		**4,52,19,27,721**	**4,41,57,30,115**
Assets			
Fixed assets	8	2,48,84,22,788	2,32,42,31,402
Investments-From earmarked/endowment funds	9	62,58,31,760	52,90,31,760
Investment - Others	10	45,68,807	6,12,30,215
Current assets, loans, advances etc.	11	1,40,31,04,366	1,50,12,36,738
Total		**4,52,19,27,721**	**4,41,57,30,115**
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

As per our report of even date,
For *Mallya & Mallya*
Chartered Accountants
FRN : 001955S

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Date: 2023.07.24 18:22:07 +05'30'

C S PRASHANTH
Partner
Membership No. : 218355
UDIN : 23218355BGPJEK4841
Place : Bengaluru,
Date : 24-07-2023

Mallya & Mallya Bangalore Chartered Accountants

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Sampad Patra
Accounts Officer

GIRIDHAR UDAPI RAO KULKARNI
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Prof. G.U. Kulkarni
President

JOYDEEP P DEB
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Joydeep Deb
Administrative Officer

JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH
INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH 2023

Amount in Rs.

Description	Schedule No.	Current year 2022-23	Previous year 2021-22
Income			
Income from sales/services	12	0	0
Grants/subsidies	13	83,80,00,000	82,72,00,000
Fees/subscriptions	14	60,68,704	60,19,246
Income from investments	15	0	0
Income from royalty, publication, licence fee etc.	16	6,13,855	2,68,649
Interest earned	17	89,88,711	16,26,943
Other income	18	1,75,54,599	82,59,195
Increase/decrease in stocks	19	0	0
Total (A)		**87,12,25,869**	**84,33,74,032**
Expenditure			
Establishment expenses	20	54,80,28,184	48,94,02,558
Other administrative expenses etc.	21	28,87,68,146	20,61,00,923
Expenditure on grants, subsidies etc.	22	0	0
Interest & bank charges	23	35,085	11,815
Depreciation		20,09,38,805	15,62,83,312
Less: Transferred from Capital Reserve		20,09,38,805	15,62,83,312
Total (B)		**83,68,31,415**	**69,55,15,295**
Balance being excess of income over expenditure **(A-B)**		3,43,94,454	14,78,58,737
Less: Prior period expenses		17,09,551	4,60,776
Balance being surplus/deficit carried to Capital Fund		**3,26,84,903**	**14,73,97,961**
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

As per our report of even date,
For *Mallya & Mallya*
Chartered Accountants
FRN : 001955S

C S PRASHANTH
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Date: 2023.07.24 18:22:45 +05'30'

C S PRASHANTH
Partner
Membership No. : 218355
Place : Bengaluru,
Date : 24-07-2023

Mallya & Mallya Bangalore Chartered Accountants

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Sampad Patra
Accounts Officer

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Date: 2023.07.24 17:54:32 +05'30'
Prof. G.U. Kulkarni
President

JOYDEEP P DEB
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Joydeep Deb
Administrative Officer

JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH
Schedules forming part of the accounts for the year ended 31st march 2023

Description	2022-23 Amount in Rs.	2021-22 Amount in Rs.
SCHEDULE 1- Capital Fund :		
A: Capital fund		
Opening balance	41,22,33,847	27,43,79,975
Add : Surplus/deficit in income and expenditure account	3,26,84,902.95	14,73,97,961
Sub total	**44,49,18,750**	**42,17,77,936**
Less : Funds-utilisation/expenditure incurred	0	95,44,089
Total (A)	**44,49,18,750**	**41,22,33,847**
B: Centre's Development Fund		
Opening balance	40,03,16,038	35,54,49,284
Additions during the year	6,11,23,749	1,46,59,120
Income from investments out of Centre's Development Fund	3,21,41,151	3,02,07,847
Sub total	**49,35,80,938**	**40,03,16,251**
Less : Funds-utilisation/expenditure incurred	780	213
Total (B)	**49,35,80,158**	**40,03,16,038**
C: Grants for creation of Capital Assets		
Opening balance	12,71,38,603	7,23,42,060
Add : Grants received during the year	28,00,00,000	37,47,61,139
Sub total	**40,71,38,603**	**44,71,03,199**
Less: Transferred to Capital Reserve upon acquisition of fixed assets	34,87,62,887	31,99,64,596
Total (C)	**5,83,75,716**	**12,71,38,603**
Total (A+B+C)	**99,68,74,624**	**93,96,88,488**
SCHEDULE 2- Reserves and surpluses :		
A: Capital Reserve		
Balance as at the beginning of the year	2,32,42,31,402	2,16,05,50,118
Add : Fixed assets addition during the Year out of Core grant	34,87,62,887	31,99,64,596
Add : Fixed assets addition during the Year out of Earmarked and endowment funds	1,63,67,304	0
Sub total	**2,68,93,61,593**	**2,48,05,14,714**
Less : Depreciation for the current year transferred to Income and Expenditure account	20,09,38,805	15,62,83,312
TOTAL	**2,48,84,22,788**	**2,32,42,31,402**

Mallya & Mallya Bangalore Chartered Accountants

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Accounts Officer

JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH
Schedules forming part of the accounts for the year ended 31st march 2023

SCHEDULE 3- Earmarked and endowment funds:	FUND - WISE BREAK UP			TOTAL	
	Scheme Funds	Endowment Others	Student Residence,VSH& Dinning Hall	2022-23	2021-22
A) Opening balance of the funds	**82,63,11,030**	**17,29,61,336**	**17,74,472**	**1,00,10,46,838**	**97,03,94,751**
B) Additions to the funds:					
i. Donations/grants	60,35,48,251	0	0	60,35,48,251	55,29,79,473
ii. Income from investment made on account of funds	3,32,53,933	2,55,16,946	0	5,87,70,879	3,51,75,196
iii. Others	0	2,179	2,26,51,892	2,26,54,071	1,65,43,786
Total (A+B)	**1,46,31,13,214**	**19,84,80,461**	**2,44,26,364**	**1,68,60,20,039**	**1,57,50,93,206**
C) Utilisation/expenditure towards objectives of funds					
i. Capital expenditure					
- Fixed assets	7,29,05,645	0	0	7,29,05,645	14,99,02,737
- Others	6,45,96,226	1,89,22,452	0	8,35,18,678	5,11,15,727
Total	**13,75,01,871**	**1,89,22,452**	**0**	**15,64,24,323**	**20,10,18,464**
i. Revenue expenditure					
- Salaries, wages & allowances etc	7,75,61,270	0	0	7,75,61,270	5,90,31,098
- Other administrative expenses	44,43,86,537	0	2,22,40,520	46,66,27,057	31,39,96,806
Total	**52,19,47,807**	**0**	**2,22,40,520**	**54,41,88,327**	**37,30,27,904**
Total (C)	**65,94,49,678**	**1,89,22,452**	**2,22,40,520**	**70,06,12,650**	**57,40,46,368**
Net balance as at the year end (A + B - C)	**80,36,63,536**	**17,95,58,008**	**21,85,844**	**98,54,07,388**	**1,00,10,46,838**

Mallya & Mallya Bangalore Chartered Accountants

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Sampad Patra
Accounts Officer

JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH
Schedules forming part of the accounts for the year ended 31st march 2023

