



**J N C A S R**

**Jawaharlal Nehru Centre for  
Advanced Scientific Research**

# **ANNUAL REPORT**

**2021-2022**

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ADVANCED SCIENTIFIC RESEARCH**

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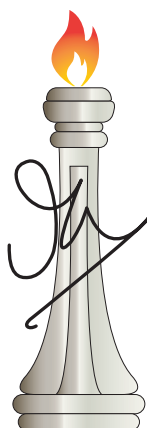
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# ANNUAL REPORT 2021-2022



**J N C A S R**

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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 33<sup>rd</sup> Annual Report of our Centre, which reflects our success story of bouncing back from the challenges of the current pandemic.

On behalf of Council of Management, I extend a hearty welcome to Dr. Srivari Chandrasekhar, who took over as Secretary, Department of Science and Technology (DST), in December 2021.

Also, I am pleased to mention here some very special recognitions and honours received by our faculty members during this period: our colleague and Honorary Professor of our Centre, Prof. Ajay K. Sood, F.R.S., has been appointed the Principal Scientific Adviser to the Government of India; and another of our colleagues Prof. Umesh V. Waghmare, Professor and Dean, Faculty Affairs, was elected as the President of Indian Academy of Sciences (IASc). It is also a proud moment when two of our faculty members, Prof. T. Govindaraju and Dr. Kanishka Biswas have won one of the most prestigious science awards of the country, the CSIR Shanti Swarup Bhatnagar Prize 2021 for the Chemical Sciences. Congratulations to all of them.

The pandemic did not deter our faculty and research scholars/students in achieving their scientific pursuits and bagging awards, fellowships, and honours. We received institutional recognitions during the pandemic times: We stood 7<sup>th</sup> among universities in India as per the Scimago Institutional Rankings and 23<sup>rd</sup> among the top 50 rising institutions in Materials Science, globally, as per Nature Index 2021.

Taking the recognition of the Centre to newer heights, our faculty members continue to get awards and honours. Prof. C. N. R. Rao received the International Eni Award for Research in Energy Frontiers on 14<sup>th</sup> October 2021 from the Italian President. Other faculty members have received honours such as the Sir C. V. Raman Young Scientist Award, fellowships/memberships of prestigious science societies and international organisations viz. the Royal Society of Chemistry, World Health Organization Committee, and many more. One of our faculty members has also received support from DST, Govt. of India, to set up the National Centre of Excellence in Carbon Capture and Utilisation (NCOE-CCU). Our students, too, have received several honours/awards. One of our start-ups BREATHE, won the National Award for Technology Start-ups from the Government of India for developing a novel CO<sub>2</sub> reduction technology. A complete list of the honours/awards received by faculty members and students can be seen inside. Hearty congratulations to all of them!

Furthermore, our student strength continues to increase despite the pandemic. With the intake of 67 new students, our student strength stands at 337. A total of 57 degrees were awarded, which include the Ph.D., Int. Ph.D, M.S., MSc Chemistry, and P.G.D.M.S. degrees.

I would like to extend a hearty welcome to our new colleagues, Dr. Pratap Vishnoi, who joined as DST Ramanujan Fellow in the International Centre for Materials Science and the New Chemistry Unit, and Dr. Achira Roy, who joined as DBT Ramalingaswami Fellow in the Neuroscience Unit. I also feel honoured

# FOREWORD

to welcome Prof. T. K. Chandrashekar, Prof. Gagandeep Kang, Prof. D. D. Sarma, and Prof. A. K. Sood for joining us as Honorary Professors.

During this period, the Centre signed several agreements and memorandums of association (MoAs). Notably, among them are technology license agreements with ICAR-NBAIR, a research agreement with Tata Steel Ltd., and an MoA with the Department of Biotechnology (DBT). On the publications front, the Centre witnessed 255 publications and received 11 patent grants.

Our science outreach activities were vibrant with various interactive lecture programmes for the benefit of school teachers and students. As part of Azadi ka Amrit Mahotsav, we celebrated India's 75<sup>th</sup> year of Independence, International Yoga Day, National Science Day, and many other events.

We had the privilege of hosting a visit by the Hon'ble Vice President of India, Shri Venkaiah Naidu (accompanied by the Hon'ble Governor of Karnataka and Hon'ble Chief Minister) on 16<sup>th</sup> August 2021. Shri Naidu laid the foundation stone of the "Innovation and Development Centre" at the Arkavathy Campus.

Unfortunately, nature wreaked havoc this year. Due to heavy monsoon rains our campus was flooded, and this caused severe damage to our laboratories and buildings. The Centre took immediate steps to contain the flood. The Hon'ble Chief Minister of Karnataka, accompanied by senior officials, visited our Centre, assessed the flood damage, and instructed officials to take necessary action to avoid flooding in the future. The Centre is in touch with these officials and preventative measures are being put in place. I would like to thank the Government of Karnataka for their timely support and intervention.

During this period, we lost our dear colleague Prof. R. Kumar, an eminent chemical engineer, who had been associated with the Centre since its inception, in various capacities including intellectual property rights related activities.

As we continue this academic journey, let's take a clarion call for the furtherance of JNCASR's academic and research capabilities.

Finally, I would like to thank every member of JNCASR for upholding the Centre's objectives and for making this yet another successful year. I take this opportunity to thank the Department of Science and Technology, Government of India, for their continued support.







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# 01.

# INTRODUCTION

The Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR) was established on a small 15-acre plot of land in 1989, to commemorate the birth centennial of Pandit Jawaharlal Nehru, the first Prime Minister of India. In 2002, JNCASR was recognised as an institution deemed-to-be-university by the University Grants Commission and its students have since been awarded degrees directly by the institution.

For more than three decades now, the institution has stood tall, committed to scientific and academic rigour, with its faculty and students having bagged various prestigious awards, received national and international patent grants, and published scientific breakthroughs in high impact publications. The Centre currently hosts 337 students and has 9 functional research units.



# ABOUT JNCASR

The Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR) was established in 1989—to commemorate the birth centenary of Pandit Jawaharlal Nehru, India's first Prime Minister—by the Department of Science and Technology (DST) of the Government of India. Its journey began with its main campus, erected upon a 15-acre tract of land near Jakkur granted by the Karnataka Government.

The Centre's founding President, Prof. C. N. R. Rao, who was awarded with India's highest civilian award, the Bharat Ratna, played a great role in setting up the institute and continues to be a part of JNCASR's journey. He has significantly developed research at the Centre and in his field in general over years. Since 2020, Prof. G. U. Kulkarni has been the President of JNCASR.

Over the years, the Indian Institute of Science (IISc), which is one of India's oldest and most prestigious research institutes, has also guided JNCASR's growth through a mutually beneficial partnership. Now in its 33<sup>rd</sup> year, JNCASR remains true to the goals with which it was established, continuing to support and conduct cutting-edge investigation in the sciences and engineering.

In the year 2002, the Centre obtained the status of an Institution Deemed-to-be-University. Based on the success and impact of the Centre on the scientific community in India, it was graded as Category-I Deemed-to-be University, giving it the benefits stipulated under clause-4 (Dimensions of Autonomy for Category-I Universities) of the UGC Regulations.

The academic programmes offered at JNCASR include Ph.D., Integrated Ph.D., and Master's programmes in various disciplines within the research units: the Chemistry and Physics of Materials Unit (CPMU), Engineering Mechanics Unit (EMU), Evolutionary and Integrative Biology Unit (EIBU), Geodynamics Unit (GDU), International Centre for Materials Science (ICMS), Molecular Biology and Genetics Unit (MBGU), Neuroscience Unit (NSU), New Chemistry Unit (NCU), Theoretical Sciences Unit (TSU), and the School of Advanced Materials (SAMat).

Today, JNCASR is known as one of the top institutions for scientific research in India and is steadily gaining ground internationally as a world-class research institute with the latest state-of-the-art experimental, computational, and infrastructural facilities. The Centre has earned the ranking of 8<sup>th</sup> best institution in India among over 200 institutes in the 2021 Nature Index Institutions Table. Further, JNCASR's academicians have bagged numerous patents and collaborated extensively with government and industry for the cause of scientific advancement.

The Centre's seamless transition into online modes during the course of the pandemic and smooth return to in-person activity over the last year allowed for numerous scientific outreach programmes to be conducted, with over 3,000 participants. As a testament to the high-quality research constantly undertaken at JNCASR during the year 2021–22, 42 new projects have been initiated this year with grants amounting to about ₹24.65 crores, and 133 ongoing projects have received grants amounting to approximately ₹49.28 crores. In addition, 19 patent applications (11 Indian, 8 international) were filed, and 11 patent grants (8 Indian, 3 international) were obtained by the Centre during this reporting period. With this, the Centre's total number of patent grants stand at 118.

JNCASR has had a highly impactful year, with collectively 54 students and faculty receiving awards including prestigious accolades such as the the CSIR Shanti Swarup Bhatnagar Prize, the Sir C. V. Raman Young Scientist State Award, and the 2021 Emerging Investigator for Chemical Communications award by the Royal Society of Chemistry. JNCASR continues to progress by leaps and bounds, and contributes meaningfully to the frontiers of science, engineering, and societal development.

# 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 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 2021-2022, there were no cases pertaining to the Centre that appeared before the CAT.



# YEAR AT A GLANCE

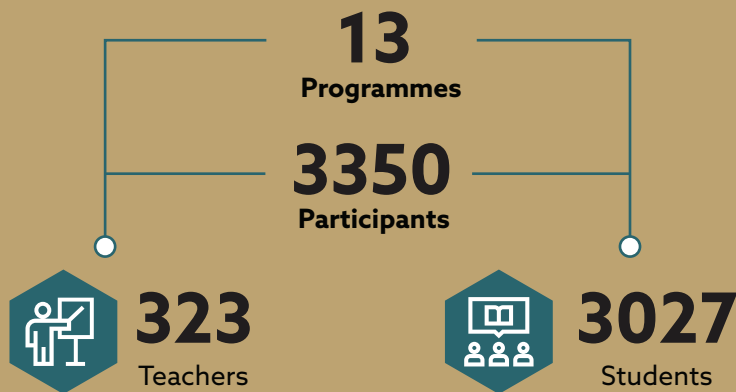
## AWARDS AND ACHIEVEMENTS



## EVENTS



## SCIENCE OUTREACH PROGRAMMES CONDUCTED BY EDUCATION TECHNOLOGY UNIT



## PUBLICATIONS



## FACULTY FELLOWSHIPS



## PATENTS GRANTED



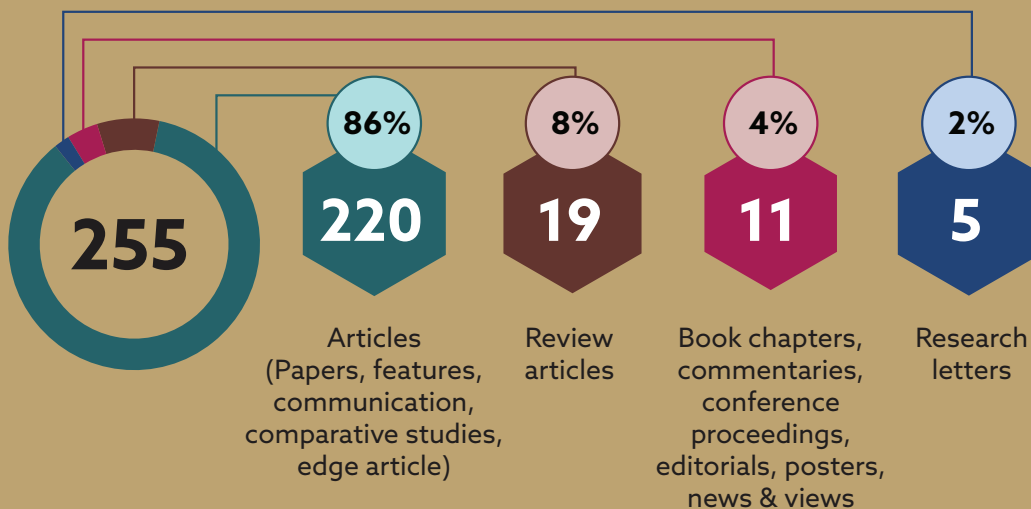
## NEW ADMISSIONS



## DEGREES AWARDED



## FACULTY PUBLICATIONS



## AVERAGE IMPACT FACTOR



# YEAR AT A GLANCE

## NEW APPOINTMENTS

- **Dr. Pratap Vishnoi**  
DST Ramanujan Fellow, NCU/ICMS (12<sup>th</sup> April 2021)
- **Dr. Achira Roy**  
DBT Ramalingaswami Re-entry Fellow, NSU (20<sup>th</sup> September 2021)
- **Prof. Hemalatha Balaram**  
Honorary Resident Professor, MBGU (1<sup>st</sup> November 2021)
- **M. R. Chandrashekhar**  
Coordinator, Security, Legal, and Campus Maintenance

## PROMOTIONS

### PROFESSOR

- Prof. Ranjan Datta
- Prof. Rajesh Ganapathy
- Prof. Jayanta Haldar

### ASSOCIATE PROFESSOR

- Dr. Sarit S. Agasti

## PATENT APPLICATIONS FILED

# 19



### 11

India

### 3

PCT

### 3

USA

### 2

Europe

## PATENTS GRANTED

# 11



### 8

India

### 2

ARIPO

### 1

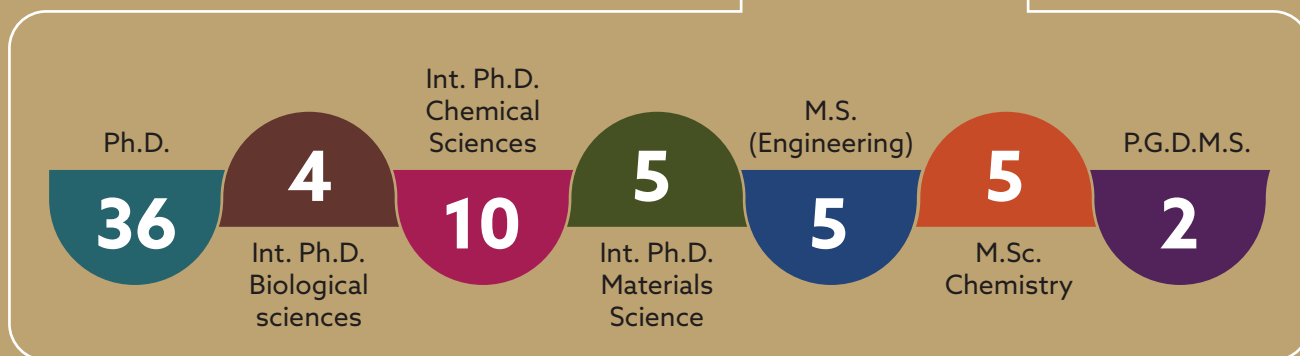
Europe

## TOTAL STUDENT STRENGTH

# 337

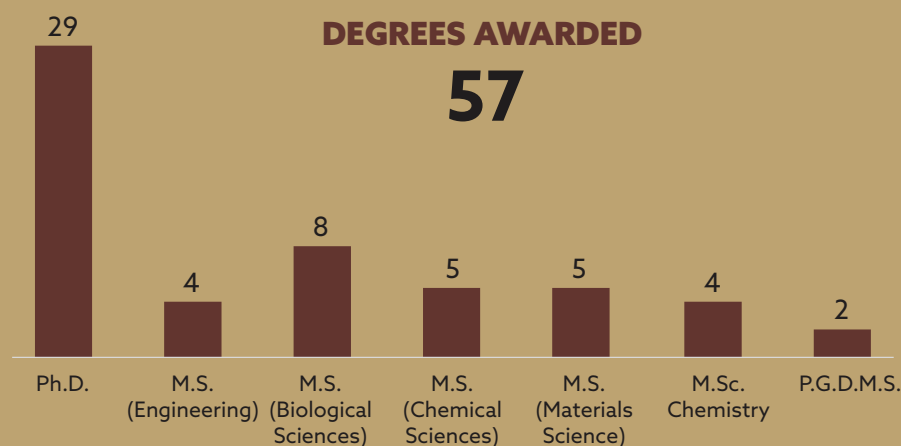
## NEW ADMISSIONS

# 67



## DEGREES AWARDED

# 57



## NEW SPONSORED PROJECTS

# 42

## TOTAL GRANT RECEIVED FOR NEW PROJECTS

# ₹24.65 cr.



# AWARDS AND ACHIEVEMENTS

## INSTITUTIONAL ACHIEVEMENTS

### NATIONAL INSTITUTE RANKING FRAMEWORK (NIRF) 2021, JNCASR RANKS



among research institutions in India

### SCIMAGO INSTITUTIONS RANKINGS 2021 (OVERALL RANK), JNCASR STANDS



among universities in India



among universities across the world

### SCIMAGO INSTITUTIONS RANKINGS 2021 (INNOVATION SECTOR), JNCASR STANDS



among universities in the world



among universities in India

### NATURE INDEX 2021, JNCASR RANKS



among top 50 rising institutions in the materials sciences globally; is only institution from India to appear on this list



among leading 200 materials science institutions globally; is one among two institutions from India on this list



among top 200 institutions in Asia Pacific region



among top 100 institutions in chemistry in Asia Pacific region

Sources: <https://www.nirfindia.org/2021/ResearchRanking.html> | <https://www.scimagoir.com/> | <https://www.nature.com/nature-index/supplements/nature-index-2021-materials-science/tables/overall> | <https://www.nature.com/nature-index/supplements/nature-index-2021-materials-science/tables/rising> | <https://www.nature.com/nature-index/annual-tables/2021/institution/all/physical-sciences/countries-India>



# AWARDS AND ACHIEVEMENTS



## TOP 5 INTERNATIONAL COLLABORATORS

01	UK Research and Innovation (UKRI)
02	French National Centre for Scientific Research (CNRS)
03	The University of Sydney (USYD)
04	University of Paris-Sud (UPSud)
05	Helmholtz Association of German Research Centres

## TOP 5 NATIONAL COLLABORATORS

01	Council of Scientific and Industrial Research (CSIR)
02	Indian Institute of Science (IISc)
03	Shiv Nadar University (SNU)
04	Indian Institute of Technology Bombay (IIT Bombay)
05	Indian Institute of Science Education and Research Mohali (IISER Mohali)

## FACULTY ACHIEVEMENTS

### AWARDS

#### **Prof. A. Sundaresan**

- Received Prof. C. N. R. Rao Oration Award Lecture 2021

#### **Prof. G. U. Kulkarni**

- Received Karnataka State Rajyotsava Award 2021

#### **Dr. Kanishka Biswas**

- Received the CSIR Shanti Swarup Bhatnagar Prize 2021 for Chemical Sciences
- Won the Silver medal of Society of Materials Chemistry
- Received the National Prize for Research in Inorganic and Physical Chemistry, donated by the C. N. R. Rao Education Foundation
- Received Merck Young Scientist Award, Chemical Science 2021
- Featured in "75 Under-50 Scientists Shaping Today's India", 2022, by the Department of Science and Technology

# AWARDS AND ACHIEVEMENTS

## **Prof. Rajesh Ganapathy**

- Featured in "75 Under-50 Scientists Shaping Today's India", 2022, by the Department of Science and Technology

## **Dr. Ravi Manjithaya**

- Received the Sir C. V. Raman Young Scientist State Award in the field of Life Sciences, Karnataka State Council for Science and Technology
- Received an award as Review Editor for *Frontiers in Aging Neuroscience Archive, Alzheimer's Disease and Related Dementias, Signaling* from Frontiers, Switzerland

## **Dr. Sarit S. Agasti**

- Named the 2021 Emerging Investigator for Chemical Communications by Royal Society of Chemistry (RSC)
- Won the Merck Young Scientist Award 2021 in the biological sciences
- Received the India Alliance Intermediate Fellowship Award

## **Dr. Sebastian C. Peter**

- Selected for the Indian National Academy of Engineering (INAE) young Innovator and Entrepreneur award
- Received support from the Department of Science and Technology (DST), Govt. of India, to set up the National Centre of Excellence in Carbon Capture and Utilisation (NCOE-CCU)
- Selected as the winner of ENRich21 Award on the theme "Preparing for the Low Carbon World", Breathe Applied Sciences Pvt. Ltd. (a start-up company from JNCASR)
- Featured in "75 Under-50 Scientists Shaping Today's India", 2022, by the Department of Science and Technology

## **Dr. Sheeba Vasu**

- Featured in "75 Under-50 Scientists Shaping Today's India", 2022, by the Department of Science and Technology

## **Prof. Subi J. George**

- Received the C. N. R. Rao National Prize for Chemical Sciences awarded by the Chemical Research Society of India (CRSI)
- Featured in "75 Under-50 Scientists Shaping Today's India", 2022, by the Department of Science and Technology

## **Prof. T. Govindaraju**

- Received the CSIR Shanti Swarup Bhatnagar Prize 2021 for Chemical Sciences
- Won the SASTRA C. N. R. Rao Award for the year 2022 for excellence in chemistry and materials science

## **Dr. T. N. C. Vidya**

- Featured in "75 Under-50 Scientists Shaping Today's India", 2022, by the Department of Science and Technology

## **Prof. Tapas Kumar Kundu**

- Received the U. N. Brahmachari 2<sup>nd</sup> Oration Award, Chemical Biology Society, Kolkata

## **Prof. Tapas Kumar Maji**

- Featured in "75 Under-50 Scientists Shaping Today's India", 2022, by the Department of Science and Technology

# AWARDS AND ACHIEVEMENTS

## FELLOWSHIPS

### **Dr. Bivas Saha**

- Received the Sheikh Saqr Career Award Fellowship from Ras Al Khaimah Centre for Advanced Materials

### **Prof. C. N. R. Rao**

- Received an Honorary Fellowship of the Karnataka Association for the Advancement of Science (KAAS) on 24<sup>th</sup> March 2022

### **Prof. G. U. Kulkarni**

- Elected as Fellow of the Indian National Science Academy (INSA), New Delhi, 2021
- Elected as Fellow of the INAE 2021

### **Prof. Hemalatha Balaram**

- Received extension on her J. C. Bose Fellowship

### **Prof. Jayanta Haldar**

- Elected as a Fellow of the Royal Society of Chemistry, 2021

### **Dr. Kanishka Biswas**

- Elected as Fellow of the Indian Academy of Sciences (FASc)

### **Dr. Premkumar Senguttuvan**

- Received Sheikh Saqr Career Award Fellowship from Ras Al Khaimah Centre for Advanced Materials

### **Dr. Ranjani Viswanatha**

- Received the SERB-POWER Fellowship

### **Prof. Tapas Kumar Kundu**

- Elected as Fellow of The National Academy of Medical Sciences (India)(FAMS)

## MEMBERSHIPS

### **Prof. Amitabh Joshi**

- Elected to a second term as an Executive Council Member of the Indian Society of Evolutionary Biologists, 2021

### **Prof. Hemalatha Balaram**

- Elected as Member, Governing Council 2022, Sun Pharma Science Foundation
- Elected as Member, Sectional Committee 2021, Sectional Committee 2022, INSA
- Elected as Member, Shanti Swarup Bhatnagar Prize, CSIR
- Elected as Convener, Sectional Committee (Biology) 2021 and 2022, Indian Academy of Sciences

### **Dr. Kanishka Biswas**

- Elected as an Editorial Advisory Board Member of *Inorganic Chemistry*, American Chemical Society (ACS); *Materials Horizons*, RSC; and *Journal of Materiomics*, Elsevier
- Elected as an Editorial Board Member of *Journal of Physics D (IOP)*, 2022 onwards

# AWARDS AND ACHIEVEMENTS

## **Prof. Kaustuv Sanyal**

- Elected as Secretary, Local Chapter, Bengaluru, of the National Academy of Sciences, India
- Became Associate Editor, *Chromosoma* (Springer)
- Elected to be a member of the Editorial Board, *Microbiology Spectrum*, American Society for Microbiology, 2021

## **Prof. Kavita Jain**

- Appointed as Associate Editor of the international journal *Evolution*

## **Prof. Maneesha Inamdar**

- Participated as an INSA nominee in the Inter Academy Partnership (IAP) Statement on regenerative medicine published on 29<sup>th</sup> July 2021 (related article is published in the journal *Stem Cell Reports*)
- Elected as a member of the World Health Organization (WHO) committee (was panellist at the international press conference on 12<sup>th</sup> July 2021 and speaker at the WHO webinar on 14<sup>th</sup> July 2021)
- Elected as a member of the Board of Reviewing Editors for the journal *eLife*
- Elected as member of the International Society for Stem Cell Research (ISSCR) Task Force to develop standards for stem cell research
- Elected as member of the ISSCR Working Group on Undifferentiated Stem cells and Pluripotency
- Became the President-elect of the Indian Society of Developmental Biology
- Elected as Member, Sectional Committee on Animal Sciences, Indian Academy of Science
- Elected as DST Nominee for the National Apex Committee of Stem Cell Research and Therapy, April 2021
- Elected as DBT Nominee for IBSC of Siddhaganga Institute of Technology, November 2021 onwards
- Elected as Member, Swarnajayanti Fellowship Committee, 2021

## **Dr. Ranjani Viswanatha**

- Selected as one of the 75 women for the project 'SHE Is: 75 women in STEAM' by the Red Dot Foundation in partnership with the Office of the Principal Scientific Adviser to the Government of India
- Became an Editorial Advisory Member of *NanoFutures*

## **Prof. Shobhana Narasimhan**

- Elected to be a member of Editorial Advisory Board, *Applied Physics Reviews*

## **Prof. Srikanth Sastry**

- Elected to be a member of Editorial Advisory Board, *Journal of Chemical Physics*
- Elected to be a member of Editorial Board, *Journal of Physics: Materials*

## **Prof. Subi J. George**

- Elected as Advisory Board Member of *Physical Chemistry Chemical Physics*, RSC, and *ACS Materials Au*

## **Prof. Subir K. Das**

- Elected as Editorial Board Member, *Soft Materials*, Taylor & Francis

## **Prof. Tapas Kumar Kundu**

- Elected as an Associate Editor in the *Journal of Biochemistry* Editorial Board
- Elected as Member, Department of Biotechnology (DBT)-Technical Expert Committee on Drug Development Program

# AWARDS AND ACHIEVEMENTS

## **Dr. T. N. C. Vidya**

- Elected to a second term as an Executive Council Member of the Indian Society of Evolutionary Biologists in June 2021
- Became a member (through invitation) of the IUCN SSC (World Conservation Union's Species Survival Commission) Asian Elephant Specialist Group, for the quadrennium 2021–25

## **Prof. Umesh V. Waghmare**

- Elected as the President of the Indian Academy of Sciences (IASc), Bengaluru
- Elected to be a member of Board of Trustees, RRI Trust
- Received Distinguished Adjunct Professorship of Chemistry in the College of Science and Technology, Temple University

## ACHIEVEMENTS BY STUDENTS AND POST-DOCS

### MOLECULAR BIOLOGY AND GENETICS UNIT

#### **Aishwarya Prakash, Alice Sinha, Prathamesh Dongre, Saloni Sinha, and Sameesh Kher**

- Received Travel Grant 2021 by International Society for Experimental Hematology

#### **Anushka Chakravorty**

- Received the Rainwater Foundation Award from Rainwater Charitable Foundation
- Received the EMBO travel grant award from European Molecular Biology Organisation

#### **Cuckoo Teresa Jetto**

- Received the Fulbright-Nehru Doctoral Research Fellowship, United States-India Educational Foundation (USIEF)

#### **Irine Maria Abraham**

- Received Best In-house Symposium Poster Prize, JNCASR

### CHEMISTRY AND PHYSICS OF MATERIALS UNIT

#### **Anjali Gaur, Kompella V. K. Srinath, and Sudarshan Behera**

- Received the Physical Chemistry Chemical Physics Poster Prize by Royal Society of Chemistry at Theoretical Chemistry Symposium, IISER, Kolkata

#### **Sourav Rudra**

- Received the Shyama Prasad Mukherjee Fellowship from CSIR India

### NEW CHEMISTRY UNIT

#### **Aditi Saraswat**

- Received the Smt. and Sri. Bapu Narayanaswamy Prize 2021 for the Best M.S. Thesis in the Chemical and Materials Sciences



# AWARDS AND ACHIEVEMENTS

## **Anustup Mukherjee**

- Received the Dr. Indumati Rao Prize 2021 for the Student with Highest CGPA in the Course work

## **Aritra Naha**

- Received the Prof. C. N. R. Rao Medal for Best Ph.D. Thesis of the Year 2021 in the Physical Sciences category

## **Geetika Dhanda**

- Won in the AMR Quest 2021 conducted by C-CAMP Centre for Cellular and Molecular Platforms, Govt. of India, for her proposal "Membrane-perturbing antibiotic adjuvants"

## **Ivy Maria**

- Received the BapuMatru Prasad Scholarship 2021 for being the Int. Ph.D. Chemical Sciences 1<sup>st</sup> year Student with Highest CGPA in Course Work

## **Saikat Ghosh**

- Received the Shyama Prasad Mukherjee Fellowship (SPMF), CSIR

## **Dr. Subham Ghosh**

- Received KPIT Poster Award, KPIT, Pune

## **Swadhin Garain**

- Received the Best Poster Award, Fluorescence Chemical Society (FCS), 2021

## NEUROSCIENCE UNIT

### **Abhilash Lakshman**

- Received the Prof. C. N. R. Rao Medal for Best Ph.D. Thesis of the Year 2021 in the Biological Sciences category

### **Aishwariya Iyengar**

- Received the Best Poster Award at the International Conference on Chronobiology 2021 organised by the Indian Society of Chronobiology and IUSSTF

### **Chitrang Dani**

- Received the Best Research Talk Award at the International Conference on Chronobiology 2021 organised by the Indian Society of Chronobiology and IUSSTF

## EVOLUTIONARY AND INTEGRATIVE BIOLOGY UNIT

### **Revathe T.**

- Received Student Travel Award by the American Society of Mammalogists to attend the 101<sup>st</sup> ASM meeting, Tucson, Arizona
- Received Travel Award by the International Society of Behavioural Ecology to attend the ISBE 2022 Conference, Stockholm, Sweden

# AWARDS AND ACHIEVEMENTS

## THEORETICAL SCIENCES UNIT

### **Bidhan Chandra Garain**

- Received the Physical Chemistry Chemical Physics Poster Prize by RSC at Theoretical Chemistry Symposium, IISER, Kolkata

### **Sachin Kaushik**

- Received the Poster Award for In-House Symposium of JNCASR

## ENGINEERING MECHANICS UNIT

### **Akanksha Bohra**

- Received the Prof. Roddam Narasimha and Family Award for the Best M.S. (Engineering) Thesis in Engineering Mechanics 2021

# MAJOR EVENTS AND CELEBRATIONS

## ENDOWMENT LECTURES

### DAE RAJA RAMANNA LECTURE IN PHYSICS 2021



Prof.  
Apoorva D. Patel



Prof.  
Abhishek Dhar

This lecture was delivered by Prof. Apoorva D. Patel from the Centre for High Energy Physics, IISc, Bengaluru, on "Quantum technology: Directions and prospects". The Prize Lecture was delivered by Prof. Abhishek Dhar from the International Centre for Theoretical Sciences, Bengaluru, on "Blast in the one-dimensional cold gas: From Newton to Euler and Navier-Stokes-Fourier". The lecture was held on 24<sup>th</sup> June 2021 in hybrid mode with YouTube livestreaming (<https://youtu.be/dUP5Vak6VXY>).

### C. N. R. RAO ORATION AWARD LECTURE 2021



This lecture was delivered by Prof. A. Sundaresan, Chair, Chemistry and Physics of Materials Unit (CPMU), JNCASR, on 7<sup>th</sup> September 2021. The title of his lecture was "Frustration in spin systems: Emergent phenomena".

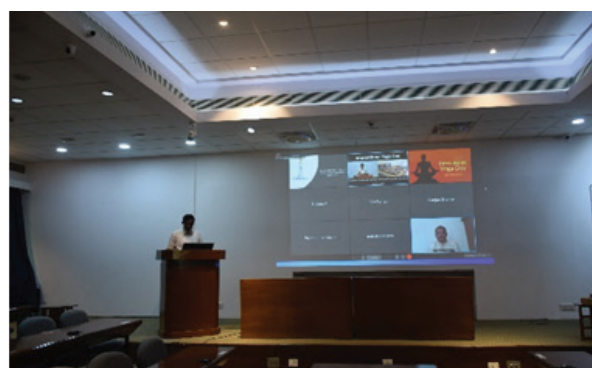
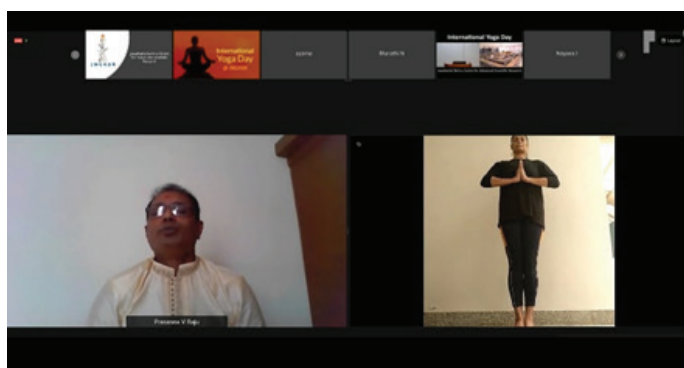
### ISRO SATISH DHAWAN LECTURE 2021



Prof. K. Kasturirangan, Honorary Distinguished Advisor, ISRO, and Emeritus Professor, National Institute of Advanced Studies, Bengaluru, delivered the ISRO Satish Dhawan Lecture at JNCASR on 22<sup>nd</sup> September 2021. The title of his talk was "My tryst with Dhawan—Some unique experiences". The lecture was attended by several eminent guests online, including Mr. Jairam Ramesh, member of the Rajya Sabha. The event was held in hybrid mode along with YouTube livestreaming (<https://youtu.be/xiHXhyzhGOQ>).

## INAUGURATIONS AND CELEBRATIONS

### INTERNATIONAL YOGA DAY



An online lecture and demonstration of asanas was organised at JNCASR on "International Yoga Day", 21<sup>st</sup> June 2021. At this event, Dr. James Chelliah, Associate Professor, JNCASR, gave an introductory talk.

# MAJOR EVENTS AND CELEBRATIONS

This was followed by a lecture delivered by Yoga Guru Shri. Prasanna V. Raju. In this talk, he shared some useful insights on the importance of yoga in everyday life. He also guided the demonstration of asanas online and discussed some helpful tips during the practice of asanas. He further answered audience queries in the concluding session. The event was livestreamed on YouTube ([https://www.youtube.com/watch?v=q\\_tyjI7tjBg-](https://www.youtube.com/watch?v=q_tyjI7tjBg-)) and was attended online through WebEx.

## RENDERING OF NATIONAL ANTHEM

Prof. G. U. Kulkarni, President, JNCASR, and the deans, faculty members, officers, staff, and students of JNCASR joined the scientific fraternity of the country online for the rendering of the national anthem as part of the celebration of the 75<sup>th</sup> year of Indian independence. The event took place at 1:30 pm on 13<sup>th</sup> August 2021. It was also attended by Dr. Jitendra Singh, Union Minister of State (MoS) (Independent Charge) for Science and Technology and the Earth Sciences, MoS, Prime Minister's Office (PMO), PP/Department of Personnel and Training (DoPT), Atomic Energy and Space; along with Prof. K. VijayRaghavan, former Principal Scientific Adviser; Prof. Ashutosh Sharma, Secretary, Department of Science and Technology (DST), and of Ministry of Earth Sciences (MoES); along with secretaries, scientists, and senior officials of Department of Biotechnology (DBT), Department of Scientific and Industrial Research (DSIR)/Centre for Scientific and Industrial Research (CSIR), MoES, Department of Space (DoS), and Department of Atomic Energy (DAE).



## INDEPENDENCE DAY

On the occasion of 75 years of India's Independence and as part of the "Azadi ka Amrit Mahotsav" celebrations, Prof. G. U. Kulkarni, President, JNCASR, hoisted the national flag along with the rendition of the national anthem. JNCASR members along with their families participated in the event. Students delivered speeches and performed a patriotic medley during the event at the Jakkur campus.





# MAJOR EVENTS AND CELEBRATIONS

## FIT INDIA FREEDOM RUN 2.0 MARATHON

To commemorate the Fit India Freedom Run 2.0 initiated by the Ministry of Youth Affairs and Sports, Government of India, as part of "Azadi ka Amrit Mahotsav", the Sports Committee of JNCASR organised a 6.3 km marathon. The run started at 5.35 am and finished at 6.40 am on 22<sup>nd</sup> August 2021. The event recorded over 120 participants including students, faculty members, and staff. All participants were given T-shirts with the branding of the "Fit India Movement" during the event.



## HINDI PAKHWADA CELEBRATION

Hindi Pakhwada Celebration was organised by JNCASR from 16<sup>th</sup> to 27<sup>th</sup> September 2021, with a series of programmes attended by the staff and students. A lecture on the achievements of Indians in the field of science and technology was given by Prof. Vidhyadhiraja N. S., Dean (Fellowships and Extension), on 24<sup>th</sup> September 2021. The programme included various competitions, such as Hindi newspaper reading, Hindi essay writing, a translation test, and a lecture in Hindi on achievements in the field of science and technology. The celebration concluded with the distribution of prizes to the winners.



## INAUGURATION OF "A GLORIOUS JOURNEY" GALLERIES I AND II

The inauguration of "A Glorious Journey" Galleries I and II and its Virtual Tour, which gives a glimpse into the personal and professional journeys of Prof. C. N. R. Rao, was held on 21<sup>st</sup> October 2021, at the Madan Mohan Malviya Amphitheatre, C. N. R. Rao Hall of Science, JNCASR. Prof. G. U. Kulkarni, President, JNCASR, inaugurated the galleries. The event was livestreamed on YouTube (<https://www.youtube.com/watch?v=8kr0cSzAB9Y>).





# MAJOR EVENTS AND CELEBRATIONS

## VIGILANCE AWARENESS WEEK

This was observed at JNCASR from 26<sup>th</sup> October to 1<sup>st</sup> November 2021, as per the notification from the Central Vigilance Commission. The theme was "Independent India @75: Self-reliance with integrity; स्वतंत्र भारत @75: सत्यनिष्ठा से आत्मनिर्भरता". The observance began with an online integrity pledge on 26<sup>th</sup> October 2021, which Prof. Kaustuv Sanyal, Vigilance Officer, administered in the presence of faculty members, staff, and students of the Centre. An online essay competition was also conducted on this occasion.

## KANNADA RAJYOTSAVA FLAG HOISTING

This was conducted at JNCASR on 1<sup>st</sup> November 2021

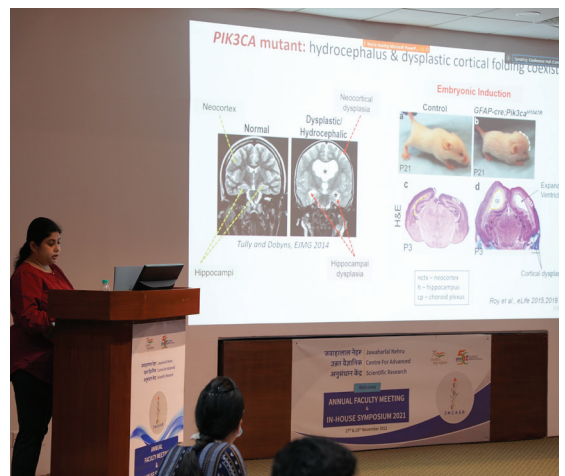
## FELICITATION TO BBMP DOCTORS AND STAFF

On 11<sup>th</sup> November 2021, Prof G.U. Kulkarni, President of the Centre, felicitated Dr. Sharada, Medical Officer at the Amruthahalli Government Medical Centre, and staff for their selfless service, support for conducting COVID-19 tests, and for organising record number of COVID-19 vaccination drive camps at JNCASR to cover all the members of the Centre. The President applauded the services of all the health workers, calling them "warriors" and thanked Dr. Sharada and each health worker for their dedicated service and untiring support to JNCASR. At the lunch-on get together, they were all presented with a certificate of appreciation and a memento.



## ANNUAL FACULTY MEETING AND IN-HOUSE SYMPOSIUM

The Annual Faculty Meeting and In-house Symposium (IHS 2021) was held in a hybrid mode during 17<sup>th</sup>-18<sup>th</sup> November 2021. Poster sessions were hosted during the afternoons and the Annual Faculty Meeting took place on the forenoon of 17<sup>th</sup> November, followed by IHS. The speakers were Dr. T. N. C. Vidya, Prof. Diwakar Venkatesan, Prof. Swapan Pati, Prof. Vidhyadhiraja N. S., Prof. Subir K. Das, Prof. Eswaramoorthy M., Prof. Anuranjan Anand, and Prof. Kavita Jain from JNCASR; Prof. Shubha Tole from TIFR, Mumbai; and Prof. Goutam Sheet from IISER Mohali. A total of 31 scientific talks were given by faculty members and students of the Centre. The event was streamed live on YouTube along with participation via Microsoft Teams.



# MAJOR EVENTS AND CELEBRATIONS

## DEGREE AWARD CEREMONY

The Degree Award Ceremony was also held on 17<sup>th</sup> November 2021. Prof. G. U. Kulkarni, President, JNCASR, distributed the degree certificates to the graduating students.



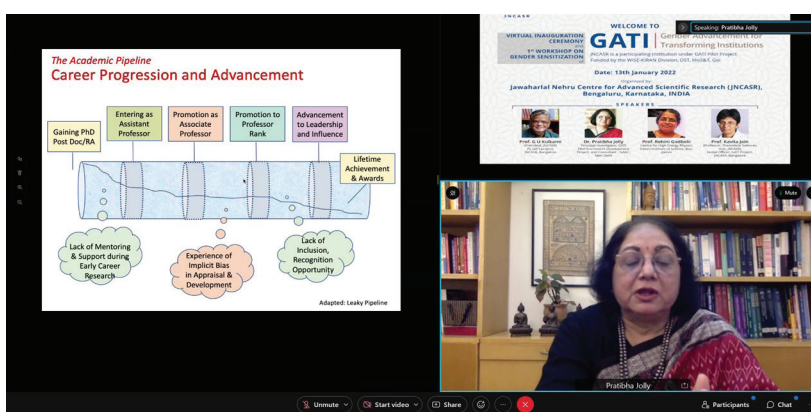
## CONSTITUTION DAY

The Constitution Day was celebrated at the Centre on 26<sup>th</sup> November 2021, wherein members of the Centre joined in through online portals for the reading of the Preamble of the Constitution along with the Hon'ble President of India.



## VIRTUAL INAUGURATION CEREMONY AND FIRST WORKSHOP ON GENDER SENSITISATION OF GATI (GENDER ADVANCEMENT FOR TRANSFORMING INSTITUTIONS)

The speakers at the event were Dr. Pratibha Jolly, Principal Investigator, GATI Pilot Framework Development Project, and Consultant, National Assessment and Accreditation Council (NAAC), New Delhi, and Prof. Rohini Godbole, Honorary Professor, Centre for High Energy Physics, IISc, Bengaluru. This event was held on Thursday, 13<sup>th</sup> January 2022.





# MAJOR EVENTS AND CELEBRATIONS

## REPUBLIC DAY CELEBRATION

During the Republic Day celebration at JNCASR on 26<sup>th</sup> January 2022, the National Flag was hoisted by Prof. G. U. Kulkarni, President, JNCASR, in the presence of faculty members, students, and other employees of the Centre. A speech on the significance of the Republic Day was delivered by Mr. M. R. Chandrashekhar, Coordinator (Security, Legal, and Campus Management). The event concluded with a cultural programme performed by students of the JNCASR Cultural Group.