Description		2022-23 Amount in Rs.	2021-22 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	54,981		
b. Others - EMD/security deposit	1,02,95,969	**1,03,50,950**	**9,33,59,316**
2. Advances received :		**12,25,874**	**14,51,117**
3. Statutory liabilities :		**28,03,612**	**67,82,592**
4. Other current liabilities:		**2,71,51,752**	**4,00,65,833**
5. Intra-Group Payables			
a) Scheme Funds			
Payable to Scheme Account 18520	2,874		
	2,874		
Less: Receivables from centre	-2,874	**0**	**0**
b) Endowment			
Payable to Grant Account	34,33,893		
Less: Receivable From Endowment Account	-34,33,893	**0**	**0**
Total (A)		**4,15,32,188**	**14,16,58,858**
B. Provisions			
Stipend/salary payable		**40,89,009**	**36,83,259**
Expenses Payable		**56,01,723**	**54,21,271**
Total (B)		**96,90,732**	**91,04,530**
Total (A+B)		**5,12,22,920**	**15,07,63,387**

Mallya & Mallya Bangalore Chartered Accountants

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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 2023

SCHEDULE 8 - FIXED ASSETS

DESCRIPTION	Rate	GROSS BLOCK				DEPRECIATION				NET BLOCK	
		Cost/Value as at beginning of the year 2022-23	Additions during the year 2022-23	Dedn. during the year 2022-23	Cost/value at the end of the year 2022-23	Depre. as at the beginning of the year 2022-23	Depre. during the year 2022-23	On Dedn. during the year 2022-23	Total upto the year end 2022-23	as at the Current year - end 2022-23	as at the Previous year - end 2021-22
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	9,96,44,552	46,89,328	0	10,43,33,880	3,88,30,505	16,62,424	0	4,04,92,929	6,38,40,951	6,08,14,047
Hostel building	1.63	1,56,60,055	0	0	1,56,60,055	70,67,404	2,55,259	0	73,22,662	83,37,393	85,92,651
Advanced material research lab	1.63	2,59,30,339	0	0	2,59,30,339	80,14,936	4,22,665	0	84,37,601	1,74,92,738	1,79,15,403
Animal house	1.63	67,88,701	0	0	67,88,701	30,22,891	1,10,656	0	31,33,547	36,55,154	37,65,810
Staff housing	1.63	43,19,353	0	0	43,19,353	15,85,261	70,405	0	16,55,666	26,63,687	27,34,092
ETU building	1.63	30,91,348	0	0	30,91,348	9,12,463	50,389	0	9,62,852	21,28,496	21,78,885
Other buildings like extn. of hostel , college etc	1.63	1,18,83,626	0	0	1,18,83,626	33,43,326	1,93,703	0	35,37,030	83,46,596	85,40,300
Nano science lab	1.63	65,95,209	0	0	65,95,209	16,92,800	1,07,502	0	18,00,302	47,94,907	49,02,409
Engineering & mechanical lab	1.63	74,26,272	0	0	74,26,272	18,12,600	1,21,048	0	19,33,648	54,92,624	56,13,672
Dining hall & kitchen block	1.63	1,43,43,962	0	0	1,43,43,962	30,61,424	2,33,807	0	32,95,230	1,10,48,732	1,12,82,538
Hostel phase II	1.63	1,95,52,377	0	0	1,95,52,377	47,80,557	3,18,704	0	50,99,261	1,44,53,116	1,47,71,820
Lecture hall & academic block	1.63	96,36,712	0	0	96,36,712	23,38,571	1,57,078	0	24,95,650	71,41,062	72,98,141
Intl. centre for material sciences	1.63	5,01,48,316	0	0	5,01,48,316	1,14,66,711	8,17,418	0	1,22,84,128	3,78,64,188	3,86,81,605
International house	1.63	2,31,42,418	0	0	2,31,42,418	53,71,733	3,77,221	0	57,48,955	1,73,93,463	1,77,70,685
Hostel phase III	1.63	2,75,01,103	0	0	2,75,01,103	62,12,500	4,48,268	0	66,60,768	2,08,40,335	2,12,88,603
Prof. CNR Rao hall of science	1.63	1,03,33,669	0	0	1,03,33,669	23,37,526	1,68,439	0	25,05,965	78,27,705	79,96,144
Extention to HIV lab	1.63	10,16,085	0	0	10,16,085	2,31,870	16,562	0	2,48,432	7,67,653	7,84,215
Security office building	1.63	21,01,625	0	0	21,01,625	2,08,307	34,256	0	2,42,564	18,59,061	18,93,317
Radio activity - lab II	1.63	30,35,391	0	0	30,35,391	3,95,645	49,477	0	4,45,121	25,90,270	26,39,746
Sewage treatment building (STP)	1.63	2,91,699	0	0	2,91,699	71,321	4,755	0	76,076	2,15,623	2,20,378
Residential quarters - Adm. Officer	1.63	36,59,034	0	0	36,59,034	7,24,174	59,642	0	7,83,816	28,75,218	29,34,860
Child care centre	1.63	9,36,699	0	0	9,36,699	1,55,709	15,268	0	1,70,977	7,65,722	7,80,990
Extension to biology lab -2009	1.63	1,94,24,005	0	0	1,94,24,005	33,69,548	3,16,611	0	36,86,159	1,57,37,846	1,60,54,457
Animal house - Additional block	1.63	82,92,632	0	0	82,92,632	18,54,162	1,35,170	0	19,89,332	63,03,300	64,38,470
Hoster phase IV (62 rooms)	1.63	2,59,34,842	0	0	2,59,34,842	47,43,072	4,22,738	0	51,65,810	2,07,69,032	2,11,91,770
Extention to pauling building - Bio block	1.63	47,66,109	0	0	47,66,109	23,57,690	77,688	0	24,35,377	23,30,732	24,08,419
SCADA-DG room	1.63	2,40,660	0	0	2,40,660	39,228	3,923	0	43,151	1,97,509	2,01,432
President's residence	1.63	77,88,054	0	0	77,88,054	12,57,926	1,26,945	0	13,84,871	64,03,183	65,30,128
Visiting students hostel	1.63	3,39,82,070	0	0	3,39,82,070	55,09,015	5,53,908	0	60,62,923	2,79,19,147	2,84,73,055
Health centre	1.63	32,43,422	2,12,677	0	34,56,099	5,28,678	54,601	0	5,83,279	28,72,820	27,14,744
Nano institute-Shivanapura	1.63	37,09,242	0	0	37,09,242	6,04,608	60,461	0	6,65,069	30,44,173	31,04,634
Matrl. science block - CCMS	1.63	5,54,31,961	0	0	5,54,31,961	85,57,465	9,03,541	0	94,61,006	4,59,70,955	4,68,74,496
Post doc housing- Srirampura	1.63	1,54,86,086	0	0	1,54,86,086	19,51,241	2,52,423	0	22,03,664	1,32,82,422	1,35,34,845
New auditorium	1.63	2,20,24,759	0	0	2,20,24,759	27,87,115	3,59,004	0	31,46,118	1,88,78,641	1,92,37,644
New auditorium phase II	1.63	4,99,08,687	0	0	4,99,08,687	40,49,561	8,13,512	0	48,63,073	4,50,45,614	4,58,59,126

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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 2023 (SCHEDULE 8 - FIXED ASSETS - Contd...)