## NATIONAL SCIENCE DAY

As part of Azadi Ka Amrit Mahotsav, JNCASR celebrated National Science Day 2022 on Monday, 28<sup>th</sup> February 2022. About 250 students and teachers from different colleges and schools were invited to participate in the celebration. The program began with an address by Bharat Ratna Prof. C. N. R. Rao. The participants were exposed to high-quality research facilities, live experimental demonstrations, state-of-the-art chemical heritage exposition, Bharat Ratna Prof. C. N. R. Rao's archives, and gallery. There were on-the-spot quiz competitions, with exciting prizes for the winners. Participants were guided by research scholars.



# MAJOR EVENTS AND CELEBRATIONS

## INTERNATIONAL WOMEN'S DAY AT JNCASR

As part of the celebrations at JNCASR on 7<sup>th</sup> March 2022, the Gender Advancement for Transforming Institutions (GATI) team at JNCASR organised a symposium and panel discussion on calcium channels, complex fluids, and quantum dots. The speakers were Dr. Ranjani Viswanatha from the International Centre for Materials Science (ICMS), JNCASR; Prof. Gaiti Hasan from the National Centre for Biological Sciences (NCBS), Bengaluru; and Prof. Kavita Jain from TSU, who is also Nodal Officer, GATI Project, JNCASR.



## HANDING OVER OF ENI ENERGY FRONTIERS AWARD 2020 TO BHARAT RATNA PROF. C. N. R. RAO



The gold medal bestowed on Bharat Ratna Prof. C. N. R. Rao, F.R.S., as part of the Eni International Award for Research in Energy Frontiers by the President of the Italian Republic was received at the Centre on 22<sup>nd</sup> March 2022. A programme was organised at JNCASR to hand over the gold medal to Prof. C. N. R. Rao on 23<sup>rd</sup> March 2022. On this occasion, Shri. Basavaraj Bommai, Hon'ble Chief Minister of Karnataka, felicitated Prof. C. N. R. Rao and handed over the Eni Energy Award to him. Dr. C. N. Ashwathnarayan, Hon'ble Minister of Higher Education, Hon'ble Minister of

Electronics, IT, BT, and Science and Technology, additional charge of Minister of Skill Development and Entrepreneurship and Livelihood, Govt. of Karnataka, was also present during this occasion along with Dr. (Mrs.) Indumati Rao, Hon'ble Coordinator, ETU, and Prof. G. U. Kulkarni, President, JNCASR.

## LECTURES

## NATIONAL PRIZE FOR RESEARCH IN INORGANIC AND PHYSICAL CHEMISTRY

This prize for the year 2021 was instituted by the C. N. R. Rao Education Foundation and given to Dr. Kanishka Biswas, Associate Professor, JNCASR, and Prof. R. Vaidhyanathan of IISER, Pune, during a special lecture programme on 2<sup>nd</sup> July 2021. Talks were delivered by both awardees. Prof. R. Vaidhyanathan spoke on "Covalent Organic Frameworks—modular polymers for energy science" and Dr. Kanishka Biswas spoke on "Enhanced atomic ordering leads to ultra-high thermoelectric performance."



# MAJOR EVENTS AND CELEBRATIONS

## CAREER GUIDANCE PROGRAMME

The PAIRs Office organised a lecture programme titled “How to launch your career” on 5<sup>th</sup> October 2021, for students and postdoctoral scholars at JNCASR. The speakers in this programme were Prof. Pushpalatha Murthy, Emeritus Dean and Professor, Graduate School, Michigan Technological University, USA; Prof. Manish Jain, faculty member at the Department of Physics, IISc, Bengaluru; and Prof. Shobhana Narasimhan, Faculty In-charge, PAIRs Office, JNCASR.



## NATIONAL PRIZE LECTURES IN THE CHEMISTRY OF PEPTIDES AND NUCLEIC ACIDS

Lectures on “Probing mood (structure) swings of therapeutic nucleic acid motifs” and “Peptides as cause and remedy in Alzheimer’s disease” were sponsored by the C. N. R. Rao Education Foundation and held on 26<sup>th</sup> November 2021. The speakers were Prof. S. G. Srivatsan from IISER Pune and Prof. T. Govindaraju from JNCASR.

## THE SECOND C. N. R. RAO ANNUAL MATERIALS LECTURE

This lecture was on semiconductor nanostructures for optoelectronics, energy, and neuroscience applications. The speaker for this lecture was Prof. Chennupati Jagadish from the Australian National University in Canberra, Australia, and it was held on 26<sup>th</sup> November 2021.

## 11<sup>TH</sup> SHEIK SAQR MATERIALS LECTURE

This lecture was on the challenges and successes in translating the huge promise of functional oxides into useful energy devices. Prof. Judith MacManus-Driscoll from the University of Cambridge, UK, delivered this lecture on 7<sup>th</sup> December 2021.

## THE FIRST C. N. R. RAO MATERIALS LECTURE

This lecture was given at JNCASR by Prof. Martin Jansen of the Max Planck Institute for Solid State Research in Stuttgart, Germany, on 18<sup>th</sup> December 2021.

# MAJOR EVENTS AND CELEBRATIONS

## SEMINARS

### STUDY AND CONTROL OF NON-ACOUSTIC COMBUSTION DRIVEN OSCILLATIONS IN GAS TURBINE COMBUSTORS

This lecture was delivered by Prof. Sathesh Mariappan, Associate Professor at the Department of Aerospace Engineering, IIT Kanpur, on 17<sup>th</sup> December 2021.

### TOWARDS ADAPTABLE SYSTEMS

This lecture was delivered by Dr. S. Ganga Prasath, post-doctoral researcher at the School of Engineering and Applied Sciences in Harvard University, Cambridge, USA, on 25<sup>th</sup> January 2022.

### MASKING IT ALL UP: TWO SOFT MATTER SOLUTIONS FOR THE COVID-19 PANDEMIC

This talk was delivered by Prof. Mahesh M. Bandi from Okinawa Institute of Science and Technology (OIST) Graduate University, Japan, on 25<sup>th</sup> March 2022.

### SPECIAL TRIBUTE LECTURE IN MEMORY OF PROF. NADRIAN SEEMAN

This was held on 28<sup>th</sup> March 2022 and delivered by Dr. Banani Chakraborty from IISc Bengaluru. The title of the talk was "DNA: Not merely the secret of life".

### CRITICAL ASPECTS OF THE THREE-DIMENSIONAL RANDOM-FIELD SYSTEMS

This talk was delivered by Dr. Manoj Kumar, Chemnitz University of Technology, Germany, on 30<sup>th</sup> March 2022.

## CONFERENCES

### TWAS-CASAREP CONFERENCE ON 'AIR QUALITY, WATER RESOURCES, ENERGY AND CLIMATE CHANGE'

This conference was held from 25<sup>th</sup> to 27<sup>th</sup> October 2021 and was organised by The World Academy of Sciences Central and South Asia Regional Partner (TWAS-CASAREP), Divecha Centre for Climate Change (DCCC), IISc, Bengaluru.

### INDIA AND ISRAEL WOMEN IN STEM: SHARING IDEAS AND INITIATIVES CONFERENCE

This conference was coordinated by Prof. Shobhana Narasimhan and Dr. Sharon Rashi Elkeles, and held on 24<sup>th</sup> November 2021.

# MAJOR EVENTS AND CELEBRATIONS

## INTERNATIONAL WINTER SCHOOL 2021 ON FRONTIERS IN MATERIALS SCIENCE

The conveners of this hybrid event were Prof. M. Eswaramoorthy and Prof. Umesh V. Waghmare, both of JNCASR. The event was held from 6<sup>th</sup> to 10<sup>th</sup> December 2021.

## CHEMSCI2021: LEADERS IN THE FIELD SYMPOSIUM

Prof. Subi J. George of the New Chemistry Unit (NCU), JNCASR, organised this symposium from 13<sup>th</sup> to 15<sup>th</sup> December 2021, in association with the Royal Society of Chemistry and its flagship diamond Open Access journal *Chemical Science*.

## THE 32<sup>ND</sup> ANNUAL GENERAL MEETING OF MRSI AND 3<sup>RD</sup> INDIAN MATERIALS CONCLAVE

This event was held at IIT Madras (online mode) on 21<sup>st</sup> December 2021. It was co-organised by Prof. Chandrabhas Narayana, JNCASR; Prof. P. N. Santhosh, IIT Madras; Dr. Ranjan Datta, JNCASR; Prof. S. Arumugam, Bharathidasan University, Tiruchirappalli; and Dr. S. M. Yusuf, Bhabha Atomic Research Centre (BARC), Mumbai.

## WEBINAR

## BIOIMAGE ANALYSIS: IMAGES2 NUMBERS

This virtual workshop was organised by JNCASR Science and Engineering Research Board (SERB)-Accelerate Vigyan Karyashala scheme on 16<sup>th</sup> August 2021.

## UNIT EVENTS

### CHEMISTRY AND PHYSICS OF MATERIALS UNIT (CPMU)

- CPMU Unit Day was organised on 4<sup>th</sup> September 2021, and Alumni's Materials Lecture on "Crystal engineering of adaptive smart materials: From mechanical bending to self-healing" was delivered by Prof. Chilla Malla Reddy, Department of Chemical Sciences, IISER, Kolkata.
- Workshop on advances in parasite biochemistry and structural biology was held on 29<sup>th</sup> October 2021.
- The Silver Jubilee Conference was conducted.

### ENGINEERING MECHANICS UNIT (EMU)

- A talk on the "Mechanics and high-performance computing for coastal hazards" was delivered by Dr. Ajay B. Harish from the Workshop and Programme Unit Events, Department of Civil and Environmental Engineering, University of California, Berkeley, USA, on 19<sup>th</sup> May 2021.
- A talk on "Multiscale problems in fluid mixing" was delivered by Dr. Narita Pal, Staff Scientist, Los Alamos National Laboratory, USA, on 7<sup>th</sup> July 2021.



# MAJOR EVENTS AND CELEBRATIONS

## EVOLUTIONARY AND INTEGRATIVE BIOLOGY UNIT (EIBU)

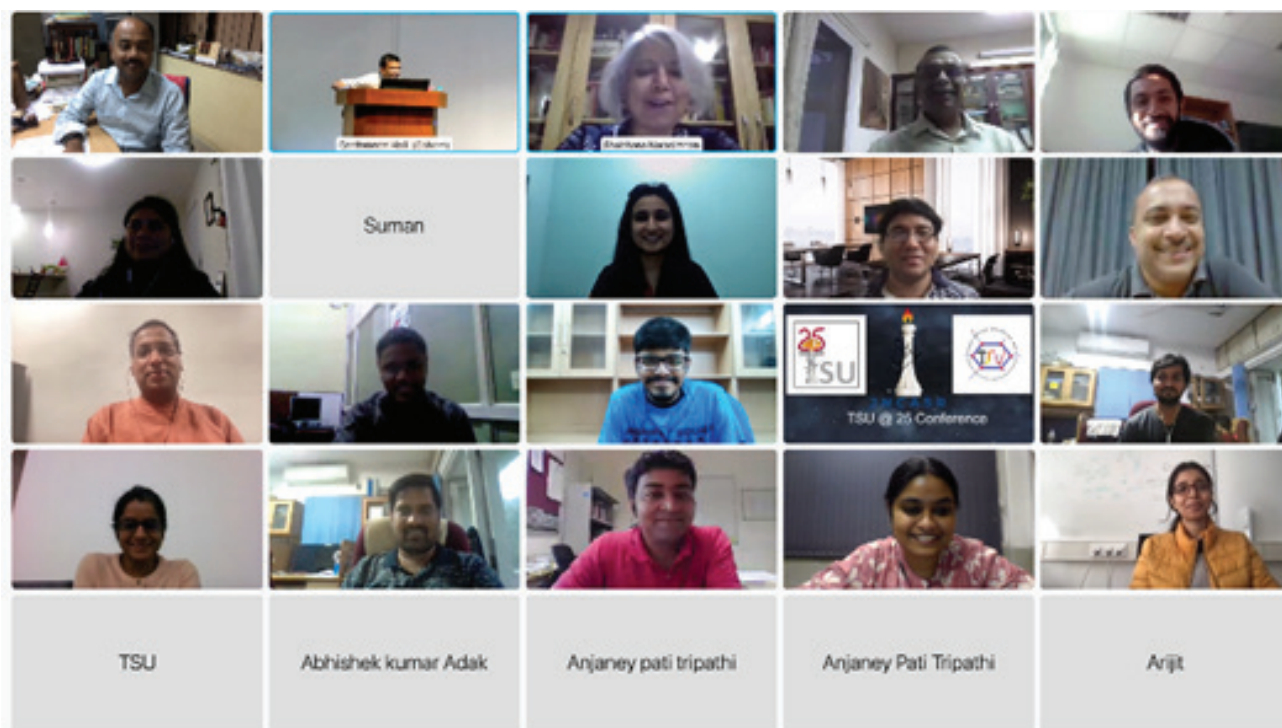
- An online talk on “Host-microbiome interactions: Insights from natural systems” was delivered by Dr. Wasimuddin from the Indian Council of Medical Research (ICMR)–National Institute of Malaria Research on 3<sup>rd</sup> September 2021.

## NEUROSCIENCE UNIT (NSU)

- The Indo-US Science and Technology Forum (IUSSTF) funded the International Conference on Chronobiology 2021 titled “Time in the living world”. This virtual event was organised from 15<sup>th</sup> to 17<sup>th</sup> July 2021.

## THEORETICAL SCIENCES UNIT (TSU)

- TSU Day was organised on 2<sup>nd</sup> September 2021, and included a series of talks, poster presentations, quizzes, and other programmes.
- The TSU@25 conference was organised by TSU at JNCASR on 28<sup>th</sup> and 29<sup>th</sup> October 2021.
- The Silver Jubilee Colloquium on “(Non-equilibrium) Thermodynamics of classical integrable models in their thermodynamic limit” was held on 29<sup>th</sup> November 2021, and the presentation was delivered by Prof. Leticia Cugliandolo.
- The Silver Jubilee Colloquium on “Puzzles and surprises in aggregation-fragmentation kinetics” was conducted by Prof. Nikolay Brilliantov on 24<sup>th</sup> January 2022.



# MAJOR EVENTS AND CELEBRATIONS

## NEW CHEMISTRY UNIT (NCU)

- A virtual conference on thermoelectrics was organised in association with the International Thermoelectric Society from 20<sup>th</sup> to 22<sup>nd</sup> July 2021.
- An international conference on "Interdisciplinary topics in advanced materials" was organised, in collaboration with IISc and Centre for Nano and Soft Matter Sciences (CeNS), by Dr. Ranjani Viswanatha, JNCASR, from 27<sup>th</sup> to 29<sup>th</sup> July 2021.
- NCU Day was held on 1<sup>st</sup> October 2021.



- The NCU Colloquium series was launched on 25<sup>th</sup> February 2022 with Prof. K. M. Sureshan, IISER Trivandrum, as the first speaker in the series. His talk was titled "Ordered covalent and non-covalent polymers: Syntheses and applications."

## MAJOR INFRASTRUCTURAL DEVELOPMENT

### INAUGURATION OF NEW ESTATE OFFICE

The New Estate Office was inaugurated by Prof. G. U. Kulkarni, President, JNCASR, on 3<sup>rd</sup> February 2022.



### INAUGURATION OF HEALTH CENTRE ANNEX BLOCK

The Annex Block was inaugurated to augment medical facilities at JNCASR on 9<sup>th</sup> February 2022 by Prof. G. U. Kulkarni, President, JNCASR.

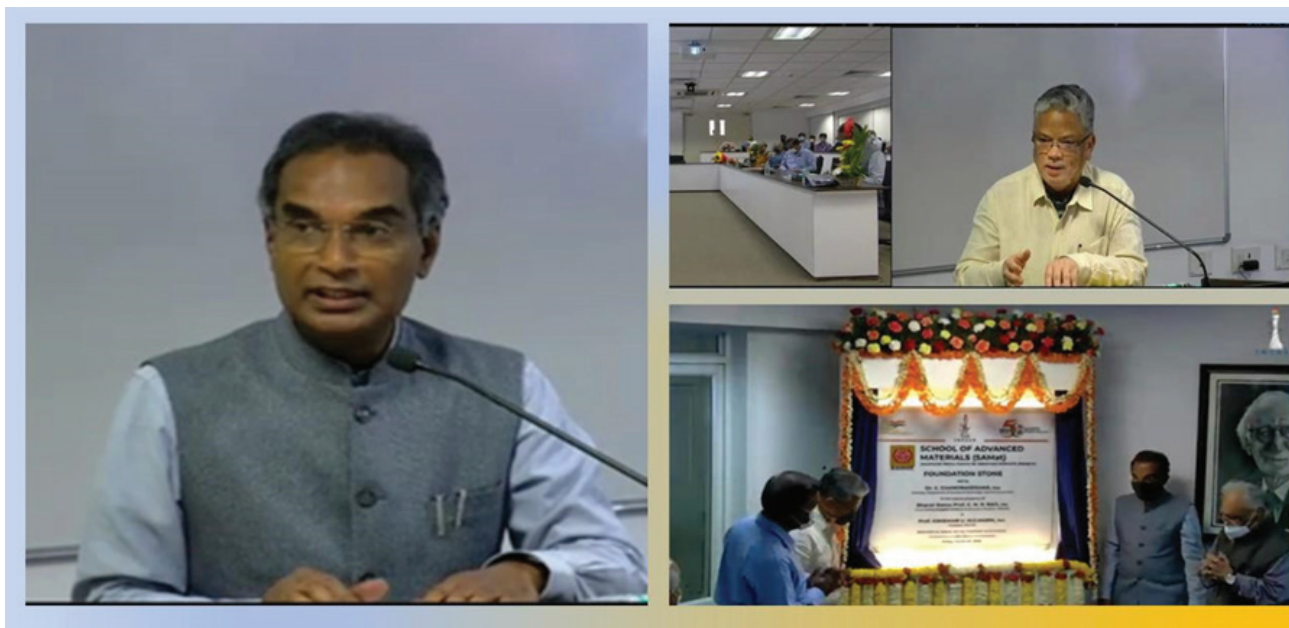




# MAJOR EVENTS AND CELEBRATIONS

## UNVEILING OF THE FOUNDATION STONE OF SAMat BUILDING

On 4<sup>th</sup> March 2022, Dr. S. Chandrasekhar, F.N.A., Secretary, DST, Government of India, unveiled the Foundation Stone of the proposed School of Advanced Materials (SAMat) building at the Jakkur campus. The ceremony was conducted in the presence of Bharat Ratna Prof. C. N. R. Rao, F.R.S.; Prof. G. U. Kulkarni, F.N.A., President, JNCASR; Directors of Raman Research Institute (RRI), Centre for Nano and Soft Matter Sciences (CeNS), and Indian Institute of Astrophysics (IIAP); Deans, Chairs of the Units, Faculty Members, and Officers of the Centre. Joydeep Deb, Administrative Officer proposed the word of thanks.



## INAUGURATION OF EXTENSION ROOM AT DAY CARE FACILITY

The Day Care Facility at the Centre has been augmented with the construction of an additional room. Prof. G. U. Kulkarni, President, JNCASR, inaugurated the facility on 10<sup>th</sup> March 2022 in the presence of the facility staff and committee members. The President congratulated the staff of the Estate and Electrical Office for providing this facility to ensure the safety of children.



# MAJOR EVENTS AND CELEBRATIONS

## EVENTS ORGANISED BY THE HINDI CELL

**17<sup>th</sup> April 2021**



During the visit by the Parliamentary Committee on Official Language and Officers from DST, the inspection questionnaire was filled in and placed before the Committee for their perusal.

In accordance with the Official Language Implementation Committee policies of the Department of Labour, Ministry of Home Affairs, Government of India, four quarterly Official Language Implementation Committee meetings were held. The President and Committee members were present in these meetings and they discussed in detail regarding the progressive use of Hindi at the Centre.



**14<sup>th</sup> June 2021**  
**31<sup>st</sup> August 2021**  
**24<sup>th</sup> December 2021**  
**28<sup>th</sup> March 2022**

**16<sup>th</sup>-27<sup>th</sup> September 2021**



Hindi week was organised, including various programmes. Winners were given cash prizes by Mr. Joydeep Deb, Administrative Officer, JNCASR, and Mr. A. N. Jayachandra, Adviser, Special Projects and Initiatives, JNCASR.

During the COVID-19 pandemic, as per the directions issued by the Ministry of Health, posters about wearing masks, maintaining social distancing, hygiene, testing temperatures, etc. were prepared in Hindi and displayed at very prominent places.



## STAFF MEMBERS OF THE HINDI CELL

Administrative Officer and Officer In-charge, Official Language: **Joydeep Deb**

Personal Secretary to Administrative Officer and In-charge, Hindi Assistant: **Swapna M.**

Translator and Trainer, Official Language: **M. G. Savadatti**

# ACTIVITIES CHART



## EDUCATION

### Academic programmes

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



## EXTENSION PROGRAMMES

### Fellowships and extension programmes

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

### Science education and education technology



## DISCUSSIONS, MEETINGS, AND OUTREACH

- 30 lectures and conferences held during 2021-2022
- 13 outreach programmes organised by the Education Technology Unit during 2021-2022



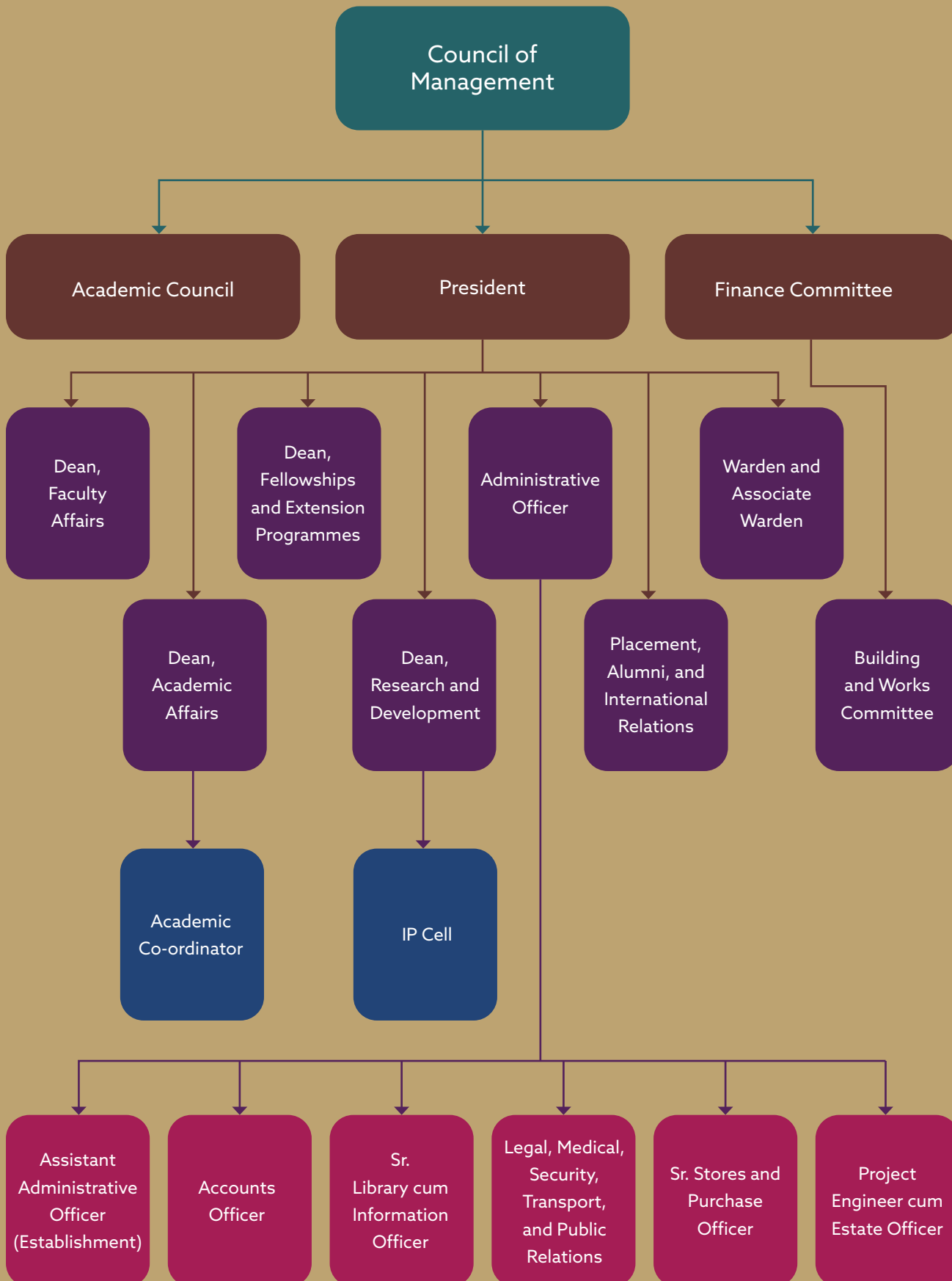
## RESEARCH

- Faculty members
- Units and Laboratories

## PUBLICATION OF MONOGRAPHS AND PROCEEDINGS



# ORGANISATIONAL CHART



# COUNCIL OF MANAGEMENT

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

The past Council of Management (2018–2022):



**Prof. Goverdhan Mehta**  
*Chairperson*  
Former Director,  
Indian Institute  
of Science (IISc),  
Bengaluru



**Prof. Virander S. Chauhan**  
*Member*  
Arturo Falaschi  
Emeritus Scientist,  
International  
Centre for Genetic  
Engineering and  
Biotechnology  
(ICGEB), New Delhi



**Prof. M. Jagadesh Kumar**  
*Member*  
Vice Chancellor,  
Jawaharlal Nehru  
University (JNU),  
New Delhi



**Prof. Vinod K. Singh**  
*Member*  
Professor,  
Indian Institute of  
Technology (IIT)  
Kanpur



**Shri K. N. Vyas**  
*Member*  
Secretary,  
Department of  
Atomic Energy (DAE)  
and  
Chairman, Atomic  
Energy Commission  
(AEC)



**Prof. Govindan Rangarajan**  
*Member*  
Director, IISc



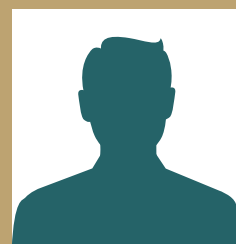
**Dr. Srivari Chandrashekar**  
*Member*  
Secretary,  
Department  
of Science and  
Technology (DST)



**Shri Vishvajit Sahay**  
*Member*  
Additional Secretary  
and Financial  
Adviser, DST



**Prof. G. U. Kulkarni**  
*Member*  
President, JNCASR



**Nominee of the Society**  
*Member*



**Prof. Sriram Ramaswamy**  
*Member*  
Professor,  
Physics Department,  
IISc



**Prof. Umesh V. Waghmare**  
*Member*  
Professor,  
Theoretical Science  
Unit (TSU) and  
Dean, Faculty  
Affairs, JNCASR



**Prof. Anuranjan Anand**  
*Member*  
Professor, Molecular  
Biology and  
Genetics Unit  
(MBGU) and  
Chair, Neuroscience  
Unit (NSU)



**Joydeep Deb**  
*Non-Member*  
Secretary  
Administrative  
Officer, JNCASR

# COUNCIL OF MANAGEMENT

The Council of Management for 2022–2026:



**Prof. V. Ramgopal Rao**  
*Chairperson*  
Former Director and Professor, Electrical Engineering Department, IIT Delhi



**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



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



**Prof. M. Jagadesh Kumar**  
*Member*  
Chairman, University Grants Commission (UGC)



**Prof. Vinod K. Singh**  
*Member*  
Professor, IIT Kanpur



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



**Prof. R. Murugavel**  
*Member*  
Professor, IIT Mumbai



**Prof. Raghavan Varadarajan**  
*Member*  
Professor, Molecular Biophysics Unit, IISc



**Prof. H. P. Khincha**  
*Member*  
Advisor, IISc



**Prof. Umesh V. Waghmare**  
*Member*  
Professor, TSU and Dean, Faculty Affairs, JNCASR



**Prof. Eswaramoorthy M.**  
*Member*  
Dean, Academic Affairs, JNCASR



**Prof. Shobhana Narasimhan**  
*Member*  
Professor, TSU



**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.

During 2018–2022, the members of the Finance Committee were:

NAME AND DESIGNATION	POSITION
<b>Prof. G. U. Kulkarni</b> , President, JNCASR	Chairperson (Ex-officio)
<b>Prof. Vinod K. Singh</b> , Professor, IIT Kanpur	Member
<b>Prof. N. Balakrishnan</b> , Professor, IISc	Member
<b>Prof. Umesh V. Waghmare</b> , Dean, Faculty Affairs, JNCASR	Member
<b>Shri Vishvajit Sahay</b> , Additional Secretary and Financial Adviser, DST	Member
<b>Sampad Patra</b> , Accounts Officer, JNCASR	Member (Ex-officio)
<b>Joydeep Deb</b> , Administrative Officer, JNCASR	Non-Member Secretary (Ex-officio)

The members of the Finance Committee for 2022–2026 are:

NAME AND DESIGNATION	POSITION
<b>Prof. G. U. Kulkarni</b> , President, JNCASR	Chairperson (Ex-officio)
<b>Prof. Umesh V. Waghmare</b> , Dean, Faculty Affairs, JNCASR	Member
<b>Shri Vishvajit Sahay</b> , Additional Secretary and Financial Adviser, DST	Member (Ex-officio)
<b>Prof. K. N. Ganesh</b> , Director, IISER Tirupati	Member
<b>R. Mohan Das</b> , Former Registrar, IISc	Member
<b>Sampad Patra</b> , Accounts Officer, JNCASR	Member (Ex-officio)
<b>Joydeep Deb</b> , 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 Academic Council for 2021–2023:

NAME AND DESIGNATION	POSITION
<b>Prof. G. U. Kulkarni</b> , President, JNCASR	Chairperson (Ex-officio)
<b>Prof. Umesh V. Waghmare</b> , Dean, Faculty Affairs, JNCASR	Dean (Ex-officio)
<b>Prof. Eswaramoorthy M.</b> , Dean, Academic Affairs, JNCASR	Dean (Ex-officio)
<b>Prof. K. R. Sreenivas</b> , Dean, Research & Development, JNCASR	Dean (Ex-officio)
<b>Prof. Vidhyadhiraja N. S.</b> , Dean, Fellowships and Extension Programmes, JNCASR	Dean (Ex-officio)
<b>Prof. Ranjan Datta</b> , Coordinator, Int. Ph.D. for Materials Science, JNCASR	Faculty Member of the Centre (Ex-officio)

# COMMITTEES

NAME AND DESIGNATION	POSITION
<b>Prof. Kaustuv Sanyal</b> , Coordinator, Int. Ph.D. for Biology, JNCASR	Faculty Member of the Centre (Ex-officio)
<b>Prof. T. Govindaraju</b> , Chair, Education Technology Unit, JNCASR	Faculty Member of the Centre (Ex-officio)
<b>Prof. Shobhana Narasimhan</b> , Faculty In-charge, Placement, Alumni and International Relations, JNCASR	Faculty Member of the Centre (Ex-officio)
<b>Prof. Jayanta Haldar</b> , Coordinator for M.Sc. Chemistry, JNCASR	Faculty Member of the Centre (Ex-officio)
<b>Dr. Sebastian C. Peter</b> , Coordinator, Int. Ph.D. for Chemical Sciences, JNCASR	Faculty Member of the Centre (Ex-officio)
<b>Prof. N. Ravishankar</b> , Professor, Department of Materials Research Centre, IISc	Member
<b>Prof. Ashok K. Ganguli</b> , Institute Chair Professor and Director (Strategy and Planning), Department of Chemistry, IIT Delhi	Member
<b>Prof. Anand K. Bachhawat</b> , Professor, Department of Biological Sciences, IISER Mohali	Member
<b>Prof. Vijay Chandru</b> , Distinguished Technologist, IISc	Member
<b>Prof. P. Seshu</b> , Director, IIT Dharwad	Member
<b>Prof. Leena Chandran-Wadia</b> , Senior Fellow, Observer Research Foundation, Mumbai	Member
<b>Joydeep Deb</b> , Administrative Officer, JNCASR	Secretary (Ex-officio)
<b>Dr. Princy P. Pereira</b> , Academic Coordinator, JNCASR	Controller of Examination (Ex-officio)

## 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
<b>Prof. T. K. Chandrashekar</b>	Senior Professor, School of Chemical Sciences, National Institute of Science Education and Research (NISER)
<b>Prof. Gagandeep Kang</b> , <i>F.R.S.</i>	Professor of Microbiology, The Wellcome Trust Research Laboratory, Division of Gastrointestinal Sciences, Christian Medical College
<b>Prof. T. V. Ramakrishnan</b> , <i>F.R.S.</i>	Emeritus Professor, Department of Physics, Banaras Hindu University
<b>Prof. D. D. Sarma</b>	Honorary Professor, Solid State and Structural Chemistry Department, IISc
<b>Prof. A. K. Sood</b> , <i>F.R.S.</i>	Principal Scientific Adviser to the Government of India



# ADMINISTRATION

POSITION	NAME OF THE MEMBER
President	<b>G. U. Kulkarni</b> , Ph.D., F.A.Sc., F.N.A.Sc., F.N.A.E., F.N.A.
Dean, Faculty Affairs	<b>Umesh V. Waghmare</b> , Ph.D., F.A.Sc., F.N.A.Sc., F.N.A.E., F.N.A.
Dean, Academic Affairs	<b>Eswaramoorthy M.</b> , Ph.D.
Dean, Fellowships and Extension Programmes	<b>Vidhyadhiraja N. S.</b> , Ph.D.
Dean, Research and Development	<b>K. R. Sreenivas</b> , Ph.D.
Warden and Student Counsellor	<b>Jayanta Haldar</b> , Ph.D.
Associate Warden	<b>Sheeba Vasu</b> , Ph.D.
Administrative Officer and Public Information Officer	<b>Joydeep Deb</b> , M.Sc. (Electronics), M.Sc. (Telecommunication), M.B.A. (HRM)
Assistant Administrative Officer (SG)	<b>C. S. Chitra</b> , B.Com.
Academic Coordinator	<b>Princy J. Pereira</b> , Ph.D.
Coordinator (FA, F&E, and R&D)	<b>Panneer K. Selvam</b> , M.A., M.B.A., L.L.B., Ph.D.
Accounts Officer	<b>Sampad Patra</b> , B.Com., P.G.D.C.A., M.B.A. (Finance)
Sr. Stores and Purchase Officer	<b>K. Bhaskara Rao</b> , M.Sc.
Sr. Library cum Information Officer	<b>Nabonita Guha</b> , M.L.I.S.
Sr. Secretary to President	<b>A. Srinivasan</b> , B.A.
Jr. Accounts Officer	<b>B. Venkatesulu</b> , B.Sc.
Assistant Public Information Officer	<b>Susheela G.</b> , B.Sc.
Project Engineer	<b>Mahadevan N.</b> , B.E., M.I.E.
Project Engineer Gr. II	<b>Nadiger Nagaraj</b> , D.C.E.
Assistant Project Engineer (Electronics)	<b>Sujeeth Kumar S.</b> , D.E.E.
Junior Project Engineer (Civil)	<b>Veerasha N. R.</b> , D.C.E.
Chief Medical Officer	<b>G. R. Nagabhushana</b> , M.B.B.S., F.C.C.P., F.C.G.P., P.G. Dip. in M&CHL
Medical Officers	<b>Kavitha Sridhar</b> , M.B.B.S. <b>Senthamarai S. Manoharan</b> , 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) <b>Elizebath Daniel</b> , M.A., M. Phil., Ph.D.
Physiotherapist	<b>Y. Yogesh</b> , B.P.T.
Adviser, Special Projects and Initiatives	<b>A. N. Jayachandra</b> , B.Com., P.G. Diploma (Finance)
Coordinator (Security, Legal, and Campus Management)	<b>M. R. Chandrasekhar</b> , B.Sc., L.L.B.
Coordinator (PR)	<b>M. G. Narayana</b>

# APPOINTMENTS, PROMOTIONS, VISITS, REPATRIATIONS, RESIGNATION, AND SUPERANNUATION

NEW APPOINTMENTS	
<b>Dr. Pratap Vishnoi</b>	DST Ramanujan Fellow, NCU/ICMS (12 <sup>th</sup> April 2021)
<b>Dr. Achira Roy</b>	DBT Ramalingaswami Re-entry Fellow, NSU (20 <sup>th</sup> September 2021)
<b>Prof. Hemalatha Balaram</b>	Honorary Resident Professor, MBGU (1 <sup>st</sup> November 2021 F/N)
<b>M. R. Chandrasekhar</b>	Coordinator, Security, Legal, and Campus Maintenance

PROMOTIONS	
<b>Prof. Ranjan Datta</b>	Promoted as Professor, ICMS
<b>Dr. Sarit S. Agasti</b>	Promoted as Associate Professor, CPMU and NCU (2 <sup>nd</sup> March 2021)
<b>Prof. Rajesh Ganapthy</b>	Promoted as Professor, ICMS (2 <sup>nd</sup> June 2021)
<b>Prof. Jayanta Halder</b>	Promoted as Professor, NCU (30 <sup>th</sup> September 2021)

ADDITIONAL RESPONSIBILITIES	
<b>Prof. K. R. Sreenivas</b> , Professor, EMU	Dean, R&D
<b>Prof. Ganesh Subramanian</b> , Professor, EMU	Chairperson, EMU
<b>Prof. Kaustuv Sanyal</b> , Professor, MBGU	Vigilance Officer
<b>Prof. M. Eswaramoorthy</b> , Professor, CPMU and Associate Director, ICMS	Dean, Academic Affairs
<b>Nabonita Guha</b> , Sr. Library cum Information Officer	Project Coordinator, GATI Data Officer related to Data and Strategy Unit (D&SU), DST
<b>Dr. James P. C. Chelliah</b> , Associate Professor, NSU	Head, CompLab
<b>Prof. Hemalatha Balaram</b> , Resident Honorary Professor, MBGU	Chairperson, Internal Grievance Committee
<b>Prof. Vidhyadhiraja N. S.</b> , Professor, TSU	Nodal Officer for Azadi Ka Amrit Mahotsav
<b>Prof. M. R. S. Rao</b> , SERB Year of Science Chair Professor, MBGU	Chair, IP Management Committee
<b>Prof. Subir K. Das</b> , Professor, TSU	Chairperson, TSU
<b>Prof. Umesh V. Waghmare</b> , Professor, TSU	Dean, Faculty Affairs
<b>Dr. Princy J. Pereira</b> , Academic Coordinator	Nodal Officer, AISHE Matters related to PAIRS Office

RE-DESIGNATION OF MEDICAL OFFICERS	
<b>Dr. G. R. Nagabhushan</b> , Consulting Medical Officer	Chief Medical Officer
Consulting Lady Medical Officers	Medical Officers

REJOINING	
<b>Prof. Tapas Kumar Kundu</b>	Professor, MBGU (1 <sup>st</sup> February 2022)
<b>Dr. Princy J. Pereira</b>	Academic Coordinator (7 <sup>th</sup> October 2021)

# APPOINTMENTS, PROMOTIONS, VISITS, REPATRIATIONS, RESIGNATION, AND SUPERANNUATION

DEPUTATION / REPATRIATION	
<b>Prof. Chandrabhas Narayana</b> , Professor, CPMU	On lien to the Rajiv Gandhi Centre for Biotechnology, Thiruvananthapuram
<b>Prof. S. M. Shivaprasad</b> , Professor, ICMS and CPMU	Lien extended by 10 months (w.e.f. August 2021)
<b>Prof. Santosh Ansumali</b> , Professor, EMU	Completed lien term at SankhyaSutra Labs and rejoined the Centre (1 <sup>st</sup> July 2021)

RESIGNATION	
<b>Dr. Meher K. Prakash</b> , Faculty Fellow, TSU	Resigned (19 <sup>th</sup> August 2021)

SUPERANNUATION	
<b>Prof. Hemalatha Balaram</b> , Professor, MBGU	Superannuated (1 <sup>st</sup> November 2021)
<b>A. V. Nagarathnamma</b> , Technical Officer Grade I, Intellectual Property Cell	Superannuated (30 <sup>th</sup> April 2021)

VISITING SCIENTISTS	
<b>Prof. Sutapa Roy</b>	IIT Gandhinagar
<b>Dr. Avanish Kumar</b>	International Centre for Theoretical Sciences, Bengaluru
<b>Dr. Mukundan Thelakkat</b>	University of Bayreuth, Germany
<b>Dr. Prashanth S. Adarakatti</b>	Assistant Professor, SVM Arts, Science and Commerce College, Ilkal, Bagalkot
<b>Dr. Khurshed A. Shah</b>	Sr. Assistant Professor, University of Kashmir
<b>Dr. Priya Brietener</b>	Faculty, Fatima College of Health Science, UAE

VISITING STUDENTS	
<b>Lingesh Guru Priyan</b>	International Centre for Materials Science (ICMS)
<b>Snigdha Sarthak</b>	Janki Devi Memorial College, Delhi University, New Delhi
<b>Nabila Tabassum</b>	Bengaluru





# 02. ACADEMIC PROGRAMMES

JNCASR is a world-class institute where cutting-edge research and interdisciplinary collaborations take place in 9 research units. The Centre offers degrees in the various sciences.

A monthly fellowship stipend is offered to research students and a highly competitive selection process ensures that students are admitted strictly based on their merit.

This section provides an overview of the academic programmes, its students, and its requirements.



# ACADEMIC PROGRAMMES

JNCASR is a vibrant institution 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. Candidates with an M.Sc., B.E., B.Tech., M.E., M.Tech. or MBBS are eligible to apply for these Ph.D. 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 Materials Science, the Chemical Sciences, and the Biological Sciences, and only begin in the August semester.

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 department 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 2021–2022, **67** students were enrolled in various degree programmes at the Centre:

Ph.D.:	36
M.S. (Engineering):	05
Integrated Ph.D. in Biological Sciences:	04
Integrated Ph.D. in Materials Science:	05
Integrated Ph.D. in Chemical Sciences:	10
M.Sc. Chemistry:	05
P.G.D.M.S.:	02

The current student strength at JNCASR is **337**

## DEGREES AWARDED

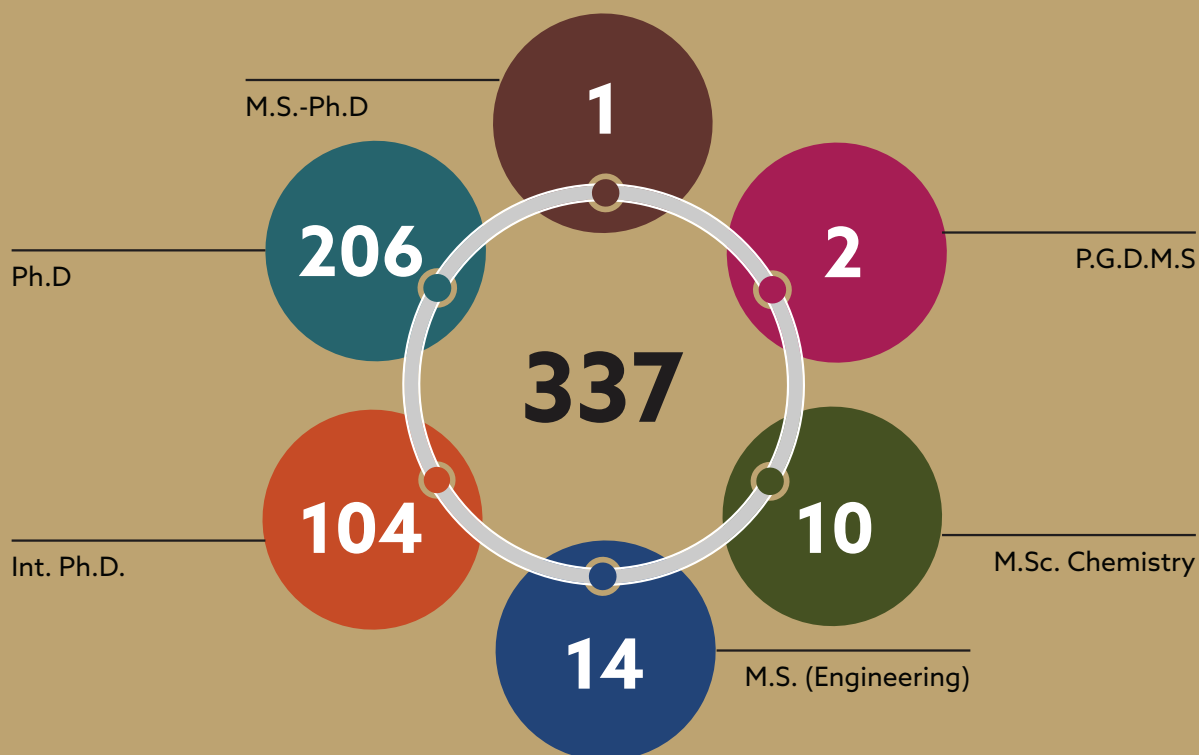
In the past year, the following number of degrees were awarded:

Ph.D.:	21
Ph.D. (through Integrated Ph.D.):	08
Ph.D. (through M.S.–Ph.D.):	00
M.S. (Engineering):	04
M.S. (Biological Sciences):	08
M.S. (Materials Science):	05
M.S. (Chemical Sciences):	05
M.Sc. Chemistry:	04
P.G.D.M.S.:	02

Total degrees awarded: **57**

# ACADEMIC PROGRAMMES

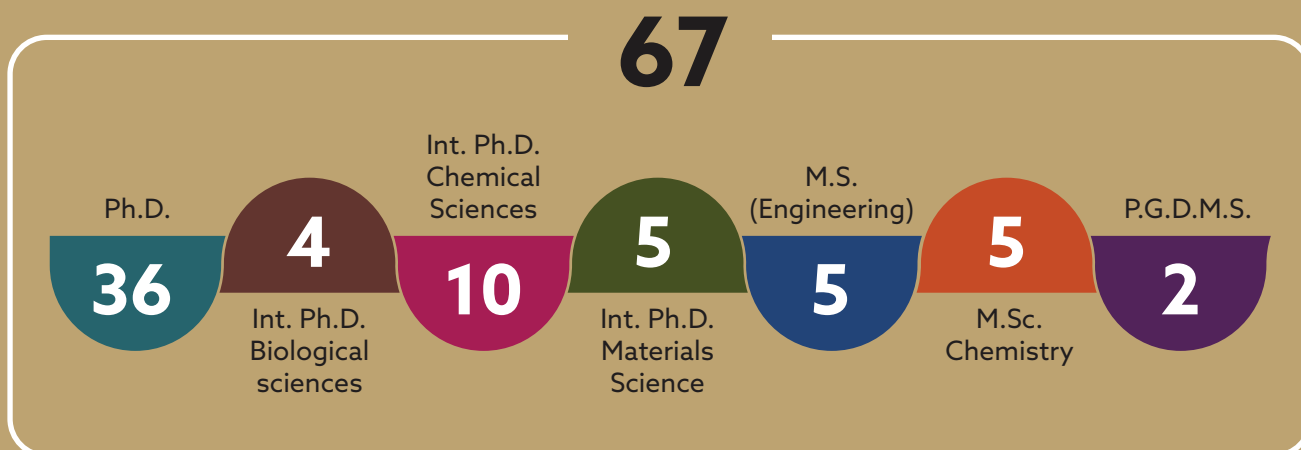
## TOTAL STUDENT STRENGTH ACROSS ACADEMIC COURSES 2021-2022



## TOTAL STUDENT STRENGTH (PAST 5 YEARS)

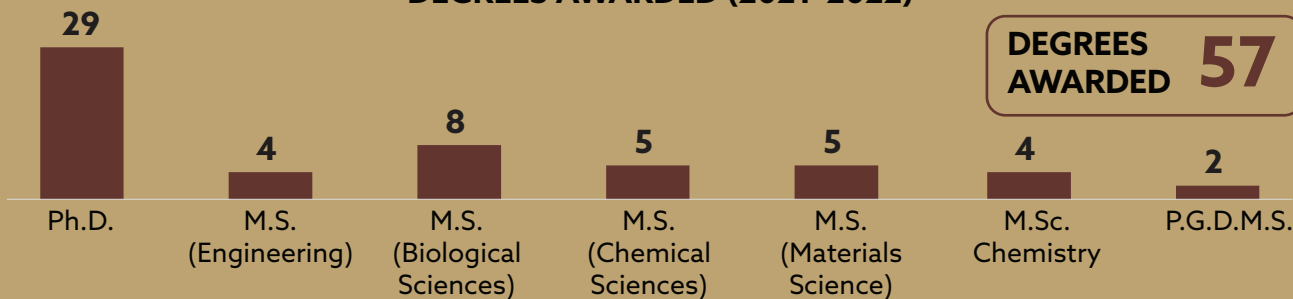


## NEW ADMISSIONS 2021-2022

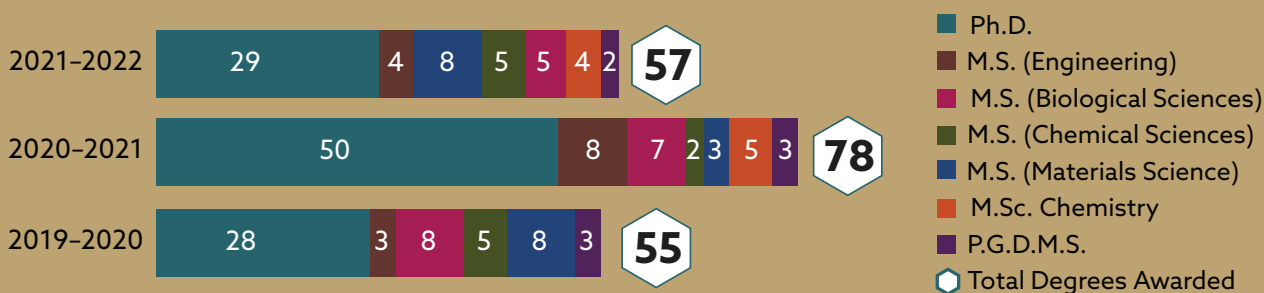


# ACADEMIC PROGRAMMES

## DEGREES AWARDED (2021-2022)



## DEGREES AWARDED (PAST 3 YEARS)



## UNIT-WISE CURRENT STUDENT STRENGTH AND DEGREES AWARDED 2021-2022

Unit	Total Students	CPMU	EIBU	EMU	ICMS	Degrees Awarded
<b>CPMU</b>	<b>82</b>					<b>15</b>
Ph.D.	47					9
Int. Ph.D.	35					
<b>EIBU</b>	<b>16</b>					—
Ph.D.	14					
Int. Ph.D.	1					
M.S.-Ph.D.	1					
<b>EMU</b>	<b>27</b>					<b>2</b>
Ph.D.	13					
M.S. (Engineering)	14					2
<b>ICMS</b>	<b>2</b>					<b>2</b>
P.G.D.M.S.	2					2

# ACADEMIC PROGRAMMES

## TOTAL STUDENTS

**66**

Ph.D.	32
Int. Ph.D.	34

**MBGU**



## DEGREES AWARDED

**14**

Ph.D.	6
M.S. (Biological Sciences)	8

**102**

Ph.D.	59
Int. Ph.D.	33
M.Sc. Chemistry	10

**NCU**



**17**

Ph.D.	7
M.S. (Chemical Sciences)	5
M.S. (Engineering)	1
M.Sc. Chemistry	4

**8**

Ph.D.	7
Int. Ph.D.	1

**NSU**



**2**

Ph.D.	2
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**34**

Ph.D.	34
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**TSU**



**5**

Ph.D.	5
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## MINIMUM SCORE TO APPLY FOR M.S.-PH.D. AND INT. PH.D.

Minimum score in the highest university examination for eligibility to apply for an M.S.-Ph.D.

**55%**

Minimum score in Bachelor's degree in any area of science/engineering or B.E/B.Tech degree or equivalent degree for eligibility to apply for an Int. Ph.D.  
Qualification in JAM mandatory.

M.Sc.

B.E.

B.Tech

M.E.

M.Tech

M.B.B.S.

**National tests to be eligible for admission to a Ph.D. programme**

GATE/JEST/GPAT/UGC/CSIR-NET-JRF/ICMR-JRF/DBT-JRF/INSPIRE-JRF



# ACADEMIC PROGRAMMES

	STIPEND		WHEN TO APPLY
Ph.D. (Science and Engineering)	Years 1 & 2: Years 3, 4, & 5: Year 6:	₹31,000 ₹35,000 ₹15,000	January session for Ph.D. and M.S. only
Int. Ph.D.	Years 1 & 2: Years 3, 4, & 5: Years 6 & 7: Year 8:	₹19,000 ₹31,000 ₹35,000 ₹15,000	Admissions are advertised in November
M.S. (Engineering/Research)	Years 1 & 2: Year 3 (first six months):	₹31,000 ₹13,000	August session for all programmes
P.G.D.M.S		₹20,000	Admissions are advertised in March

Check [www.jncasr.ac.in/admit](http://www.jncasr.ac.in/admit) for more details

## NEW STUDENTS PER UNIT 2021-2022

### CPMU



Ph.D.	6
Int. Ph.D.	5

### NCU



Ph.D.	12
Int. Ph.D.	10
M.Sc. Chemistry	5

### EMU



Ph.D.	1
M.S. (Engineering)	5

### TSU



Ph.D.	7
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### MBGU



Ph.D.	4
Int. Ph.D.	4

### EIBU



Ph.D.	4
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### NSU



Ph.D.	2
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### ICMS



P.G.D.M.S	2
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## ACADEMIC OFFICE STAFF

Dean: **Prof. M. Eswaramoorthy, Ph.D.**

Academic Coordinator: **Dr. Princy J. Pereira, Ph.D.**

Jr. Admin Assistants: **Vinutha S., Bhagya Shree P.**



# 03.

## RESEARCH AND DEVELOPMENT

Research and development at the highest levels of quality and integrity remain at the core of the Centre's activities. The researchers at JNCASR have continuously and steadily made path breaking discoveries and important innovations leading to the Centre's prominence in national and international scientific communities.

In the past year, the Centre has filed 19 patents and obtained 11 patent grants. This section highlights the achievements and progress of each of the 9 research units at JNCASR, namely, 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).

# 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 up and running 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

- Atomic layer deposition and pulsed laser deposition
- Magnetoelectrics and multiferroics
- Framework solids
- Biological systems (essentially proteins)
- Quantum materials
- Electrochemical energy storage
- Neuromorphic devices
- Supramolecular self-assembly
- Molecular systems and properties
- Epitaxial growth of semiconductors
- Nanoscale metal-organic frameworks and composites
- Superconductivity
- High energy resolution electron energy loss spectroscopy (HREELS)
- Functional processable 'soft' organic/hybrid gel materials
- Porous materials (metal organic frameworks and organic porous polymers)
- Nanolithography and fabrication
- Two-dimensional materials
- Aberration corrected high-resolution transmission electron microscopy
- Heterogeneous catalysis and electrocatalysis
- Membranes

## RESEARCH HIGHLIGHTS

- Cluster-glass behaviour was explored in the two-dimensional triangular lattice Ising-spin compound  $\text{Li}_2\text{Mn}_3\text{O}_7$
- The adsorbate-induced phase transformation of noncubic gold lattices was investigated
- Direct spatial estimation of  $L_d$  in a device configuration in single crystals was studied and analysed
- Thermally activated dynamic gating was studied in metal-organic frameworks
- High activity NiCoP nanoporous material was explored as efficient water splitting electrocatalyst for the oxygen evolution reaction
- Inorganic-organic hybrid materials were synthesized, cost-effective chemical feedstock separation was explored, and catalysts for energy conversion processes were developed



- Highly directional nano-torches/nano-beams/nano-lighthouses with tunable frequencies were developed
- Molecular recognition in synthetic systems was unravelled
- Secondary phase limited metal-insulator phase transition was explored in chromium nitride thin films

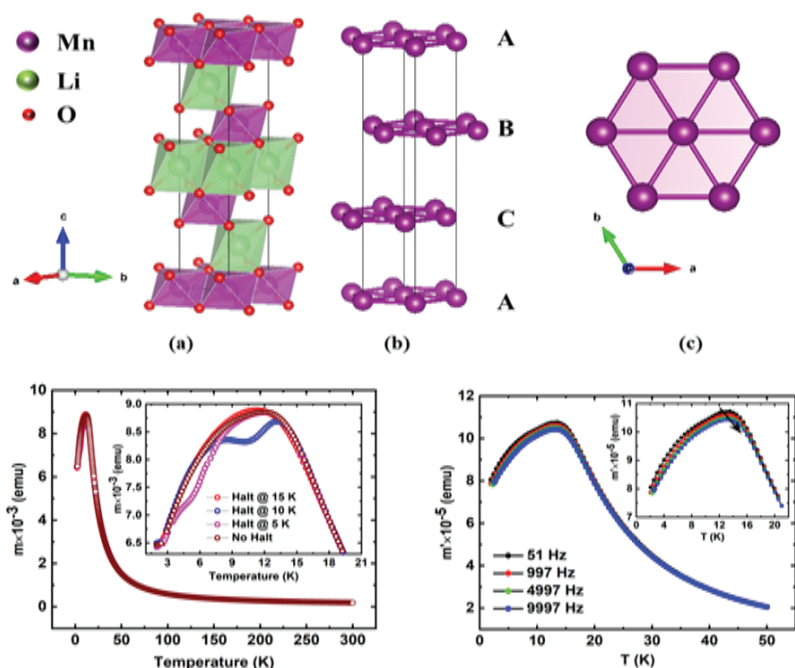
## RESEARCH ACTIVITIES AND ACHIEVEMENTS DURING 2021-2022

**Prof. Sundaresan A.** Ph.D., F.A.Sc.

*Professor and Chair, CPMU*

We presented the detailed structural and magnetic properties of the Ising-spin compound  $\text{Li}_2\text{Mn}_3\text{O}_7$ . Using powder x-ray diffraction (XRD) our team investigated the DC and AC susceptibility, heat capacity, thermoremanent magnetization, magnetic memory, and exchange bias effect for the compound. A Rietveld refinement of XRD data revealed that this compound has a rhombohedral structure composed of a layered triangular lattice. A closer look at the DC magnetization and AC susceptibility results confirmed the onset of spin-glass transition in  $\text{Li}_2\text{Mn}_3\text{O}_7$ , which was further analysed using dynamic scaling laws. Our results indicated that the magnetic field dependence on irreversible temperature follows the Almeida-Thouless line, which is characteristic of Ising-spin glass systems.

Further evidence of cluster-glass behaviour comes from the frequency dependence of the freezing temperature, which when fitted with the Vogel-Fulcher law with values of fitting parameters:  $E_a/k_B = 27.62$  K and  $T_0 = 9.57$  K, confirms the cluster-glass behaviour. The presence of magnetic relaxation below freezing temperature and the magnetic memory effect confirms the nonequilibrium dynamics of the system through many metastable states. These observations reveal that the triangular lattice causes a disordered ground state as a result of competing for exchange interactions.



Top: Two-dimensional magnetic triangular lattice in  $\text{Li}_2\text{Mn}_3\text{O}_7$   
 Bottom left: Magnetic memory effect.  
 Bottom right: AC susceptibility data

**Reference:**

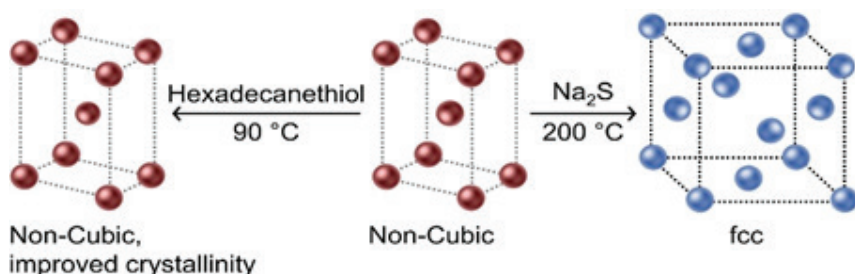
*Phys. Rev. B.* 103 (21): 214427.  
 doi: 10.1103/PhysRevB.103.214427



**Prof. G. U. Kulkarni** Ph.D., F.N.A.Sc., F.A.Sc., F.N.A.E., F.N.A  
*Professor and President, JNCASR*

Our team is broadly involved in the exploration of crystal structure-dependent properties of metals in bulk, micro, and nanostructures. In a recent work, we studied the stability of gold (Au) microcrystallites in unconventional body-centred orthorhombic and tetragonal ((bc(o,t)) lattices, in the presence of common chemical adsorbates such as hexadecanethiol (HDT) and sodium sulphate ( $\text{Na}_2\text{S}$ ). We found that treatment with HDT enhanced the proportion of bc(o,t) structures whereas  $\text{Na}_2\text{S}$  facilitated an irreversible lattice transformation from bc(o,t) to the conventional face-centred cubic (fcc). The latter was unexpected since these Au crystals are known to have extraordinary stability even under high pressures and temperatures.

Using density functional theory (DFT), we calculated the adsorption energies associated with the crystalline structure and found that fcc exhibits higher stability than the bc(o,t) lattices, as expected. However, the trend was just the opposite in the case of HDT treatment.



*Structures exhibited by Au crystallites in the presence of chemical adsorbates*

**Reference:**

*J. Phys. Chem. C.* 126 (1): 823–831.  
 doi: 10.1021/acs.jpcc.1c09551

**Prof. K. S. Narayan** Ph.D., F.A.Sc., F.N.A.Sc., F.N.A.  
*Professor*

Record high efficiencies of hybrid perovskites are attributed to long carrier diffusion length (Ld). In the literature, numerous Ld values have been reported, and its variation has been studied as a function of charge generation density. Previous studies largely used indirect estimates, i.e., independent determinations of lifetime and mobility. A study on the direct spatial estimation of Ld in a device configuration in single crystals was hence desirable. We directly estimated Ld by employing the scanning photocurrent microscopy technique. Measurements on high-quality single crystals of methylammonium lead tribromide ( $\text{MAPbBr}_3$ ) eliminated contributions from recombination processes at grain boundaries. We studied the dependence of Ld on the carrier generation density by introducing a uniform light bias, and correlated the observed trends with independent lifetime measurements using transient photoluminescence experiments. Interestingly, we observed an increase in steady-state modulated photocurrents, as the background light bias, which was explained using a simple intuitive model of trap-filling. We analysed the results using drift-diffusion formalism. The key highlights of this work include:

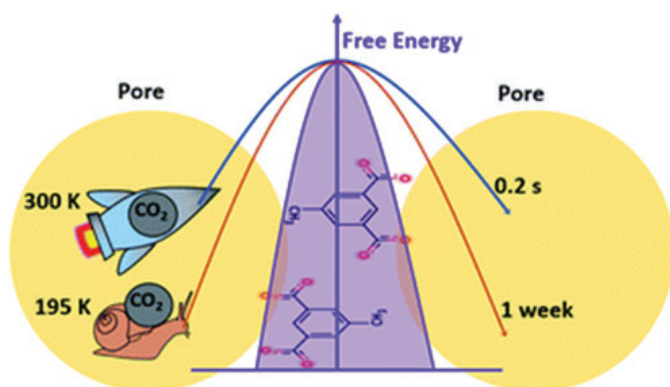
1. Spatial estimation of Ld and its dependence on carrier density using scanning photocurrent microscopy.
2. Superposition of a background-DC light uniformly on the crystal, increasing the modulated photocurrent and simultaneously decreasing Ld, presenting a direct demonstration of trap assisted recombination and trap-filling.
3. Photoluminescence studies bringing out the effects of monomolecular and bimolecular recombination. The emission lifetime trends explained the Ld results.
4. The defect tolerance capability of hybrid perovskite crystals along with the Ld and carrier lifetime studies should help in tailoring hybrid-perovskite single-crystal solar cells.

These findings are of fundamental scientific interest and of direct relevance to enhance the performance of hybrid perovskite-based solar cells. Understanding carrier diffusion in the context of recombination and carrier trapping allows for tailoring of the device architecture for suitable optoelectronic applications.

## Prof. Balasubramanian Sundaram Ph.D., F.A.Sc.

### Professor

Alongside experimentation, advanced computational tools have played a major role in unravelling the mechanism of kinetically governed gas adsorption in flexible metal-organic frameworks (MOFs). In our recent study, we used computational tools to investigate the CO<sub>2</sub> adsorption of CID-Me ([Zn(5-methylisophthalate)(bipyridine)]<sub>n</sub>), a flexible MOF which showed an unusually high gas uptake at higher temperatures.



CO<sub>2</sub> absorption rate at different temperatures

#### Reference:

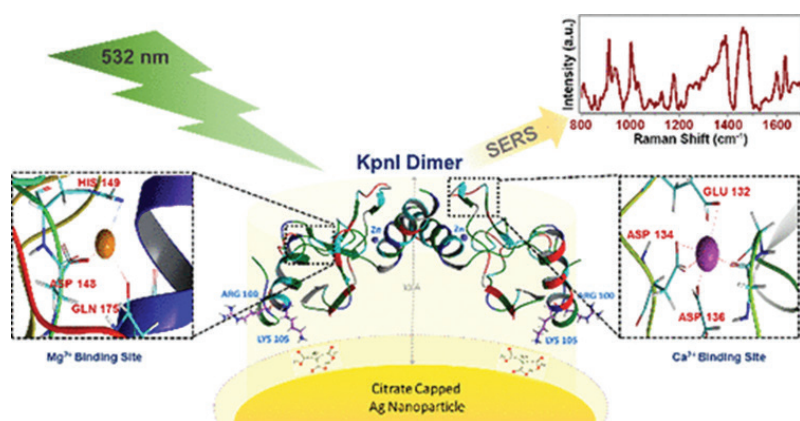
*J. Mater. Chem. A*, 9 (48): 27398–27407.  
doi: 10.1039/D1TA06562A

To understand the diffusion mechanism of CO<sub>2</sub> between pores, which is better facilitated by the thermally activated dynamic gating process, we carried out molecular dynamics simulations. We also applied density functional theory calculations to determine binding energy and available binding sites for CO<sub>2</sub> molecules on MOF pores. The results revealed that the minimum free energy path for CO<sub>2</sub> diffusion exhibits a barrier of more than 16 kcal mol<sup>-1</sup>, which supports the phenomenon of increased gas adsorption at higher temperatures. The molecular-level insights provided by the study can be used to design materials that can adsorb more gas upon heating.

## Prof. Chandrabhas Narayana Ph.D., F.A.Sc., F.N.A.Sc., F.R.S.C.

### Professor (on deputation with RGCB)

Our group has been using Raman spectroscopy, surface enhanced Raman spectroscopy (SERS), and X-ray diffraction tools to understand the molecular origins of the physical properties shown by various materials. We have looked at materials from the perspectives of energy, condensed matter, and biological phenomena. We have looked at metal-organic framework (MOF) materials, demonstrating unusual gas or guest adsorption properties and their stabilities. In addition, we have provided insight into high-performance asymmetric supercapacitors made of covalent graphene–MOF hybrids. Another material we studied is the antimony telluride (Sb<sub>2</sub>Te<sub>3</sub>)/graphite nanocomposite to understand its thermal conductivity. Further, we have been looking at the molecular origins of biological phenomena. We have successfully demonstrated the use of Raman spectroscopy as a tool to detect extracellular vesicles, which can be disease markers. The effect of divalent ions on the DNA cleavage property of restriction enzymes has, additionally, been a very important research topic, because with a better understanding of their molecular origins, disease management can be improved. In this regard, we were able to use SERS to understand protein secondary structural changes, gaining insight into the effect of divalent ion-induced switching in DNA cleavage.



Schematic representation of the process used for the research

**Reference:**

*J. Phys. Chem. B.* 125 (9): 2241–2250.  
doi: 10.1021/acs.jpcc.0c10667

**Major talks during 2021–2022:**

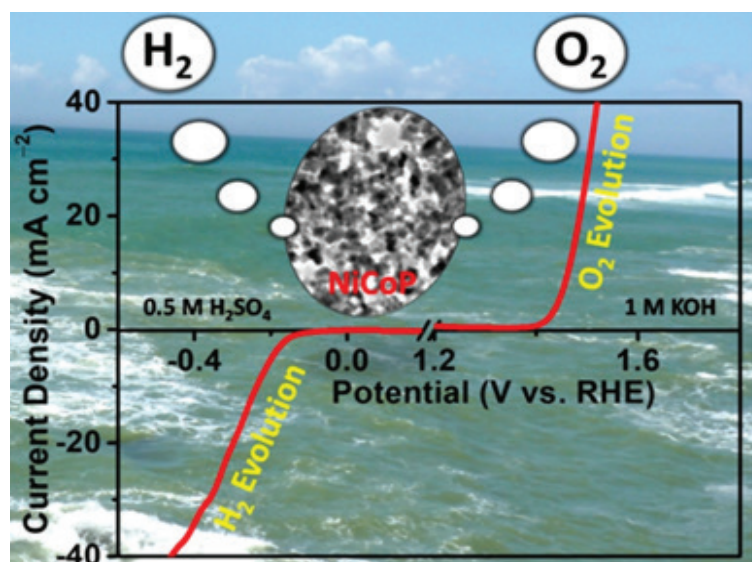
- 31<sup>st</sup> May 2021: Keynote speaker at the conference on Advanced Materials for Energy Applications at the Department of Physics, Mangalore University, Mangalagangothri, Karnataka
- 22<sup>nd</sup> May 2021: Invited speaker at the Indian Society for Analytical Scientists (ISAS), Mumbai
- 19<sup>th</sup> May 2021: Plenary Lecture at the International Conference on Light-Matter Interaction (IC-LMIN 2021) organised by the Indira Gandhi Centre for Atomic Research, Kalpakkam
- 8<sup>th</sup> April 2021: Keynote speaker at the International Conference on Hierarchical Structured Materials (ICHSM 2021), held at the Department of Physics, SRM Institute of Science and Technology, Ramapuram Campus, Chennai, Tamil Nadu

**Prof. Eswaramoorthy M. Ph.D.**

*Professor and Associate Director, ICMS*

Our lab focuses on the development of efficient electrocatalysts for electrochemical reactions in the following applications:

1. Fuel cell technology (hydrogen evolution reaction, oxygen evolution reaction, oxygen reduction reaction, and urea electro-oxidation)
2. Electrochemical CO<sub>2</sub> reduction to value-added products
3. Ammonia synthesis by electrochemical NO<sub>3</sub> reduction
4. Electrochemical N<sub>2</sub> reduction reaction



A schematic for both the oxygen and hydrogen evolution reaction activities of the bimetallic NiCoP catalyst

**Reference:**

*Mat. Res. Bull.* 140: 111312.  
doi: 10.1016/j.materresbull.2021.111312

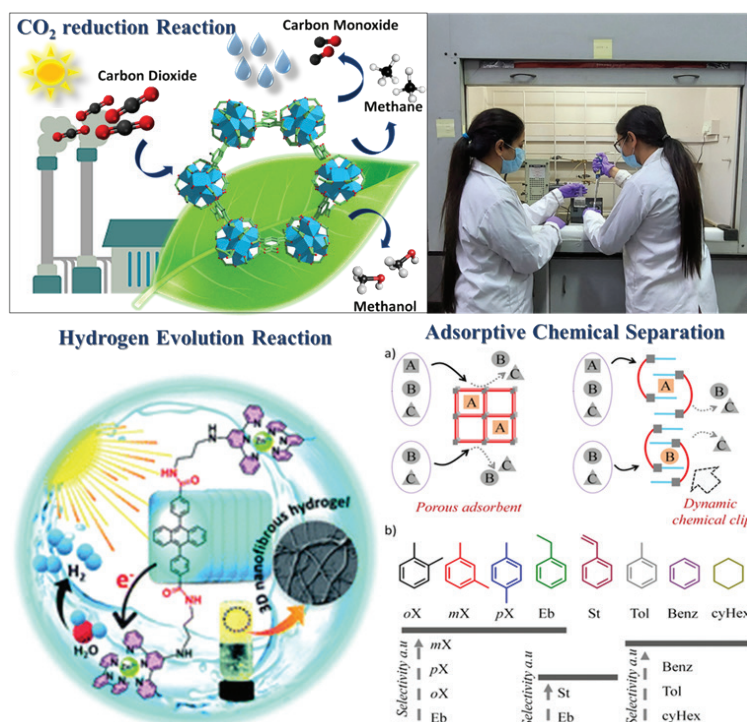
In one of our most recent works, we presented a simple route for the synthesis of nanoporous bimetallic phosphide NiCoP(Ni<sub>0.2</sub>Co<sub>0.8</sub>P). The prepared matter was then used to catalyse water splitting and oxygen evolution reactions under alkaline conditions. NiCoP showed excellent catalytic activity due to its large surface area and highly dense electrochemically active sites. The nanoporous material can also catalyse hydrogen evolution reactions under alkaline as well as acidic conditions. Further investigation of its properties using first principles theoretical analysis revealed that the high catalytic activity arises from the synergistic effect of Ni and Co on energies of the d and p bands of NiCoP. This effect is further enhanced by rapid mass transport facilitated by the porous architecture of its three-dimensional network morphology.

## Prof. Tapas Kumar Maji Ph.D., F.R.S.C., F.A.Sc.

### Professor

We, at MolMat Lab, are working on major problems in the energy and environment sector by designing and synthesising inorganic-organic hybrid materials (known as metal-organic frameworks in bulk and nanoscopic forms, porous organic polymers (POPs), and coordination polymer gels (CPGs)). Our interests also lie in the cost-effective separation of chemical feedstock (CO<sub>2</sub>/H<sub>2</sub>, CO<sub>2</sub>/N<sub>2</sub>, olefin/paraffin, etc.) and geometrical isomers by exploiting charge-transfer interactions in MOFs, POPs, processable soft CPGs. Our group has opened novel vistas in the development of cost-effective and efficient catalysts for photo and electrochemical energy generation and conversion processes such as water splitting and CO<sub>2</sub> reduction.

As energy efficiency has become crucial in abating global warming, our group has drawn conclusions that may have great significance for the welfare of the society.



Illustrative depiction of photocatalytic CO<sub>2</sub> reduction and hydrogen evolution along with adsorptive chemical separation carried out at the MolMat Lab

**Reference:**  
*ACS Appl. Mater. Interfac.* 14 (22): 25220–25231;  
doi: 10.1021/acsami.1c23458



## Major talks during 2021-2022:

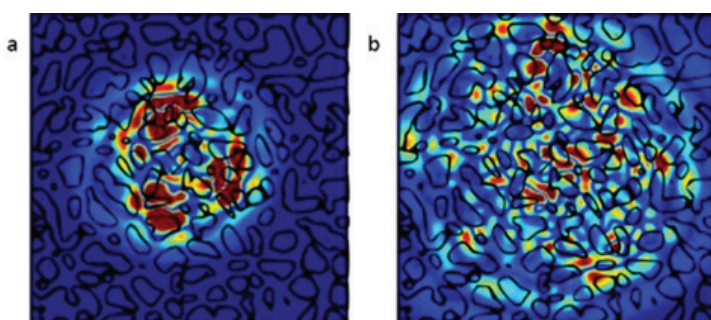
- 26<sup>th</sup> March 2022: Talk at Conference titled Emerging Topics in the Interdisciplinary and Applied Sciences, on the topic "Coordination Driven Metal-Organic Functional 'Soft' Materials", organised by School of Applied and Interdisciplinary Sciences (SAIS), IACS, Kolkata
- 21<sup>st</sup> January 2022: Talk on "Inorganic-organic Hybrid Materials for Capture, Separation, and Chemical Conversion of CO<sub>2</sub>" at the Sixth Lecture Workshop on Trans-disciplinary Areas of Research and Teaching by Shanti Swarup Bhatnagar Awardee, organised by Deen Dayal Upadhyay College, University of Delhi
- 22<sup>nd</sup>-23<sup>rd</sup> December 2021: Talk at the Recent Trends in Environmental Chemistry/Technology Towards Sustainable Society Conference on "Coordination Driven Supramolecule Metal-Organic 'Soft' Hybrid Nano-catalysts", organised by IIT Ropar
- 15<sup>th</sup> July 2021: Talk at the Launch Symposium of the CO<sub>2</sub> India Network on "CO<sub>2</sub> Capture, Separation, and Conversion Research at MolMat Lab", organised by CO<sub>2</sub> India Network
- 9<sup>th</sup>-10<sup>th</sup> July 2021: Talk at the 15<sup>th</sup> National Frontiers of Engineering (NatFoE) Symposium on "Metal-organic 'Soft' Hybrids for Photocatalytic CO<sub>2</sub> Reduction and H<sub>2</sub> Production", organised by Institute of Technology Hyderabad and Indian National Academy of Engineering

## Prof. S. M. Shivaprasad Ph.D.

*Professor (on lien with KSHEA, Dharwad; jointly with ICMS)*

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Scaling down the size of semiconductor cavity lasers and engineering their electromagnetic environment can bring about spectacular advances in nanodevice fabrication. Our team is working towards the development of highly directional nano-torches/nano-beams/nano-lighthouses with tunable frequencies. In one of our recent research works, we provided experimental evidence of intense photon emission from the nanocavities of the nanowall network (NwN) morphology of gallium nitride (w-GaN) upon highly localized excitation by a high energy electron beam. We presented numerical modelling results to support non-linear frequency conversion and the creation of whispering gallery modes (WGMs). Our results support the argument that the characteristic NwN morphology plays a very important role in sustaining WGMs and in providing an escape route through nanocavities preferentially for near-infrared emissions. Our approach might be a precursor to obtaining highly intense laser sources of ultra-small dimensions packed with high density, where each source is addressable by appropriately deflecting the incident electron beam.



*Pulse propagation in the NwN morphology, setting up whispering gallery type modes for a short duration*

### Reference:

*Sci. Rep.* 11 (1): 9368.

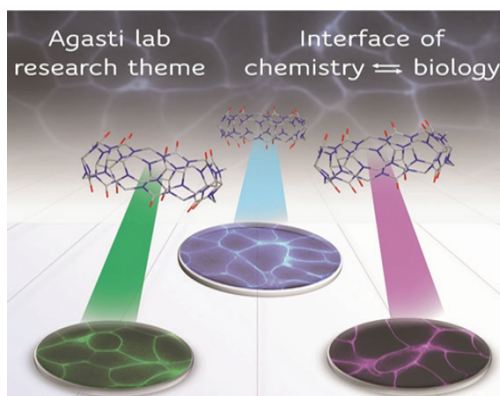
doi: 10.1038/s41598-021-88660-3

## Dr. Sarit S. Agasti Ph.D.

*Associate Professor (jointly with NCU)*

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We are a group of chemists and enthusiasts of non-covalent interactions working at the interface of chemistry and biology and trying to contribute to the advancement of the natural sciences. The central



theme of our research is molecular recognition in synthetic systems: from fundamental studies to applications in biology and materials. Our primary design principles rely on two types of synthetic scaffolds, macrocyclic host-guest receptors, and nucleic acid scaffolds. We are working on combining these supramolecular systems with biological interfaces to develop various novel technologies with relevance to both fundamental and medical research. Examples include biorthogonal imaging and sensing, methods for super-resolution imaging, and new approaches for the delivery and activation of therapeutic materials.

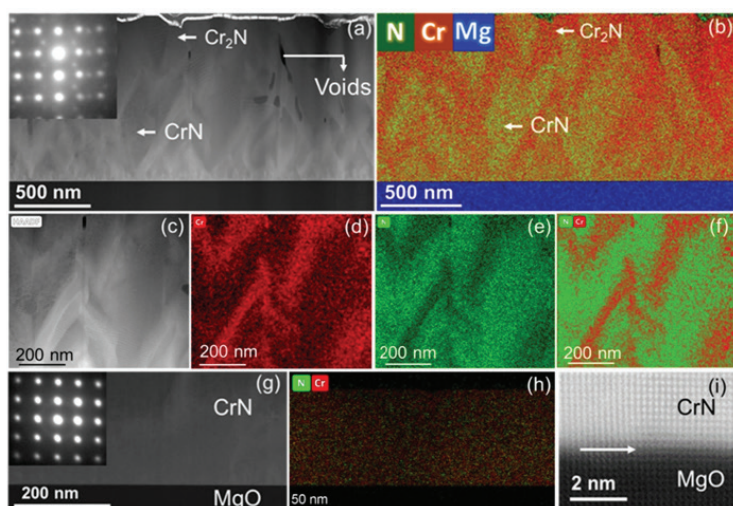
*A schematic representing the research in the lab*

**Reference:** *Chem. Sci.* 12 (15). doi: 10.1039/D0SC06860H

## Dr. Bivas Saha Ph.D.

*Faculty Fellow (jointly with ICMS)*

Chromium nitride (CrN) is a hard coating material that is widely used in abrasion and wear-resistant cutting tools, bearings, and tribology applications due to its high hardness, high-temperature stability, and corrosion-resistant properties. In our study, we reported that the formation of the secondary metallic  $\text{Cr}_2\text{N}$  phase during growth inhibits observation of metal-insulator phase transition in CrN thin films. When the Cr-flux during deposition is reduced below a critical limit, an epitaxial and stoichiometric CrN thin film is obtained that reproducibly exhibits the phase transition. Annealing of the mixed-phase film inside the reducing  $\text{NH}_3$  environment converts the  $\text{Cr}_2\text{N}$  into CrN, and a discontinuity in the electrical resistivity at  $\sim 277$  K appears, which supports the underlying hypothesis.



These observations provide insights into the origin of the controversy of the metal-insulator transition in CrN thin films and mark significant progress that would enable the nanoscale device realization of CrN thin films.

*Atomic-resolution STEM image of CrN crystal growth in the MgO substrate. HAADF-STEM micrograph and STEM-EDS map of the film show the presence of both  $\text{Cr}_2\text{N}$  and CrN*

**Reference:**  
*Acta Materialia.* 227: 117737.  
doi: 10.1016/j.actamat.2022.117737

### Major talks during 2021-2022:

- Invited to a talk at the Materials Research Society India
- Invited to a talk at the Materials Research Meeting
- Invited to a talk at the meV-Resolved Inelastic X-ray Scattering Workshop
- Invited to a talk at the Satyendra Nath Bose National Centre for Basic Sciences

## UNIT MEMBERS

### FACULTY MEMBERS

Professor and Chair	<b>Prof. Sundaresan A.</b>
Linus Pauling Research Professor	<b>Prof. C. N. R. Rao</b>
Professors	<b>Prof. G. U. Kulkarni</b> (President, JNCASR) <b>Prof. Narayan K. S.</b> <b>Prof. Balasubramanian S.</b> <b>Prof. Chandrabhas Narayana</b> (on deputation with RGCB) <b>Prof. Eswaramoorthy M.</b> (Associate Director, ICMS) <b>Prof. Tapas Kumar Maji</b> <b>Prof. S. M. Shivaprasad</b> (on lien with KSHEA, Dharwad; jointly with ICMS)
Associate Professor	<b>Dr. Sarit S. Agasti</b> (jointly with NCU)
Faculty Fellow	<b>Dr. Bivas Saha</b> (jointly with ICMS)

### ASSOCIATE FACULTY

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

### RESEARCH STUDENTS

Ph.D.	<b>Swarnamayee Mishra, Debendra Prasad Panda, Rahul Kumar, Souvik Banerjee, C. S. Deepak, Abdul Azeez H., Purohit Sumukh Anil, Sinay Simanta Behera, Abhijith Krishnan, Bhupesh Yadav, Tejaswini S. Rao, Nimish D., Kompella V. K. Srinath, Avula Venkata Siva Nikhil, Sudarshan Behera, Oishika Jash, Megha, Soumita Chakraborty, Momin Ahamed, Divya, Surishi Vashishth, Sanchita Karmakar, Faruk Ahamed Rahimi, Rohan Jena, Anupam Dey, Abhijit Chatterjee, Rajendra Kumar, Shivaram B. Kubakaddi, Manodeep Mondal, Navneet Singh, Krishna Chand Maurya, Sourjyadeep Chakraborty, Bidesh Biswas, Prasanna Das, Priyanka Jain, Divya C., Anjana Joseph, Suhas K. T., Soumen Pradhan, Simanta Kalita, Disha Brahma, Sourav Rudra, Athira M. P., Souvik Mondal, Rahul Sharma, Sudip Ghosh, Kamlesh Mishra</b>
Int. Ph.D.	<b>Pavitra Nityanand Shanbhag, Anaranya Ghorai, Sukanya Das, Manish Tiwari, Srimayee Mukherji, Anjali Gaur, 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, Dipanjana Patra, Ashutosh Kumar Singh, Narendra Kumar, Shashank Chaturvedi, Raagya Arora, Surabhi Menon, Anirudha Mirmira, Gurshidali P., Gunjan Sharma, Aashish Kumar, Sohini Chatterjee, Brijesh, Sohom Das, Rahul Singh Rawat, Soumya Satpathi, Sakshi Verma, Utkarsh Singh</b>

## TECHNICAL STAFF

Sr. Technical Officers	Sreenath V., Srinivas S.
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## RESEARCH STAFF

SERB (TARE)	Dr. Shafeekh Kulathinte Meethal
SERB National Postdoctoral Fellows (NPDF)	Dr. Sandip Biswas, Dr. Padipkanti Devi Lairengam
Research Associates	Dr. Shivanandkumar Vassam, Dr. Indrajit Mondal, Dr. Kamal Saravanan R., Dr. Ravi Shankar P. N., Dr. Sudhakar Chennu, Dr. Subhajit Laha, Dr. Premkumar Yanda, Dr. Parul Verma, Dr. Chaitali Sow, Dr. Anzar Ali, Dr. Abhishek Sharma, Dr. Sudip Das, Dr. Prashant Kumar, Dr. Soumitra Barman, Dr. Saraswathi C., Dr. Bharath B.
Research Associate (Provisional)	Pradipta Behera
Senior Research Fellows	Nimish Dwarkanath, Kompella V. K. Srinath, Priyanka Jain, Divya Chalapathi
Junior Research Fellows	Srimayee Mukherji, Ganesh N.
R&D Assistants	Girish K. H., Shilauni Dadwal

## ADMINISTRATIVE STAFF

Sr. Lab Assistants	Anilkumar J., Vasudeva B. S., Alla Srinivasa Rao
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## CONTRACTUAL STAFF

Consultant (On Contract)	Usha G. Tumkurkar
Technical Assistant Trainee	Arun Aravindakshan K. V.
Secretarial Assistant Trainee	Prema M. S.
Workshop Assistant	Raja Kumar D.
Mectronic Lab Support	Sunoj K. R.

## UNIT AT A GLANCE

### HONOURS RECEIVED



### FACULTY ACHIEVEMENTS:

#### Prof. A. Sundaresan

- Received Prof. C. N. R. Rao Oration Award Lecture 2021



# CPMU

## Prof. C. N. R. Rao

- Received Honorary Fellowship of the Karnataka Association for the Advancement of Science (KAAS), 2022

## Prof. G. U. Kulkarni

- Chairman, Sub-Committee on Academic Matters, for drafting Detailed Project Report for the restructuring of DST research and development institutes
- Received the Karnataka State Rajyotsava Award 2021
- Elected as Fellow of the Indian National Science Academy (INSA), New Delhi, 2021
- Elected as Fellow of the Indian National Academy of Engineering (INAE) 2021

## Prof. Tapas Kumar Maji

- Featured in "75 Under-50 Scientists Shaping Today's India", 2022, by the Department of Science and Technology

## Dr. Sarit S. Agasti

- Named the 2021 Emerging Investigator for Chemical Communications by Royal Society of Chemistry.
- Won the Merck Young Scientist Award, 2021 (Biological Sciences)
- Received the India Alliance Intermediate Fellowship Award

## Dr. Bivas Saha

- Received Sheikh Saqr Career Award Fellowship from Ras Al Khaimah Centre for Advanced Materials

## STUDENT ACHIEVEMENTS:

**Anjali Gaur** (Int. Ph.D.), **Kompella V. K. Srinath**, and **Sudarshan Behera** (Ph.D. students; research supervisor: Prof. Balasubramanian S.)