EOBU lab block	1.63	2,09,11,646	4,36,783	0	2,13,48,429	31,80,087	3,44,420	0	35,24,507	1,78,23,922	1,77,31,559
Modern Biomedical Science Research Laboratory	1.63	6,34,53,166	1,13,433	0	6,35,66,599	32,57,823	10,35,211	0	42,93,034	5,92,73,565	6,01,95,343
Chemical Heritage Exposition	1.63	2,04,76,876	0	0	2,04,76,876	9,67,715	3,33,773	0	13,01,488	1,91,75,387	1,95,09,160
Extension to Engineering & Machanical Unit (EMU)	1.63	1,46,16,712	0	0	1,46,16,712	6,20,249	2,38,252	0	8,58,501	1,37,58,211	1,39,96,463
Extension to Hall of Science	1.63	9,64,309	0	0	9,64,309	47,155	15,718	0	62,873	9,01,436	9,17,154
Infrastructure facility- Road, street lights, partitions etc	1.63	13,41,64,656	74,50,794	0	14,16,15,450	2,49,66,821	22,51,142	0	2,72,17,963	11,43,97,487	10,91,97,835
Basic Infrastructure Facilities -New Campus- Chokkanalli	1.63	2,90,95,819	0	0	2,90,95,819	4,74,262	4,74,262	0	9,48,524	2,81,47,295	2,86,21,557
Hostel Phase - V	1.63	7,86,93,104	29,56,372	0	8,16,49,476	12,52,454	13,29,071	0	25,81,525	7,90,67,951	7,74,40,650
Child Care Centre - Additional Room	1.63	13,98,667	0	0	13,98,667	22,798	22,798	0	45,597	13,53,070	13,75,869
Computer Lab - Pre Fab Structure	1.63	4,98,715	0	0	4,98,715	8,130	8,130	0	16,259	4,82,456	4,90,585
Estate Office	1.63	23,11,880	0	0	23,11,880	28,765	37,684	0	66,449	22,45,431	22,83,115
Pre - Fab Innovation & Development Centre - Arkavathi Campus	1.63	71,54,686	1,96,17,175	0	2,67,71,861	0	2,76,501	0	2,76,501	2,64,95,360	71,54,686
Library Renovation - Pre Fab Contruction	1.63	3,42,164	0	0	3,42,164	0	5,577	0	5,577	3,36,587	3,42,164
Equipments :											
Plant/machinery/scientific equipments	4.75	1,55,85,07,364	26,95,37,630	3,12,07,217	1,79,68,37,777	63,60,02,173	7,94,39,173	0	71,54,41,346	1,08,13,96,431	92,25,05,191
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	0	39,93,37,774	16,18,14,783	1,89,68,544	0	18,07,83,328	21,85,54,446	23,75,22,990
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	14,24,64,787	2,76,23,096	5,41,806	16,95,46,077	10,60,88,680	1,04,00,658	0	11,64,89,339	5,30,56,738	3,63,76,106
Office equipments	4.75	2,90,14,344	38,08,700	4,94,468	3,23,28,576	1,81,91,352	14,77,119	0	1,96,68,472	1,26,60,105	1,08,22,992
Computer/peripherals	16.21	10,76,69,174	1,46,68,823	373	12,23,37,624	10,11,79,677	78,06,695	0	10,89,86,372	1,33,51,252	64,89,497
Electrical installations	1.63	13,01,43,303	75,22,436	0	13,76,65,739	2,55,96,478	21,95,972	0	2,77,92,450	10,98,73,289	10,45,46,825
Electrical Installations - 2000 KVA DG SET	1.63	2,33,56,842	0	0	2,33,56,842	11,19,021	3,80,717	0	14,99,738	2,18,57,104	2,22,37,821
Library books	4.75	2,96,92,690	2,71,212	0	2,99,63,902	2,26,54,125	14,17,675	0	2,40,71,800	58,92,102	70,38,565
Library Journals	4.75	22,81,17,186	76,71,618	0	23,57,88,804	12,02,51,884	1,10,21,087	0	13,12,72,971	10,45,15,833	10,78,65,302
Tubewells & water supply	1.63	2,73,587	5,69,950	0	8,43,537	76,725	13,566	0	90,291	7,53,246	1,96,862
Other fixed assets											
Intangeable assets-Softwares	40.00	11,91,71,924	1,21,88,242	1,15,539	13,12,44,627	6,35,37,704	5,16,69,589	0	11,52,07,293	1,60,37,334	5,56,34,220
Capital work in progress											
Samat Building	0.00	0	1,42,57,317	0	1,42,57,317	0	0	0	0	1,42,57,317	0
Animal House Annex Building - Additional Space	0.00	0	38,94,008	0	38,94,008	0	0	0	0	38,94,008	0
Total		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
Previous year		3,51,70,96,578	32,76,32,926	76,68,330	3,83,70,61,174	1,35,65,46,460	15,62,83,312	0	1,51,28,29,772	2,32,42,31,402	2,16,05,50,118

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Sampad Patra
Accounts Officer

JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH
Schedules forming part of the accounts for the year ended 31st march 2023

Description	2022-23 Amount in Rs.	2021-22 Amount in Rs.
SCHEDULE 9- Investments - Earmarked/endowment funds (Long term)		
Fixed deposits - Housing development finance corporation limited	9,35,90,265	9,35,90,265
Fixed deposits - PNB housing finance limited	50,72,41,495	37,24,41,495
Fixed deposits - Stock holding corporation of india	2,50,00,000	6,30,00,000
Total	**62,58,31,760**	**52,90,31,760**
SCHEDULE 10- Investments - Others (Current)		
Short term deposits	45,59,917	6,12,21,325
Others	8,890	8,890
Total	**45,68,807**	**6,12,30,215**
Schedule 11- Current assets, loans, advances etc.,		
Cash & bank balances (Schemes)		
Cash in hand	0	0
Cash at bank - Canara bank	5,73,96,266	13,74,32,500
ZBSA Bank-Bank of Maharashtra-60418511062	66,08,099	
ZBSA Bank-Bank of Maharashtra-60419419634	7,94,32,043	
ZBSA Bank-Union Bank of India-203022010000838	6,87,56,393	
ZBSA Bank-ICICI Bank-754901000196	41,19,072	
Fixed deposits - Canara bank	40,00,000	6,09,57,745
Fixed deposits - Housing development finance corporation limited	29,01,95,870	28,78,60,000
Fixed deposits - PNB housing finance limited	25,20,93,308	28,50,00,000
Sub total	**76,26,01,051**	**77,12,50,245**
Loans and advances (Schemes)		
Interest accrued on fixed deposits	1,02,05,611	81,72,294
TDS receivable	70,95,623	74,04,388
Receivables from various funding agencies	2,37,58,377	2,99,32,893
Sub total	**4,10,59,611**	**4,55,09,575**
Total of Schemes	**80,36,60,662**	**81,67,59,820**
Cash & bank balances		
Cash in hand -Student Residence & VSH	7,634	13,126
Cash in hand - Dinning Hall	6,103	503
Cash in hand - Grant account	0	0
Cash at bank - Canara Bank - Grants account	33,94,05,333	27,83,98,526
Cash at bank - Canara Bank - FCRA account	1,58,398	1,22,632
Cash at bank - Canara Bank - Endowments account	4,76,10,234	1,10,78,303
Cash at bank - SBI	1,94,643	1,88,223
Cash at bank - HDFC	14,38,73,009	9,62,91,851
Cash at bank - Student Residence & VSH	14,65,140	7,60,770
Cash at bank - Dinning Hall	14,51,829	6,31,370
Sub total	**53,41,72,324**	**38,74,85,304**
Loans and advances		
Advances to staff	74,871	1,39,312
Deposits	39,98,967	39,98,967
Interest accrued on earmarked/endowment funds	13,37,508	4,28,181
Other advances & receivables	1,17,86,181	24,54,36,495
Receivables- CSIR, UGC, DBT, DST	2,01,49,862	3,50,16,793
Endowment account - Receivables	34,33,893	22,68,000
TDS receivable - Grant account	50,50,263	42,35,561
TDS receivable - Endowment account	17,92,557	16,70,735
Imprest balance	20,000	20,000
Student Residence & VSH - Receivables	44,53,418	18,77,767
Dinning Hall -Receivables	12,67,089	11,80,071
Prepaid Expenses	1,19,06,770	7,19,733
Intra-Group Receivables		
a) Endowment		
Receivables From Endowment	34,33,893	2,72,720
Less: Payable to Grant Account-13474	-34,33,893	-2,72,720
Sub total	**6,52,71,379**	**29,69,91,614**
Total of other than Schemes	**59,94,43,704**	**68,44,76,918**
Total	**1,40,31,04,366**	**1,50,12,36,738**