- Received Physical Chemistry Chemical Physics Poster Prizes by Royal Society of Chemistry at Theoretical Chemistry Symposium, IISER, Kolkata

**Sourav Rudra** (Ph.D. student; research supervisor: Dr. Bivas Saha)

- Received Shyama Prasad Mukherjee fellowship from CSIR India

## TOTAL PUBLICATIONS



**86**

Peer reviewed articles indexed in Web of Science/Scopus

## SPONSORED PROJECTS



**9**

New Projects

**₹4.80 cr**

Funding



**24**

Ongoing Projects

**₹5.18 cr**

Funding

## STUDENTS GRADUATED DURING 2021-2022



**9**  
**Ph.D.**

- Sharona Thomas Horta
- Usha Manjunath Bhat
- Ravi Shankar P. N.
- Subhajit Laha
- Yanda Premakumar
- Ganesh N.
- Parul Verma
- Meenakshi Pahwa
- Lakshay Dheer

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**5**  
**M.S.**  
**(Material Science)**

- Manish Tiwari
- Swapnasopan Datta
- Gunjan Sharma
- Gurshidali P.
- Abhishek Kumar

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**1**  
**M.S.**  
**(Engineering)**

- Mohit Chaudhary

## STUDENTS ADMITTED DURING 2021-2022



**6**  
**Ph.D.**

- Sourav Rudra
- Athira M. P.
- Souvik Mondal
- Rahul Sharma
- Sudip Ghosh
- Kamlesh Mishra

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**5**  
**Int. Ph.D.**

- Sohom Das
- Rahul Singh Rawat
- Soumya Satpathi
- Sakshi Verma
- Utkarsh Singh

# 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 focussed 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 behavior
- Life-history evolution, using lab populations of *Drosophila*
- Evolution of competitive ability and population dynamics, using *Drosophila*
- Foundational conceptual issues in evolutionary theory

## RESEARCH HIGHLIGHTS

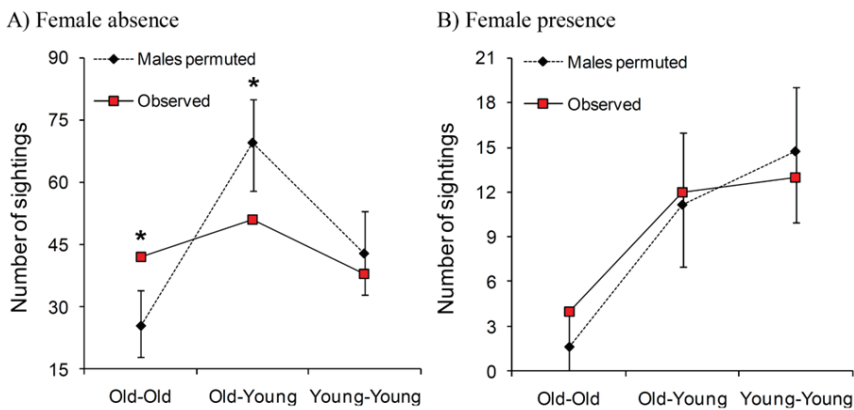
- Different association patterns shown by adult male Asian elephants amongst themselves were explored
- The evolution of competitive ability in *Drosophila* (fruit fly) was shown to be affected by specific conditions of crowding, and not merely larval density

RESEARCH ACTIVITIES AND ACHIEVEMENTS DURING 2021-2022

**Dr. T. N. C. Vidya Ph.D.**

*Associate Professor and Chair, EIBU*

We carried out a long-term study to examine associations amongst adult male Asian elephants in the Kabini Asian elephant population, in southern India. Adult males associated with one another in the absence of female groups over 10% of their time. Since elephants are polygynous and competition amongst males is expected to shape male society, hypotheses to explain associations were examined. Based on six years of field data on individually-identified elephants, we found that old adult males (>30 years) associated preferentially with other old males, and old and young (15-30 years) adult males associated less than expected by chance. Young males did not preferentially approach old males to associate. Thus, associations seemed to be based on testing strengths among age peers rather than primarily for social learning from old males. This difference in male associations compared to the African Savannah elephant seemed to arise from a constraint on group size in Kabini.



*Permuted and observed numbers of times adult males of different age classes were sighted in the A) absence and B) presence of females. Significant differences are marked with asterisks.*

**Reference:**

*Front. Ecol. Evol. 9: 616666  
doi: 10.3389/fevo.2021.616666*

**Major talks during 2021-2022:**

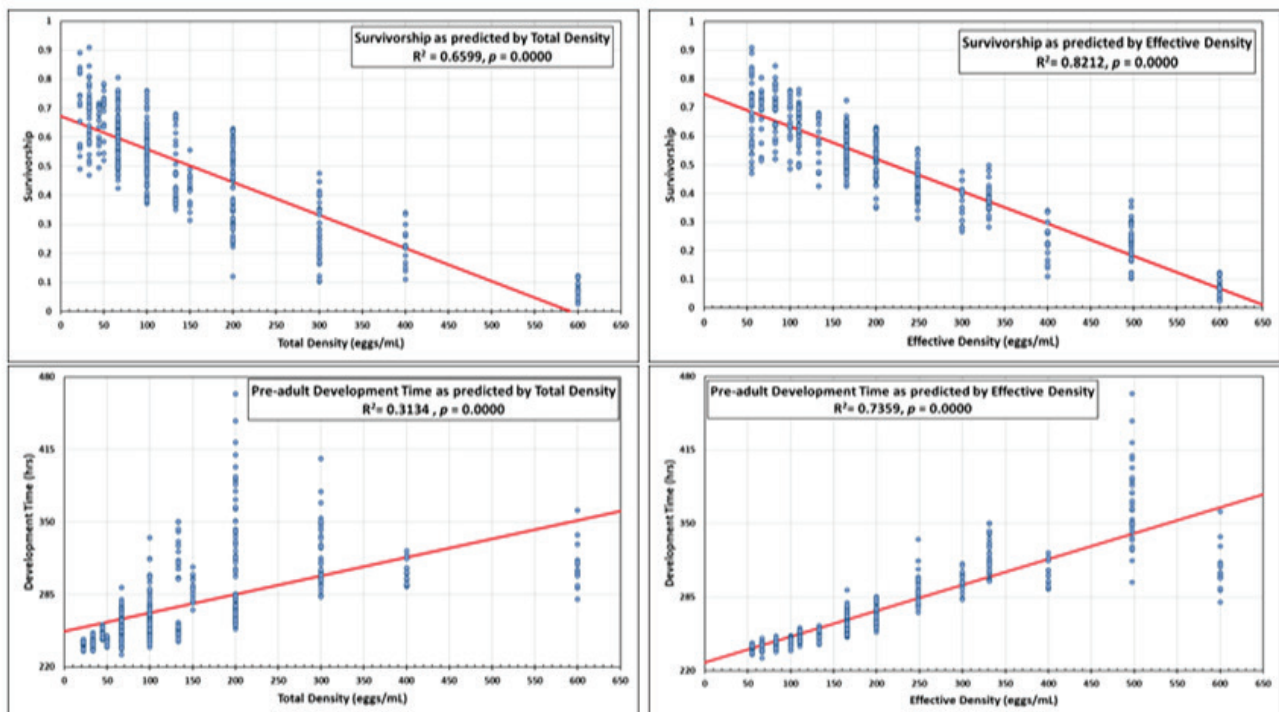
- 18<sup>th</sup> February 2022: Invited talk (online) on “Associations and Agonism in Asian Elephants” at the Centre for Research in Animal Behaviour, University of Exeter, UK.
- 16<sup>th</sup> February 2022: Invited talk (online) at the ISEB3: International Conference on Insect Systematics and Evolutionary Biology, organised by Punjabi University, Patiala, and Indian Society of Evolutionary Biologists (ISEB)
- 24<sup>th</sup> December 2021: Plenary talk (online) on “Associations and Agonism amongst Male Asian Elephants” at the Forty Fourth National Conference on Animal Behaviour (Virtual) and Annual Meetings of the Ethological Society of India, St. Joseph’s College (Autonomous), Bengaluru, and Ethological Society of India
- 17<sup>th</sup> November 2021: Invited talk on “Associations and Agonism amongst Male Asian Elephants” at the JNCASR Annual Faculty Meeting
- 6<sup>th</sup> November 2021: Keynote talk (online) on “Asian Elephant Socioecology and Behaviour: Insights from the Kabini Elephant Project” at the IIIT Palakkad Research Scholars’ Day
- 2<sup>nd</sup> July 2021: Invited talk (online) on “Socioecology of Asian Elephant Females” at the International Symposium on Advances in Comparative Endocrinology and Behavioural Ecology, Department of Zoology, S. P. Pune University, India



## Prof. Amitabh Joshi Ph.D.

### Professor

A large and paradigm-changing experimental study on the ecology of competitive ability in laboratory populations of *Drosophila* revealed hitherto unappreciated complexity in how the ecological context in which larval crowding is experienced mediates alterations in fitness components like survivorship, body size, and development time. Across vials with the same larval density (eggs per unit food volume), but achieved with different combinations of food surface area and food column height, survivorship, development time, and body size varied considerably. Effective larval density in the feeding band at the top of the food column explained variation in survivorship and development time better than total larval density (larvae per unit volume food medium). The results suggest that effective competition in the feeding band, and diffusion of waste across the food column, are both important in determining the precise nature of selection for increased competitive ability under larval crowding.



Linear regressions of pre-adult survivorship and pre-adult development time versus either total density (eggs per unit volume food medium) or effective density (eggs per unit volume of food medium in the feeding band within which larvae feed at the top of the food column in a vial). For both fitness-related traits, effective density in the feeding band explains considerably more variance in the trait than total density.

#### Reference:

*J. Genetics* 101: 13. doi: 10.1007/s12041-021-01355-6

#### Major talks during 2021-2022:

- 8<sup>th</sup> March 2022: Online talk at the Refresher Course in Organization, Complexity and Evolution of Living Systems, organised by the Indian Academy of Sciences, Indian National Science Academy, and National Academy of Sciences, India, at the Government Degree College in Srikakulam
- 18<sup>th</sup> Feb 2022: Invited online talk at ISEB3: International Conference on Insect Systematics and Evolutionary Biology, organised by the Indian Society of Evolutionary Biologists and Punjabi University, Patiala
- 14<sup>th</sup> July 2021: Online talk on "The illusion of mechanism in biology", as part of the Centre for Cellular and Molecular Biology (Hyderabad) Biologue series

- 11<sup>th</sup> July 2021: Online talk on “Two decades of experimental population ecology”, organised by Biologically Speaking, on the occasion of World Population Day
- 13<sup>th</sup> April 2021: Online panel discussion in Hindi on “Science of learning: academics to institutional perspective”, organised by the Department of Science and Technology, Rajasthan

## UNIT MEMBERS

### FACULTY MEMBERS

Associate Professor and Chair	<b>Dr. T. N. C. Vidya</b>
Professor	<b>Prof. Amitabh Joshi</b>

### RESEARCH STUDENTS

Ph.D.	<b>Revathe T., Athira. T. K., Ankana Sanyal, Neha Pandey, Satyabrata Nayak, Medha Rao, Chinmay Krishna Yadav, Pavitra Prakash, Anuj Menon, Viveka Jagdish Singh, Mohnish Singh, Bhawna Mittal, Jabili Chowdari, Divya Choudhary</b>
Int. Ph.D.	<b>Srikant Venkitachalam</b>
M.S. Ph.D.	<b>Anvitha S.</b>

### RESEARCH STAFF

Research Associate	<b>Dr. Hansraj Gautam</b>
Project Associate-1	<b>Thanikodi M.</b>
R&D Assistant	<b>Ramesh M. K., Sajith V. S.</b>

### ADMINISTRATIVE STAFF

Helper	<b>Rajanna N.</b>
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### CONTRACTUAL STAFF

Tracker	<b>Shankar</b>
Driver	<b>Pramoda Kumar S.</b>
Lab Helper	<b>Muniraju</b>

## UNIT AT A GLANCE

### HONOURS RECEIVED



## FACULTY ACHIEVEMENTS:

### Dr. T. N. C. Vidya

- Featured in "75 Under-50 Scientists Shaping Today's India", 2022, by the Department of Science and Technology
- Elected to a second term as an Executive Council Member of the Indian Society of Evolutionary Biologists, 2021
- Became Member (through invitation) of the IUCN SSC (World Conservation Union's Species Survival Commission) Asian Elephant Specialist Group, for the quadrennium 2021-25

### Prof. Amitabh Joshi

- Elected to a second term as an Executive Council Member of the Indian Society of Evolutionary Biologists, 2021

## STUDENT ACHIEVEMENT:

### Revathe. T (Ph.D. student; research supervisor: Dr. T. N. C. Vidya)

- Received the Student Travel Award by the American Society of Mammalogists to attend the 101<sup>st</sup> ASM meeting, Tucson, Arizona
- Received the Travel award by the International Society of Behavioural Ecology to attend the ISBE 2022 conference, Stockholm, Sweden

## TOTAL PUBLICATIONS



**3**

Peer reviewed articles indexed in Web of Science

## SPONSORED PROJECTS



**1**

Ongoing Project

**₹18.11 lac**

Funding

## STUDENTS ADMITTED DURING 2021-2022



**4**

Ph.D.

- Mohnish Singh
- Bhawna Mittal
- Jabili Chowdari
- Divya Choudhary

# ENGINEERING MECHANICS UNIT (EMU)



EMU pursues research on a wide range of problems where momentum, heat, and mass transport processes play a critical role. At EMU, we delve into the science underlying the physical origin of events observed both in nature and in a laboratory. It is relevant to a host of technological applications as well. Our current research endeavours include the study of both complex micro-structured fluids (suspensions and emulsions, granular materials, polymer solutions, melts, active matter) and complex flows (linear and non-linear evolution of hydrodynamic instabilities, vortex dynamics, 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 observations, experiments, massively parallel computations, and theoretical analyses.

## RESEARCH AREAS

- Mechanics of granular suspensions: dilute to dense, rapid to Stokesian to Mohr-Coulombian rheology
- Heat transfer
- Experimental fluid dynamics
- Complex fluids and flows
- Nonlinear dynamics and bifurcation phenomena
- Insect flight dynamics
- Multiphase flows

## RESEARCH HIGHLIGHTS

- The existence of purely elastic instability in a rectilinear shearing flow (plane Poiseuille flow) was demonstrated for the first time
- A major research facility for fog prediction next to the North runway at the Kempegowda International Airport Bengaluru was operationalized
- Multiroll transition and the role of compressibility in axisymmetric Taylor-Couette flow of a dilute gas was investigated using direct numerical simulation (DNS) of compressible Navier-Stokes equations
- A tool for medical inventory projections during COVID-19 was developed
- Theoretical and experimental approaches were applied to understand various convection wave regimes
- The relevance of generalised Fourier's law was demonstrated in the near-continuum limit of granular Poiseuille flow

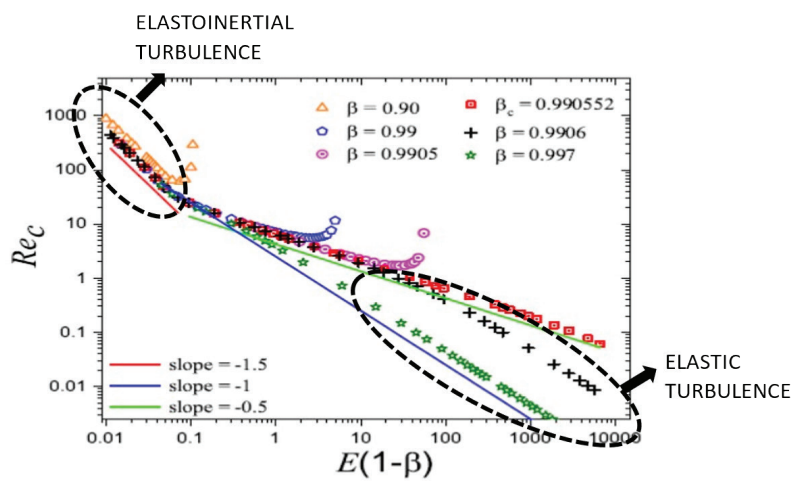


RESEARCH ACTIVITIES AND ACHIEVEMENTS DURING 2021-2022

**Prof. Ganesh Subramanian Ph.D.**

*Professor and Chair*

In our recent work, we demonstrated for the first time the existence of purely elastic instability in a rectilinear shearing flow (plane Poiseuille flow). Our findings disproved the long-held notion of purely elastic instabilities requiring the hoop stresses associated with curvilinear streamlines. We also highlighted, again for the first time, the existence of a continuous pathway between elastic turbulence and the recently discovered state of elastoinertial turbulence. Our findings can help with the ongoing efforts to understand precisely the physical origin of this instability and its domain of existence in the relevant parameter space.



*Regimes of elastic and elastoinertial turbulence in parameter space*

**Reference:**

*Phys. Rev. Lett.* 127 (13): 134502.  
doi: 10.1103/PhysRevLett.127.134502

**Major talks during 2021-2022:**

- 4<sup>th</sup>-8<sup>th</sup> April 2022: Talk at a Discussion Meeting Titled "Waves, Instabilities and mixing in Rotating and Stratified flows" on "The Orientation Dynamics of Sedimenting Anisotropic Particles in Stratified Fluids" organised by the International Centre for Theoretical Sciences (ICTS), Bengaluru
- 14<sup>th</sup>-18<sup>th</sup> March 2022: Talk at the Discussion Meeting titled "Complex Lagrangian Problems of Particles in Flows" on "Anisotropic Swimmer Suspensions: Shear-induced Migration and Dispersion" organised by the International Centre for Theoretical Sciences (ICTS), Bengaluru
- 29<sup>th</sup> December 2021: Talk at the Seminar Series: Mechanical Engineering Dept. on "Transition to turbulence in rectilinear shearing flows of dilute polymer solutions" organised by IIT Delhi

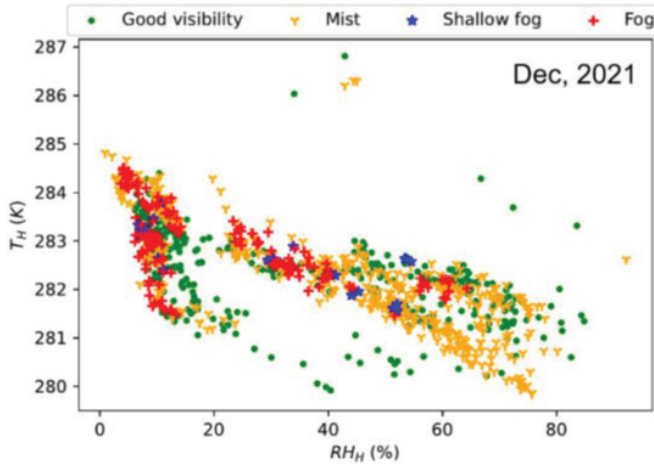
**Prof. K. R. Sreenivas Ph.D.**

*Professor and 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%.



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

### Major talks during 2021-2022:

- Invited as an International Speaker at the Technical Seminars, University of Lille, Lille, France

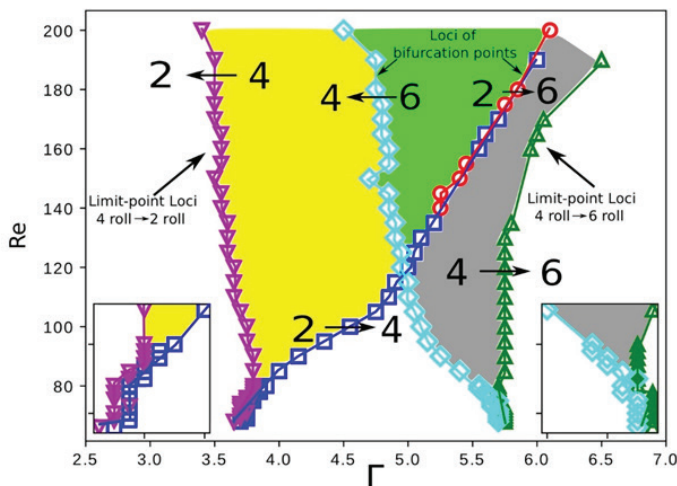
## Prof. Meheboob Alam Ph.D.

### Professor

In our study, the direct numerical simulation (DNS) of compressible Navier-Stokes equations was used for the first time to understand the effects of

- gas compressibility, and
- the finite aspect-ratio on the evolution of nonlinear Taylor vortices and the related bifurcation scenario, resulting in the multiplicity of states, in Taylor-Couette (TC) flow.

We identified the phase boundaries of both symmetric and asymmetric rolls and the coexisting regions of the different number of rolls as functions of Reynolds number ( $Re$ ) and aspect ratio. We have shown that the gas compressibility has a stabilizing effect on nonlinear Taylor vortices that can be tied to the weakening of the outward jets, which aids in the strengthening of the Ekman vortices with increasing Mach number.



Forward and backward bifurcations, along with cusp formation, among nonlinear Taylor vortices in compressible TC flow; the Mach number is unity and the radius ratio of the TC-cell is 0.5.

### Reference:

*J. Fluid Mech.* 908: A24; doi:10.1017/jfm.2020.897

## Major talks during 2021–2022:

- 21<sup>st</sup> July 2021: Talk at the 9th International Conference on Micromechanics of Granular Media (one of 11 Plenary Talks) on “Unified Rheology of Granular and Gas-Solid Suspensions” organised by Powders and Grains 2021, Buenos Aires, Argentina
- 22<sup>nd</sup> April 2021: Talk on “Nonlinear Rheology of Granular and Gas-Solid Suspension” at a Seminar organised by the Department of Chemical Engineering, Northwestern University, Chicago, USA
- 14<sup>th</sup> April 2021: Talk on “Dynamics and Patterns in Sheared Granular Fluid: Order Parameter Description and Bifurcation Scenario” at a Seminar organised by the Okinawa Institute of Science and Technology, Japan

## Prof. Santosh Ansumali Ph.D.

### Professor

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During the recent COVID-19 crisis, we developed a tool that guides medical inventory projections for national needs, which helped in the prediction of herd immunity as well as the growth pattern of the disease. We have created an India-specific model to take into account emerging situations. This initiative was facilitated by the office of the Principal Scientific Adviser to the Government of India. This research work has resulted in several publications.

We have also been working on techniques to solve the Fokker–Planck equation using deterministic methods. Now, in collaboration with researchers at Boston University, we have explored a new method to solve the Fokker–Planck equation for wealth distribution in a model economic system.

Our work on the Fokker–Planck equation was also extended to the kinetic theory of gases. A Fokker–Planck based solver was developed for the gaseous mixture.

### Reference:

- *Phil. Trans. Royal Soc. A.* 378 (2175): 20190401. doi: 10.1098/rsta.2019.0401
- *J. Fluid. Mech.* 899: A25. doi: 10.1017/jfm.2020.459
- *Curr. Sci.* 120 (11)
- *PLoS ONE.* 15 (12): e0242132. doi: 10.1371/journal.pone.0242132
- *Ann. Rev. Contr.* 50: 432–447. doi: 10.1016/j.arcontrol.2020.10.003
- *Phys. Rev E.* 102: 021301 (R). doi: 10.1103/PhysRevE.102.021301

## Dr. Diwakar Seyyanur Venkatesan Ph.D.

### Faculty Fellow

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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 non-linear partial differential equations, we have developed a new weighted scheme that considers an average of the convective forward

time-centered 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	<b>Prof. Ganesh Subramanian</b>
Professors	<b>Prof. Sreenivas K. R. (Dean R&amp;D, JNCASR), Prof. Meheboob Alam, Prof. Santosh Ansumali</b>
Faculty Fellow	<b>Dr. Diwakar Seyyanur Venkatesan</b>

### RESEARCH STUDENTS

Ph.D.	<b>K. Siddharth, Vybhav G. R., Mohammad Raifuddin (U), Suryadev Pratap Singh, Subham Banerjee, Prateek Anand, Arun kumar Varanasi, Piyush Garg (U), Raksha Mahalinkam, Praveen Kumar K. (U), Shaurya Kaushal, Akshaysingh Bhawarsingh, Abhisek Ganguly</b>
M.S. (Engineering)	<b>Mayank Toprani, Adharsh S., Shashank R., Sangamesh Gudda, Biswadeep Roy, Ritwik Das, Saumyakanta Mishra, Akhilesh Srivastava, Anomitra Saha, Ganesh Kumar B., Jishnu Goswami, Guruprasad S., Manoj Tanaji Tanagawade, Akash Bansal</b>

### RESEARCH STAFF

SERB National Postdoctoral Fellow (NPDF)	<b>Dr. Manojit Ghosh</b>
Research Associates	<b>Dr. Abhijit Dhamanekar, Dr. Harish N. Mirajkar, Dr. Subrat Kotoky</b>
Research Associate-II	<b>Dr. Pavan Kumar Singeetham</b>
Senior Research Fellow	<b>Prateek Anand</b>
Junior Research Fellows	<b>Soumyakanta Mishra, Piyush Garg</b>
R&D Assistant	<b>Arunkumar V.</b>

### CONTRACTUAL STAFF

Office Executive	<b>Gayathri T. S.</b>
Helper	<b>K. Ravi Kumar</b>



## UNIT AT A GLANCE

### HONOUR RECEIVED



### STUDENT ACHIEVEMENT:

**Akanksha Bohra** (M.S. (Engineering) student; research supervisor: Prof. Santosh Ansumali with Dr. Diwakar S. Venkatesan as in-charge)

- Received the Prof. Roddam Narasimha and Family Award for the Best M.S.(Engineering) Thesis in Engineering Mechanics 2021

### TOTAL PUBLICATIONS



**10**

Peer reviewed articles indexed in Web of Science/Scopus

### SPONSORED PROJECTS



**2**

New Projects



**8**

Ongoing Projects

**₹64,888**

Funding

### STUDENTS GRADUATED DURING 2021-2022



**2**

**M.S. (Engineering)**

- Sabarish V. N.
- Akshay Chandran

### STUDENTS ADMITTED DURING 2021-2022



**1**

**Ph.D.**

- Abhisek Ganguly

**5**

**M.S. (Engineering)**

- Ganesh Kumar B.
- Jishnu Goswami
- Guruprasad S.
- Manoj Tanaji Tanagawade
- Akash Bansal



At GDU, we focus on natural hazards, reconstruction of paleo-monsoon dynamics, and behaviour of the inter-tropical climatic zone with reference to extreme climatic events over the Himalayas, as a part of the Department of Science and Technology project.

We use reconstruction databases for advanced modelling experiments to explain the causal linkages between global and regional climates and the monsoon rainfall recorded in the proxy data.

Along with this work, we conduct fieldwork to collect samples from select urban lakes in Bengaluru, which we use to trace climatic and anthropogenic activity via environmental geochemistry, in collaboration with 'Geological Survey of India' Bengaluru. We have also initiated natural analogue studies, in collaboration with the Theoretical Science Unit of JNCASR and Bhabha Atomic Research Centre, Mumbai. In this, we focus on the multidisciplinary structure and the vibrational and elastic properties of natural hydroxyapatites with carbonate and actinide substitutions. This work is a unique combination of experimental and simulation studies, used to understand the stability of carbonate in apatite-type matrices. Our findings will assist in understanding the changes in the properties of apatites and will have important implications for the development of bio-computable materials for groundwater cleaning, nuclear waste disposal, and dental/orthopaedic applications.

## RESEARCH AREAS

- Study of limestone caves (speleothem) and paleo and urban lakes
- Reconstruction of past climatic variations in the Himalayas
- Relationship between global and regional climate
- The regional atmospheric circulation mode
- Petrography and mineralogy of speleothems
- Environmental geochemistry and stable isotopes
- Potential hazards in the Himalayan active mountain belt
- Structural and vibrational properties of natural apatites

## RESEARCH HIGHLIGHTS

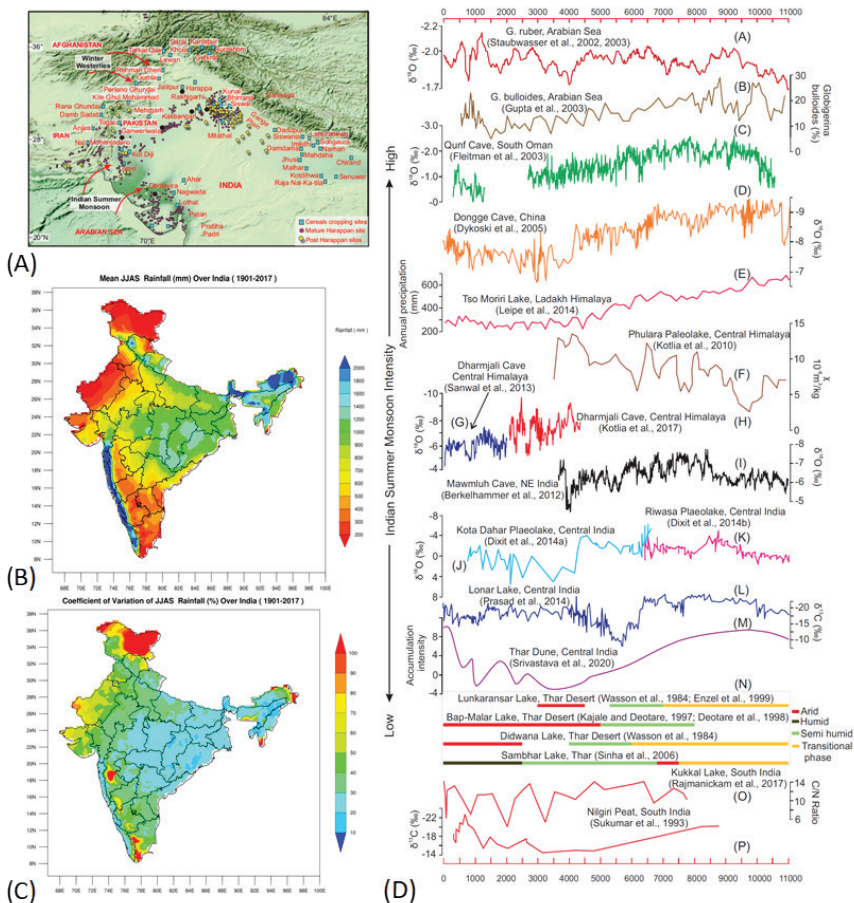
- The "Proxy Response Heterogeneity" of the Indian summer and winter monsoons during the last millennium in the Himalayan region was established
- The evaluation and evolution of monsoon's journey in the past, present, and future, which has tremendously impacted human life and civilization, was highlighted
- How monsoons, and societal dependency on them to date, has remained a lifeline for societal evolution and uplift, was brought out

RESEARCH ACTIVITIES AND ACHIEVEMENTS DURING 2021-2022

**Dr. Jaishri Sanwal Bhatt Ph.D.**

*DST Women Scientist*

To reconstruct the long-term variations of Indian summer monsoon (ISM), and winter westerlies, in the Himalayan region, we employed sediment-based biotic proxies (pollen and  $\delta^{13}C_{org}$ ) and speleothem ( $\delta^{18}O$ ) records as proxy. This comparative study displayed the heterogeneity among these proxies within the Himalayan region. The outcomes of this study highlighted that the vegetation predominantly responds to ISM dynamics, whereas in addition to ISM dynamics, the speleothem also captures fluctuations in winter westerlies. Another study, based on the evaluation and evolution of monsoon's journey in the past, present, and future, demonstrated the role of monsoons in human life and civilization. Our research brings out the societal dependence on monsoons, which remains a lifeline for societal evolution and uplift. Our latest synthesis on monsoons showed us how it has been linked to the history of human evolution to date and provided us with a mature and comprehensive overview of monsoon's evolution.



(A) Location of major excavated sites of the Indus Valley civilization during different evolutionary phases and the locations of barley and rice cultivation in the Indian subcontinent. (B) Mean all India summer monsoon rainfall during June to September (1901-2017). (C) Mean coefficient of variability (%). (D) A few marines and continental proxy records of ISM variability and paleoclimate during the Holocene

**Reference:**

- J. Paleosci. JPS/2022/04 (in press)
- Front. Ecol. Evol. 10:778825. doi: 10.3389/fevo.2022.778825

**Major talks during 2021-2022:**

- 25<sup>th</sup>-28<sup>th</sup> April 2022: Organised Science Outreach Program at Gangolihat, Uttarakhand, with Hall of Science, Education Technology Unit (ETU), JNCASR, and Himalayan Gram Vikas Samiti (HGVS)
- 3<sup>rd</sup> April 2022: Organised a webinar on "International Year of Cave and Karst, and Geologist Day 2022" with Speleological Association of India

## Major talks during 2021-2022

- 14<sup>th</sup> June, 2022: Invited talk at the International Seminar *One Earth - Rebalance Energy to Sustain* on "The Mighty Himalaya: Land, People, and Environment," organised by the Indian Women Scientists' Association (IWSA), Mumbai, to celebrate World Environment Day 2022
- 25<sup>th</sup>-28<sup>th</sup> April 2022: Talk on "Science of Dynamic Planet: Geological Wonder" at the Science Outreach Program organised by Hall of Science, Education Technology Unit (ETU), JNCASR, and Himalayan Gram Vikas Samiti (HGVS), Gangolihat, Uttarakhand
- 3<sup>rd</sup> April 2022: Talk at the International Year of Cave and Karst, and Geologist Day 2022 Webinar on "Discover the Karst and Cave Geology" organised by Speleological Association of India

## UNIT MEMBER

DST Woman Scientist

Dr. Jaishri Sanwal Bhatt

## UNIT AT A GLANCE

### TOTAL PUBLICATION



1

Peer reviewed article indexed in Web of Science/Scopus

### SPONSORED PROJECT



1

Ongoing Project

₹11 lac

Funding



# INTERNATIONAL CENTRE FOR MATERIALS SCIENCE (ICMS)



ICMS is the first international centre of its kind devoted to high impact, interdisciplinary scientific research, education, and extension activity in materials science. It is established in the confines of a scientific cum educational institution. ICMS was envisaged by the Department of Science and Technology (DST), Government of India. The plans to establish the centre crystallised in 2007 when the Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR) took the lead and the necessary steps to establish it. It was inaugurated and dedicated to the nation on 3<sup>rd</sup> December 2008 by the then Honourable Prime Minister of India—Dr. Manmohan Singh.

An important and unique activity of ICMS is to provide global research opportunities and support international exchange programs.

ICMS is a constituent of the School of Advanced Materials, JNCASR.

## RESEARCH AREAS

- Solid-state chemistry
- Nanomaterials
- Biodegradable polymers
- Electrocatalytic water splitting reactions
- Epitaxial growth of semiconductors
- Optical properties of semiconductor nanocrystals
- Stereochemistry and chirality of organic molecules
- High energy resolution electron energy loss spectroscopy (HREELS)
- Aberration corrected high-resolution transmission electron microscopy
- Hybrid layered double perovskite (HLDP) halides
- Experimental soft condensed matter physics
- Rechargeable zinc-ion batteries

## RESEARCH HIGHLIGHTS

- Nanocomposites of MoS<sub>2</sub> with carboxyl-functionalized carbon nanotubes and borocarbonitrides nanosheets were synthesised for electrocatalytic hydrogen evolution reaction
- High activity NiCoP nanoporous material was explored as an efficient water splitting electrocatalyst for the oxygen evolution reaction
- Image simulations were conducted through atomic resolution transmission electron microscopy by considering the atom as an electrostatic interferometer
- Direct methods were applied to phase retrieval in high resolution transmission electron microscopy (HRTEM) imaging
- A strategy to tune the nature of the chiral activity of three-dimensionally printed granular ellipsoids without altering their shape or size was developed
- Fundamental quantum mechanical phenomenon and optical properties for doped semiconducting nanocrystals were discussed

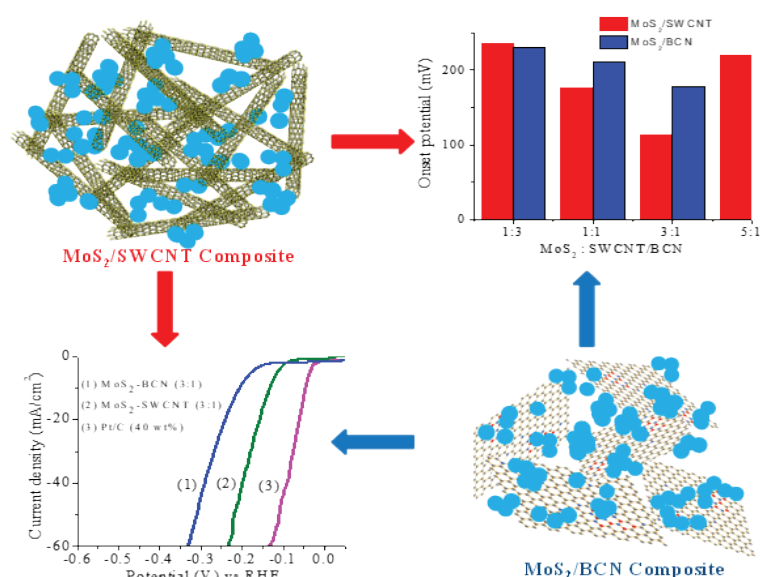
- A new class of biodegradable aliphatic polymers was developed with potential applications in the bio-medical industry
- Secondary phase limited metal-insulator phase transition was explored in chromium nitride thin films
- A new highly polar and non-aqueous co-solvent, propylene carbonate (PC) was introduced for high-performance Zn-ion battery applications

## RESEARCH ACTIVITIES AND ACHIEVEMENTS DURING 2021-2022

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

*Linus Pauling Research Professor, Honorary President, and Director, ICMS*

Transition metal dichalcogenides such as molybdenum disulfide ( $\text{MoS}_2$ ) are being widely studied due to their outstanding electrocatalytic properties for hydrogen generation from water due to active sulfur edges. In our research, we reported a facile method for the preparation of  $\text{MoS}_2$ /single-walled carbon nanotubes (SWCNT) and  $\text{MoS}_2$ /borocarbonitride ( $\text{BC}_6\text{N}$ ) composites. The nanocomposites were obtained by mixing  $\text{MoS}_2$  nanoparticle dispersion with different proportions of carboxyl-functionalized SWCNT and BCN in water. The prepared composites were then used for catalyzing an electrochemical hydrogen evolution reaction (HER). We found that the  $\text{MoS}_2$ /SWCNT and  $\text{MoS}_2$ /BCN composites show higher electrocatalytic activity for HER when compared to the individual constituents. The tests also revealed that the activity increased proportionally with the amount of  $\text{MoS}_2$  in the composite. Among the prepared catalysts,  $\text{MoS}_2$ -SWCNT with a 3:1 ratio of  $\text{MoS}_2$  and SWCNT exhibited highly positive onset potential (-113 mV vs RHE) and a small Tafel slope ( $59 \text{ mV dec}^{-1}$ ) along with remarkable stability in an acid electrolyte. Our study showed that a combination of  $\text{MoS}_2$  nanoparticles with SWCNT or BCN can be a promising material in the field of catalysis reactions.



*MoS<sub>2</sub>/SWCNT and MoS<sub>2</sub>/BCN composites exhibiting superior electrocatalytic HER activity*

**Reference:**

*Mater. Res. Bull.* 149: 111697.  
 doi: 10.1016/j.materresbull.2021.111697

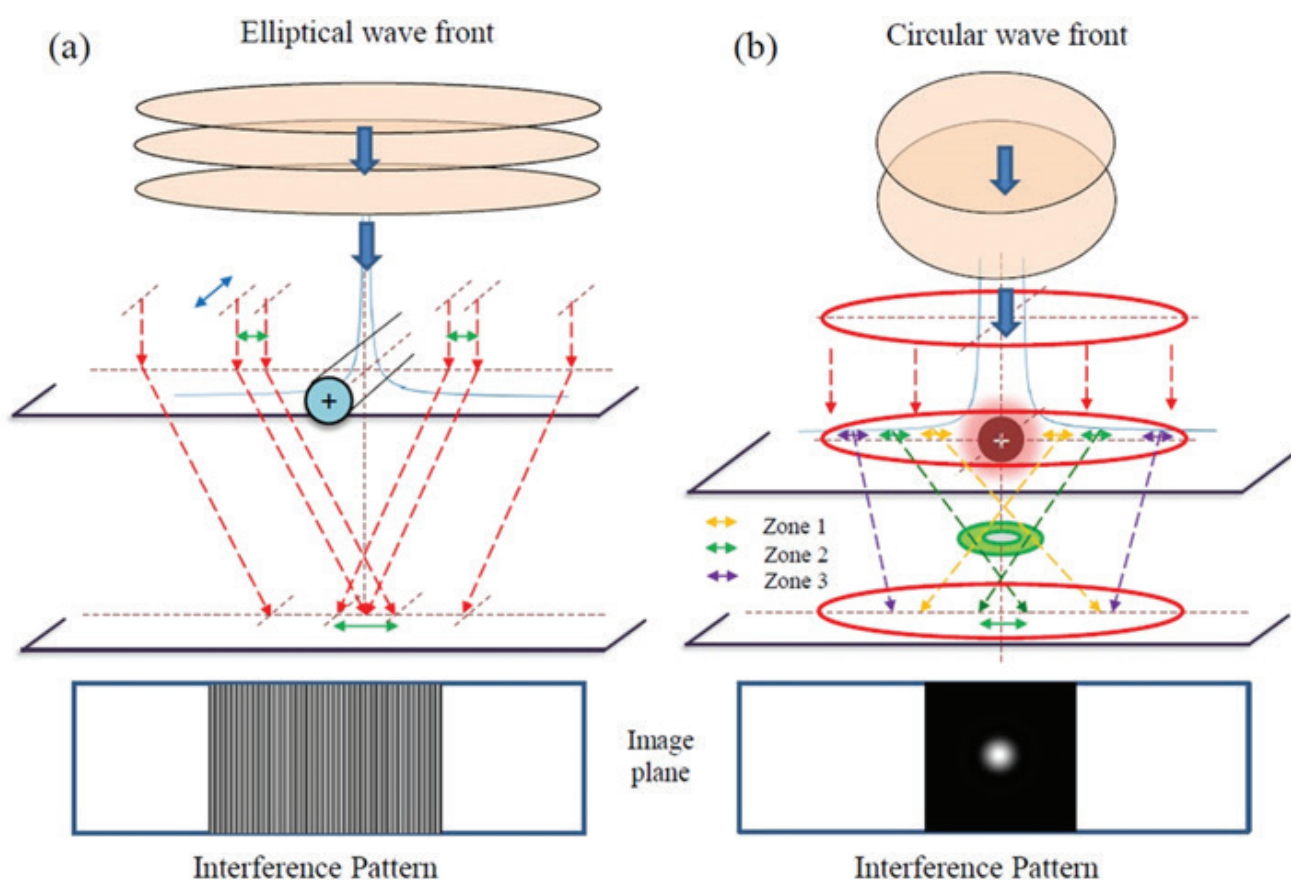
**Major event organised during 2021-2022:**

- 6<sup>th</sup>-10<sup>th</sup> December 2022: Talk on "Frontiers in Materials Science" at the International Winter School

## Prof. Ranjan Datta Ph.D.

### 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 biprism 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 were in close agreement with the experimental images of Mo and B atoms recorded under the optimum combination of third-order spherical aberration  $C_s = -35 \mu\text{m}$  and defocus  $\Delta f = 1, 4,$  and  $8 \text{ nm}$ .