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Accounts Officer

JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH
Schedules forming part of the accounts for the year ended 31st march 2023

Description	2022-23 Amount in Rs.	2021-22 Amount in Rs.
SCHEDULE 12- Income from sales/services	**0**	**0**
SCHEDULE 13- Grants/subsidies :		
Grants - DST	83,80,00,000	82,72,00,000
Grants - From governement agencies/travel grants etc.	0	0
Grants - From other institutes	0	0
Grants - Other international agencies	0	0
Total	**83,80,00,000**	**82,72,00,000**
SCHEDULE 14- Income from fee/subscriptions etc :		
Income from fee, subscriptions, medical contribution etc.	60,68,704	60,19,246
Total	**60,68,704**	**60,19,246**
SCHEDULE 15- Income from investments;	**0**	**0**
SCHEDULE 16- Royalty income, publication, licence fee etc:		
From royalty	0	0
Licence fee	6,13,855	2,68,649
Total	**6,13,855**	**2,68,649**
SCHEDULE 17- Interest earned:		
From term deposits	17,63,158	11,67,759
Interest From SB Accounts	67,65,036	0
Interest earned - Others	4,60,517	4,59,184
Total	**89,88,711**	**16,26,943**
SCHEDULE 18- Other income:		
From visitors house, guest rooms, students residense etc.	1,01,41,184	20,44,958
Prior year receipts	52,50,108	21,25,979
Miscellaneous income	19,06,059	32,82,214
From others (tender fee & other fee collected)	2,57,248	8,06,044
Total	**1,75,54,599**	**82,59,195**
SCHEDULE 19- Increase/decrease in stock:	**0**	**0**

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JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH
Schedules forming part of the accounts for the year ended 31st march 2023

Description	2022-23 Amount in Rs.	2021-22 Amount in Rs.
SCHEDULE 20- Establishment expenses:		
Salaries & scholarship to students	33,60,33,137	30,70,99,323
Wages	16,12,00,552	13,72,48,081
Allowances (Medical reimbursements etc.,)	1,13,52,096	92,70,942
Contribution to CPF	20,36,307	21,13,332
Contribution to new pension scheme	2,27,94,449	2,51,81,759
Contribution to group gratuity scheme	95,02,083	2,28,481
Leave encashment benefits	31,43,051	74,87,589
LTC	19,66,509	7,73,051
Total	**54,80,28,184**	**48,94,02,558**
SCHEDULE 21- Other Administrative expenses		
Electricity & power	5,67,37,325	5,51,33,905
Water charges	46,43,704	33,35,997
Insurance	16,67,853	11,56,219
Repairs & maintenance	9,65,25,736	7,47,94,089
Rents, rates & taxes	7,40,204	1,20,470
Vehicles running & maintenance	25,51,376	8,90,163
Postage, telephone & communication	40,92,329	17,00,742
Printing, stationery, books	55,04,575	56,24,883
Travelling and conveyance	51,06,762	6,90,681
Expenses on seminars/workshops/discussion meetings	1,79,33,683	97,71,302
Membership & subscriptions	28,43,830	23,68,180
Professional / Legal charges	43,45,539	52,52,892
Laboratory consumables	6,49,81,316	4,23,97,715
Advertisement & publicity	13,92,467	19,84,159
Student residence, guest house, I house, etc	17,88,379	4,47,076
Statutory audit fee	1,29,800	1,18,000
POBE & POCE prgramme	91,983	65,000
Summer research fellowship & student programme	9,76,509	75,640
Loss on Asset Disposal	1,67,08,650	1,73,312
Foreign Exchage - Loss	6,124	499
Total	**28,87,68,146**	**20,61,00,923**
SCHEDULE 22- Expenditure on grants, subsidies etc:	**0**	**0**
SCHEDULE 23- Interest and bank charges:	**35,085**	**11,815**

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JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH SCHEDULES FORMING PART OF THE ACCOUNTS FOR THE YEAR ENDED 31 MARCH 2023

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	2022-23 (Amount)	2021-22 (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)(1) 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.

Mallya & Mallya Bangalore Chartered Accountants

5. Schedule 1 to 25 are annexed to and from an integral part of the Balance Sheet as on 31st March 2023 and the Income and Expenditure Account for the year ended on that date.

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Prof. G.U. Kulkarni
President

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Joydeep Deb
Administrative Officer

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Sampad Patra
Accounts Officer

For *Mallya & Mallya*
Chartered Accountants
FRN: 001955S

C S PRASHANTH
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CA CS Prashanth
Partner
Membership No. : 218355

Mallya & Mallya Bangalore Chartered Accountants

Place : Bengaluru
Date : 24-07-2023

JAWAHARLAL CENTRE FOR ADVANCED SCIENTIFIC RESEARCH
RECEIPTS AND PAYMENT ACCOUNT FOR THE YEAR ENDED 31ST MARCH 2023

Amount in Rs.