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

#### Reference:

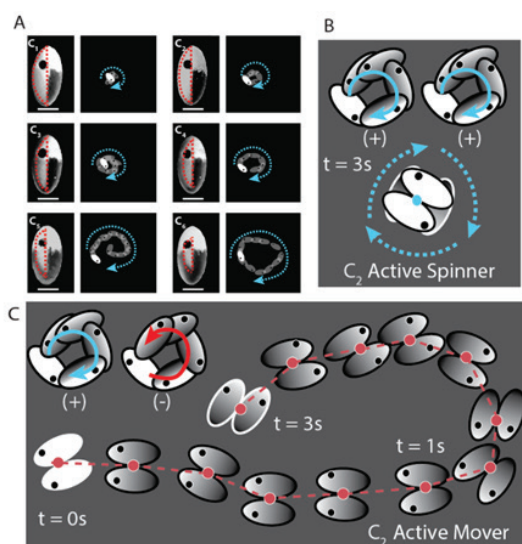
*J. Phys. Commun.* 5: 085004. doi: 10.1088/2399-6528/ac1839

## Prof. Rajesh Ganapathy Ph.D.

### Professor

When chirality is present as a static feature of building blocks, interactions between and reactions involving them are often stereoselective. In many active matter systems, however, it is not the particle shape that is chiral. Rather, it is a feature of the dynamics: particle trajectories have a well-defined handedness associated with them. Whether such chiral activity can introduce stereoselective interactions between particles is not

known. Recently, we developed a strategy to tune the nature of the chiral activity of three-dimensional printed granular ellipsoids without altering their shape or size. In vertically agitated monolayers of these particles, we observed two types of dimers form depending on the chirality of the pairing monomers. Heterochiral dimers moved collectively as a single achiral active unit, while homochiral ones formed a translationally immobile spinner. In active racemic mixtures, the former was more abundant than the latter, indicating that interactions were stereoselective. We further demonstrate chiral self-recognition in mixtures of particles with different chiral activities.



A. Left: Snapshots of 3D-printed chiral active ellipsoids for six different left-right mass asymmetries. Right: Superimposed snapshots showing a nearly circular path traced by the ellipsoids under vertical agitation. B and C: Superimposed snapshots of representative active spinners and movers, respectively.

**Reference:**  
*Sci. Adv.* 7, 9: eabd0331.  
 doi: 10.1126/sciadv. abd0331

## Major talks during 2021-2022:

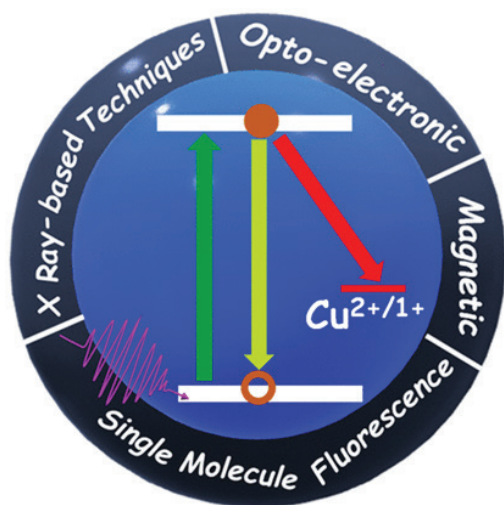
- December 2021: Talk on "The Physics and Chemistry of Materials, Colloidal Epitaxy" at the Winter School Seminar at JNCASR
- December 2021: Talk on "Emergent Dynamics in Designer Active Granular Matter" at the Symphy-21 Seminar at IIT Bombay, India
- November 2021: Talk on "Machine Learning Devitrification" at the Annual Faculty Meet Seminar at JNCASR
- November 2021: Talk on "Making Research Presentations" at a KHEA Training Event Seminar at the Karnataka Higher Education Academy, Dharwad, Karnataka
- April 2021: Talk on "Micrometer-sized Heat Engines: Design, Construction and Tuning Performance" at a group webinar in University of Gothenburg, Sweden

## Dr. Ranjani Viswanatha Ph.D.

### Associate Professor

Our research activities during the last year has made contributions to semiconductor nanomaterials, with an emphasis on intriguing optical and magneto-optical properties, suggesting pathways to circumvent fundamental selection rules. While resolving several long-standing debates in the field, including the three-decade-old issue of energy transfer mechanisms for manganese (Mn) emission in doped nanomaterials, we have established innovative, practical consequences of our fundamental discoveries, such as the determination of the Cu oxidation state and its use as nanosensors to probe wavefunctions of nanomaterials.





*Fundamental quantum mechanical phenomenon behind optical properties of Cu-dopants*

**Reference:**

*J. Phys. Chem. Lett.* 13, 8: 1952-1961.  
doi: 10.1021/acs.jpcllett.1c04076

**Major event organised during 2021-2022:**

- 27<sup>th</sup>-29<sup>th</sup> July 2021: Organised an event on "Interdisciplinary Topics in Materials Conference (IITAM-2021)" in collaboration with IISc, and CeNS

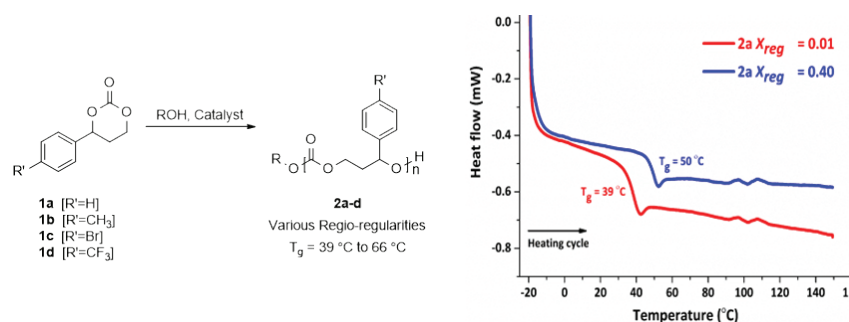
**Major talks during 2021-2022:**

- 12<sup>th</sup> January 2022: Talk on "Radiation & Photochemistry (TSRP-2022) Spectroscopy and Dynamics in Nanomaterials and Interfaces" at the Trombay Symposium at Bhaba Atomic Research Centre, Mumbai
- 8<sup>th</sup> December 2021: Talk on "The Story of Manganese in Quantum Dots" at the International Winter School 2021 at JNCASR
- 5<sup>th</sup> October 2021: Talk on "Perovskite-Based Couples Light Emitters for Enhanced Energy Efficiency" at Applied Light-Matter Interactions in Perovskite Semiconductors Conference (ALMI-PS 2021), organised by nanoGE
- 29<sup>th</sup> July 2021: Talk on "Magneto-optical Stark Effect in Fe-doped CdS Nanocrystals" at the Interdisciplinary Topics in Advanced Materials Conference (ITAM-2021), organised by IISc, JNCASR, and CeNS
- 14<sup>th</sup> April 2021: Talk on "Physics of Dopant Emission to Harness the Rainbow Emission of Nanocrystals" at ECS Webinar

## Dr. Sridhar Rajaram Ph.D.

### Associate Professor

During the past year, we worked on developing biodegradable polymers with potential applications in the bio-medical 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.*

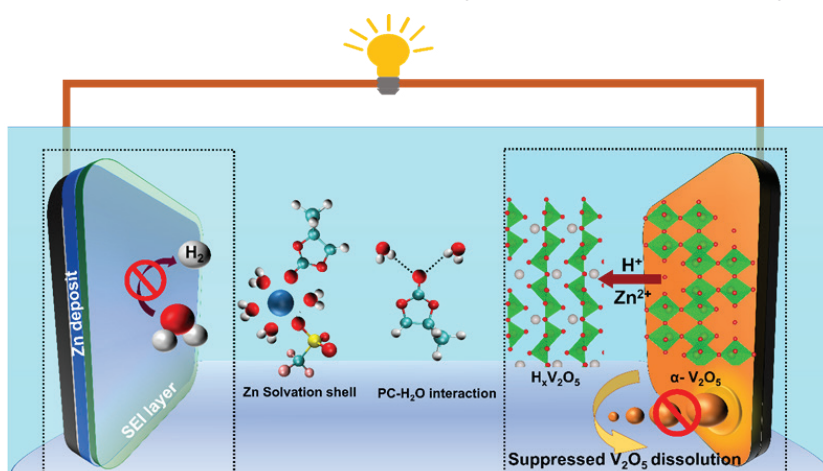
**Reference:**

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

## Dr. Premkumar Senguttuvan Ph.D.

*Faculty Fellow (jointly with NCU)*

Aqueous rechargeable zinc-ion batteries are a lucrative option for large-scale energy storage applications. The dendritic growth of zinc, structural degradation, and poor coulombic efficiencies (CEs) limit the scope of these batteries. These shortcomings can be reduced by using organic co-solvents and additives in low concentration  $Zn^{2+}$  ion. However, these solvents are effective only when used in large amounts, reducing key electrolyte properties such as electrical conductivity. Our study introduced polar propylene carbonate (PC) as the non-aqueous co-solvent for high-performance Zn-ion batteries. We found that the highly polar propylene carbonate (PC) imparted a dual-functionality - it suppressed water-derived parasitic reactions occurring at both the Zn anode and the  $V_2O_5$  cathode. The spectroscopic and molecular dynamics simulation studies revealed that water molecules solvating  $Zn^{2+}$  ions were being partly replaced by the carbonate and the triflate anions on the addition of a small addition of PC ( $\leq 20$  wt%) in 1 M zinc triflate electrolyte. The assembled Zn|Cu cells showed CEs of  $\sim 99.3\%$  for 700 cycles. The observations indicated that such excellent efficiencies could be a result of the stable zinc plating/stripping process induced by electrochemical reduction of the PC and triflate anions present in the  $ZnF_2$ -rich solid-electrolyte interphase. Our study also discovered that the highly basic carbonyl oxygen of PC strongly interacted with water molecules, which suppressed the dissolution of the cathode, which imparted our Zn-ion cell with exceptional capacities of  $\sim 300$  mA h  $g^{-1}$  over 900 cycles at 1 A  $g^{-1}$ .



*Effect of propylene carbonate additive on the electrochemical performance of Zn-ion batteries*

### Reference:

*J. Mater. Chem. A.* 10 (23): 12597-12607.  
doi: 10.1039/D2TA01501C

### Major talk during 2021-2022:

- 14<sup>th</sup> December 2021: ChemSci2021 Talk on "Leaders in the Field Symposium, Tailoring High Energy Density Phosphate Cathodes for Na-ion Batteries" at RSC and JNCASR

## Prof. Eswaramoorthy M. Ph.D.

*Professor and Associate Director, ICMS (jointly with CPMU)*

Please see pg 48 for research activities

## Prof. S. M. Shivaprasad Ph.D.

*Professor (on lien with KSHEA, Dharwad; jointly with CPMU)*

Please see pg 50 for research activities

## Dr. Bivas Saha Ph.D.

### Faculty Fellow (jointly with CPMU)

Please see pg 51 for research activities

## UNIT MEMBERS

### FACULTY MEMBERS

Director	<b>Prof. C. N. R. Rao</b>
Professor and Associate Director	<b>Prof. Eswaramoorthy M.</b> (jointly with CPMU)
Professors	<b>Prof. S. M. Shivaprasad</b> (on lien with KSHEA, Dharwad; jointly with CPMU) <b>Prof. Ranjan Datta</b> <b>Prof. Rajesh Ganapathy</b>
Associate Professors	<b>Dr. Ranjani Viswanatha, Dr. Sridhar Rajaram</b>
Faculty Fellows	<b>Dr. Bivas Saha</b> (jointly with CPMU) <b>Dr. Premkumar Senguttuvan</b> (jointly with NCU)

### ASSOCIATE FACULTY

**Prof. G. U. Kulkarni** (Professor, CPMU; President, JNCASR)  
**Prof. Balasubramanian S.** (Professor, CPMU)  
**Prof. Chandrabhas Narayana** (Professor, CPMU; on deputation with RGCB)  
**Prof. Narayan K. S.** (Professor, CPMU)  
**Dr. Kanishka Biswas** (Associate Professor, NCU)

### RESEARCH STUDENTS

P.G.D.M.S.	<b>Chirag Sarthi J., Chiku Parida</b>
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### TECHNICAL STAFF

Sr. Research Officer	<b>Jay Ghatak</b>
Technical Assistant (Inst)	<b>Mahesh J. I.</b>

### RESEARCH STAFF

SERB National Postdoctoral Fellow (NPDF)	<b>Dr. Nidhi Pandey</b>
Senior Research Associate	<b>Dr. Chithaiah P.</b>
Research Associates	<b>Dr. Mohd Monis Ayyub, Dr. Usha Manjunath Bhat, Dr. Pramoda K., Dr. Sudeesh Krishnamurthy</b>
Research Associate-III	<b>Dr. K. Manjunath</b>
Research Associate (Provisional)	<b>Mahima Makkar</b>
Research Scientist-B	<b>Sanjit Kumar Parida</b>
Project Scientist	<b>Ankur</b>
R&D Assistant	<b>Sneha Kobri</b>

### ADMINISTRATIVE STAFF

Laboratory Assistant	<b>Mune Gowda H.</b>
Jr. Admin Assistant	<b>Ramya C.</b>

## CONTRACTUAL STAFF

Technical Assistant Trainees

Sachin Kumar, Ruther Tyson Lewis

## UNIT AT A GLANCE

### HONOURS/FELLOWSHIPS/MEMBERSHIPS RECEIVED



### FACULTY ACHIEVEMENTS:

#### Prof. C. N. R. Rao

- Received Honorary Fellowship of the Karnataka Association for the Advancement of Science (KAAS), 2022

#### Prof. Rajesh Ganapathy

- Featured in "75 Under-50 Scientists Shaping Today's India", 2022, by the Department of Science and Technology

#### Dr. Ranjani Viswanatha

- Received extension on her J. C. Bose Fellowship
- Received the SERB-POWER Fellowship
- Selected as one of the 75 women for the project 'SHE Is: 75 women in STEAM' by the Red Dot Foundation in partnership with the Office of the Principal Scientific Adviser to the Government of India
- Editorial Advisory Member of NanoFutures

#### Dr. Bivas Saha

- Received Sheikh Saqr Career Award Fellowship from Ras Al Khaimah Centre for Advanced Materials

#### Dr. Premkumar Senguttuvan

- Received Sheikh Saqr Career Award Fellowship from Ras Al Khaimah Centre for Advanced Materials

### TOTAL PUBLICATIONS



**37**

Peer reviewed articles indexed in Web of Science/Scopus



## SPONSORED PROJECTS



**7**

New Projects

**₹1.33 cr.**

Funding



**7**

Ongoing Projects

**₹4.96 cr.**

Funding

## STUDENTS GRADUATED DURING 2021-2022



**2**

P.G.D.M.S

- Unnimaya K. C.
- Aiswarya R. P.

## STUDENTS ADMITTED DURING 2021-2022



**2**

P.G.D.M.S

- Chirag Sarthi J.
- Chiku Parida

# MOLECULAR BIOLOGY AND GENETICS UNIT (MBGU)



At MBGU, we use fundamental principles and advanced approaches to improve the understanding of concepts in biology and provide solutions for healthcare and medicine. Initiated in the field of infectious diseases, the Unit has expanded into several current areas of cell and molecular biology, developmental genetics, and biochemistry while incorporating 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 global network of collaborations.

Our research impacts the understanding and application of clinical and translational studies. Biological concepts and processes are unravelled by studying various organisms, including viruses, yeast, protozoa, *Drosophila*, and mouse, stem cells, 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 designed to foster interdisciplinary interactions. With decades of experience, the faculty hold key administrative and advisory positions at JNCASR, and also nationally and internationally. MBGU faculty have received numerous awards and honours for their contributions to the development of science in the country. MBGU's significant contribution has helped JNCASR achieve the recent excellent ranking of 7<sup>th</sup> in Nature index normalized and 4<sup>th</sup> in the life sciences.

## RESEARCH AREAS

### Mechanisms of intracellular regulation

- Chromatin dynamics and transcriptional regulation in cancer
- Epigenetics: long non-coding RNA in chromatin regulation
- Novel regulators of autophagy pathways
- Organelle-level regulation of stem cell differentiation and hematopoiesis
- Cytoskeletal regulation of the epithelial to mesenchymal transition in development and cancer
- Xenophagy and mitophagy
- Mechanisms of mitochondrial dynamics and lineage bias
- Molecular enzymology and protein structure-function analysis

### Genetics and disease models

- Genetic basis of human neurodevelopmental disorders and human sensory epilepsy syndrome
- Genetic models of blood and cardiovascular development and disease
- Human stem cell biology and models of development and disease

### Molecular and cell biology of infectious diseases; immunobiology

- Genome evolution and histone variants in fungal pathogens
- Transcriptional and epigenetic regulation of immunity
- Cell cycle regulation in *Candida*
- Parasitology and biochemistry of *Plasmodium*
- Evolution, replication fitness and latency of HIV-1C

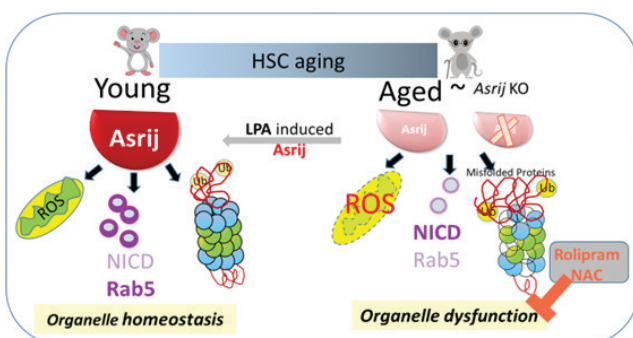
RESEARCH HIGHLIGHTS

- Cell-intrinsic mechanisms regulating blood stem cell aging were studied in the context of aiding the reversal or slowing of aging
- The structural basis for the hyperthermostability of an archaeal enzyme induced by succinimide formation was determined
- Autophagy underlying the proteostasis mechanisms of artemisinin resistance in *P. falciparum* malaria was demonstrated
- Zinc finger GRF-type containing 1 (ZGRF1), a new gene underlying a human sensory epilepsy syndrome was discovered
- Emerging promoter-variant strains of HIV-1 subtype C were identified along with their evolution of regulatory elements
- Histone chaperone nucleophosmin which regulates transcription of key genes involved in oral tumorigenesis was studied
- Clade-specific genome rearrangements in *Candida auris* and a chromosome number change in related species were revealed via the functional and comparative analysis of centromeres
- Synaptic dysfunction in a *Drosophila* model of Spinocerebellar Ataxia Type 3 (SCA3) was characterized using locomotion-based behavioural assays as surrogate readouts of presynaptic function
- Genome-wide, high-resolution chromosome-conformation capture (Hi-C) experiments were performed on ex vivo mTECs from wild-type and Aire-mutant mice
- The role of lncRNA Mrhl in regulating differentiation programs in mESCs was revealed in the context of appropriate cues through chromatin-mediated responses

RESEARCH ACTIVITIES AND ACHIEVEMENTS DURING 2021-2022

**Prof. Maneesha S. Inamdar** Ph.D., F.N.A.Sc., F.I.A.Sc., J. C. Bose National Fellow  
*Professor and Chair*

Aging of the blood system is defined by increased hematopoietic 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 analyzing 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.

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

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

## Major talks during 2021-2022:

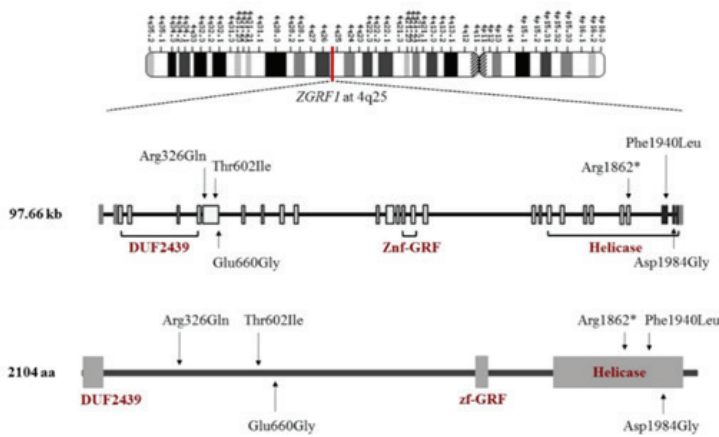
- 2<sup>nd</sup> April 2022: Seminar at the SAC meeting, Rajiv Gandhi Centre for Biotechnology, Trivandrum
- 28<sup>th</sup> February 2022: National Science Day talk on "Opportunities in Stem Cells and Regenerative Medicine" at the Amritha Institute for Biotechnology
- 18<sup>th</sup> December 2021: Talk at the inStem Science Setu seminar
- 20<sup>th</sup> November 2021: Seminar at APPSCON2021

## Prof. Anuranjan Anand Ph.D., F.A.Sc., F.N.A., F.N.A.Sc., J. C. Bose National Fellow Professor and Chair, NSU

Sensory epilepsies are seizures that are triggered by a wide range of stimuli, one among them is contact with hot water. This disorder is most prevalent in the southern parts of India. It usually onsets during adolescence and seizures often lead to impaired awareness, possibly of temporal lobe origin. In about one-third of the patients, these seizures become bilateral convulsive seizures. Even though a prevalent issue, the molecular genetic basis of these disorders remains a mystery. We found evidence of mutations in *ZGRF1* that maps to chromosome 4q25. A single non-synonymous, heterozygous variant c.1805C>T located in the exon 5 of *ZGRF1*, encoding zinc finger GRF-type containing 1, co-segregates with the disorder, and this variant leads to an amino acid change, p.Thr602Ile in the corresponding protein. Among the available sequences for the protein, Thr602 is conserved among higher mammals, namely, *Homo sapiens*, *M.mulatta*, *B.taurus*, and *P.troglodytes*.

Our work implicated the involvement of *ZGRF1* variants in hot water epilepsy. Further understanding of the protein function can be attained by creating and studying *ZGRF1* null mice, transcriptome analysis, CHIP-sequencing analysis, and examining

primary cell cultures containing the HWE variants and domain-specific variants created using CRISPR/Cas9. Our study opened up multiple avenues to consider exploring molecular mechanisms that might underlie this intriguing brain disorder.



*Chromosomal location, gene structure, and protein structure of ZGRF1 showing the positions of the six rare variants.*

## Major talk during 2021-2022:

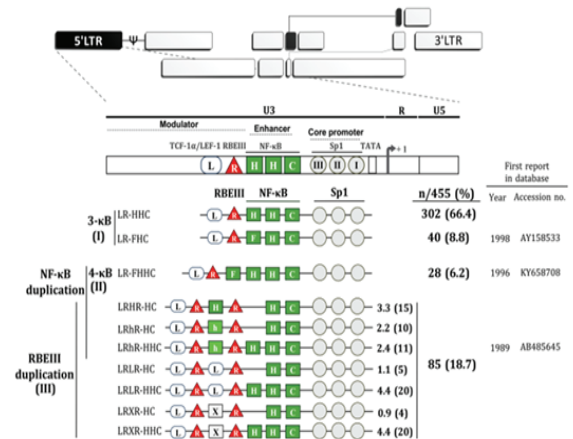
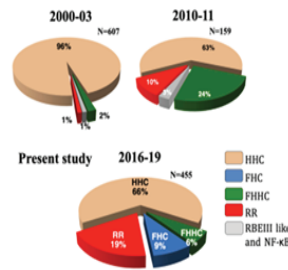
- 17<sup>th</sup> December 2021: Talk at the IAN Annual Meeting Conference on "Human epilepsy genetics: a drift from the ion channel genes involvement" at Indian Academy of Neurosciences (IAN)

## Prof. Ranga Udaykumar Ph.D., F.N.A., F.A.Sc., F.N.A.Sc. Professor

Our laboratory focuses on characterizing the biological and molecular properties of HIV-1C viruses with special emphasis on how these differences at the biological level might influence their pathogenic properties. We have recently identified nine different promoter variant strains of HIV-1C emerging in the Indian population, with some of these variants being reported for the first time. The emerging viral strains



contained additional copies of the existing transcription factor binding sites (TFBS), including TCF-1 $\alpha$ /LEF-1, RBEIII, AP-1, and NF- $\kappa$ B, created by sequence duplication. We found that, 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. Our study provides insights for further investigating the diverse TFBS profiles of the viral promoter following the initiation of antiretroviral therapy.



Profile of HIV-1C promoter variants in the Indian population

**Reference:**

*Front. Microbiol.* 12: 779472. doi: 10.3389/fmicb.2021.779472.

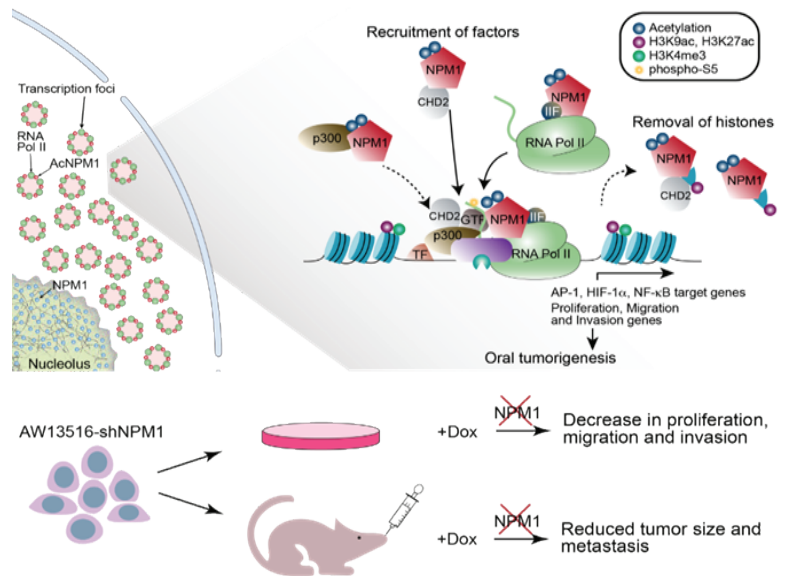
**Major event organised during 2021-2022:**

- 22<sup>nd</sup> May 2021: Organised seminar on "COVID-19 Pandemic: Reality and Myths" with Dr. Ramakrishna Prasad, a medical doctor

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

The focus of our group is to understand the different aspects of functional chromatin dynamics, which are responsible for gene regulation and its link to cellular physiology, differentiation, and pathobiology. Apart from regulating chromatin organisation, neuroglial differentiation, and adipogenesis, we also study three different diseases: cancer (oral cancer and breast cancer), AIDS, and neurological disorders.

Recently, NPM1 acetylation is also being explored as a diagnostic marker in oral cancer. Nucleophosmin (NPM1) is a multifunctional histone chaperone that can activate acetylation-dependent transcription. Our recent study explored NPM1's role in transcriptional regulation in cells and oral tumorigenesis. We established that the nucleolar protein



Evidence for the role of NPM1 in RNA Polymerase II driven transcription relevant to health and disease

**Reference:**

*Mol. Cell. Biol.* 42 (2): e0066920. doi: 10.1128/MCB.00669-20

NPM1 is a histone chaperone that regulates the RNA polymerase II driven transcription and is critical for oral cancer progression. The results showed that the activation of p300/CBP acetyltransferase activity by a small-molecule activator could result in almost complete memory recovery in the neurodegenerative disease model. This activation could also dramatically lead to repairing spinal injury in mice and rats. We also initiated preclinical studies for the activator molecule.

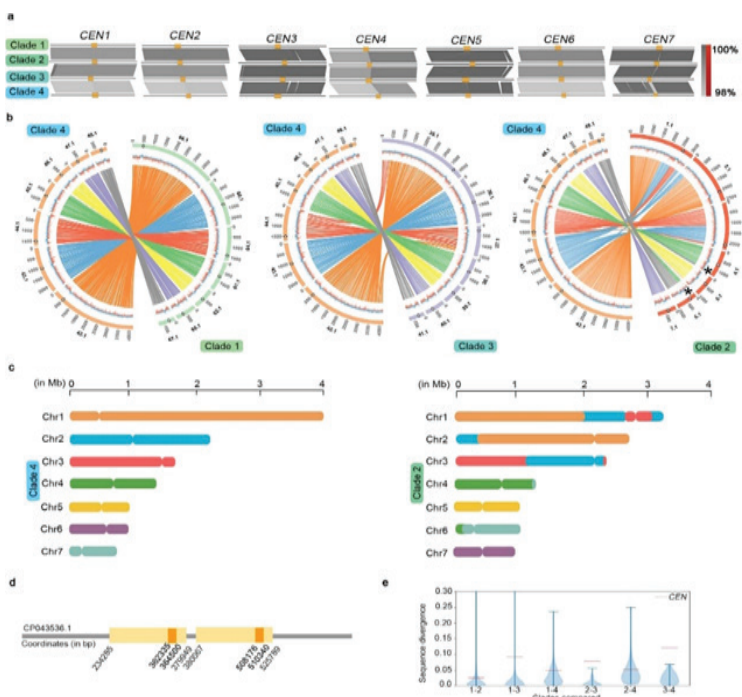
### Major talks during 2021-2022:

- 12<sup>th</sup>-14<sup>th</sup> March 2022: Talk at the International Symposium on Current Trends in Drug Discovery Research, (CTDDR-2022) on "Epigenetic modulator(s) to target intellectual disability" at CSIR-CDRI, Lucknow
- 2<sup>nd</sup>-5<sup>th</sup> March 2022: Talk at the 41st International Annual Conference of the Indian Association for Cancer Research (IACR-2022) on "Combating Cancer: Biology to Therapy to Drug Resistance" and "Epigenetic Regulation of Oral Cancer: Implications of Histone Chaperone NPM1" at Amity Institute of Molecular Medicine and Stem Cell Research (AIMMSCR), Amity University, Noida, Uttar Pradesh
- 17<sup>th</sup> November-2<sup>nd</sup> December 2021: Lecture at Epigenetic Regulation of Gene Expression and Cancer Lecture, H Lee Moffitt Cancer Center and Research Institute, Tampa, Florida, USA

## Prof. Kaustuv Sanyal Ph.D., F.A.A.M, F.N.A., F.A.Sc., F.N.A.Sc., J. C. Bose National Fellow Professor

*Candida auris*, the killer fungus, has evolved as different clades in various geographical regions. This thermotolerant multidrug-resistant ascomycete fungus has rapidly emerged since 2009, causing systemic infections worldwide. In our recent study, we explored the most elusive molecular events that orchestrated this sudden emergence of the killer fungus. We identified centromeres in *C. auris* and related species using a combined approach of chromatin immunoprecipitation and comparative genomic analyses. We found that *C. auris* and multiple other species in the Clavispora/Candida clade shared a conserved small regional GC-poor centromere landscape lacking pericentromeric or repeats. The interspecies genome analysis identified several structural chromosomal changes around centromeres. The analysis also discovered centromeres to be rapidly evolving loci among the different geographical clades of the same species of *C. auris*. Finally, we revealed an evolutionary trajectory of the unique karyotype associated with clade two that

consists of the drug-susceptible isolates of *C. auris*. Exhibiting multidrug resistance and high karyotype plasticity.



Schematic representation of chromosomal rearrangements resulted in an exclusive centromere relocation in clade 2

**Reference:**  
mBio 12: e00905-21.  
doi: 10.1128/mBio.00905-21

## Major talks during 2021-2022:

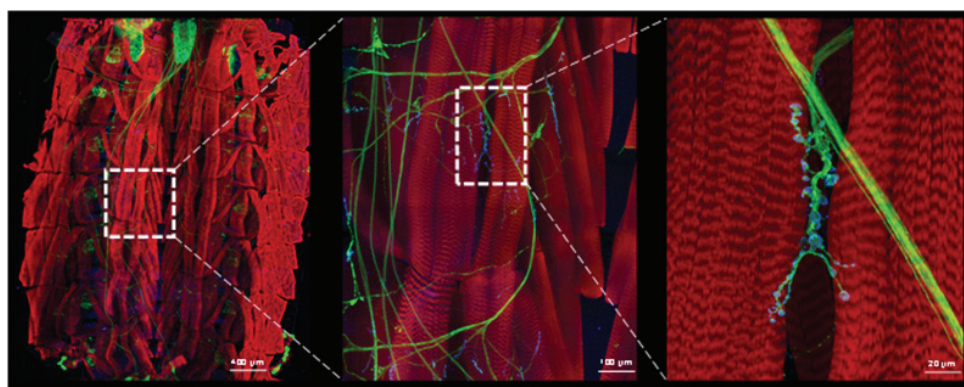
- 19<sup>th</sup> December 2021: Talk at the "90th Annual Meeting of Society of Biological Chemists (SBC)" at Society of Biological Chemists (SBC)
- 7<sup>th</sup> October 2021: Talk at International conference, Korean Society for Molecular and Cellular Biology
- 21<sup>st</sup> September 2021: Talk at JNCASR Council Meeting, JNCASR
- 26<sup>th</sup> August 2021: Talk at Institute Colloquium, National Institute of Immunology, Delhi
- 11<sup>th</sup> August 2021: Talk at Tamesek life science laboratories, Singapore
- 8<sup>th</sup> July 2021: Talks at 23<sup>rd</sup> International Chromosome Conference (ICC), Canberra

**Dr. Ravi Manjithaya** Ph.D., F.N.A., F.A.Sc., F.N.A.Sc.

## Associate Professor

In many neurodegenerative diseases (NDs), including Alzheimer's, Huntington's, and prion diseases, the cellular manifestation of disease pathology is seen earliest at the presynapse. Simultaneously, compromised proteostasis, including autophagy, is a hallmark of these NDs. Autophagy in neurons is highly compartmentalized and subtle modulation of presynaptic autophagy may confer neuroprotective effects against synaptopathy associated with such NDs.

To investigate this idea, we first characterized synaptic dysfunction in a *Drosophila* model of Spinocerebellar Ataxia Type 3 (SCA3) using locomotion-based behavioral assays as surrogate readouts of presynaptic function. Detailed characterization of the neuromuscular junctions (NMJs) revealed defects in the morphology and function of these synapses, with a concomitant dysfunction of the autophagy pathway. Our work revealed that genetic modulation of the autophagy pathway rescued these defects, thus providing a platform for screening for therapeutic targets against synaptopathies.



*Drosophila* neuromuscular junctions. Left: *Drosophila* body wall musculature. Middle: Motor neurons innervating muscle 6/7 form synapses called neuromuscular junctions (NMJ). Right: An NMJ between muscle 6/7

## Major event organised during 2021-2022:

- 16<sup>th</sup>-26<sup>th</sup> August 2021: Organised a Hands-on Training Workshop on "Bioimage Analysis-Image 2 Numbers" at JNCASR

## Major talks during 2021-2022:

- 4<sup>th</sup> March 2022: Talk at Molecular Biology of the Cell Symposium on "Autophagy in Health and Diseases" at the Department of Studies in Biochemistry and Molecular biology, University of Mysore, Manasagangothri, Mysuru
- 2<sup>nd</sup> March 2022: Talk at the One Day Symposium of School of Biological Sciences on "Insights into Mechanisms of Autophagy Flux by Chemical Genetic Approaches" at the Indian Association for the Cultivation of Science (IACS), Jadavpur, Kolkata

- 25<sup>th</sup> February 2022: Talk at the Online/Virtual DBT-INDIA Sponsored International Conference on Biological Innovations and Computational Exploration for Pandemic Challenges (BICPAC-22) on “Role of Autophagy in Health and Disease” at Bishop Heber College Tiruchirappalli, Tamil Nadu
- 16<sup>th</sup> September 2021: Talk at the 18<sup>th</sup> Horizons in Molecular Biology Symposium on “Insights into Mechanisms of Autophagy Flux by Chemical Genetic Approaches” at the International Max Planck Research School for Molecular Biology, Göttingen, Germany

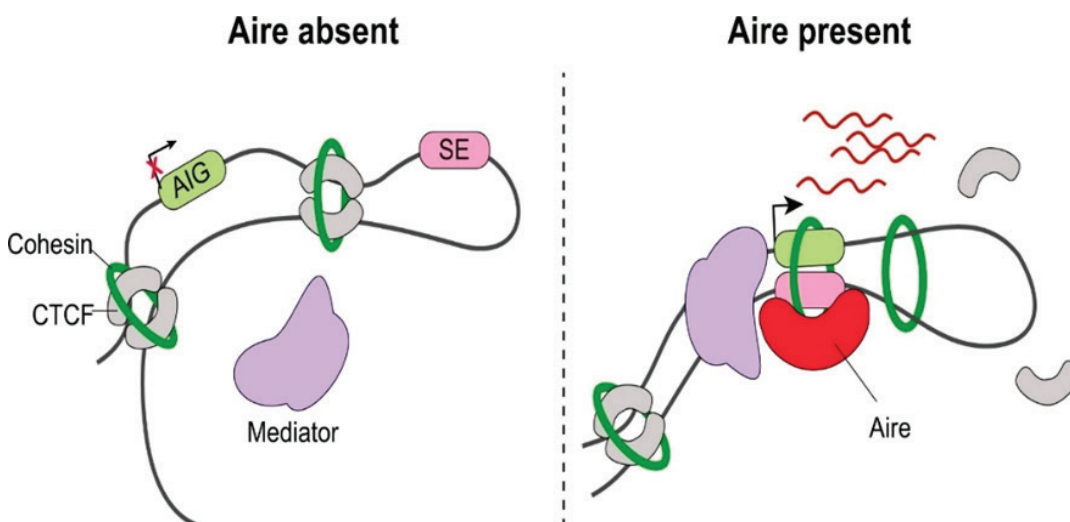
## Dr. Kushagra Bansal Ph.D.

### Faculty Fellow

Autoimmune regulator (Aire), a transcriptional regulator expressed in medullary thymic epithelial cells (mTECs), controls the negative selection of T cells in the thymus by inducing the expression of peripheral tissue antigens. However, how Aire achieves the goal of driving promiscuous expression of a large swath of the genome in mTECs remains an enigma. In our study, we addressed the hypothesis that Aire impacts chromatin organization through the widespread promotion of super-enhancer promoter loops, thus enhancing the expression of a large battery of genes in mTECs.

We performed genome-wide, high-resolution chromosome-conformation capture (Hi-C) experiments on ex vivo mTECs from wild-type and Aire-mutant mice. Our results suggested that Aire has a widespread impact on higher-order chromatin structure, disfavoring architectural loops while favouring transcriptional loops. We found that Aire promoted the accumulation of mediator and cohesin complexes at super-enhancers. Aire’s association with the cohesin loader, NIPBL, further strengthened this. The chromatin-domain enforcer CCCTC-binding factor (CTCF), on the other hand, was relatively depleted from structural domain boundaries in the presence of Aire. We also created a mouse line with deletion of gene encoding cohesin complex subunit, SA-2, and Aire-induced transcripts were downregulated in mTECs from this mouse line.

Our model explains many unusual features of Aire’s impact on mTEC transcription, providing molecular insight into tolerance induction.



*Model for Aire-induced gene (AIG) transcription resulting from Aire’s promotion of transcriptional (superenhancer-promoter) loops (right) at the expense of architectural loops (left)*

#### Reference:

*Biol. Sci.* 118 (38): e2110991118. doi:10.1073/pnas.2110991118



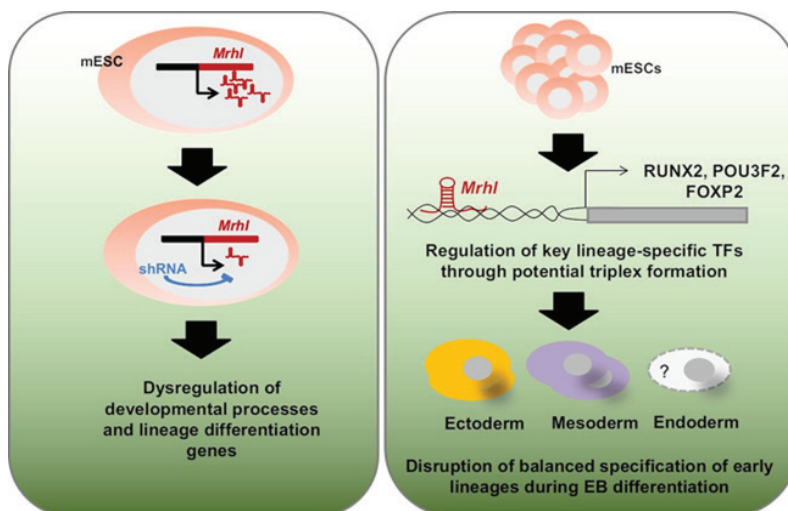
## Major event organised 2021-2022:

- 27<sup>th</sup>-29<sup>th</sup> April 2022: Organised "Single Cell Genomics Workshop" with 10x Genomics, Premas Life Sciences Organising Team, and JNCASR

## **Prof. M. R. Satyanarayana Rao** Ph.D., FASc., FNASc., FNA., FTWAS., FAMS. *Honorary Professor and SERB YOS-Chair Professor*

Mrhl is a nuclear-localized, chromatin-bound lncRNA with moderately stable expression in mESCs. Transcriptome analyses and loss-of-function phenotype studies revealed dysregulation of developmental processes, lineage-specific transcription factors, and key networks along with aberrance in the specification of early lineages during differentiation of mESCs. Genome-wide chromatin occupancy studies suggest regulation of chromatin architecture at key target loci through the triplex formation. Our studies thus revealed a role for lncRNA Mrhl in regulating differentiation programs in mESCs in the context of appropriate cues through chromatin-mediated responses.

Genome-wide occupancy analysis using a highly specific antibody against the CTD of H1T2 demonstrated the binding of H1T2 to the LINE L1 repeat elements and a significant percentage of the genic regions (promoter-TSS, exons, and introns) of the rat spermatid genome. Immunoprecipitation followed by mass spectrometry analysis revealed the open chromatin architecture of H1T2 occupied chromatin encompassing the H4 acetylation and other histones PTMs characteristic of transcriptionally active chromatin. In addition, the present study has identified the interacting protein partners of H1T2-associated chromatin mainly as nucleo-skeleton components, RNA-binding proteins, and chaperones.



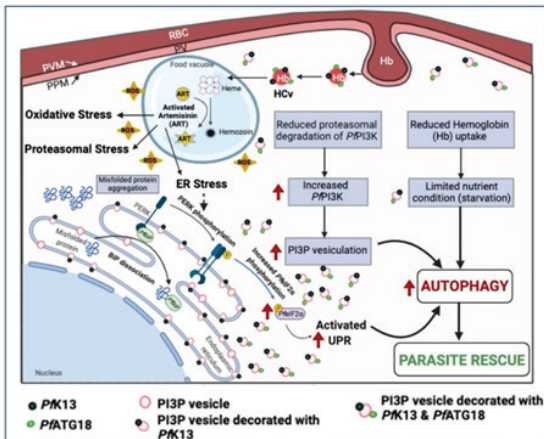
*Schematic showing the involvement of Mrhl in differentiation processes*

**Reference:**  
*Stem Cell Res.* (53):102250.  
doi: 10.1016/j.scr.2021.102250

## **Prof. Hemalatha Balaram** Ph.D., F.N.A.Sc., F.A.Sc *Resident Honorary Professor*

The stability of proteins from hyperthermophiles—organisms existing under boiling water conditions—enabled by a reduction of conformational flexibility is obtained through various mechanisms. A succinimide (SNN) arising from the post-translational cyclization of the side chains of aspartyl/asparaginyl residues with the backbone amide -NH can serve as a new route for hyperthermostability because the succeeding residue would restrain the torsion angle  $\Psi$ . However, such a succinimide is typically prone to hydrolysis and transformation into either an aspartyl or  $\beta$ -isoaspartyl residue. We determined the crystal structure of





*Schematic representation for role of autophagy in proteostasis mechanisms of ART resistance in P. falciparum. Activated ART generates reactive oxygen species (ROS) and leads to alkylation and misfolding of proteins, causing activation of the stress response pathways.*

**Reference:**  
mBio. e0063022. doi: 10.1128/mbio.00630-22

## UNIT MEMBERS

### FACULTY MEMBERS

Professor and Chair	<b>Prof. Maneesha S. Inamdar</b>
Professors	<b>Prof. Anuranjan Anand</b> (Chair, NSU) <b>Prof. Ranga Uday Kumar</b> <b>Prof. Tapas Kumar Kundu</b> <b>Prof. Kaustuv Sanyal</b> <b>Prof. Hemalatha Balaram</b> (superannuated on 1 <sup>st</sup> November 2021)
Associate Professor	<b>Dr. Ravi Manjithaya</b>
Faculty Fellow	<b>Dr. Kushagra Bansal</b>
SERB Year of Science Chair Professor	<b>Prof. M. R. S. Satyanarayana Rao</b>
Resident Honorary Professor	<b>Prof. Hemalatha Balaram</b> (1 <sup>st</sup> November 2021 onwards)
DBT Distinguished Biotechnology Research Professor	<b>Prof. Namita Surolia</b>

### RESEARCH STUDENTS

Ph.D.	<b>Wulligundam Praveen, Preeti Jindal, Rajarshi Batabyal, Kamat Kajal Murli, Alice Sinha, Shrilaxmi V. Joshi, Nazia, Asutosh B. R., Nivedita Pandey, Resmi Ravi, Anusha Chandrashekarmath, Ananya Ray, Arun Panchapakesan, Sreshtha Pal, Swarnima Mishra, Buch Hrimkar Bhargav, Shobith Suresh, Aditya Bhattacharya, Moumita Basu, Smitha A. S., Priya Brahma, Anushka Chakravorty, Cuckoo Teresa Jetto, Kumari Ruchika Ranjan, Aarti Pant, Prerana M., Amit Kumar, Joshi Pooja Amrishkumar, Chinthapatla Sri Charani, Shree Krishna K., Pratiksha P. Bhat, Pai Shruta Sandesh</b>
Int. Ph.D. (Biological Sciences)	<b>Dongre Prathamesh Rajesh, Aishwarya Prakash, Yashashwinee Rai, Arpitha A. Suryavanshi, Chhavi Saini, Jyotsna Karan, Siddharth Singh, 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, Harshit Arya, Vanshika Sood, Jayendra Singh, Amrutha A. S., Arghakusum Das, Deepam Bhattacharya, Vishal Rajesh Lolam, Ritoprova Sen, Souradip Mukherjee, Aman Sharma, Ankit Sharma, Sharma Pragy Niraj, Priyesh Singh Parihar, Joyee Bhattacharya, Kamakshi Tomar, Priyadarshini Ghosh</b>

## TECHNICAL STAFF

Technical Officer Gr II	Suma B. S.
Technical Assistant (Inst)	Mohan V.