OPENING BALANCES & RECEIPTS	2022-23	2021-22	PAYMENTS & CLOSING BALANCES	2022-23	2021-22
I. Opening Balances :			I. Expenses :		
- Cash in hand & imprest at Centre	20,000	49,040	- Establishment Expenses	55,22,47,961	44,25,50,446
			- Administrative Expenses	29,10,73,890	21,79,36,404
Bank balances:			- Expenditure out of Endowments	1,57,62,059	5,71,625
In savings bank Accounts :			Sub Total :	85,90,83,911	66,10,58,474
- Canara Bank - Grant A/c	27,83,98,526	5,47,58,948			
- Canara Bank (Grant A/c) FCRA	1,22,632	1,19,140			
- Canara Bank - Endowment A/c	1,10,78,303	4,53,10,513			
- State Bank Of India	1,88,223	1,84,445			
- HDFC BANK	9,62,91,851	1,37,45,650	II. Expenditure on Fixed assets and Capital Work-in-progress :		
			- Purchase of fixed assets	38,31,16,738	26,19,26,682
In Deposit accounts :					
			III. Refund of surplus money/loans	0	0
- At HDFC Trust	9,35,90,265	8,10,90,265			
- At PNB	37,24,41,495	32,54,41,495	IV. Finance charges(Bank charges)	43,572	0
- At SHC of India	6,30,00,000	6,30,00,000			
- At Canara Bank (Grant A/c)	6,12,21,325	28,30,11,123			
Sub Total :	97,63,52,620	86,67,10,619	V. Other payments :		
II. Grants Received :			- Earnest money deposit returned	54,34,612	5,10,366
			- Staff advances (Festival adv. etc.)	0	1,63,168
- From DST-Grant in aid	1,29,28,61,139	1,02,71,00,000	- Other advances	31,09,01,893	20,03,18,117
- On behalf of endowments/Centre's Development Fund,others	0	0	- Security deposit returned	7,32,000	11,11,863
Sub Total :	1,29,28,61,139	1,02,71,00,000	- TDS payments	6,83,42,749	5,49,77,713
			- Professional tax	6,73,200	6,74,200
III. Income on Investments :			- Provident fund	4,75,35,348	4,87,62,161
Interest on FD's :			- Advances to faculty	59,371	18,55,984
- From earmarked/endowment funds	5,34,97,088	2,10,30,175	- Payment to sundry creditors	92,03,326	1,07,47,691
- From own funds	18,19,635	6,68,526	- Advances to CPF Account	0	1,13,89,601
Sub Total :	5,53,16,723	2,16,98,701	Sub Total :	44,28,82,499	33,05,10,864
IV. Interest received on SB accounts :			VI. Closing Balances :		
- From grant in aid	1,17,05,821	1,47,84,095			
Sub Total :	1,17,05,821	1,47,84,095	- Cash in hand & Imprest at centre	20,000	20,000
			- Bank balances:		
			In savings bank accounts at :		
			- Canara Bank - Grant A/c	33,94,05,333	27,83,98,526
V. Other Income :			- At Canara Bank (Grant A/c) FCRA	1,58,398	1,22,632
- Collections from visitors, guest room etc	69,57,826	9,98,711	- Canara Bank - Endowment A/c	4,76,10,234	1,10,78,303
- From fee, subscription etc	37,16,938	33,53,135	- State Bank Of India	1,94,643	1,88,223
- CSIR fellowships,UGC, DBT, SRFP	4,31,80,842	4,25,51,567	- HDFC BANK	14,38,73,009	9,62,91,851
Sub total :	5,38,55,606	4,69,03,413	Sub Total :	53,12,61,618	38,60,99,535
Balance carried forward	2,39,00,91,909	1,97,71,96,828	Balance carried forward	2,21,63,88,339	1,63,95,95,555

Mallya & Mallya Bangalore Chartered Accountants

JAWAHARLAL CENTRE FOR ADVANCED SCIENTIFIC RESEARCH
RECEIPTS AND PAYMENT ACCOUNT FOR THE YEAR ENDED 31ST MARCH 2022 (Contd...)

Amount in Rs.

OPENING BALANCES & RECEIPTS	2022-23	2021-22	PAYMENTS & CLOSING BALANCES	2022-23	2021-22
Balance Brought Forward	2,39,00,91,909	1,97,71,96,828	Balance Brought Forward	2,21,63,88,339	1,63,95,95,555
VI. Other receipts :			*In deposit accounts at :*		
- Income tax refunds	28,85,887	14,12,859	- At HDFC Trust	9,35,90,265	9,35,90,265
- From Sundry Creditors	0	0	- At PNB	50,72,41,495	37,24,41,495
- Staff advances recovered	0	0	- At SHC of India	2,50,00,000	6,30,00,000
- Settlement of advance to faculty	4,23,621	1,23,267	- At Canara Bank (Grant A/c)	45,59,917	6,12,21,325
- Earnest money received	21,36,000	8,20,000			
- Project funding received	6,51,89,784	4,52,18,260			
- GSLI receipt	45,83,558	85,92,341			
- Support to meetings	0	30,72,288			
- Other	38,14,69,257	19,34,12,797			
Sub Total :	45,66,88,107	25,26,51,812	Sub Total :	63,03,91,677	59,02,53,085
TOTAL	2,84,67,80,016	2,22,98,48,640	TOTAL	2,84,67,80,016	2,22,98,48,640

For Jawaharlal Nehru Centre for Advanced Scientific Research

As per our report of even date,
For *Mallya & Mallya*
Chartered Accountants
FRN : 001955S

C S PRASHANTH
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Date: 2023.07.24 18:23:35 +05'30'

C S PRASHANTH
Partner
Membership No. : 218355
Place : Bengaluru,
Date : 24-07-2023

GIRIDHAR UDAPI RAO KULKARNI
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Date: 2023.07.24 17:56:02 +05'30'

Prof. G.U. Kulkarni
President

JOYDEEP DEB
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Date: 2023.07.24 16:53:02 +05'30'

Joydeep Deb
Administrative Officer

SAMPAD PATRA
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Date: 2023.07.24 16:42:20 +05'30'

Sampad Patra
Accounts Officer

Mallya & Mallya Bangalore Chartered Accountants

JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH
STATEMENT OF ENDOWMENT, CENTRE'S DEVELOPMENT FUND & OTHER FUNDS BALANCES AS ON 31/03/2023
(2022- 23)

Rs. in Lakhs

PARTICULARS	Principal Endow. Fund	Opening balance 2022-23	Additions during 2022-23	Interest Received 2022-23	Interest Accrued 2022-23	Total 2022-23	Expen-diture 2022-23	Closing balance 2022-23
ENDOWMENT CHAIRS	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
Hindustan Lever Ltd. & Gharda Chemicals Chair	32.00	40.96	0.00	2.42	0.00	43.38	3.60	39.78
Astra Zeneca & IBM Chair	20.00	58.15	0.00	1.51	0.00	59.66	0.00	59.66
DAE - Dr.Vikram Sarabhai Chair	22.00	39.37	0.00	1.75	0.00	41.12	0.00	41.12
DRDO & CSIR Chair	30.00	73.84	0.00	2.27	0.00	76.11	0.00	76.11
Silver Jubilee Professorship -Prof. C.N.R. Rao	25.00	31.90	0.00	2.11	0.00	34.02	0.75	33.27
TOTAL- ENDOWMENT CHAIRS	**129.00**	**244.22**	**0.00**	**10.06**	**0.00**	**254.29**	**4.35**	**249.94**
RELIANCE INDUSTRIES								
Prof.Linus Pauling Professorship	**84.34**	**55.56**	**0.00**	**6.95**	**0.00**	**62.51**	**15.39**	**47.12**
OTHER ENDOWMENT FUNDS								
Contribution from Prof.CNR Rao	4.25	14.93	0.00	0.34	0.00	15.27	0.03	15.25
Shantha Seetharamaiah Award	1.00	3.49	0.00	0.08	0.00	3.57	0.17	3.40
Bapu Narayanaswamy Prize	1.00	3.14	0.00	0.08	0.00	3.22	0.06	3.16
Prof. Roddam Narasimha Prize	2.00	3.36	0.00	0.16	0.00	3.53	0.06	3.47
Prof. M.K.Chandrashekaran Fund	5.43	5.74	0.00	0.32	0.00	6.06	0.00	6.06
Sanjay S R Rao	25.00	27.76	0.00	1.93	0.00	29.69	1.20	28.49
Indumathi Rao	34.00	36.72	0.00	3.95	0.00	40.67	2.16	38.51
Reliance Fund - Sankhyasutra	431.37	512.07	0.00	35.32	0.00	547.39	0.00	547.39
TOTAL - OTHER ENDOWMENT FUNDS	**504.05**	**607.22**	**0.00**	**42.19**	**0.00**	**649.40**	**3.68**	**645.73**
LECTURE SERIES								
Dr. A.V.Rama Rao Fund	31.00	36.28	0.00	2.62	0.00	38.90	1.68	37.22
ISRO-Dr. Satish Dhawan	14.00	24.84	0.00	1.04	0.00	25.89	0.00	25.89
DAE-Dr. Raja Ramanna	15.00	18.77	0.00	1.27	0.00	20.04	0.79	19.25
DBT-Prof. V Ramalingaswamy	7.00	12.95	0.00	0.52	0.00	13.47	0.00	13.47
TOTAL - LECTURE SERIES	**67.00**	**92.84**	**0.00**	**5.45**	**0.00**	**98.29**	**2.47**	**95.82**
C.N.R. RAO HALL OF SCIENCE FUND	**170.00**	**232.93**	**0.00**	**14.27**	**0.00**	**247.19**	**20.76**	**226.43**
MATERIALS RESEARCH FUND	**341.45**	**496.85**	**150.00**	**28.28**	**0.00**	**675.13**	**142.57**	**532.56**
CENTRE'S DEVELOPMENT FUND	**1,682.07**	**4003.15**	**611.24**	**310.30**	**9.09**	**4,933.79**	**0.01**	**4,933.78**
GRAND TOTAL	**2,977.91**	**5,732.77**	**761.24**	**417.50**	**9.09**	**6,920.61**	**189.23**	**6,731.38**