## RESEARCH STAFF

SERB (TARE)	Dr. H. Dhanalakshmi
SERB National Postdoctoral Fellows (NPDF)	Dr. Karthikeyan R., Dr. Subha S.
Women Scientist Scheme A	Dr. Shweta Panchal
Research Associates	Dr. Priya Jaitly, Dr. Arindam Ray, Dr. Dileep Pullepu, Dr. Ghazala Ambrin, Dr. Rima Singha, Dr. Bhavana Kayyar, Dr. Vijaya Verma, Dr. Aswathy Narayanan, Dr. Sundar Ram S.
Research Associate I	Dr. Sumedha Swarnkar
Research Associate II	Dr. Narendra Nala
DBT- Research Associate	Dr. Keerti
DBT- Research Associates I	Dr. Mukesh Kumar Chaurasia, Dr. Md. Hashim Reza
Research Associates (Provisional)	Dr. U. D. Kumaresan, Aditya Battacharya, Shveta Jaishankar
Senior Research Fellows	Arpitha Suryavanshi, Asutosh B. R., Arun Panchapakesan
Junior Research Fellows	Nivedita Pandey, Narmathaa Palanisamy, Nidhi Ray, Vaishali S., Tanya Pareek
R&D Assistants	Deepika S., Deepak Selvam, Gipika K. G., Sai Krishna A. V. S., Maithili Balkrishna Sawant, Anjitha R. Vijay, Afzal Amanullah, Yuvrajsinh Gohil, Anish D'silva
Project Assistants	Ananya Ray, Vishnu V. Ashok

## CONTRACTUAL STAFF

Technician	Keerthana J.
Project Technical Officer	Kruthi H. T.
Project Technician - II	Sunil Kumar R.
Sr. Instructor (Biological Sciences)	Ramesh G. R.
Lab Manger	Bhavana R.
Office Assistant (Part-time)	Jyothi
Trainee	Sahana Ravi

## ADMINISTRATIVE STAFF

Helpers	Mune Gowda N., Chandrashekara H. C., Lakkappa G., Raju B. N.
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## ANIMAL FACILITY STAFF

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



## UNIT AT A GLANCE

### HONOURS/FELLOWSHIPS/MEMBERSHIPS RECEIVED



### FACULTY ACHIEVEMENTS:

#### Prof. Maneesha Inamdar

- Participated as an Indian National Science Academy (INSA) nominee in the Inter Academy Partnership (IAP) Statement on regenerative medicine published on 29<sup>th</sup> July 2021 (related article is published in the journal *Stem Cell Reports*)
- Elected as a member of the World Health Organization (WHO) committee (was panellist at the international press conference on 12<sup>th</sup> July 2021 and speaker at the WHO webinar on 14<sup>th</sup> July 2021)
- Elected as Member, Board of Reviewing Editors of the journal *eLife*
- Elected as Member, International Society for Stem Cell Research (ISSCR) Task Force to develop standards for stem cell research
- Elected as Member ISSCR Working Group on Undifferentiated Stem cells and Pluripotency
- Became President-elect, Indian Society of Developmental Biology
- Elected as Member, Sectional Committee on Animal Sciences, Indian Academy of Science
- Elected as DST Nominee for the National Apex Committee of Stem Cell Research and Therapy, April 2021
- Elected as DBT Nominee for IBSC of Siddhaganga Institute of Technology, November 2021 onwards
- Elected as Member, Swarnajayanti Fellowship Committee, 2021

#### Prof. Hemalatha Balaram

- Received extension on her J. C. Bose Fellowship
- Elected as Member, Governing Council 2022, Sun Pharma Science Foundation
- Elected as Member, Sectional Committee 2021, Indian National Science Academy
- Elected as Member, Sectional Committee 2021, Shanti Swarup Bhatnagar Prize, CSIR
- Elected as Convener 2021 and 2022, Sectional Committee (Biology), Indian Academy of Sciences

#### Prof. Kaustuv Sanyal

- Elected as Secretary, Local Chapter, Bengaluru, of the National Academy of Sciences, India
- Became Associate Editor, *Chromosoma (Springer)*
- Elected to be a member of Editorial Board, *Microbiology Spectrum*, American Society for Microbiology

#### Prof. Tapas Kumar Kundu

- Elected as Associate Editor of *Journal of Biochemistry* Editorial Board
- Elected as Member, DBT-Technical Expert Committee on Drug Development Program
- Elected as Fellow of The National Academy of Medical Sciences (India)(FAMS)
- Received U. N. Brahmachari 2<sup>nd</sup> Oration Award, Chemical Biology Society, Kolkata

## Dr. Ravi Manjithaya

- Received Sir C. V. Raman Young Scientist State Award in the field of Life Sciences Karnataka State Council for Science and Technology
- Received award as Review Editor for Frontiers in Aging Neuroscience Archive, Alzheimer's Disease and Related Dementias, *Signaling from Frontiers*, Switzerland

## STUDENT AND ALUMNI ACHIEVEMENTS:

**Aishwarya Prakash** (Int. Ph.D student), **Alice Sinha** (Ph.D. student), **Prathamesh Dongre** (Int. Ph.D student), **Saloni Sinha** (alumnus), and **Sameesh Kher** (alumnus) (research supervisor: Prof. Maneesha Inamdar)

- Received Travel Grant 2021 by International Society for Experimental Hematology

**Cuckoo Teresa Jetto** (Ph.D. student; research supervisor: Dr. Ravi Manjithaya)

- Received the Fulbright-Nehru Doctoral Research Fellowship, United States-India Educational Foundation (USIEF)

**Anushka Chakravorty** (Ph.D. student; research supervisor: Dr. Ravi Manjithaya)

- Received Rainwater Foundation Award from Rainwater Charitable Foundation
- Received the EMBO travel grant award from European Molecular Biology Organisation

**Irine Maria Abraham** (Int. Ph.D. student; research supervisor: Dr. Ravi Manjithaya)

- Received the Best In-House Symposium poster prize, JNCASR

## TOTAL PUBLICATIONS



**28**

Peer reviewed articles indexed in Web of Science/Scopus

## SPONSORED PROJECTS



**6**

New Projects

**₹81.69 lac**

Funding



**31**

Ongoing Projects

**₹6.95 cr**

Funding

## STUDENTS GRADUATED DURING 2021-2022



**6**

Ph.D.

- Dongre Aparna Vilas Pushpalatha
- Pallabi Mustafi
- Arindam Ray
- Shveta Jaishankar
- Bhavana Kayyar
- Priya Jaitly

**8**

M.Sc. (Biological Sciences)

- Aishwarya Prakash
- Yashashwinee Rai
- Rohit Goyal
- Srijana Dutta
- Bhat Mallika Dattatray
- Harshdeep Kaur
- Pallawi Choubey
- Karandeep Singh

## STUDENTS ADMITTED DURING 2021-2022



**4**  
Ph.D.

- Chinthapatla Sri Charani
  - Shree Krishna K.
  - Pratiksha P. Bhat
  - Pai Shruta Sandesh
- 

**4**  
Int. Ph.D

- Priyesh Singh Parihar
- Joye Bhattacharya
- Kamakshi Tomar
- Priyadarshini Ghosh

# NEW CHEMISTRY UNIT (NCU)



NCU has been created by JNCASR as part of the 11<sup>th</sup> 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 synthesize 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 thermoelectrics, photovoltaics, batteries, fuel cells, lasers, organic synthesis of polymers, supramolecules, and multi-functional metal-organic frames are some of the major research activities carried out 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 characterization 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 centers 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 the experimental research.

## RESEARCH AREAS

- Water splitting/H<sub>2</sub> generation
- Atomic layer deposition and pulsed laser deposition
- Fuel cells and catalysis
- Synthesis of novel materials and supramolecular polymers
- Solid state chemistry of metal chalcogenides
- Understanding conformational properties
- Thermoelectric materials
- Molecular architectonics
- Semiconductor nanocrystals, nanoplasmonics, and their heterostructures
- Circularly polarized luminescent (CPL) materials
- Chemical biology, medicinal chemistry, drug discovery, biomaterials, antimicrobial resistance
- Diagnostic therapy (theranostics)
- 2D layered materials
- Silk-inspired and cyclic dipeptide (CDP) based biomimetics and biomaterials
- Halide based perovskites
- Understanding the  $n \rightarrow \pi^*$  interaction
- Materials for energy storage



## RESEARCH HIGHLIGHTS

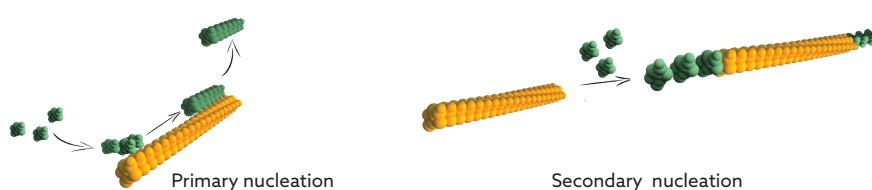
- An unprecedented molecular chirality control was reported on the primary and secondary nucleation events in seed-induced supramolecular polymerization
- Nanocomposites of MoS<sub>2</sub> with carboxyl-functionalized carbon nanotubes and borocarbonitride nanosheets were synthesized for electrocatalytic hydrogen evolution reaction
- A single-pot synthesis method for 4-Amino-2-(het)aryl-5-substituted thiazoles employing functionalized pithioesters as thiocarbonyl precursors was proposed
- A novel drug candidate (TGR63; now being considered for clinical studies) for the treatment of Alzheimer's disease via the significant reduction of amyloid burden and reversal of cognitive decline (mouse model) was discovered
- Efforts to tackle vancomycin-resistant superbugs were discussed in conjunction with the development of semisynthetic vancomycin analogues
- Inorganic materials exhibiting a wide range of physical properties that make them useful in a variety of applications—particularly, fuel cells, CO<sub>2</sub> reduction, and water splitting—were effectively synthesised
- A rare phenomenon of emphanisis was revealed upon the investigation of thermoelectric properties of (SnSe)<sub>0.5</sub>(AgSbSe<sub>2</sub>)<sub>0.5</sub>
- Molecular recognition in synthetic systems were unravelled
- Stabilization of azapeptides by N(amide)...HN(amide) hydrogen bonds were experimentally shown
- A new highly polar and non-aqueous co-solvent, propylene carbonate (PC) was introduced for high-performance Zn-ion battery applications

## RESEARCH ACTIVITIES AND ACHIEVEMENTS DURING 2021-2022

**Prof. Subi Jacob George Ph.D., F.A.Sc., F.R.S.C.**

*Professor and Chair, NCU*

Supramolecular polymers have emerged as promising candidates for designing dynamic, adaptive, and recyclable materials. This new era of supramolecules demands better structural and dynamic control leading to increased attention towards the study of dynamic and adaptive polymers. The synergy between structural and temporal control is important for the advent of supramolecular polymers to be employed as functional adaptive materials. Thus, taking a cue from the biological self-assembly process, kinetically controlled seeded growth has been recently shown to provide control on the primary structure of dynamic supramolecular polymers. However, command over the molecular organization at all hierarchical levels for the modulation of higher-order structures of supramolecular polymers remains a formidable task. The secondary nucleation process, which plays an important role in the autocatalytic generation of amyloid fibrils and during the chiral crystallization of small monomers, offers exciting possibilities for topology control. But mechanistic insights into the molecular determinants and driving forces for the secondary nucleation are still not known. Recently, we filled this dearth by showing an unprecedented molecular chirality control on the primary and secondary nucleation events in seed-induced supramolecular polymerization. We attempted to use the surface catalyzed secondary nucleation process to modulate the topology of supramolecular polymers and to modulate the functional outcomes of supramolecular materials.



*Schematic representation of primary and secondary nucleation events in the synthetic supramolecular polymerization process*

**Reference:**

*J. Am. Chem. Soc.* 2022.  
doi: 10.1021/jacs.2c03230

**Major event organised during 2021–2022:**

- 13<sup>th</sup>–15<sup>th</sup> December 2021: Organised Symposium titled “CHEMSCI2021: Leaders in the field symposium” with Royal Society of Chemistry (RSC), UK, London, and Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR), Bengaluru

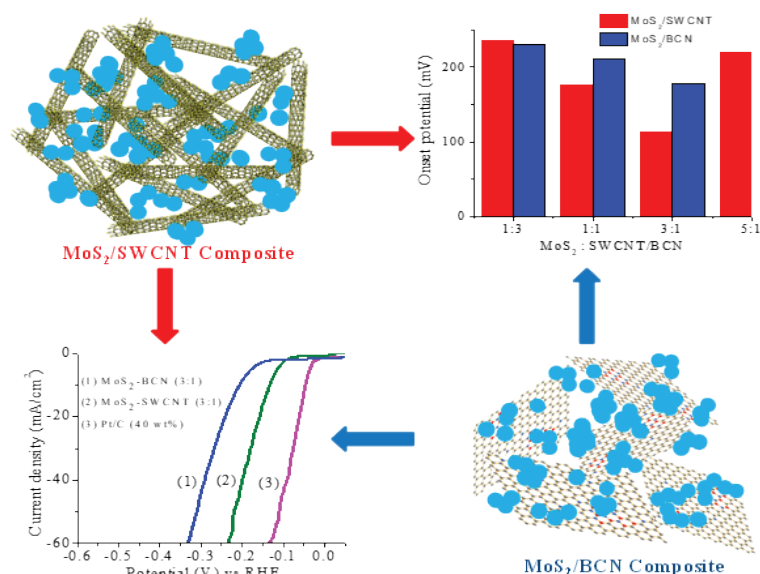
**Major talks during 2021–2022:**

- 22<sup>nd</sup> March 2022: Talk at Chemistry Meet in Manali on “Exploring the Higher Hierarchical Levels of Molecular Self-Assembly: Secondary Nucleation Triggered Supramolecular Polymerization”
- 5<sup>th</sup> March 2022: National Science Day 2022 talk on “Bioinspired Reaction Coupled Supramolecular Polymers: Towards Life-like Materials with Structural and Temporal Precision” at the Pt. Ravishankar Shukla University, Raipur
- 25<sup>th</sup>–28<sup>th</sup> November 2021: Talk at XXI NOST Organic Chemistry Conference on “Bioinspired Reaction Coupled Supramolecular Polymers: Towards Life-like Materials with Structural and Temporal Precision” at the National Organic Chemistry Symposium Trust (NOST), Chennai.
- 26<sup>th</sup>–28<sup>th</sup> October 2021: Talk at the 27<sup>th</sup> International Conference of International Academy of Physical Sciences (CONIAPS XXVII) on “Recent Advances in chemical sciences, Bioinspired Reaction Coupled Supramolecular Polymers: Towards Life-like Materials with Structural and Temporal Precision” organised by JNU-BHU, Prayagraj, India
- 28<sup>th</sup> September 2021: Talk at the Departmental Seminar, Department of Chemistry, Gyeongsang National University (GNU), Korea, on Structural Control in Supramolecular Polymers”

**Bharat Ratna C. N. R. Rao Ph.D., F.R.S.**

***Founder Chair, New Chemistry Unit; Linus Pauling Research Professor, Honorary President, and Director, ICMS***

Transition metal dichalcogenides such as molybdenum disulfide ( $\text{MoS}_2$ ) are being widely studied due to their outstanding electrocatalytic properties for hydrogen generation from water due to active sulfur edges. In our research, we reported a facile method for the preparation of  $\text{MoS}_2$ /single-walled carbon nanotubes (SWCNT) and  $\text{MoS}_2$ /borocarbonitride ( $\text{BC}_6\text{N}$ ) composites. The nanocomposites were obtained by mixing  $\text{MoS}_2$  nanoparticle dispersion with different proportions of carboxyl-functionalized SWCNT and BCN in water. The prepared composites were then used for catalyzing an electrochemical hydrogen evolution reaction (HER). We found that the  $\text{MoS}_2$ /SWCNT and  $\text{MoS}_2$ /BCN composites show higher electrocatalytic activity for HER when compared to the individual constituents. The tests also revealed that the activity increased proportionally with the amount of  $\text{MoS}_2$  in the composite. Among the prepared catalysts,  $\text{MoS}_2$ -SWCNT with a 3:1 ratio of  $\text{MoS}_2$  and SWCNT exhibited highly positive onset potential (-113 mV vs RHE) and a small Tafel slope ( $59 \text{ mV dec}^{-1}$ ) along with remarkable stability in an acid electrolyte. Our study showed that a combination of  $\text{MoS}_2$  nanoparticles with SWCNT or BCN can be a promising material in the field of catalysis reactions.



**Major event organised during 2021-2022:**

- 6<sup>th</sup>-10<sup>th</sup> December 2022: Talk on “Frontiers in Materials Science” at the International Winter School

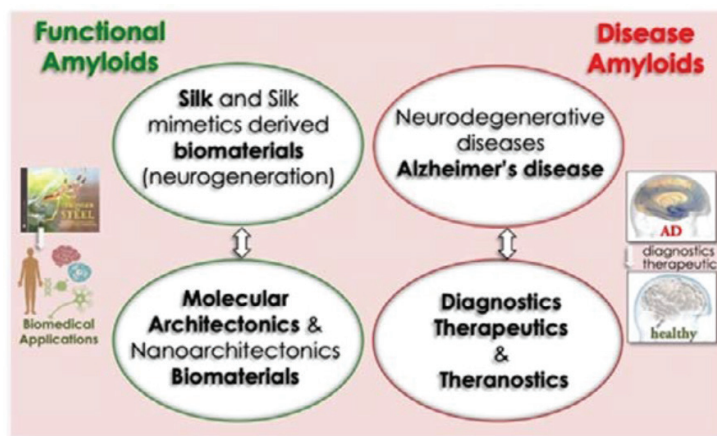
**Prof. Govindaraju T. Ph.D.**

*Professor and Chair, Education Technology Unit*

Our research interests are at the interface of chemistry, biology, and biomaterial science, focused on the chemical biology of ‘functional and disease amyloids’. Our group is effectively using tools from organic synthesis, biophysics, chemistry, and chemical biology to tackle two classes of challenging problems currently relevant to human health and society: i) disease amyloids, where our work has led to the development of novel diagnostics for Alzheimer’s disease (AD) and a novel drug candidate molecule (TGR63; now been taken up for clinical studies by a pharmaceutical company), which can significantly reduce the amyloid burden in the AD brain and reverse cognitive decline in animal models; ii) functional amyloids, where our work has led to the development of silk-derived formulations for sustained in vivo insulin delivery, diabetic wound healing, and skeletal muscles and neuronal tissue engineering, a value addition to the sericulture industry and farmers. This work further inspired the concept of molecular architectonics, which integrates the realms of molecules and derived nanoscale molecular architectures into functional biomaterials.

**Major talk during 2021-2022:**

- 18<sup>th</sup>-20<sup>th</sup> May 2021: Talk on “Small Molecule Ameliorates Amyloid Burden and Cognitive Decline in AD Mouse Model” at the First Commonwealth Chemistry Conference 2021, (London, Virtual), organised by Commonwealth Chemistry, Federation of Chemical Sciences Societies



Flowchart depicting the uses of research on amyloids

**Reference:**

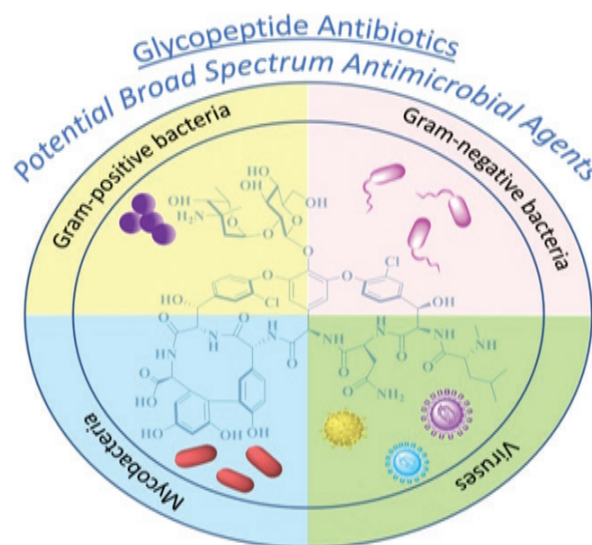
*Adv. Therap.* 4 (4): 2000225. doi: 10.1002/adtp.202000225

**Prof. Jayanta Haldar** Ph.D., F.R.S.C.

*Professor*

Vancomycin is a blockbuster antibiotic of the glycopeptide class that has been a life-saving medication against multidrug-resistant gram-positive infections. The emergence of glycopeptide resistance however led to the investigation and development of credible alternatives with potent activity against vancomycin-resistant bacteria. Many groups, including ours, have been contributing to the development of semisynthetic vancomycin analogues to tackle vancomycin-resistant bacteria. In our article, we shared our journey with the gram-positive antibiotic vancomycin, and efforts to tackle vancomycin-resistant superbugs through the development of semisynthetic vancomycin analogues. We also discussed the next-generation glycopeptides developed by our group over the past decades that tackle both gram-positive and gram-negative superbugs, and their non-inherited forms of resistance such as biofilms, stationary phase, and persister cells, intracellular infections, etc.

The feature article covered the work of two illustrious young researchers Dr. Venkateswarlu Yarlagadda and Dr. Paramita Sarkar from our group. We also described existing problems and charted the potential directions for future investigations in glycopeptide research. The article is co-authored by Mr. Yash Acharya, Ms. Geetika Dhanda, Dr. Paramita Sarkar, and Prof. Jayanta Haldar.



*The chemical formulae for the potential broad-spectrum antimicrobial agents proposed in the study*

**Reference:**  
*Chem. Commun.* (58): 1881-1897.  
 doi: 10.1039/D1CC06635H

**Dr. Sebastian C. Peter** Ph.D.

*Associate Professor*



*Schematic of the groundbreaking CO<sub>2</sub> conversion reaction proposed in this study*

**Reference:**  
*ACS Energy Lett.* 2021. 6 (2): 509-516. doi: 10.1021/acscenergylett.0c02614



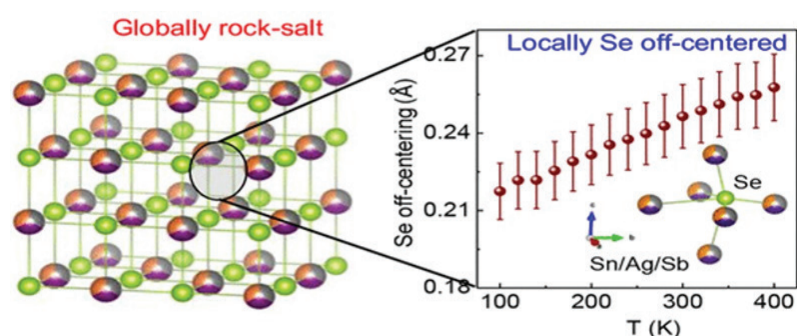
Water splitting is one of the techniques to find renewable energy sources to meet our energy needs. Our research focuses on improving the synthesis of inorganic materials exhibiting a wide range of physical properties that make them useful in a variety of applications with a special attention to fuel cell, CO<sub>2</sub> reduction, etc. Utilising basic concepts of chemistry, we controlled the structural chemistry of materials to enhance their catalytic performance towards a selected reaction. Our strategies included alloying, structural ordering, dealloying, etc. The research has been turned commercial after Prof. Peter co-founded a start-up called "Breathe Applied Sciences Pvt. Ltd." which scaled-up the conversion of CO<sub>2</sub> to chemicals/fuels to the pilot level.

## Dr. Kanishka Biswas Ph.D., F.R.S.C.

### Associate Professor

The structural transformation induced by heating prefers to attain a higher symmetric structure from a lower symmetric one. However, the formation of locally broken asymmetric phases upon warming has been evidenced in PbQ (Q = S, Se, Te). This rare phenomenon is called *emphanisis*, which can play a crucial role in deciding the thermal transport and thermoelectric properties of materials.

In this context, we studied (SnSe)<sub>0.5</sub>(AgSbSe<sub>2</sub>)<sub>0.5</sub> which crystallizes in rock-salt cubic average structure, with the three cations occupying the same Wyckoff site and Se in the anion position. Using synchrotron X-ray pair distribution function (X-PDF) analysis, we showed the gradual deviation of the local structure of (SnSe)<sub>0.5</sub>(AgSbSe<sub>2</sub>)<sub>0.5</sub> from the overall cubic rock-salt structure with warming, resembling *emphanisis*. The local structural analysis indicated that Se atoms remain in an off-centered position by a magnitude of ~0.25 Å at 300 K along the [111] direction and the magnitude of this distortion was found to increase with temperature resulting in three short and three long M-Se bonds. We found that this distortion hindered phonon propagation which further led to a lowering of lattice thermal conductivity ( $\kappa_{lat}$ ). The results also indicated that *emphanisis* induced low  $\kappa_{lat}$  and favorable electronic structure with multiple valence band extrema within close energy concurrently and gave rise to a promising thermoelectric figure of merit for the optimized Ge doped new rock-salt phase of (SnSe)<sub>0.5</sub>(AgSbSe<sub>2</sub>)<sub>0.5</sub>.



Graphical representation of the gradual distortion of the cubic structure of the rock-salt crystal with heating

#### Reference:

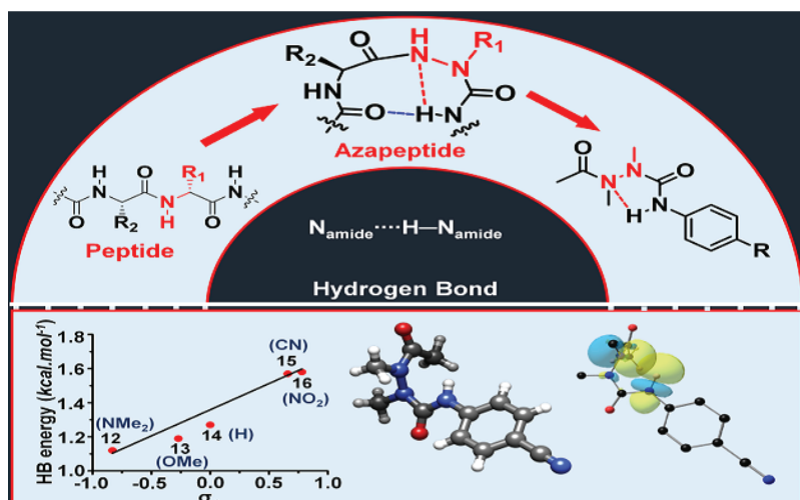
*J. Am. Chem. Soc.* 143 (40): 16839–6848.  
doi:10.1021/jacs.1c08931

## Dr. Bani Kanta Sarma Ph.D.

### Faculty Fellow

An unusual N<sub>amide</sub>...H-N<sub>amide</sub> hydrogen bond (HB) was previously proposed to stabilize the azapeptide  $\beta$ -turns. In our study, we provided experimental evidence for the N<sub>amide</sub>...H-N<sub>amide</sub> HB and showed that this HB endowed a stabilization of 1–3 kcal·mol<sup>-1</sup> and enforced the trans-cis-trans (t-c-t) and cis-cis-trans (c-c-t) amide bond conformations in azapeptides and N-methyl-azapeptides, respectively. Our results indicated that these N<sub>amide</sub>...H-N<sub>amide</sub> HBs can have stabilizing contributions even in short azapeptides that cannot fold to form  $\beta$ -turns.





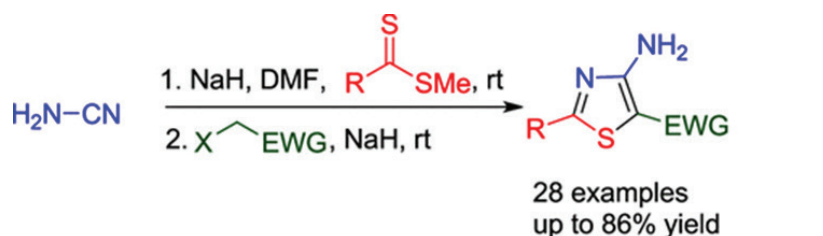
Schematic representation of the stabilization of azapeptides

**Reference:**  
*Org. Lett.* 23: (13): 4949–4954. doi: 10.1021/acs.orglett.1c01111

## Prof. Hiriyakkanavar Ila Ph.D.

### Hindustan Unilever Professor

We presented an effective, diversity-oriented, one-pot reaction of 4-amino-2-(het)aryl/alkyl-5-functionalized thiazoles. Our synthesis technique utilised aryl/heteroaryl/alkyl dithioesters as thiocarbonyl coupling partners in a modified Thorpe–Ziegler type cyclization. We found that even at room temperature, under mild conditions, our method provided excellent yields and displayed broad functional group compatibility at 2 and 5 positions of thiazoles. Furthermore, we expanded our synthetic strategy for the one-pot construction of two highly potent tubulin polymerization inhibitors, i.e., 2-(het)aryl-4-amino-5-(3,4,5-trimethoxyaroyl) thiazoles, which also led to high yields.



R = Ar, (Het)Ar, Alkyl;

EWG = CN, COAr, COMe, CO<sub>2</sub>Et, CONH<sub>2</sub>, NO<sub>2</sub>, CO<sub>2</sub>Me

- 3 steps one-pot procedure
- Mild conditions, high yields
- Broad substrate scope

Chemical equation for the one-pot reaction presented in this study

**Reference:**  
*J. Org. Chem.* 86 (12): 8508–8515.  
 doi: 10.1021/acs.joc.1c00616

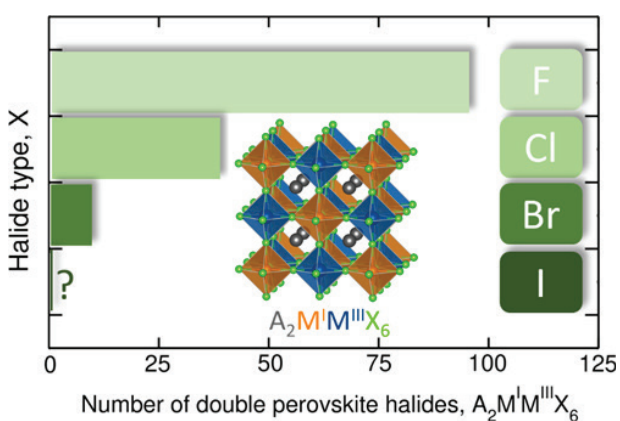
### Major talks during 2021–2022:

- 31<sup>st</sup> January 2022: Plenary Lecture on “Design and Development of Efficient and Sustainable Synthetic Methods for Biologically Important Heterocycles” at International Symposium in Chemistry, Deshbandhu College, University of Delhi
- 21<sup>st</sup> January 2022: Keynote Lecture on “Organic Synthesis: Health, Sustainability, Diversity, and Efficiency” at International Conference on Environment, Water, Agriculture, Sustainability and Health (EWASH-2022), Hindu College, Delhi University

**Dr. Pratap Vishnoi Ph.D.**

*DST Ramanujan Fellow*

Double perovskite halides with an  $A_2M^I M^III X_6$  composition are alternatives to lead (Pb) halide perovskites. Of these, iodide double perovskites are highly desirable since their band gaps are expected to be similar to those found in the parent Pb iodides. However, the number of structurally characterized iodides are virtually zero. To accelerate the discovery of double perovskite iodides, in this work, we examined the likelihood their formation using a combination of the Goldschmidt tolerance factor and the radius ratio of the trivalent metals,  $M^III$ . We rationalized the rarity of double perovskite iodides in terms of these descriptors. We showed that because the radii of trivalent metals tend to be quite small, the formation of iodides is particularly challenging. Furthermore, challenges are also associated with their synthesis.



Bar diagram showing the distribution of 3D double perovskite halides with respect to their halide anions. Only the corner-connected 3D structures available on ICSD, CCDC, or COD are included

**Reference:**

*J. Phys. Chem. C.* 125 (21): 11756–11764.  
doi: 10.1021/acs.jpcc.1c02870

**Major talks during 2021-2022:**

- 18<sup>th</sup> November 2021: Talk at Anthony K. Cheetham 75 Mini-Symposium on “Ruthenium halide double perovskites”, organised by Prof. Wei Li of Nankai University, China
- 18<sup>th</sup> November 2021: Talk at the Annual Faculty Meeting and In-house Symposium on “Chemical control on structural dimensionality in ruthenium halide double perovskites” at JNCASR
- 4<sup>th</sup> October 2021: Talk at Organic-Inorganic Hybrid Materials (OIHM-2021) Conference on “Hybrid Lead Halide Perovskites and Related Congeners”, organised by Department of Chemistry, Sardar Vallabhbhai National Institute of Technology (SVNIT), Surat, Gujrat
- 1<sup>st</sup> October 2021: Talk at New Chemistry Unit Day on “Ruthenium halide double perovskites”, organised by NCU, JNCASR

**Dr. Sarit S. Agasti Ph.D.**

*Associate Professor (jointly with CPMU)*

Please see pg. 50 for research activities.

**Dr. Premkumar Senguttuvan Ph.D.**

*Faculty Fellow (jointly with ICMS)*

Please see pg. 75 for research activities

## UNIT MEMBERS

### FACULTY MEMBERS

Professor and Chair	<b>Prof. Subi Jacob George</b>
Linus Pauling Research Professor	<b>Prof. C. N. R. Rao</b>
Professors	<b>Prof. Govindaraju T. (Chair, ETU), Prof. Jayanta Haldar</b>
Associate Professors	<b>Dr. Sebastian C. Peter Dr. Kanishka Biswas Dr. Sarit S. Agasti (jointly with CPMU)</b>
Faculty Fellows	<b>Dr. Bani Kanta Sarma, Dr. Premkumar Senguttuvan (jointly with ICMS)</b>
Hindustan Unilever Professor	<b>Prof. Hiriyakkanavar Ila</b>
DST Ramanujan Fellow	<b>Dr. Pratap Vishnoi (jointly with ICMS)</b>

### ASSOCIATE FACULTY

**Dr. Ranjani Viswanatha** (Associate Professor, ICMS)

### RESEARCH STUDENTS

Ph.D.	<b>Anusha S. Avadhani, Swadhin Garain, Souvik Sarkar, Angshuman Das, Satyajit Patra, Anju A. K., Saikat Ghosh, Mohd Monis Ayyub, Rohit, Debasis Ghosh, Sumon Pratihar, Biswanath Maity, Madhu R., Mary Antony P., Ashish Kumar, Dikshaa Padhi, Hariharan M., Sabyasachi Mandal, Rajib Dey, Acharya Yash Sanjay, Brinta Bhattacharjee, Arjun C. H., Risov Das, Debabrata Bagchi, Bitan Ray, Devender Goud G., Soumi Mondal, Subhajit Chakraborty, Yogendra Kumar, Payel Mondal, Saptarshi Chakraborty, Prasenjit Mandal, Gauttam Dash, Subham Das, Paribesh Acharyya, Debattam Sarkar, Animesh Bhui, Anustoop Das, Arka Som, Ahuja Vinita Ashok Kumar, Arindam Ghosh, Bhaskar Kakoty, Biplab Patra, Ramesh M. S., Robi Sankar Patra, Debajit Kalita, Paramesh Das, V. Manikandan, Krithi K. Bhagavath, Subhankar Maity, Nandini Saha, Vaishali Taneja, Nilutpal Dutta, Soumya Panja, Sushanta Show, Debashree Borah, Anshulata, Papiya Sadhu, Devesh Chandra Binwal</b>
Int. Ph.D.	<b>Suchi Smita Biswas, Mohd Arif, Adrija Ghosh, Taraknath Das, Darshana Deb, Manaswee Barua, Reetendra Singh, Aditi Saraswat, Sreyan Ghosh, Geetika Dhanda, Sudip Mukherjee, Sushmita Chandra, Riddhimoy Pathak, Animesh Das, Akshay Saroha, Ivy Maria, Prabhat Thapliyal, Sayan Chakravarty, Surya Pravo Mookerjee, Ritika Raghuvanshi, Arghya Ghosh, Vandana Kushwaha, Madhulika Mazumder, Tamagna Mandal, Geetansh, Aritra Naha, Vishwajith N. S., Shreyasri Sain, Shenoy Pralhad Shankar, Debranjana Hati, Shuva Biswas, Ayon Phukan, Amrendra Kumar Gupta</b>
M.Sc. (Chemistry)	<b>Daizy Kalita, Anupama Ghata, Darshini Raghavan, Chahat, Kulkarni Saurav Ajit, K. Palani Ganesh, Arpita Panda, Jatin Chauhan, Ramjayakumar V., Kashish Kumar Taneja</b>

TECHNICAL STAFF	
Technical Assistant Trainees	Dr. Samiran Misra, D. Kannan, Dr. Naga Durgasri Darapureddi, Gayathri Govind V.
Technical Assistant (Inst)	Shivakumar K. M.
Technical Support	Meenakshi Baburao Tayade
Technician	Ramesh Hiralal Choudhary

RESEARCH STAFF	
UGC-DR. D. S. Kothari Post-Doctral Fellow	Dr. Veenu Mishra
SERB (TARE)	Dr. Ashly P. C., Dr. Manjunatha S. O., Dr. B. N. Ramesh
SERB National Postdoctoral Fellows (NPDF)	Dr. Soumik Dinda, Dr. Deepa Bhatt, Dr. Jayita Pradhan, Dr. Pratibha Kumari
Research Associates	Dr. Bharath Velaga, Dr. Mohd. Riyaz, Dr. Suvankar Bera, Dr. Sushmitha Chandrabhas, Dr. Abdul Ahad, Dr. Shagufi Naz Ansari, Dr. Subham Ghosh, Dr. Prashurya Pritam Mudoj, Dr. Jugal Kishore Rai Deka, Dr. Keshav Kumar, Dr. Jeevan Chakravarthy A. S., Dr. Wagalgave Sopan Mahadev, Dr. Suresh R., Dr. Ankita Kumari, Dr. Sourav Samanta, Dr. Debajyoti Basak, Dr. Jerrin Thomas George, Dr. Mouli Konar, Dr. Tanmay Mondal, Dr. Manikandan A., Dr. Archana K Munirathnappa, Dr. Meenakshi Pahwa, Dr. Chenikkayala Balachandra, Dr. Moinak Dutta, Dr. Swagatam Barman, Dr. Ranjan Sasmal, Dr. Y. V. Suseela, Dr. B. Senthilkumar, Dr. Supriya Ghanty, Dr. Prabir Dutta, Dr. Biswajit Sahariah, Dr. Sathyapal Churipard R., Dr. Raju Laishram, Dr. Kousik Das
Research Associate-1	Dr. Radha Krishna Gopal
DBT Research Associate-1	Dr. Sohini Basu Roy
Research Associates (Provisional)	Subarna Das, Arjun C. H., Kalpita Baruah, Prayasee Baruah, Deepika Gupta, Paramita Sarkar, Ekashmi Rathore, Dr. B Senthilkumar, Dr. Supriya Ghanty
Senior Research Fellow	Payel Mondal
Junior Research Fellows	Sreshtha Ganguly, Asish Borah, Vinayak Narayanmurthy Vernekar, Amit Tevatia, Sucheta Biswas, Anish Yadav, Subham Sarkar
R&D Assistants	Bhawna, Vijay B. B., Logia Jolly, Mohamed Nabeel Mattath, Subhajit Das
Project Associate I	Gouri Ramadas Nayanar

ADMINISTRATIVE STAFF	
Scientific Administrative Assistant	Ragina K. K.