SAMPA D PATRA
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Date: 2023.07.24 16:42:56 +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 2023

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.	4,30,00,000	
Opening balance	4,32,16,502		Government of India 8 % Bonds (SHCIL)	70,00,000	
Add : Subscriptions received during the year	52,31,260		Fixed Deposits at PNB housing finance	2,10,00,000	7,10,00,000
Advances repayments	4,60,721				
Interest on subscriptions	32,28,640		**Cash at Bank :**		
Sub total	5,21,37,123		Canara Bank, SB A/C No. 0683101017513	1,31,25,553	1,31,25,553
Less : Advances granted	3,03,614				
Less : Part final / Final settlement	21,56,370		**TDS receivable :**		
Sub total	24,59,984		For the F.Y. 2012-13	1,48,000	
Closing balance		4,96,77,139	For the F.Y. 2014-15	1,48,000	
			For the F.Y. 2015-16	1,49,400	
Contribution :			For the F.Y. 2018-19	1,40,020	
Opening balance	3,26,45,156		For the F.Y. 2022-23	25,54,250	31,39,670
Add : Contribution during the year	20,36,026				
Interest on total contributions	23,00,208		**Accrued interest :**		
Sub total	3,69,81,390		Accrued interest on deposit in GoI 8 % Bonds (SHCIL)	38,99,780	
Less : Final settlement	18,49,128		Accrued interest on Deposit in PNB housing finance	39,83,537	
Closing balance		3,51,32,262	Accrued interest on Deposit in HDFC Ltd.	3,15,962	81,99,279
Balance surplus/deficit (-)		1,06,55,101			
Total		9,54,64,502	**Total**		9,54,64,502

For Jawaharlal Nehru Centre for Advanced Scientific Research

For Mallya & Mallya
Chartered Accountants
FRN : 001955S

C S PRASHANTH
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C S PRASHANTH
Partner
Membership No. : 218355
Place : Bangalore,
Date : 24-07-2023

GIRIDHAR UDAPI RAO KULKARNI
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Prof. G.U. Kulkarni
President

JOYDEEP DEB
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Joydeep Deb
Administrative Officer

SAMPAD PATRA
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Date: 2023.07.24 16:43:37 +05'30'

Sampad Patra
Accounts Officer

Mallya & Mallya Bangalore Chartered Accountants

JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH							
Details of Scheme funds for the financial year 2022-23							
		Opening Balance		Additions to	Utilisation /	Closing Balance	
Sl. No.	Code	Debit	Credit	the Funds	Expenditure	Debit	Credit
1	4164	25,813	0	0	0	25,813	0
2	4176	0	1,91,625	0	1,91,625	0	0
3	4179	0	98,108	0	98,108	0	0
4	4197	0	82,042	0	82,042	0	0
5	4215	0	10,000	0	10,000	0	0
6	4235	0	62,793	0	62,793	0	0
7	4238	0	16,42,830	0	0	0	16,42,830
8	4254	3,12,285	0	0	0	3,12,285	0
9	4267	0	1,62,265	0	1,62,265	0	0
10	4270	0	20,000	0	20,000	0	0
11	4272	3,219	0	0	0	3,219	0
12	4276	12,352	0	0	0	12,352	0
13	4277	0	5,80,488	0	14,440	0	5,66,048
14	4282	0	3,14,167	0	3,14,167	0	0
15	4284	0	30,162	0	30,162	0	0
16	4286	33,549	0	0	0	33,549	0
17	4288	6,16,803	0	0	0	6,16,803	0
18	4292	54,112	0	0	0	54,112	0
19	4294	18,36,463	0	0	0	18,36,463	0
20	4297	99,865	0	0	0	99,865	0
21	4298	2,85,189	0	0	0	2,85,189	0
22	4300	19,02,409	0	0	0	19,02,409	0
23	4301	1,89,347	0	0	0	1,89,347	0
24	4302	1,07,814	0	0	0	1,07,814	0
25	4308	0	2,39,309	0	2,39,309	0	0
26	4312	1,52,000	0	0	0	1,52,000	0
27	4313	0	2,01,186	0	2,01,186	0	0
28	4314	3,77,469	0	0	0	3,77,469	0
29	4318	1,212	0	0	0	1,212	0
30	4319	15,985	0	0	0	15,985	0
31	4320	62,558	0	0	0	62,558	0
32	4324	0	24,30,582	0	1,87,802	0	22,42,780
33	4325	0	24,994	0	24,994	0	0
34	4327	47,323	0	0	0	47,323	0
35	4333	4,83,351	0	0	0	4,83,351	0
36	4334	5,41,134	0	0	0	5,41,134	0
37	4336	0	6,45,799	0	83,766	0	5,62,033
38	4337	3,02,836	0	0	0	3,02,836	0
39	4342	0	6,53,182	0	5,57,424	0	95,758
40	4344	1,09,450	0	0	0	1,09,450	0
41	4346	0	9,40,756	0	5,07,670	0	4,33,086
42	4351	1,59,277	0	0	0	1,59,277	0
43	4353	0	30,30,080	0	30,30,080	0	0
44	4354	0	1,45,197	0	0	0	1,45,197
45	4355	63,842	0	0	0	63,842	0

46	4357	0	3,85,856	0	0	0	3,85,856
47	4360	93,562	0	0	0	93,562	0
48	4361	0	3,79,312	0	3,79,312	0	0
49	4362	0	96,011	0	96,011	0	0
50	4365	41,564	0	0	0	41,564	0
51	4371	2,63,624	0	0	0	2,63,624	0
52	4372	0	4,000	0	4,000	0	0
53	4375	2,66,161	0	0	0	2,66,161	0
54	4376	0	2,28,77,691	91,31,992	35,35,194	0	2,84,74,489
55	4377	0	5,60,202	0	1,78,972	0	3,81,230
56	4378	3,42,097	0	0	0	3,42,097	0
57	4384	0	1,84,528	0	1,94,883	10,355	0
58	4386	0	2,58,63,321	1,00,00,000	2,12,85,118	0	1,45,78,203
59	4387	0	1,43,23,918	3,00,00,000	1,44,18,236	0	2,99,05,682
60	4388	14,28,425	0	14,28,425	0	0	0
61	4394	0	1,00,129	6,765	1,000	0	1,05,894
62	4400	90,586	0	0	0	90,586	0
63	4402	9,71,693	0	0	0	9,71,693	0
64	4404	2,48,492	0	0	0	2,48,492	0
65	4405	15,401	0	0	0	15,401	0
66	4406	10,31,359	0	0	0	10,31,359	0
67	4409	40,413	0	0	0	40,413	0
68	4411	8,35,737	0	0	0	8,35,737	0
69	4412	19,25,456	0	0	0	19,25,456	0
70	4414	9,50,932	0	9,50,932	0	0	0
71	4419	0	2,455	0	2,455	0	0
72	4420	6,89,420	0	6,89,420	0		0
73	4422	2,97,094	0	25,68,934	15,12,921	0	7,58,919
74	4423	0	3,98,617	0	3,98,617	0	0
75	4424	2,48,936	0	2,48,936	0	0	0
76	4427	0	2,85,740	0	1,52,692	0	1,33,048
77	4428	28,23,647	0	0	13,52,205	41,75,852	0
78	4430	1,72,426	0	0	0	1,72,426	0
79	4433	33,356	0	33,356	0	0	0
80	4436	0	4,022	0	4,022	0	0
81	4442	1,22,569	0	0	0	1,22,569	0
82	4444	8,58,625	0	0	0	8,58,625	0
83	4445	77,449	0	77,449	0	0	0
84	4446	0	55,263	0	55,263	0	0
85	4448	62,018	0	61,990	61,990	62,018	0
86	4450	1,69,039	0	0	0	1,69,039	0
87	4455	0	14,599	1,06,476	0	0	1,21,075
88	4457	2,57,388	0	0	0	2,57,388	0
89	4458	49,698	0	0	0	49,698	0
90	4462	33,041	0	0	0	33,041	0
91	4467	4,604	0	0	0	4,604	0
92	4469	0	6,74,199	0	6,74,199	0	0
93	4471	16,909	0	0	0	16,909	0
94	4472	61,878	0	61,878	0	0	0
95	4475	6,324	0	0	0	6,324	0
96	4476	13,15,756	0	0	0	13,15,756	0

97	4477	83,763	0	0	0	83,763	0
98	4478	12,530	0	0	0	12,530	0
99	4483	1,22,931	0	0	0	1,22,931	0
100	4487	1,11,522	0	0	0	1,11,522	0
101	4488	2,852	0	2,852	0	0	0
102	4489	0	1,96,014	0	1,96,014	0	0
103	4492	0	12,23,202	0	12,23,202	0	0
104	4494	0	3,38,620	0	2,15,386	0	1,23,234
105	4496	0	4,06,945	0	4,06,945	0	0
106	4500	0	28,38,082	0	4,95,637	0	23,42,445
107	4501	6,63,466	0	6,43,578	1,06,707	1,26,595	0
108	4502	0	98,200	0	63,200	0	35,000
109	4503	0	10,63,974	0	10,96,391	32,417	0
110	4504	5,65,034	0	15,45,108	3,78,718	0	6,01,356
111	4505	7,58,814	0	12,05,479	4,03,951	0	42,714
112	4506	0	11,70,446	0	11,70,446	0	0
113	4514	0	7,76,733	0	8,86,594	1,09,861	0
114	4515	0	79,09,819	0	79,09,819		0
115	4519	0	29,969	0	0	0	29,969
116	4551	0	1,085	0	1,085	0	0
117	4552	0	7,23,120	0	9,16,336	1,93,216	0
118	4553	0	32,78,829	0	32,78,829	0	0
119	4554	0	2,36,654	16,00,000	16,83,746	0	1,52,908
120	4556	0	10,857	0	10,447	0	410
121	4558	0	19,351	0	2,85,275	2,65,924	0
122	4559	24,095	0	77,534	0		53,439
123	4564	7,930	0	0	0	7,930	0
124	4565	1,47,154	0	0	1,06,992	2,54,146	0
125	4566	7,247	0	36,00,000	33,99,552	0	1,93,201
126	4567	2,05,643	0	2,05,643	0	0	0
127	4568	0	9,25,731	0	9,25,731	0	0
128	4569	0	29,428	35,843	0	0	65,271
129	4570	4,94,197	0	0	0	4,94,197	0
130	4571	0	52,679	0	1,39,322	86,643	0
131	4574	30,176	0	0	0	30,176	0
132	4575	0	37,74,622	0	11,02,587	0	26,72,035
133	4576	0	5,36,320	0	5,53,973	17,653	0
134	4578	0	1,88,721	33,85,000	5,25,554	0	30,48,167
135	4579	0	3,80,221	0	1,08,675	0	2,71,546
136	4580	0	4,15,977	3,722	3,96,533	0	23,166
137	4581	0	15,27,516	0	13,80,020	0	1,47,496
138	4582	0	57,36,039	15,00,000	40,78,366	0	31,57,673
139	4583	0	4,23,622	8,42,104	10,37,523	0	2,28,203
140	4585	0	10,81,969	0	10,81,969	0	0
141	4586	0	2,12,26,056	28,00,00,000	27,60,69,318	0	2,51,56,738
142	4587	9,52,244	0	42,47,794	30,18,612	0	2,76,938
143	4588	0	2,83,432	0	3,65,836	82,404	0
144	4589	0	9,16,702	0	8,47,277	0	69,425
145	4590	0	78,96,460	0	79,92,173	95,713	0
146	4591	0	53,668	40,990	0	0	94,658
147	4592	2,08,854	0	0	1,20,892	3,29,746	0

148	4593	0	11,63,294	0	10,95,958	0	67,336
149	4594	0	2,34,546	4,59,992	4,58,695	0	2,35,843
150	4595	2,522	0	33,47,190	33,40,981	0	3,687
151	4596	0	5,62,917	13,00,000	9,83,943	0	8,78,974
152	4597	0	36,175	10,00,000	5,51,514	0	4,84,661
153	4598	0	1,95,646	17,00,000	15,54,066	0	3,41,580
154	4599	89,560	0	89,560	0		0
155	4601	0	51,174	0	98,811	47,637	0
156	4602	0	16,99,105	0	1,86,773	0	15,12,332
157	4603	0	5,06,089	12,00,000	11,27,674	0	5,78,415
158	4604	0	5,05,094	12,00,000	12,32,206	0	4,72,888
159	4605	0	2,90,633	0	1,03,527	0	1,87,106
160	4606	4,58,547	0	15,00,000	10,29,465	0	11,988
161	4607	0	8,58,086	15,73,610	15,30,512	0	9,01,184
162	4608	0	9,156	2,00,000	2,09,156	0	0
163	4609	0	4,84,193	8,50,000	7,59,104	0	5,75,089
164	4610	0	4,92,866	14,00,000	18,18,468	0	74,398
165	4611	1,34,036	0	8,50,083	6,40,248	0	75,799
166	4614	0	3,61,191	15,00,000	18,61,191	0	0
167	4615	0	3,87,584	19,00,000	21,08,357	0	1,79,227
168	4616	0	27,27,192	9,00,000	20,91,393	0	15,35,799
169	4617	0	65,836	13,00,000	13,65,836	0	0
170	4618	0	3,09,758	15,00,000	18,09,758	0	0
171	4619	0	9,64,146	0	0		9,64,146
172	4620	0	1,31,510	69,678	0	0	2,01,188
173	4621	0	6,55,998	0	1,84,455	0	4,71,543
174	4622	0	22,449	11,56,086	11,61,837	0	16,698
175	4623	0	84,48,241	0	79,51,338	0	4,96,903
176	4624	0	12,10,928	9,60,000	7,49,463	0	14,21,465
177	4627	0	2,56,775	19,00,000	16,85,242	0	4,71,533
178	4629	0	80,359	3,04,700	1,750	0	3,83,309
179	4630	0	46,193	0	16,054	0	30,139
180	4632	10,46,345	0	14,04,092	2,00,332	0	1,57,415
181	4633	0	5,21,357	0	10,000	0	5,11,357
182	4634	0	12,51,053	0	6,99,271	0	5,51,782
183	4635	0	2,690	0	39,657	36,967	0
184	4636	63,829	0	63,829	0	0	0
185	4637	0	2,13,358	16,86,000	17,13,755	0	1,85,603
186	4638	0	9,02,403	9,60,000	18,53,925	0	8,478
187	4640	0	11,89,000	0	0	0	11,89,000
188	4642	0	15,12,996	0	12,67,141	0	2,45,855
189	4643	0	4,01,255	15,00,000	6,82,712	0	12,18,543
190	4644	0	2,83,897	0	2,47,277	0	36,620
191	4645	0	18,13,766	12,00,000	25,17,606	0	4,96,160
192	4647	33,694	0	8,50,000	8,16,306	0	0
193	4648	11,814	0	10,89,209	10,77,395	0	0
194	4650	0	2,58,885	0	2,58,885	0	0
195	4651	0	1,82,942	0	63,691	0	1,19,251
196	4652	0	1,68,729	0	1,60,897	0	7,832
197	4653	0	12,470	3,35,000	3,34,838	0	12,632
198	4654	0	3,99,193	0	3,73,501	0	25,692