## UNIT AT A GLANCE

### HONOURS/FELLOWSHIPS/MEMBERSHIPS RECEIVED



## FACULTY ACHIEVEMENTS:

### Prof. Subi J. George

- Received the C. N. R. Rao National Prize for Chemical Sciences awarded by the Chemical Research Society of India (CRSI)
- Featured in "75 Under-50 Scientists Shaping Today's India", 2022, by the Department of Science and Technology
- Elected as Advisory Board Member of *Physical Chemistry Chemical Physics*, RSC, and *ACS Materials Au*

### Prof. C. N. R. Rao

- Received Honorary Fellowship of the Karnataka Association for the Advancement of Science (KAAS), 2022

### Prof. T. Govindaraju

- Received the Council of Scientific and Industrial Research (CSIR) Shanti Swarup Bhatnagar Prize 2021 for Chemical Sciences
- Received the SASTRA C. N. R. Rao Award for the year 2022 for excellence in chemistry and materials science

### Prof. Jayanta Haldar

- Elected as a Fellow of the Royal Society of Chemistry, 2021

### Dr. Kanishka Biswas

- Received the CSIR Shanti Swarup Bhatnagar Prize 2021 for Chemical Sciences
- Selected for the Silver medal of Society of Materials Chemistry
- Received the National Prize for Research in Inorganic and Physical Chemistry, donated by the C. N. R. Rao Education Foundation
- Featured in "75 Under-50 Scientists Shaping Today's India", 2022, by the Department of Science and Technology
- Elected as Fellow of the Indian Academy of Sciences (FASc)
- Elected as an Editorial Advisory Board Member of *Inorganic Chemistry*, ACS; *Materials Horizons*, RSC; *Journal of Materiomics*, Elsevier
- Elected as an Editorial Board Member of *Journal of Physics D (IOP)*
- Received the Merck Young Scientist Award, Chemical Science 2021

### Dr. Sebastian C. Peter

- Selected for the Indian National Academy of Engineering (INAE) young Innovator and Entrepreneur award
- Received support from DST for setting up the National Centre of Excellence in Carbon Capture and Utilisation (NCOE-CCU)
- Selected as the winner of ENRich21 Award on the theme "Preparing for the Low Carbon World", Breathe Applied Sciences Pvt. Ltd. (a start-up company from JNCASR)
- Featured in "75 Under-50 Scientists Shaping Today's India", 2022, by the Department of Science and Technology

### Dr. Sarit S. Agasti

- Named the 2021 Emerging Investigator for Chemical Communications by Royal Society of Chemistry
- Won the Merck Young Scientist Award, 2021 (Biological Sciences)
- Received the India Alliance Intermediate Fellowship Award



## Dr. Premkumar Senguttuvan

- Received Sheikh Saqr Career Award Fellowship from Ras Al Khaimah Centre for Advanced Materials

## RESEARCH ASSOCIATE AND STUDENT ACHIEVEMENTS:

### Dr. Subham Ghosh (Research Associate)

- Received KPIT Poster Award, KPIT, Pune

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

- Won in the AMR Quest 2021 conducted by C-CAMP Centre for Cellular and Molecular Platforms, Government of India, for her proposal "Membrane-perturbing antibiotic adjuvants"

### Saikat Ghosh (Ph.D. student; research supervisor: Prof. Subi Jacob George)

- Shyama Prasad Mukherjee Fellowship (SPMF), CSIR

### Swadhin Garain (Ph.D. student; research supervisor: Prof. Subi Jacob George)

- Won the Best Poster Award, Fluorescence Chemical Society (FCS), 2021

### Aritra Naha (Int. Ph.D. student; research supervisor: Prof. Subi J. George)

- Received the Prof. C. N. R. Rao Medal for Best Ph.D. Thesis of the Year 2021 in the Physical Sciences category

### Aditi Saraswat (Int. Ph.D. student; research supervisor: Prof. C. N. R. Rao)

- Received the Smt. and Sri Babu Narayanaswamy Prize 2021 for the Best MS Thesis in Chemical and Materials Sciences

### Ivy Maria (Int. Ph.D. student; research supervisor: Prof. Kaniska Biswas)

- Received the BabuMatru Prasad Scholarship 2021 for the Int. Ph.D. Chemical Sciences 1<sup>st</sup> year Student with Highest CGPA in Course Work

### Anustup Mukherjee (M.Sc. Chemistry student)

- Received the Dr. Indumati Rao Prize 2021 for the Student with Highest CGPA in the Course work

## TOTAL PUBLICATIONS



**76**

Peer reviewed articles indexed in Web of Science/Scopus

## SPONSORED PROJECTS



**17**

New Projects

**₹17.89 cr**

Funding



**41**

Ongoing Projects

**₹31.31 cr**

Funding

## STUDENTS GRADUATED DURING 2021-2022



**7**  
Ph.D.

- Ranjan Sasmal
- Swagatam Barman
- Mahima Makkar
- Paramita Sarkar
- Ekashmi Rathore
- Moinak Dutta
- Subham Ghosh

**5**  
M.S. in Chemical  
Science

- Adrija Ghosh
- Darshana Deb
- Aditi Saraswat
- Riddhimoy Pathak
- Akshay Saroha

**4**  
M.Sc. in Chemistry

- Anustup Mukherjee
- Aditya Bhardwaj
- Amit Ghoshal
- Naral Vinay Srinivas

**1**  
M.S. (Engineering)

- Devesh Chandra Binwal

## STUDENTS ADMITTED DURING 2021-2022



**12**  
Ph.D.

- V. Manikandan
- Krithi K. Bhagavath
- Subhankar Maity
- Nandini Saha
- Vaishali Taneja
- Nilutpal Dutta
- Soumya Panja
- Sushanta Show
- Debashree Borah
- Anshulata
- Papiya Sadhu
- Devesh Chandra Binwal

**10**  
Int. Ph.D

- Tamagna Mandal
- Geetansh
- Aritra Naha
- Vishwajith N. S.
- Shreyasri Sain
- Shenoy Pralhad Shankar
- Debranjana Hati
- Shuva Biswas
- Ayon Phukan
- Amrendra Kumar Gupta

**5**  
M.Sc. in Chemistry

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



NSU pursues an understanding of the nervous system and its role in modulating behaviours and physiological processes associated with health and disease. Our research areas encompass studies on the unique molecular and biophysical properties of neuronal cells and their partners to emergent properties of neuronal networks.

Our current research interests include understanding synaptic function and its relationship with intellectual disability, neurodevelopmental disorders, genetics and neuronal circuits driving circadian rhythms and sleep, molecular and cellular mechanisms underlying human brain disorders including epilepsies, deafness, and neurodegeneration, and biomaterials for interfacing sensory organs with soft analogue devices. The diversity in individual research themes of the faculty reflects the interdisciplinary approaches and methodologies employed to understand how the nervous system functions and defines behaviour.

In the years to come, the Unit intends to expand its activities into computational neuroscience, cellular neuroscience, and mammalian developmental neurobiology. The Unit is also looking toward building advanced imaging technologies to investigate synaptic function, morphology, and neuronal circuit functions, which will have biomedical implications.

## RESEARCH AREAS

- Cellular mechanisms underlying *PIK3CA* related epilepsy and drug-resistant epilepsies
- Cellular and molecular dysfunctions leading to autism spectrum disorder
- Chronotype evolution of 'owl' and 'lark' phenotypes
- Gap junction proteins in circadian neuronal circuits in the *Drosophila* model
- Dysregulated autophagy in neurodegenerative diseases

## RESEARCH HIGHLIGHTS

- Active pathway-driven cellular mechanisms underlying *PIK3CA*-related epilepsy were studied
- The crucial role of gap junction proteins called innexins in determining the intrinsic period of activity-rest rhythms in flies was reported
- A novel compound called 6-BIO and its potential in improving daily activities like learning and recollecting in patients with ASD/Intellectual disability (ID) was demonstrated

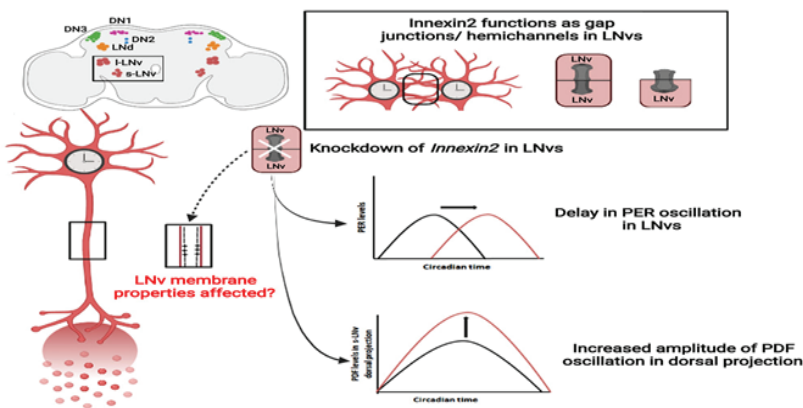
RESEARCH ACTIVITIES AND ACHIEVEMENTS DURING 2021-2022

**Prof. Anuranjan Anand** Ph.D., F.A.Sc., F.N.A., F.N.A.Sc., J. C. Bose National Fellow  
*Professor, MBGU, and Chair, NSU*

Please see pg 81 for research activities.

**Dr. Sheeba Vasu** Ph.D.  
*Associate Professor*

*Drosophila melanogaster* or fruit flies are widely used as a model organism in the study of circadian biology due to their robust and easily quantifiable behaviours and relatively fewer regulatory neurons. Each neuron in the circadian circuit has a ticking molecular clock composed of a self-sustained transcriptional translational feedback loop composed of several core clock genes such as *clock*, *cycle*, *period*, and *timeless*. To create coherent ~24-hr rhythms in locomotion for *Drosophila melanogaster*, the seven distinct neuronal clusters of ~150 neurons have to function as a network and chemically communicate with each other. However, little is known about communication via electrical synapses made up of gap junctions. In our study, we reported a role for gap junction proteins called innexins. These proteins play crucial roles in determining the intrinsic period of activity-rest rhythms in flies. We showed that Innexin2 in the ventral lateral neurons modulates speed of activity-rest rhythm along with alterations in the oscillation of a core clock protein period and the output molecule pigment dispersing factor. Our results indicated that specifically disrupting the channel-forming ability of Innexin2 can cause period lengthening, suggesting that Innexin2 may function as hemichannels or gap junctions in the clock circuit.



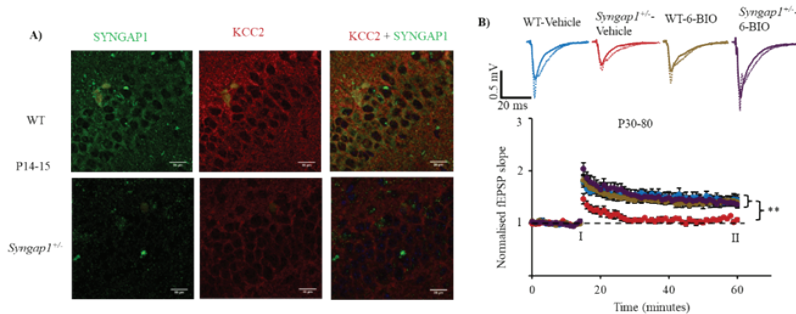
*Schematic showing how disrupting the channel forming ability of Innexin2 affects adult Drosophila activity-rest rhythms via circadian molecular clock proteins*

**Reference:**  
*iScience* 24 (9): 103011.  
 doi: 10.1016/j.isci.2021.103011.

**Dr. James Premdoss Clement Chelliah** Ph.D.  
*Associate Professor*

A major challenge in finding better therapeutics to treat autism spectrum disorder (ASD) is the potency of the drug to help patients to perform their daily activities with an efficiency close to that of a healthy person. Achieving this is particularly difficult after a certain age, especially after the mid-childhood stages. Our recent research shows that in a pre-clinical evaluation, the novel compound 6-BIO has proven to have the potential for improving daily activities like learning and recollecting new tasks in patients with ASD/

intellectual disability (ID). We demonstrated the potential of 6-BIO to treat ASD/ID in a pre-clinical mouse model called *Syngap1*<sup>+/-</sup>. In our research, published in *Experimental Brain Research*, using behaviour and electrophysiology techniques, we demonstrated that the administration of 6-BIO restores neuronal function, learning, and memory, and reduces epileptic seizures in *Syngap1*<sup>+/-</sup> mice.



A) IHC data from P1–16–day old mice showing the difference in expression of KCC2. B) Administration of 6-BIO in adults restored LTP (cellular correlate of memory) in *Syngap1*<sup>+/-</sup> mice.

**Reference:**

*Exp. Brain. Res.* 240: 289–309.  
doi: 10.1007/s00221-021-06254-x

**Major talk during 2021–22:**

- 31<sup>st</sup> August 2021: Talk on “Small Compounds as Potential Therapeutics to Treat Autism”, at International Epilepsy Congress Conference, organised by the International League Against Epilepsy

**Dr. Achira Roy Ph.D.**

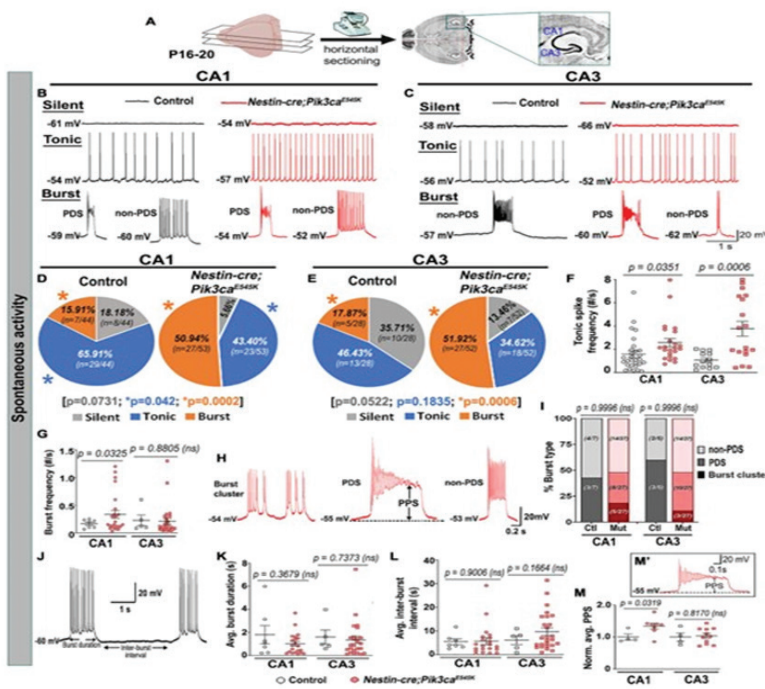
**DBT Ramalingaswami Fellow**

Patients with mutations in the PI3K–AKT–MTOR pathway-encoding genes often develop a spectrum of neurodevelopmental disorders, including epilepsy. Unfortunately, a significant proportion of them remains unresponsive to conventional anti-seizure medications. It is essential to understand mutation-specific pathophysiology to develop more molecularly targeted therapies. In one of our previous studies, we established that mouse models expressing a patient-related activating mutation in *PIK3CA*, encoding the p110 $\alpha$  catalytic subunit of phosphoinositide-3-kinase (PI3K), were epileptic and acutely treatable by PI3K inhibition, irrespective of dysmorphology. Our recent study reported the physiological mechanisms underlying this dysregulated neuronal excitability. We demonstrated epileptiform events in the *PIK3CA* mutant hippocampus *in vivo*. We also conducted *ex vivo* analysis to show that *PIK3CA*-driven hyperactivation of hippocampal pyramidal neurons is mediated by changes in multiple non-synaptic, cell-intrinsic properties. Our results indicated that acute inhibition of PI3K or AKT suppresses the intrinsic hyperactivity of the mutant neurons and not the MTOR activity. Finally, we established that acute mechanisms are distinct from those causing neuronal hyperactivity in other AKT–MTOR epileptic models. The parameters defined by our study can facilitate the development of new molecularly rational therapeutic interventions for intractable epilepsy.

**Major talks during 2021–22:**

- 18<sup>th</sup> February 2022: Talk on “Determining Mechanisms and Therapeutics for Human Developmental Brain Disorders” at the Sci-ROI@India Launch Event Science Showcase 2022, organised by WinStep Forward
- 18<sup>th</sup> November 2021: Talk on “Determining Underlying Mechanisms and Preclinical Treatment for *PIK3CA*-driven Hydrocephalus” at the JNCASR In-House Symposium 2021
- 29<sup>th</sup> October 2021: Talk on “Determining Underlying Mechanisms and Preclinical Treatment for *PIK3CA*-driven Hydrocephalus and Epilepsy” at the International Scientific Meeting for *PIK3CA* Related Conditions, organised by Cloves Syndrome Community, GoPI3Ks, MCM-Network, and others





Schematic representation of mutant hippocampal neurons producing increased epileptiform burst activity.

**Reference:**  
 Front. Mol. Neurosci. 14: 772847.  
 doi: 10.3389/fnmol.2021.772847

## UNIT MEMBERS

### FACULTY MEMBERS

Professor and Chair	<b>Prof. Anuranjan Anand</b> (Professor, MBGU)
Associate Professors	<b>Dr. Sheeba Vasu</b> <b>Dr. James Premdoss Clement Chelliah</b>
DBT Ramalingaswami Fellow	<b>Dr. Achira Roy</b>

### ASSOCIATE FACULTY

**Prof. Narayan K. S.** (Professor, CPMU)  
**Prof. Tapas Kumar Kundu** (Professor, MBGU)  
**Dr. Ravi Manjithaya** (Associate Professor, MBGU)

### RESEARCH STUDENTS

Ph.D.	<b>Yashwini Dewan, Iyenger Aishwariya Prasan, Iyer Aishwarya, Dani Chitrang Kamal, Arijit Ghosh, Nilpawan Roy Choudhury, Mansi Rathi</b>
Int. Ph.D.	<b>Kulkarni Rutvij Kaustubh</b>

### RESEARCH STAFF

Research Associate	<b>Dr. Roshan Fatima Begum</b>
Research Associate (Provisional)	<b>Vijay Kumar M. J.</b>
R&D Assistants	<b>Shatabdi Choudhury, Sushmitha S. P., Sushma S. Rao</b>
Project Assistant	<b>Neeharika Reddy M. N.</b>

### ADMINISTRATIVE STAFF

Sr. Helper	<b>Samuel S.</b>
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## UNIT AT A GLANCE

### HONOURS RECEIVED



#### FACULTY ACHIEVEMENT:

**Dr. Sheeba Vasu**

- Featured in "75 Under-50 Scientists Shaping Today's India", 2022, by the Department of Science and Technology



#### STUDENT ACHIEVEMENT:

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

- Received the Prof. C. N. R. Rao Medal for Best Ph.D. Thesis of the Year 2021 in the Biological Sciences category

**Aishwariya Iyengar** (Ph.D. student; research supervisor: Dr. Sheeba Vasu)

- Received the Best Poster Award at the International Conference on Chronobiology 2021 organised by the Indian Society of Chronobiology and IUSSTF

**Chitrang Dani** (Ph.D. student; research supervisor: Dr. Sheeba Vasu)

- Received the Best Research Talk Award at the International Conference on Chronobiology 2021 organised by the Indian Society of Chronobiology and IUSSTF

### TOTAL PUBLICATIONS



**9**

Peer reviewed articles indexed in Web of Science/Scopus

### SPONSORED PROJECTS



**2**

New Projects

**₹47.24 lac**

Funding



**4**

Ongoing Projects

**₹47.24 lac**

Funding

### STUDENTS GRADUATED DURING 2021-2022



**2**

Ph.D.

- Vijaya Verma
- Vijay Kumar M. J.

### STUDENTS ADMITTED DURING 2021-2022



**2**

Ph.D.

- Nilpawan Roy Choudhury
- Mansi Rathi

# THEORETICAL SCIENCES UNIT (TSU)



In the Theoretical Sciences Unit at JNCASR, we aim to address, explain and understand the rich diversity we observe in the physical world. We also use our theoretical knowledge to predict new phenomena, design new materials, and improve their practical applications. We believe in an interdisciplinary approach where the techniques or theories from physics, chemistry, and biology are incorporated to gain fresh insight into the workings of our physical world.

The research at TSU is inspired by two complementary approaches to the study of matter and life: the search for universality and the exploration and explanation of diversity. At TSU, we aim to address, explain, understand, and predict new physical phenomena, and design new materials. We unravel the perplexing and fascinating range of behaviours shown by materials by looking into their structures and properties at a very fundamental level using various analytical and computational techniques. The concept of "emergence", where the underlying natural laws are simple in form but manifest as complex behaviour as the system sizes increase, is of specific interest to the researchers at the Unit.

The faculty members from this Unit have expertise in many-body physics, computational chemistry, quantum mechanical density functional theory, statistical mechanics, and mathematical physics, and often collaborate with researchers within and outside JNCASR. Since the nature of research conducted at TSU is quite interdisciplinary (foraying into theoretical physics, chemistry, mathematics, and evolutionary biology), students and researchers from a variety of academic disciplines, such as chemistry, physics, engineering, and computer science, are welcome to join.

## RESEARCH AREAS

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

## RESEARCH HIGHLIGHTS

- Mpemba effect was observed in a simple model exhibiting para to ferromagnetic transitions
- Effects of alignment activity on the collapse kinetics of a flexible polymer were studied
- It was shown that tetrazine-based covalent organic frameworks can act as promising electro- and photo-catalysts for hydrogen evolution reactions
- The kinetics of crystallization in deeply supercooled liquid silicon employing computer simulations and the Stillinger-Weber three-body potential were studied
- Flat phonon band-based mechanism of amorphization of MOF-5 at ultra-low pressures was demonstrated

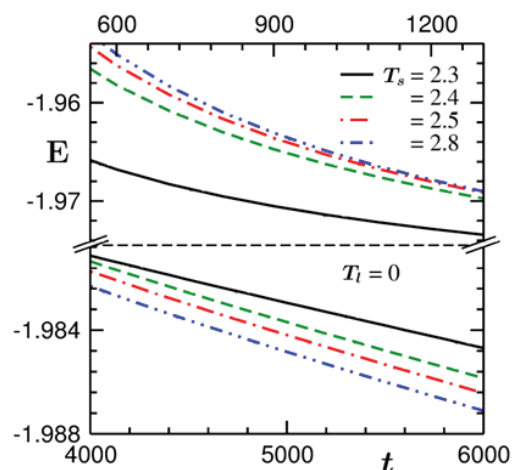
- Factors affecting the de-oxidation temperature of Cu nanoparticles were established
- Quantum critical Mott transitions were found to belong to an emergent soft-gap Anderson model universality class
- The properties of the conditional fixation time defined as the time to fixation of a new mutant were studied
- Trace inequality for commuting d-tuples of operators was determined

## RESEARCH ACTIVITIES AND ACHIEVEMENTS DURING 2021-2022

### Prof. Subir K. Das Ph.D.

#### Professor and Chair

Our team uses statistical mechanical approaches to study static and dynamic critical phenomena; nucleation and wetting; kinetics of phase transitions; pattern formation in granular, active and biological matters; etc. In recent times we have published works from studies of passive as well as active matter systems. In the passive domain we have contributed towards the understanding of the Mpemba effect by showing that a hotter paramagnet transforms quicker, than a colder one, to a ferromagnet following quench to a temperature below the Curie temperature. We have also contributed towards the understanding of the role of interface roughness in the ordering of a ferromagnet. In the area of active matter, we have made progress on the understanding of the role of hydrodynamics in kinetics of phase transition in systems of self-propelling particles. In this domain, we have also investigated the influence of alignment activity on the collapse kinetics of flexible polymers.



*Plots of potential energy versus time, following quenches of paramagnetic configurations to a ferromagnetic state point for Ising model. The results demonstrate the presence of the Mpemba effect, i.e., a hotter paramagnet transforms to a ferromagnet quicker than a colder one*

**Reference:**

*Phys. Chem. Chem. Phys.* 23: 11186. doi: 10.1039/D1CP00879J

#### Major events organised during 2021-2022:

- 17-19<sup>th</sup> November 2021: JNCASR In-House Symposium, jointly with Prof. Kavita Jain and Prof. N. S. Vidyadhiraja
- 28-29<sup>th</sup> October 2021: TSU@25: A conference to celebrate 25 years of the Theoretical Sciences Unit of JNCASR, with Prof. Shobhana Narasimhan

## Major talks during 2021-2022:

- 26<sup>th</sup> March 2022: Talk on "Mpemba Effect: Is it common?" for an invited lecture in Memory of Neelangshu Saha at Spectrum, St. Xavier's College, Kolkata
- 21<sup>st</sup> February 2022: Talk on "Kinetics of Phase Transitions: A few interesting exceptions to the traditional picture" at an Invited Physics Colloquium at IISER Pune
- 15<sup>th</sup> December 2021: Talk on "Structure and Dynamics in Active Fluids: Bulk versus confinement" at Complex Fluids 2021 held at IIT Gandhinagar
- 22<sup>nd</sup> November 2021: Talk on "Mpemba Effect: Does it exist?" at conference titled Current Trends in Nonequilibrium Physics, held at Jawaharlal Nehru University, New Delhi
- 2<sup>nd</sup> November 2021: Talk on "Kinetics of Phase Separation in an Assembly of Vicsek-like Active Particles" at the International Conference on Mathematics and Physics of Fluids, at IIT Gandhinagar
- 28<sup>th</sup> October 2021: Talk on "Mpemba Effect: Surprising, yet common?" at TSU@25 - a hybrid (online-offline) conference to celebrate the 25 years of Theoretical Sciences Unit of JNCASR, TSU, JNCASR, Bengaluru
- 6<sup>th</sup> October 2021: Talk on "Recognizing Pattern in the Spread of Communicable Diseases: A scaling approach", as part of a webinar series Diving Deep into Physics, Department of Physics, IIT Jodhpur

## Prof. Swapan K. Pati Ph.D., F.N.A., F.A.Sc., F.N.A.Sc., F.T.W.A.S.

### Professor

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We studied four distinct maricite ( $\text{NaCoPO}_4$ ) phases ( $\alpha$ ,  $\beta$ , ABW, and  $\gamma$ ) in detail and published the first report of a high temperature  $\gamma$  phase for  $\text{NaCoPO}_4$ , which has a different coordination geometry than the other phases but can be reversibly transformed into lower temperature  $\alpha/\beta$  phases via controlled cooling. We probed the formation mechanisms of these systems through density functional theory modelling, simulated the phase transitions of the  $\gamma$  phase by ab initio molecular dynamics and observed the topological variations at local sites. We also noted how a first order phase transition from a disordered  $\gamma$  phase to a more ordered  $\beta$  phase is entropically driven. Further, we discovered that although these maricite systems are known to be poor candidates for cathodes as they lack ionic diffusion channels and deliver poor voltages, the  $\gamma$  phase seems to be promising as it has low kinetic barriers for Na diffusion.

In other research work, we performed density functional theory calculations and investigated a family of intramolecular stannylum/nitrogen frustrated Lewis pairs (FLPs) (1-R-X) for their ability to activate dihydrogen and subsequently facilitate the catalytic hydrogenation of organic compounds with their unsaturated functional groups. We designed these FLPs by embedding stannylum motifs into a cyclic guanidinate backbone, which provides a complementary Lewis basic nitrogensite.

We also explored a b- $\text{TeO}_2$  system, in which with strain we achieved very high charge carrier mobility values. We found that upon the application of a small uniaxial strain, the electron mobility increases many fold along one direction and hole mobility increases to a very high value in the other direction. Such anisotropic carrier mobility can be created using small uniaxial strain in a stable layered  $\text{TeO}_2$  semiconductor.

## Prof. Srikanth Sastry Ph.D., F.N.A., F.A.Sc., F.N.A.Sc.

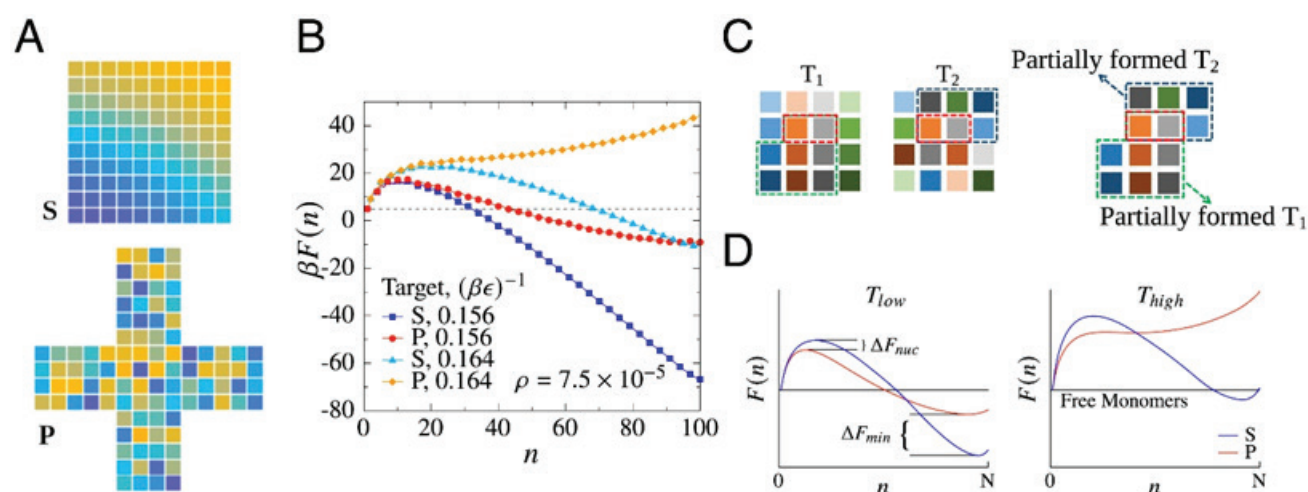
### Professor

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We demonstrated the qualitative change in yielding behavior in glasses depending on the degree of annealing. We investigated a family of models, which reproduce key features of the dependence of



yielding behavior of amorphous solids on the degree of annealing observed. We investigated the statistics of avalanches and clusters in silica and obtained a satisfactory analysis of the relationship between exponents within a framework that envisages the fragmentation of avalanches in the presence of long-range interactions. We studied the kinetics of crystallization in deeply supercooled liquid silicon employing computer simulations and the Stillinger-Weber three-body potential. We investigated the computational design of a multicomponent self-assembly system that can be guided into forming one of two predefined competing structures through simple temperature protocols and demonstrated that temperature protocols can be designed that lead to the formation of either one of the target structures with high selectivity. We also show that the occurrence of isotropic jamming densities above the minimal density leads both to the emergence of shear-induced jamming and dilatancy in frictionless packings. We investigated a family of models that reproduce key features such as the strong dependence of the yielding behavior of amorphous solids on the degree of annealing observed in simulations. We provided an interpretation for the intriguing presence of a threshold energy below which the nature of yielding changes qualitatively.



(A) Shows the two structures that we used as design targets in this study. (B) Shows the free-energy landscapes of the two targets at  $kBT/\epsilon = 0.156$  and  $0.164$  when all designed bonds are of equal strength  $\epsilon$ . (C) Illustration showing two example structures,  $T_1$  and  $T_2$ , that differ in their internal arrangement of components. (D) Schematic showing a scenario where one target has the lower barrier, while the other has the lower free-energy minimum

### Major talks during 2021-2022:

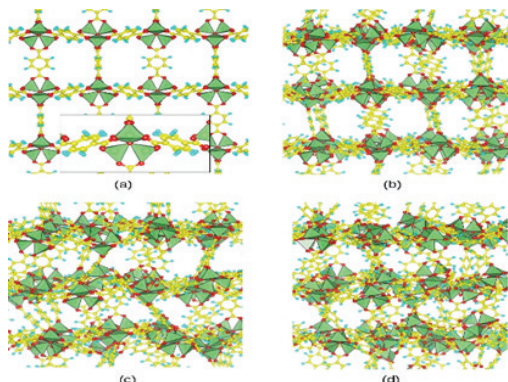
- 21<sup>st</sup> March 2022: Talk on "Yielding in Amorphous Solids under Symmetric and Asymmetric Cyclic Shear" at Statphys, Kolkata
- 10<sup>th</sup>-11<sup>th</sup> February 2022: Talk on "Recent Advanced in Glass Physics and the Glass Science Landscape in India" at the U. N. International Year of Glass 2022 Conference organised by the United Nations
- 15<sup>th</sup>-18<sup>th</sup> December 2021: Talk on "Crystal Nucleation and Liquid-Liquid Transition in Supercooled Silicon" at RARE 2021 Symposium, IIT Kanpur
- 15<sup>th</sup>-18<sup>th</sup> December 2021: Talk on "The Structural Glass Transition and Replica Theory" at Celebrating the Science of Giorgio Parisi Seminar, International Centre for Theoretical Sciences, Bengaluru
- 22<sup>nd</sup>-26<sup>th</sup> November 2021: Talk on "Yielding and Fatigue Failure of Amorphous Solids under Cyclic Deformation" at the Current Trends in Non-Equilibrium Physics Conference, Jawaharlal Nehru University, Delhi
- 13<sup>th</sup> November 2021: Talk on "Decoding Complexity: Giorgio Parisi, the Theory of Spin Glasses, Glasses, and Beyond Seminar" at Indian Physics Association, Punjab University
- 7<sup>th</sup> November 2021: Talk on "Decoding Complexity: Giorgio Parisi, the theory of spin glasses, glasses, and beyond" at Banaras Hindu University, Varanasi

- 29<sup>th</sup> October 2021: Talk on “Crystal nucleation and liquid-liquid transition in supercooled silicon” at theTSU@25 Seminar, JNCASR
- 22<sup>nd</sup> October 2021: Talk at the Statistical Thermodynamics and Molecular Simulations Seminar Series on “Guided Self Assembly of Competing Structures”
- 29<sup>th</sup> June 2021: Talk at the Cargese school and workshop on Glassy Systems and Inter-Disciplinary Applications on “Yielding of amorphous solids under cyclic deformation”, organised by CNRS/Université de Corse/Université Côte d'Azur

## **Prof. Umesh V. Waghmare** Ph.D., F.N.A., F.A.Sc., F.N.A.Sc., F.N.A.E., F.M.A.Sc. *Professor and Dean, Faculty*

MOF-5 is a crystalline metal-organic framework with large pore volume and exceptional thermal stability which is known to undergo irreversible amorphization at surprisingly low pressures (~10 MPa). In our study, we used first-principles theoretical phonon-spectral analysis, to demonstrate that thermally stable MOF-5 crystal cannot sustain hydrostatic compression due to pressure-induced symmetry-lowering torsional forces that end up destabilizing its octahedral SBUs.

We carried out a group-theoretical analysis of MOF-5 phonons to unravel the role of normal modes in the mid-frequency range ( $\omega \sim 1.6$ – $3.2$  THz). We found that it became unstable and formed dispersion-less phonon bands at very small compressive strains ( $\sim -0.3\%$ ), leading to an order-to-disorder structural phase transition. We observed that at slightly larger strains, structures distorted with random combinations of localized modes in the flat bands of these unstable phonons and associated instabilities of the transverse acoustic branches relaxed to lower-energy states that exhibited structural shearing at the nanoscale. This phenomenon resulted in the loss of long-range order and irreversible amorphization of the MOF-5 crystal while preserving the local structural coordination.



*Pressure-induced amorphization of MOF-5*

### Reference:

*J. Phys. Chem. C.* 125 (27): 14924–14931.  
doi: 10.1021/acs.jpcc.1c02598

### Major event organised during 2021–2022:

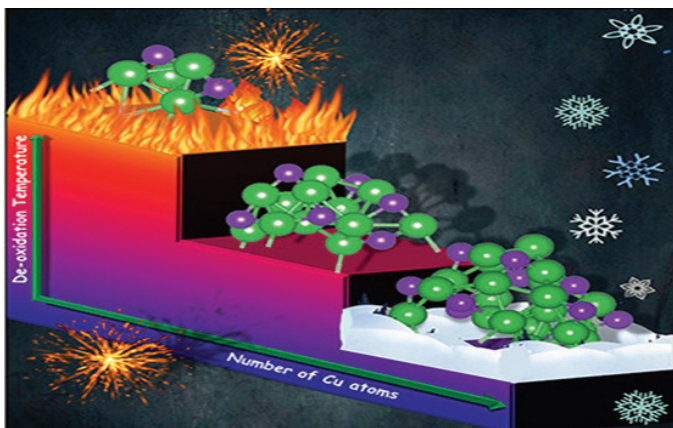
- 6<sup>th</sup>–9<sup>th</sup> December 2021: Organised the International Winter School with Prof. M Eswarmorthy (ICMS)

### Major talks during 2021–2022:

- 24<sup>th</sup> March 2022: Talk at the 2<sup>nd</sup> International Conference on Materials Genome on “Predictive Models for Innovative Design of Materials Using Quantum Mechanics and Machine Learning”, organised by the SRM University, NCL and JNCASR
- 24<sup>th</sup>–27<sup>th</sup> October 2021: Talk at the Physics and Chemistry of Advanced Materials Conference on “Mechanisms of Energy and Charge Transport in Thermoelectric Chalcogenides”, organised by IIT Delhi

## **Prof. Shobhana Narasimhan** Ph.D., F.N.A.Sc., F.A.Sc. *Professor*

We showed that the morphology, charge, and reactivity of supported Au nanoparticles can be tuned by doping the oxide substrate with an electron donor. We showed that the temperature at which Cu nanoparticles get de-oxidized depends on both the size and the support. We obtained simple yet successful descriptors for the self-assembly of organic molecules on surfaces.

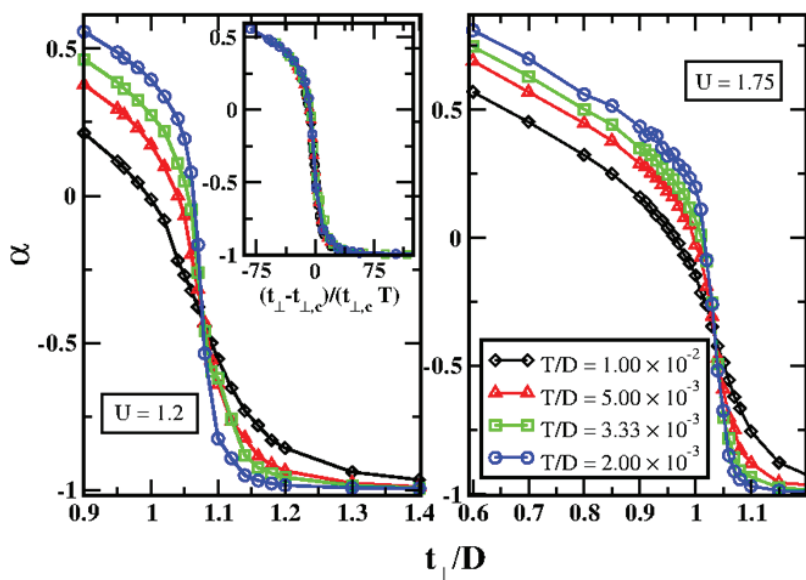


De-oxidation temperature of Cu nanoparticles

**Prof. Vidhyadhiraja N. S. Ph.D.**

**Professor**

The study of the critical nature of quantum phases is gaining momentum in the field of condensed matter physics. Local quantum criticality in itinerant fermion systems is being extensively investigated through the soft-gap Anderson impurity model, wherein a localized, correlated impurity, hybridizes with a broad conduction band with a singular density of states. However, lattice models hosting quantum critical points (QCPs) do not appear to have such a spectrum emerging at the QCP. In our work, we reported the emergence of such a singular form of the density of states in a three-orbital lattice model, within the dynamical mean-field theory, precisely at a quantum critical point, separating a gapless, Fermi liquid, metallic phase from a gapped, Mott insulating phase. The corresponding Matsubara self-energy was observed to have a soft gap form with the temperature-dependent exponent varying from +1 deep in the FL regime, to -1 in the Mott insulator regime. Interestingly, we found that the exponent becomes temperature independent, and hence isosbestic, precisely at the QCP. We found that the isosbestic exponent was a consequence of an emergent soft-gap spectrum at the QCP. We also discussed the implications of our findings for non-Fermi liquid behaviour in the quantum critical region of the phase diagram.



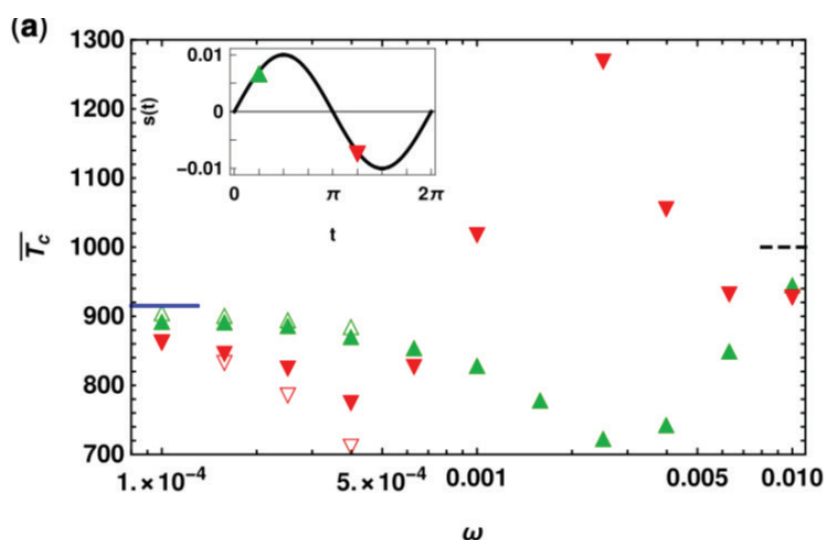
The exponent  $\alpha$  appearing in the low-frequency dependence of the self-energy is plotted as a function of interband coupling for (a)  $U/D = 1.2$  (left panel) and (b) and  $U/D = 1.75$  (right panel) for different temperatures. It is found to smoothly crossover, asymptotically, from a value of 0.7 (FL) to -1 (MI) for the various temperatures shown

**Reference:**  
 arXiv:2203.07348.  
 doi: 10.48550/arXiv.2203.07348  
 (under review in *Phy. Rev. B*)

## Prof. Kavita Jain Ph.D.

### Professor

Although many experimental and theoretical studies on natural selection have been carried out in a constant environment, as natural environments typically vary in time, it is important to ask if and how the results of these investigations are affected by a changing environment. We studied stochastic models of biological evolution in periodically varying environments and showed that the genetic diversity is significantly affected even when the environment changes slowly. We also studied the first passage time properties in changing environments and investigated the impact of varying selection on within-population genetic diversity.