199	4655	0	11,76,227	20,00,000	6,28,199	0	25,48,028
200	4656	0	2,24,173	13,00,000	5,96,773	0	9,27,400
201	4657	52,758	0	19,00,000	12,23,967	0	6,23,275
202	4658	0	12,61,893	0	7,69,642	0	4,92,251
203	4659	0	23,257	10,68,400	10,91,657	0	0
204	4662	0	24,86,000	0	14,83,085	0	10,02,915
205	4663	0	13,71,910	0	11,61,875	0	2,10,035
206	4664	0	25,35,490	0	16,11,514	0	9,23,976
207	4674	0	10,08,992	0	6,53,385	0	3,55,607
208	4660	0	50,269	12,47,600	11,28,528	0	1,69,341
209	4661	0	1,28,650	0	1,16,640	0	12,010
210	4675	0	6,83,747	17,15,178	23,24,031	0	74,894
211	4676	0	14,74,817	0	1,12,371	0	13,62,446
212	4677	0	2,643	4,99,200	4,27,321	0	74,522
213	4679	0	3,61,873	15,00,000	14,01,857	0	4,60,016
214	4680	0	75,99,669	1,00,00,000	77,86,869	0	98,12,800
215	4681	0	7,41,527	9,65,033	11,31,742	0	5,74,818
216	4682	0	4,87,760	0	4,85,378	0	2,382
217	4683	0	8,21,638	0	1,95,082	0	6,26,556
218	4684	0	13,53,829	23,96,948	25,53,802	0	11,96,975
219	4685	0	13,63,650	7,00,000	10,37,850	0	10,25,800
220	4686	0	35,27,947	0	25,47,452	0	9,80,495
221	4687	0	12,92,25,316	2,94,91,525	3,02,53,955	0	12,84,62,886
222	4688	0	8,82,905	12,30,000	6,89,430	0	14,23,475
223	4689	0	29,45,649	0	8,14,693	0	21,30,956
224	4690	0	9,16,248	0	8,97,804	0	18,444
225	4691	0	9,70,297	0	9,50,860	0	19,437
226	4692	0	9,70,297	0	9,06,960	0	63,337
227	4693	0	10,00,931	0	9,84,512	0	16,419
228	4694	0	10,50,934	0	9,24,541	0	1,26,393
229	4696	0	3,38,65,603	0	26,43,456	0	3,12,22,147
230	4697	0	13,97,589	12,03,300	26,00,889	0	0
231	4698	0	21,24,591	0	17,39,615	0	3,84,976
232	4699	0	11,18,400	0	8,13,931	0	3,04,469
233	4700	0	38,18,185	7,50,000	27,88,604	0	17,79,581
234	4701	0	27,34,560	0	26,30,786	0	1,03,774
235	4702	0	76,68,649	0	71,45,550	0	5,23,099
236	4703	0	19,88,817	0	12,01,621	0	7,87,196
237	4704	0	11,18,400	0	11,03,853	0	14,547
238	4705	0	2,36,08,013	0	1,45,45,072	0	90,62,941
239	4706	0	0	3,65,00,000	2,22,49,659	0	1,42,50,341
240	4715	0	0	24,92,000	19,63,651	0	5,28,349
241	4716	0	0	16,02,850	6,76,669	0	9,26,181
242	4717	0	0	38,82,200	6,65,930	0	32,16,270
243	4718	0	0	16,81,532	1,84,232	0	14,97,300
244	4720	0	0	5,12,000	5,12,000	0	0
245	4721	0	0	3,35,000	21,261	0	3,13,739
246	4722	0	0	6,00,000	4,46,804	0	1,53,196
247	4723	0	0	25,88,370	20,132	0	25,68,238
248	4724	0	0	39,74,400	3,02,576	0	36,71,824
249	4725	0	0	20,00,000	2,50,000	0	17,50,000

250	4726	0	0	54,600	54,600	0	0
251	4727	0	0	13,90,670	3,60,500	0	10,30,170
252	4728	0	0	1,11,34,000	93,35,046	0	17,98,954
253	4729	0	0	7,36,280	2,38,760	0	4,97,520
254	4730	0	0	3,99,967	1,75,000	0	2,24,967
255	4731	0	0	12,87,500	3,85,952	0	9,01,548
256	4732	0	0	3,30,000	1,55,000	0	1,75,000
257	4733	0	0	3,30,000	1,55,000	0	1,75,000
258	4734	0	0	2,99,000	1,24,000	0	1,75,000
259	4735	0	0	1,142	0	0	1,142
260	4736	0	0	2,39,155	70,000	0	1,69,155
261	4737	0	0	1,41,097	70,000	0	71,097
262	4738	0	0	1,39,645	70,000	0	69,645
263	4739	0	0	4,05,527	70,000	0	3,35,527
264	4740	0	0	10,22,440	4,167	0	10,18,273
265	4741	0	0	32,00,000	0	0	32,00,000
266	4742	0	0	74,88,000	0	0	74,88,000
267	4743	0	0	4,92,440	0	0	4,92,440
268	4744	0	0	2,14,83,000	0	0	2,14,83,000
269	6001	0	56,75,865	0	0	0	56,75,865
270	6003	0	33,00,847	0	33,00,847	0	0
271	6004	0	8,28,29,839	4,13,07,935	4,40,43,408	0	8,00,94,366
272	6005	0	14,96,872	0	0	0	14,96,872
273	6006	0	79,81,127	15,72,247	0	0	95,53,374
274	P.D.F.	0	56,99,959	44,06,841	29,63,612	0	71,43,188
275	O.C.B.	0	29,78,77,557	8,82,06,053	9,11,23,804	0	29,49,59,806
		2,99,32,893	82,63,11,030	69,17,54,304	70,82,27,282	2,37,58,377	80,36,63,536

Mallya & Mallya Bangalore Chartered Accountants

SAMPA D PATRA

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Date: 2023.07.24 16:44:43 +05'30'

Sampad Patra
Accounts Officer

NOTES

NOTES

Azadi Ka Amrit Mahotsav

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