*Conditional mean fixation time of a dominant mutant (green) and a recessive mutant (red) to show the symmetry between the conditional mean fixation time for dominant beneficial and recessive deleterious mutants in static environments is not preserved in changing environments*

#### Reference:

*Genetics* 219 (3):iyab148.

doi: 10.1093/genetics/iyab148

#### Major events organised during 2021-2022:

- March 2022: Organised a Symposium on "Calcium channels, Complex fluids and Quantum dots" with Nabonita Guha and Anjana V.
- February 2022: Organised the "ICTS meeting on Statistical Physics: Recent advances and Future directions, Discussion" with Dr. Tridib Sadhu (TIFR Mumbai) and Dr. Sakuntala Chatterjee (SN Bose Centre)
- January-February 2022: Organised the "5<sup>th</sup> ICTS School on Population Genetics and Evolution School" with Deepa Agashe (NCBS)
- January 2022: Organised a "Virtual Inauguration Ceremony and First Workshop on Gender Sensitization of GATI" with Nabonita Guha and Anjana V.
- November 2021: Organised the In-House Symposium at JNCASR with Prof. Subir K. Das and Prof. Vidhyadhiraja N. S.
- November 2021: Organised a "TSU colloquium by Leticia Cugliandolo" along with Prof. Swapan Pati
- April 2021: Organised a Webinar by Sudipta Tung

#### Major talks during 2021-2022:

- February 2022: Talk at the ICTS meeting on "Statistical Physics: Recent advances and future directions, Slow quench dynamics in classical systems" organised by ICTS, Bengaluru
- February 2022: Physics Colloquium on "Randomness in biological evolution" organised by IIT Delhi, New Delhi

- January–February 2022: Lectures (3) at the 4<sup>th</sup> ICTS School on Population Genetics and Evolution on “Introduction to Stochastic Modeling in Evolution” and a talk on “Genetic Diversity in Changing environments” organised by ICTS, Bengaluru
- November 2021: Talk at the In-House Symposium of JNCASR on “Evolution in a changing world” organised by TSU, JNCASR
- October 2021: Talk at the TSU@25 Conference on “Slow quench dynamics in classical systems” organised by TSU, JNCASR
- May 2021: Talk at the Outreach Talk Webinar on “Randomness in biological evolution” organised by Manav-Data Science Webinar series
- April 2021: Talk at the Perspectives in Computational Biology Symposium on “Adaptation in changing environments” organised by IISER Mohali

## **Prof. Kalyan B. Sinha** Ph.D., F.N.A., F.A.Sc., F.T.W.A.S.

### **INSA Senior Scientist**

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We defined the  $[[T^*, T]]$  determinant by symmetrizing the products in the Laplace formula for the determinant of a scalar matrix. We proved that the determinant of  $[[T^*, T]]$  equals the generalized commutator of the 2d-tuple of operators  $(T_1, T_{*1}, \dots, T_d, T_{*d})$  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  $[[T^*, T]]$  must be 0. We also showed that if the d-tuple  $T$  is cyclic, the determinant of  $[[T^*, T]]$  is non-negative, and the compression of a fixed set of words in  $T^{*j}$  and  $T_i$ —to a nested sequence of finite-dimensional subspace increases to the  $H$ —does not grow very rapidly. We provided 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): doi : 10.1007/s00020-022-02693-5

#### **Major event organised during 2021–2022:**

- 17<sup>th</sup>–20<sup>th</sup> January 2022: Organised an Online Conference named “Qp-42” along with Prof. B. V. R. Bhat, Indian Statistical Institute (ISI), Bengaluru

#### **Major talks during 2021–2022:**

- 17<sup>th</sup>–20<sup>th</sup> January 2022: Talk at the QP-42 (Quantum Probability & Infinite Dim. Analysis) Conference on “Sufficient Statistic and Rao-Blackwell Theorem in Quantum Probability”, organised by ISI, Bengaluru
- 13<sup>th</sup>–15<sup>th</sup> October 2021: Talk at Quantum Bio-Informatics Conference (QBIC) on “Sufficient Statistic in Quantum Probability” organised by Tokyo University of Science, Japan
- 20<sup>th</sup>–25<sup>th</sup> September 2021: Talk at Non-Commutative Algebra Probability and Analysis in Action Conference on “Decision Theory in Non-Commutative Domain” organised by Technical University, Berlin, Germany
- 21<sup>st</sup> August 2021: Talk at Vigyan Parikrama’s Online Seminar on “Symmetry & Mathematics” organised by the West Bengal Government



## UNIT MEMBERS

### FACULTY MEMBERS

Professor and Chair	<b>Prof. Subir Kumar Das</b>
Professors	<b>Prof. Swapan K. Pati</b> <b>Prof. Srikanth Sastry</b> <b>Prof. Umesh V. Waghmare</b> (Dean, Faculty) <b>Prof. Shobhana Narasimhan</b> <b>Prof. Vidhyadhiraja N. S.</b> <b>Prof. Kavita Jain</b>
Faculty Fellow	<b>Dr. Meher K. Prakash</b> (superannuated on 19 <sup>th</sup> August 2021)
INSA Senior Scientist	<b>Dr. K. B. Sinha</b>

### RESEARCH STUDENTS

Ph.D.	<b>Pallavi Sarkar, Bidhan Chandra Garain, Supriti Dutta, Anita Gemmy Francis, Alok Kumar Dixit (ERP), Koyendrila Debnath, Ankit Kumar, Arijit Sinha, Bhuvaneswari R., Abhishek Kumar Adak, Arpan Das, Ritam Chakraborty, Vinayak M. Kulkarni, Sujan K. K., Koyel Das, Arabinda Bera, Soumik Ghosh, Purnendu Pathak, Sachin Kaushik, Monoj Adhikari, Pallabi Das, Yagyik Goswami, Varghese Babu, Khandare Pushkar Gopalrao, Krishna Kanhaiya Tiwari, Malay Ranjan Biswal, Himanshu Joshi, Anjaney Pati Tripathi, Sayantan Maity, Lakshita, Mayank Sharma, Sayan Paul, Swarnendu Maity, Debargha Sarkar</b>
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### RESEARCH STAFF

SERB National Postdoctoral Fellows (NPDF)	<b>Dr. Durgesh Kumar Sharma, Dr. Devina Sharma</b>
Research Associates	<b>Dr. Lakshay Dheer, Dr. Shivakumar Athani, Dr. Arpita Sen, Dr. Neha Bothra, Dr. Arunkumar Bupathy, Dr. Meghna Manae A., Dr. Paramita Banerjee, Dr. Triparna Mondal, Dr. Aswin Nandagiri, Dr. Raju Kumar Biswas, Dr. Abhiroop Lahiri, Dr. Arijit Dutta, Dr. Matukumilli V. D. Prasad, Dr. Arpita Paul, Dr. Tanay Paul</b>
Research Associate-III	<b>Dr. Shazia Janwari</b>
Research Associates (Provisional)	<b>Gour Jana, Sonu Prasad Keshri, Malay Ranjan Biswal</b>
Researchers	<b>Koyal Das, Nalina V.</b>
R&D Assistants	<b>Mohit Chaudhary, Monoj Adhikari</b>
Project Assistant	<b>Anjana V.</b>

### CONTRACTUAL STAFF

Office Executive	<b>Bindu H. K.</b>
Helper	<b>Chandan Kumar D. V.</b>

## UNIT AT A GLANCE

### HONOURS RECEIVED



### FACULTY ACHIEVEMENTS:

#### Prof. Kavita Jain

- Appointed as Associate Editor of the journal *Evolution*

#### Prof. Umesh V. Waghmare

- Elected as the President of the Indian Academy of Sciences, Bengaluru
- Elected to be a member of Board of Trustees, RRI Trust
- Received Distinguished Adjunct Professorship of Chemistry in the College of Science and Technology, Temple University

#### Prof. Shobhana Narasimhan

- Elected to be a member of Editorial Advisory Board, *Applied Physics Reviews*

#### Prof. Srikanth Sastry

- Elected to be a member of Editorial Advisory Board, *Journal of Chemical Physics*
- Elected to be a member of Editorial Board, *Journal of Physics: Materials*

#### Prof. Subir K. Das

- Elected as Editorial Board Member, *Soft Materials*, Taylor & Francis

### STUDENT ACHIEVEMENTS:

#### Bidhan Chandra Garain (Ph.D. student; research supervisor: Prof. Swapan K. Pati)

- Received Physical Chemistry Chemical Physics poster prize by Royal Society of Chemistry at Theoretical Chemistry Symposium, IISER, Kolkata

#### Sachin Kaushik (Ph.D. student; research supervisor: Prof. Kavita Jain)

- Received Poster Award for In-House Symposium of JNCASR

### TOTAL PUBLICATIONS



## 58

Peer reviewed articles indexed in Web of Science/Scopus

## SPONSORED PROJECTS



**3**

New Projects

**₹44.07 lac**

Funding



**18**

Ongoing Projects

**₹88.14 lac**

Funding

## STUDENTS GRADUATED DURING 2021-2022



**5**

Ph.D.

- Neha Bothra
- Meha Bhogra
- Raju Kumar Biswas

- Archana Devi
- Nalina V.

## STUDENTS ADMITTED DURING 2021-2022



**7**

Ph.D.

- Anjaney Pati Tripathi
- Sayantan Maity
- Lakshita
- Mayank Sharma

- Sayan Paul
- Swarnendu Maity
- Debargha Sarkar

# SCHOOL OF ADVANCED MATERIALS (SAMat)

From 1<sup>st</sup> April 2021 to 31<sup>st</sup> March 2022, the School of Advanced Materials (SAMat) conducted various activities.

## 26<sup>TH</sup> NOVEMBER 2021: THE SECOND C. N. R. RAO ANNUAL MATERIALS LECTURE WAS CONDUCTED



**SPEAKER:** **Prof. Chennupati Jagadish,**  
The Australian National University, Canberra, Australia

**TITLE:** "Semiconductor Nanostructures for Optoelectronics, Energy and Neuroscience Applications"

## 26<sup>TH</sup> NOVEMBER 2021: AWARD LECTURES OF THE NATIONAL PRIZES FOR RESEARCH IN CHEMISTRY OF PEPTIDES AND NUCLEIC ACIDS WERE HELD



**SPEAKER 1:** **Prof. S. G. Srivatsan,**  
IISER Pune

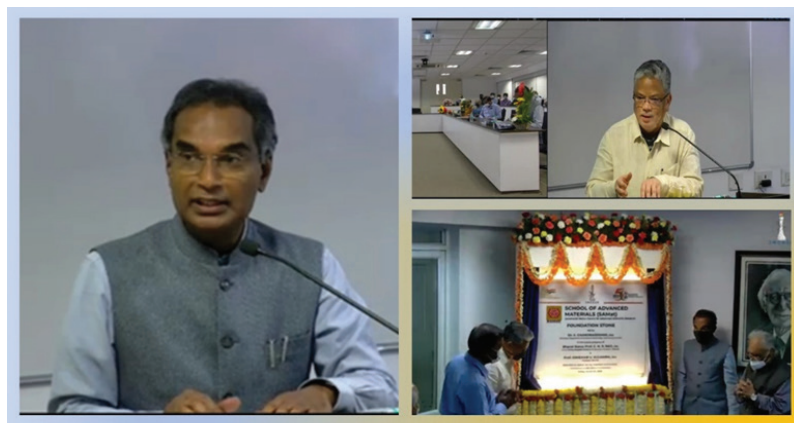
**TITLE:** "Probing Mood (Structure) Swings of Therapeutic Nucleic Acid Motifs"



**SPEAKER 2:** **Prof. T. Govindaraju,**  
NCU, JNCASR

**TITLE:** "Peptides as Cause and Remedy in Alzheimer's Disease"

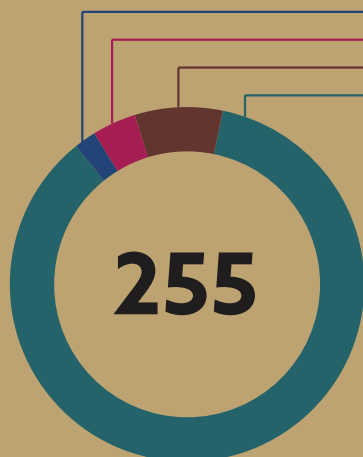
## 4<sup>TH</sup> MARCH 2022: FOUNDATION STONE LAYING CEREMONY



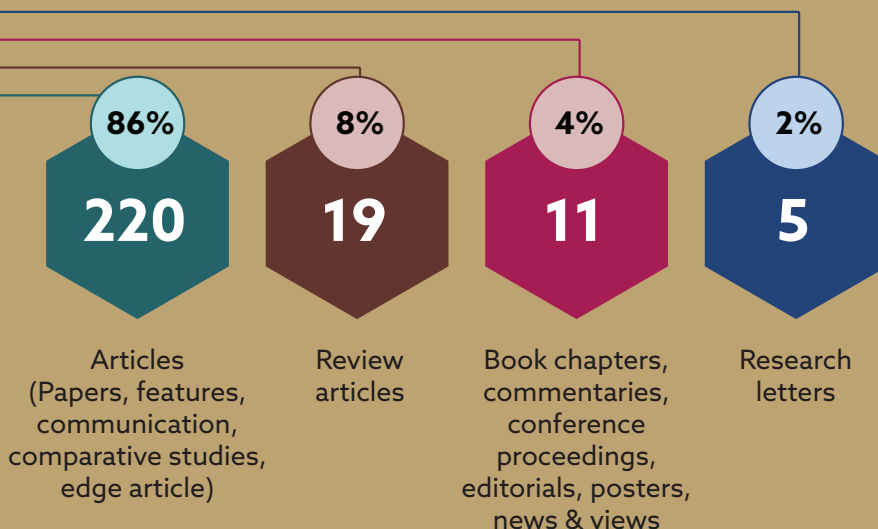
The foundation stone for SAMat was laid in the august presence of Bharat Ratna Prof. C. N. R. Rao and Prof. G. U. Kulkarni by Dr. S. Chandrasekhar, FNA, Secretary, Department of Science and Technology, Government of India.

# FACULTY PUBLICATIONS

## TOTAL NUMBER OF PUBLICATIONS IN 2021



## TYPES OF PUBLICATIONS



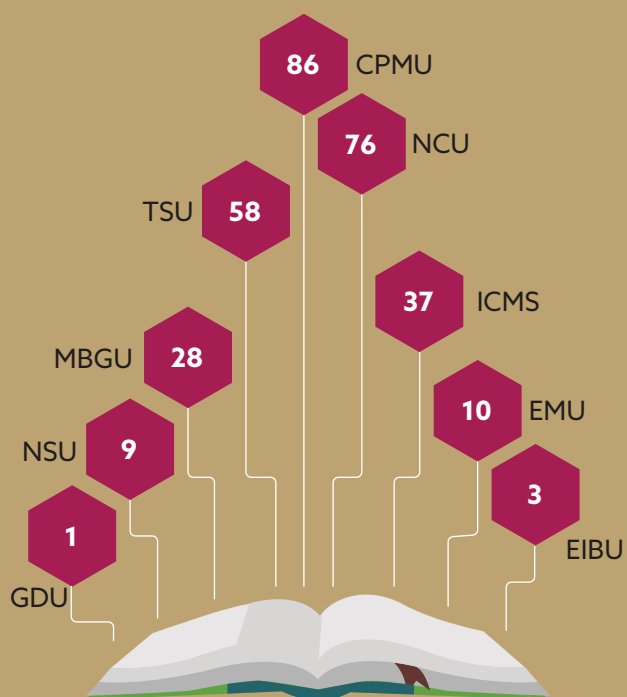
## TOTAL PUBLICATIONS IN IMPACT FACTOR JOURNALS

**248**

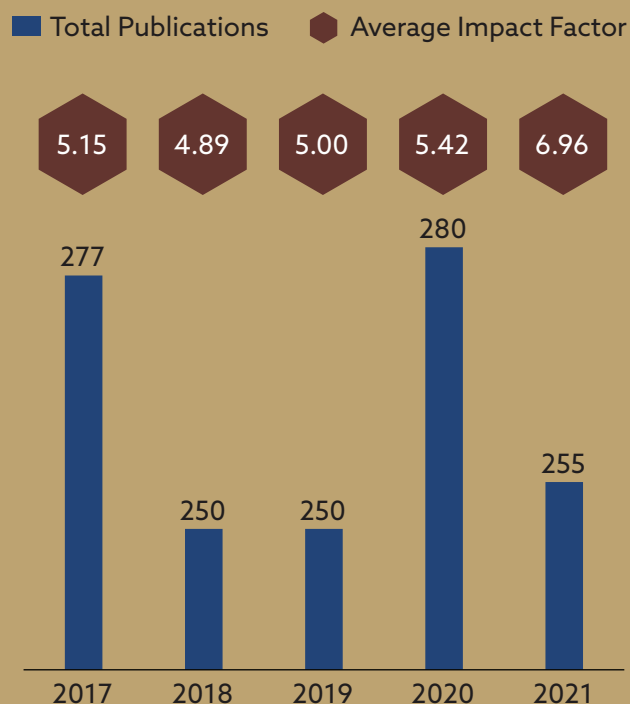
## AVERAGE IMPACT FACTOR

**6.96**

## UNIT-WISE PUBLICATIONS



## KEY INFORMATION YEAR-WISE



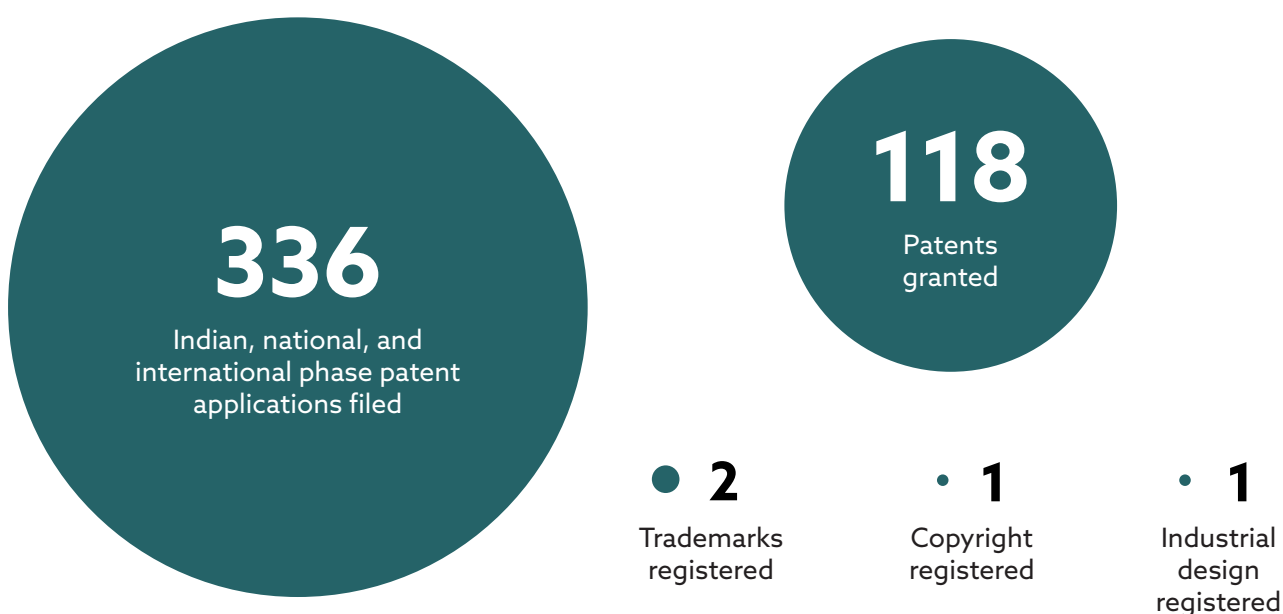


# INTELLECTUAL PROPERTY

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 of and financial returns from technologies, products, and services.

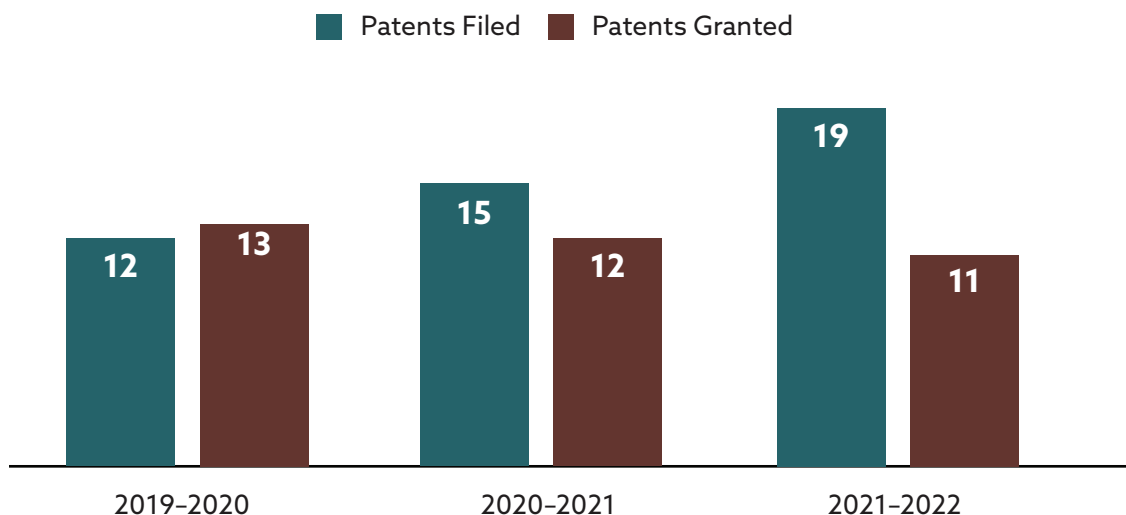
The Centre has been one of the foremost research institutes in the country to realise the importance of IPAs created by its researchers. The Centre encourages and facilitates the creation, development, protection, and management of commercially exploitable IPs and their enforcement in addition to fostering academia-industry partnerships.

## TOTAL IPAs OVER THE YEARS UNTIL MARCH 2022



## PATENTS

### PATENTS FILED AND GRANTED (PAST 3 YEARS)



# INTELLECTUAL PROPERTY

## PATENT APPLICATIONS FILED 2021-2022

INDIAN PATENT APPLICATIONS					
Title of invention	Inventors	Unit	Territory	Application no.	Date of filing
Confidential	James Premdoss Clement Chelliah, Ravi Manjithaya, Sridhar Rajaram, Vijaya Verma, Kavita Sharma, Suresh Santhi Natesan	NSU and MBGU and ICMS	India (Prov.)	202141019767	29 <sup>th</sup> April 2021
Confidential	James Premdoss Clement Chelliah, Ravi Manjithaya, Sridhar Rajaram, Vijaya Verma, Kavita Sharma, Suresh Santhi Natesan	NSU and MBGU and ICMS	India (Prov.)	202141019766	29 <sup>th</sup> April 2021
Confidential	Sridhar Rajaram, Mokshan Sridhar Ramesh	ICMS	India (Prov.)	202141033811	27 <sup>th</sup> July 2021
Confidential	Sebastian C. Peter, Soumi Mondal	NCU	India (Prov.)	202141037359	17 <sup>th</sup> August 2021
A Method for Improving Figure of Merit (zT) of $\text{Bi}_{0.5}\text{Sb}_{1.5}\text{Te}_3$ (BST) and a $\text{Bi}_{0.5}\text{Sb}_{1.5}\text{Te}_3$ (BST)-GeSe Composite	Kanishka Biswas	NCU	India	202131024500	8 <sup>th</sup> June 2021
Confidential	Govindaraju Thimmaiah, Sumon Pratihar	NCU	India (Prov.)	202141055905	2 <sup>nd</sup> December 2021
Confidential	Sebastian C. Peter, Jithu Raj, Arjun C. H.	NCU	India (Prov.)	202241001975	13 <sup>th</sup> January 2022
Confidential	Sebastian C. Peter, Soumi Mondal	NCU	India (Prov.)	202241007999	15 <sup>th</sup> February 2022
Confidential	Govindaraju Thimmaiah, Madhu Ramesh, Chenikkayala Balachandra	NCU	India (Prov.)	202241011941	4 <sup>th</sup> March 2022
Confidential	Eswaramoorthy Muthusamy, Momin Ahamed	CPMU	India (Prov.)	202241015608	21 <sup>st</sup> March 2022
Confidential	Bivas Saha, Dheemahi Rao	ICMS	India (Prov.)	202241018024	28 <sup>th</sup> March 2022

INTERNATIONAL PHASE PATENT APPLICATIONS FILED					
Title of invention	Inventors	Unit	Territory	Application no.	Date of filing
Antimicrobial Compounds and Uses Thereof	Jayanta Halder, Sreyan Ghosh, Riya Mukherjee	NCU	PCT	PCT/IN2021/050329	1 <sup>st</sup> April 2021

# INTELLECTUAL PROPERTY

## INTERNATIONAL PHASE PATENT APPLICATIONS FILED

Title of invention	Inventors	Unit	Territory	Application no.	Date of filing
Composition, Injectable Hydrogel and Methods Thereof	Govindaraju Thimmaiah, Biswanath Maity, Sourav Samanta	NCU	PCT	PCT/IN2021/050337	5 <sup>th</sup> April 2021
Naphthalene Monoimide Compounds and Methods Thereof	Govindaraju Thimmaiah, Rajasekhar Kolla, Sourav Samanta	NCU	PCT	PCT/IB2021/056633	22 <sup>nd</sup> July 2021

## NATIONAL PHASE PATENT APPLICATIONS FILED

Title of invention	Inventors	Unit	Territory	Application no.	Date of filing
Catalyst, its Process of Preparation, and Applications Towards Reduction of Carbon Dioxide to Chemicals	Sebastian C. Peter, Soumyabrata Roy, Arjun C.H, Manoj Kaja Sai	NCU	USA	17/298,378	28 <sup>th</sup> May 2021
Catalyst, its Process of Preparation, and Applications Towards Reduction of Carbon Dioxide to Chemicals	Sebastian C. Peter, Soumyabrata Roy, Arjun C.H, Manoj Kaja Sai	NCU	Europe	19832739.7	4 <sup>th</sup> June 2021
Small-Molecular Adjuvants and Implementations Thereof	Jayanta Halder, Geetika Dhanda	NCU	USA	17/594,408	14 <sup>th</sup> October 2021
Small-Molecular Adjuvants and Implementations Thereof	Jayanta Halder, Geetika Dhanda	NCU	Europe	20790881.5	15 <sup>th</sup> November 2021
A p-Type Material, and Implementations Thereof	Kanishka Biswas, Subhajit Roychowdhury, Tanmoy Ghosh	NCU	USA	17/626,953	13 <sup>th</sup> January 2022

## PATENTS GRANTED 2021-2022

Title of invention	Inventors	Unit	Territory	Application no.	Date of filing
High Surface Area Ordered Porous Carbon, Method and Applications Thereof	Eswaramoorthy Muthusamy, Dheeraj Kumar Singh, Katla Sai Krishna	CPMU	India	370059	23 <sup>rd</sup> June 2021
A Compound and Pharmaceutical Composition Thereof	Govindaraju Thimmaiah, Nagarjun Narayanaswamy	NCU	India	371310	7 <sup>th</sup> July 2021

# INTELLECTUAL PROPERTY

Title of invention	Inventors	Unit	Territory	Application no.	Date of filing
Palladium Based Selenides as Highly Stable and Durable Cathode Materials in Fuel Cell for Green Energy Production	Sebastian C. Peter, Saurav Chandra Sarma	NCU	India	373323	30 <sup>th</sup> July 2021
A Method of Forming A Photovoltaic Cell	Kavassery Sureswaran Narayan, Anshuman Jyothi Das	CPMU	Europe	2831934	11 <sup>th</sup> August 2021
A Compound and Pharmaceutical Composition Thereof	Govindaraju Thimmaiah, Nagarjun Narayanaswamy	NCU	ARIPO	AP 5749	3 <sup>rd</sup> September 2021
A Process for Synthesis of Graphene	Giridhar Udapi Rao Kulkarni, Umesha Mogera, Narendra Kurra	CPMU	India	377411	21 <sup>st</sup> September 2021
Shape Tailored Ordered PdCu <sub>3</sub> Nanoparticle Surpassing the Activity of State-of-the-art Fuel Cell Catalyst	Sebastian C. Peter, Rajkumar Jana, Saurav Chandra Sarma	NCU	India	380514	28 <sup>th</sup> October 2021
Compounds as DNA Probes, Methods, and Applications Thereof	Govindaraju Thimmaiah, Nagarjun Narayanaswamy	NCU	ARIPO	AP 5953	25 <sup>th</sup> December 2021
Compounds as DNA Probes, Methods and Applications Thereof	Govindaraju Thimmaiah, Nagarjun Narayanaswamy	NCU	India	386930	20 <sup>th</sup> January 2022
A Tellurium-Free n-Type Material, and Implementations Thereof	Kanishka Biswas, Manisha Samanta	NCU	India	390688	28 <sup>th</sup> February 2022
Process for Purification of Hydrocarbons	Tapas Kumar Maji, Subhajit Laha, Ritesh Halder	CPMU and NCU	India	393130	28 <sup>th</sup> March 2022

## TECHNOLOGIES TRANSFERRED

Title of invention	Name of principal inventor	Licensee	Effective date
Controlled Release Dispensers for Delivery of Semiochemicals	Prof. M. Eswaramoorthy	M/s. Bannari Amman Sugars Ltd, Tamil Nadu	7 <sup>th</sup> April 2021
Controlled Release Dispenser for Delivery of Rice Stem Borer, <i>Scirpophaga incertulas</i> , Citrus Leaf Miner, <i>Phyllocnistis citrella</i> , Diamond Back Moth, <i>Plutella xylostella</i> , Fall Armyworm, <i>Spodoptera frugiperda</i> and Tomato Pinworm, <i>Tuta absoluta</i> Pheromone	Prof. M. Eswaramoorthy	M/s. ICAR-NBAIR and ATGC Biotech Pvt. Ltd, Hyderabad	30 <sup>th</sup> July 2021
Transfer of Proprietary Technology to Treat Certain Nervous System Disorders in Humans	Prof. T. Govindaraju	M/s. Hamsa Biopharama India Pvt. Ltd, Delhi	28 <sup>th</sup> March 2022

# OVERVIEW OF INTELLECTUAL PROPERTY (2021-2022)

## PATENT APPLICATIONS FILED



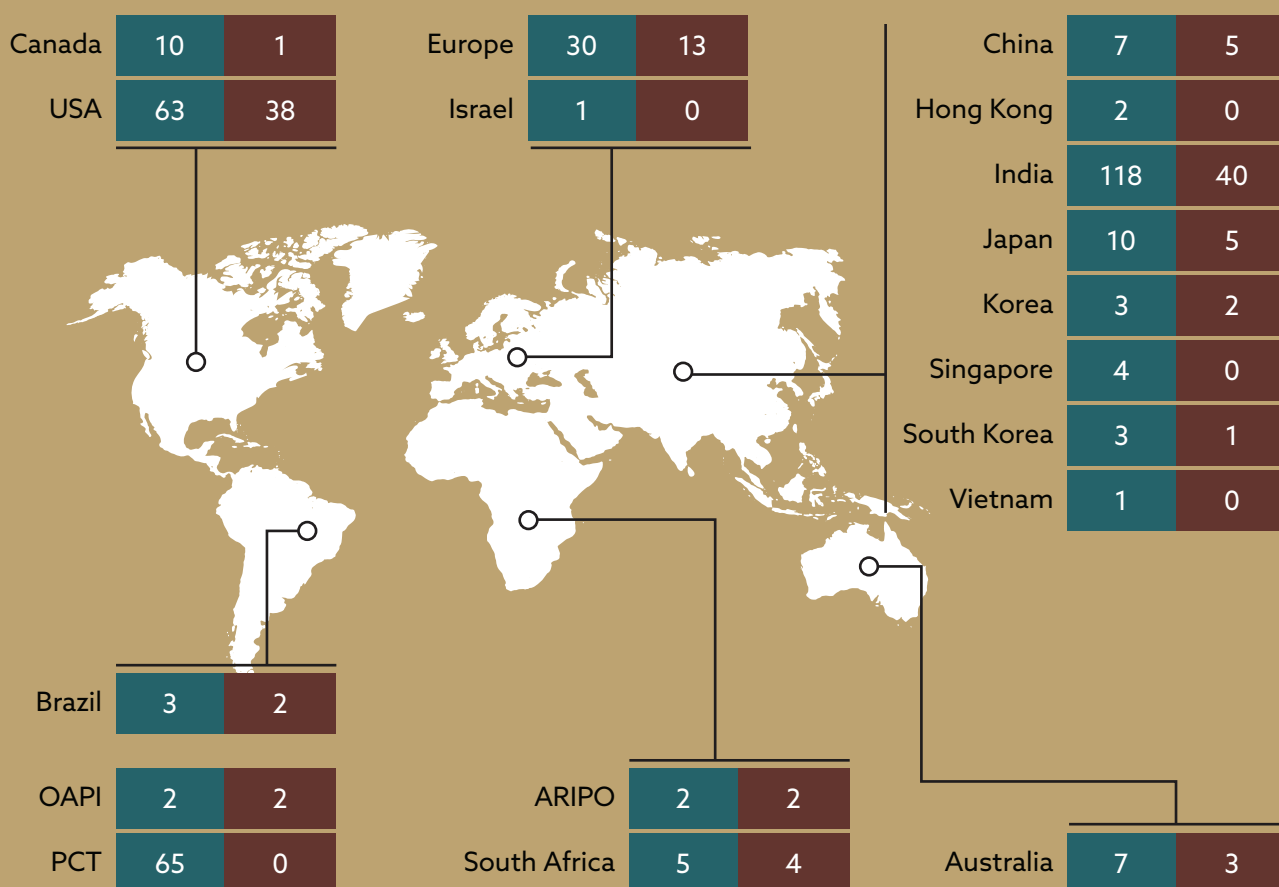
**11** India | **3** PCT | **3** USA | **2** Europe

## PATENTS GRANTED



**8** India | **2** ARIPO | **1** Europe

## TERRITORY-WISE DISTRIBUTION OF INTELLECTUAL PROPERTY (SINCE INCEPTION TILL 31<sup>ST</sup> MARCH 2022)



## MEMBERS OF INTELLECTUAL PROPERTY CELL

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

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

Technical Officer Grade 1: **A. V. Nagarathamma** (superannuated on 30<sup>th</sup> April 2021)

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

Lab Helper: **Varadaiah K.**



# AGREEMENTS SIGNED

## Consultancy Agreement

Sankhyasutra Labs Ltd.

## License Agreement

Hamsa Biopharma India Pvt. Ltd.

## Memorandum of Association (Grant Agreement)

Department of Biotechnology

## Non-Disclosure Agreements

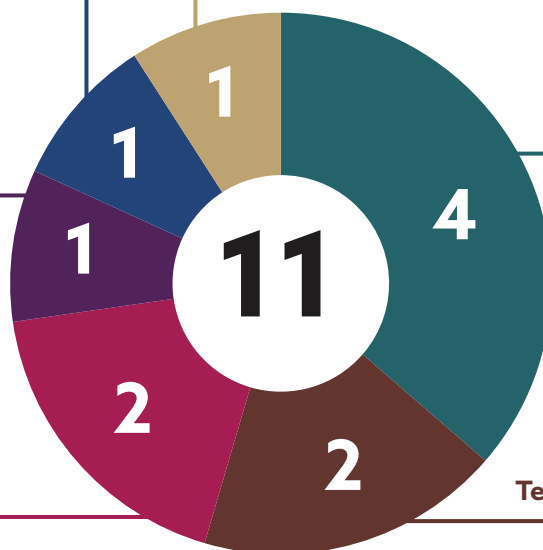
Techni Bharathi Pvt. Ltd.  
Cookson India Pvt. Ltd.  
Simode Solutions Pvt. Ltd.  
Trilok Corporation Pvt. Ltd.

## Research Agreements

Cookson India Pvt. Ltd.  
Tata Steel Ltd.

## Technology License Agreements

ICAR-NBAIR/Bannari Amman  
ICAR-NBAIR/ATGC Biotech Pvt. Ltd.



## 4 NON-DISCLOSURE AGREEMENTS WERE SIGNED IN 2021-2022

- Prof. T. Govindaraju**, from the New Chemistry Unit (NCU) of **JNCASR**, entered into a non-disclosure agreement with **Techni Bharathi Pvt. Ltd. (TBL), New Delhi**, for a period of 5 years from date of signing (3<sup>rd</sup> June 2021).  
 The title of the NDA is: *To exchange certain trade secret, confidential, and proprietary information pertaining to customers, clients, employees, strategies, plans, ideas, and other compilations of data and to disclose and to exchange confidential Information for the limited purpose of Scientific Consultancy.*
- Prof. M. Eswaramoorthy** signed two **NDA**s in 2021.
  - » The first was with **Cookson India Pvt. Ltd., Ambattur, Chennai**, valid for a period of 2 years from 30<sup>th</sup> July 2021, the date of signing.  
 The NDA was signed to disclose and exchange Confidential Information for the limited purpose of Scientific Consultancy for the project "*Understand the type of volatile gasses evolved during reflow process responsible for causing solder joint voids; develop a robust mechanism for voiding by evolved gas analysis.*"
  - » The second **NDA** was entered into with **Simode Solutions Pvt. Ltd., Bengaluru**, to disclose and exchange of confidential information for the limited purpose of *developing mix design and corresponding formulations of Autoclaved Aerated Concrete Blocks and Panels*. This agreement is valid for 2 years from 17<sup>th</sup> September 2021, the date of signing.
- Dr. Sebastian C. Peter** signed an **NDA** with **Trilok Corporation Pvt. Ltd., Mumbai**, to disclose certain information pertaining to "*techno-commercial information related to Higeer Technology*". The agreement is valid for a period of 5 years from 26<sup>th</sup> November 2021, the date of signing.

# AGREEMENTS SIGNED

## 2 TECHNOLOGY LICENSE AGREEMENTS WERE SIGNED IN 2021-2022

- Agreement with **ICAR-NBAIR and Bannari Amman, Tamil Nadu**, for project titled: *"Controlled Release Dispensers for delivery of Semiochemicals"* (signed on 7<sup>th</sup> April 2021).
- Agreement with **ICAR-NBAIR and ATGC Biotech Pvt. Ltd., Hyderabad**, for project titled: *"Controlled release dispenser for delivery of rice stem borer, Scirpophaga incertulas, citrus leaf miner, Phyllocnistis citrella, diamond back moth, Plutella xylostella, fall armyworm, Spodoptera frugiperda and tomato pinworm, Tuta absoluta pheromone"* (signed on 30<sup>th</sup> July 2021).

## 2 RESEARCH AGREEMENTS WERE SIGNED IN 2021-2022

- **Dr. Kanishka Biswas** entered into a **research agreement** with **Tata Steel Ltd., Mumbai**, effective for 1 year from 28<sup>th</sup> October 2021, the date of signing, for the project titled: *"Scale-up synthesis of high-performance n-type and p-type materials and device fabrication for near room temperature thermoelectric waste heat recovery"*. The project is funded by Tata Steel Ltd., Mumbai.
- **Prof. M. Eswaramoorthy** signed a **research agreement** with **Cookson India Pvt. Ltd., Ambattur, Chennai**, for a period of 8 months (ranging from 1<sup>st</sup> November 2021 to 30<sup>th</sup> June 2022) for a project on *"Evolved gas analysis and its correlation to voiding in solder joint of a solder paste"*. The agreement was signed on 5<sup>th</sup> November 2021. Cookson India Pvt. Ltd. will also be funding the project.

## OTHER AGREEMENTS

- **Dr. Ravi Manjithaya**, from the Molecular Biology and Genetics Unit (MBGU) of **JNCASR**, entered into a **memorandum of association (MoA)**: grant agreement valid for 3 years from date of signing, 5<sup>th</sup> August 2021) with the **Department of Biotechnology (DBT)** for a project titled: *"Investigating the role of peroxisomes in Parkinson's disease"*. The project is funded by DBT.
- **Sankhyasutra Labs Ltd. (SSL), Bengaluru**, and **Prof. Santosh Ansumali** entered into a **consultancy agreement** for a period of one year (ranging from 1<sup>st</sup> November 2021 to 31<sup>st</sup> October 2022), for *advice on the technical aspects of ongoing stimulation software design and development, modelling aspect, etc.* The agreement was signed on 24<sup>th</sup> November 2021. SSL Bengaluru will undertake the funding for the project.
- **Hamsa Biopharma India Pvt. Ltd., Delhi**, and **Prof. T. Govindaraju** signed a **license agreement** on 28<sup>th</sup> March 2022, for the *"Transfer of proprietary technology to treat certain nervous system disorders in humans"*.

# 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 health challenges, climate change, energy scarcity, and resource management.

The programme focuses on enabling application-oriented research, creating product IP, and facilitating industry partnerships for technologies with high growth potential. This helps in product commercialisation, easing industry licensing, and strengthening of research and development (R&D) infrastructure for innovators and start-ups.

During the past five years, the TRC has supported R&D at the Centre by:

- Fostering 18 translational R&D and six application-oriented R&D projects;
- Facilitating industrial licensing for 17 technologies;
- Creating a rich pipeline of IPs;
- Establishing four start-ups;
- Supporting 83 patents;
- Publishing 38 peer-reviewed research papers;
- Training 56 researchers;
- Facilitating collaboration with more than 15 industrial partners;
- Establishing centralised state-of-the-art R&D infrastructure for academic and industrial stakeholders; and
- Building a vast network of R&D stakeholders in a conducive innovation ecosystem.

The programme is structured to promote translational research by achieving the right balance across basic research, directed development, and deployment. To sum up, the TRC programme helps strengthen the translational research capabilities of the scientific community and foster research to generate new knowledge with the potential to address some of the most pressing challenges in agriculture, health, sustainability, and more.

## SIGNIFICANT ACHIEVEMENTS

- JNCASR received an invitation to be a part of the Indian SARS-CoV-2 Genomic Consortia (INSACOG), an initiative of the Department of Biotechnology and Ministry of Health and Family Welfare.
- With TRC's support, VNIR Biotechnologies Pvt. Ltd. (a JNCASR start-up) highlighted the importance of locally developing 'molecular probes' and utilizing them to make COVID-19 test kits and components.
- On the National Technology Day (11<sup>th</sup> May 2021), a JNCASR start-up, Breathe Applied Sciences Pvt. Ltd., Bengaluru, won the National Award for Technology Start-ups from the Technology Development Board (TDB), Department of Science and Technology (DST), Government of India. The start-up developed a novel CO<sub>2</sub> reduction technology that can convert 300 kg of CO<sub>2</sub> per day into methanol and other useful chemicals.
- JNCASR scientists, in collaboration with the University of Alberta and Eiwave Digitech, designed and developed a mobile oxygen concentrator named "OxyJani" to cater to acute and chronic oxygen needs at the grassroots level. It is easily deployable in emergencies at any location and has excellent application in rural settings. The primary raw material, zeolite, was donated by Honeywell UOP, Italy.

# TECHNICAL RESEARCH CENTRE

- As part of its technology commercialisation activities, TRC facilitated a technology license agreement between JNCASR, ICAR-NBAIR, and ATGC Biotech Pvt. Ltd. for developing a "Controlled release dispenser for delivery of rice stem borer, *Scirpophaga incertulas*, citrus leaf miner, *Phyllocnistis citrella*, diamondback moth, *Plutella xylostella*, Fall armyworm, *Spodoptera frugiperda*, and tomato pinworm, *Tuta absoluta* pheromone."
- TRC has supported the filing of multiple patent applications (India: 5, PCT: 3, Europe: 1, and USA: 1) in various areas such as energy, transport, solar, supply of raw materials, and climate action as a part of its protection of intellectual property rights.



# MEDIA REPORTS

Each year, various research and personal achievements of the faculty at JNCASR are collated from leading national media (print, online, and radio) and the social media handles of the Department of Science and Technology (DST) and JNCASR.

## LEADING NEWS

### NATIONAL SUPERCOMPUTING MISSION INITIATIVES

The initiatives of JNCASR under the National Supercomputing Mission were appreciated by Prof. Ashutosh Sharma, Secretary, Department of Science and Technology (DST), Government of India, via a letter dated 7<sup>th</sup> April 2021.

- 📧 Tweet by @IndiaDST. 7<sup>th</sup> April 2021. <https://bit.ly/3tycgMF>
- 📧 Tweet by @jncasr. 8<sup>th</sup> April 2021. <https://bit.ly/3aPyxiG>

### REVIEW OF PARLIAMENTARY COMMITTEE ON OFFICIAL LANGUAGE

The Parliamentary Committee on Official Language held a meeting with the officials of JNCASR on 16<sup>th</sup> April 2021. During the meeting, the Committee reviewed the work undertaken at JNCASR on official languages.

- 📧 Tweet by @jncasr. 17<sup>th</sup> April 2021. <https://bit.ly/3MMOzqE>



### BREATHE APPLIED SCIENCES PVT. LTD., A JNCASR START-UP, WINS TDB NATIONAL AWARD 2021

Breathe Applied Sciences Pvt. Ltd., a JNCASR start-up headed by Dr. Sebastian C. Peter of JNCASR, had developed commercially viable efficient catalysts and methodologies to convert CO<sub>2</sub> into methanol and other useful chemicals, reducing the anthropogenic CO<sub>2</sub> content in the atmosphere. For this achievement, the start-up received the National Award 2021 from the Technology Development Board, Department of Science and Technology, Government of India.

- 📧 'Recycling carbon technology by Bengaluru start-up wins TDB National Award 2021.' *Deccan Herald*. 24<sup>th</sup> May 2021. <https://bit.ly/3O2FPho>
- 📧 Tweet by @jncasr. 25<sup>th</sup> May 2021. <https://bit.ly/3xtuG2e>



# MEDIA REPORTS

## INDIAN STEM CELL AND DEVELOPMENTAL BIOLOGIST PART OF WHO ADVISORY COMMITTEE ON HUMAN GENOME EDITING

Indian stem cell and developmental biologist Prof. Maneesha S. Inamdar is a member of the WHO Expert Advisory Committee on Developing Global Standards for Governance and Oversight of Human Genome Editing, which will release two new companion reports providing the first global recommendations to ensure that human genome editing is used for public health, with an emphasis on safety, effectiveness, and ethics.

- ② 'Indian stem cell and developmental biologist part of WHO advisory committee on human genome editing'. *Department of Science and Technology*. 12<sup>th</sup> July 2021. <https://bit.ly/3NOqwcs>
- ② 'Indian stem cell and developmental biologist part of WHO advisory committee on human genome editing'. *Press Information Bureau*. 12<sup>th</sup> July 2021. <https://bit.ly/3aSf1IA>
- ② 'Indian stem cell and developmental biologist part of WHO advisory committee'. *Mint*. 12<sup>th</sup> July 2021. <https://bit.ly/3ml1509>
- ② Tweet by @jncasr. 12<sup>th</sup> July 2021. <https://bit.ly/3Hi8e0B>

## JNCASR PARTICIPATES IN THE INDIAN SARS-COV-2 GENOMIC CONSORTIUM (INSACOG)

JNCASR has been invited to be a part of the Indian SARS-CoV-2 Genomic Consortium (INSACOG), an initiative of the Department of Biotechnology and Ministry of Health and Family Welfare.

## FOUNDATION STONE OF JNCASR INNOVATION AND DEVELOPMENT CENTRE UNVEILED BY THE HON'BLE VICE PRESIDENT OF INDIA

The foundation stone of the Innovation and Development Centre at JNCASR was unveiled by Shri M. Venkaiah Naidu, the Hon'ble Vice President of India. The event took place in the august presence of Shri Thaawarchand Gehlot, the Hon'ble Governor of Karnataka; Shri Basavaraj S. Bommai, the Hon'ble Chief Minister of Karnataka; Bharat Ratna Prof. C. N. R. Rao, F.R.S.; and Prof. G. U. Kulkarni, President, JNCASR. The Centre will facilitate, via state-of-the-art tools and by hosting start-ups, laboratory inventions for scale-up and technology transfer.

- ② 'Vice President M. Venkaiah Naidu calls upon scientific fraternity to undertake research in new emerging areas of science.' *All India Radio News Service Division*. 16<sup>th</sup> August 2021. <https://bit.ly/3Ensc7r>
- ② 'VP visits Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR) at Bengaluru.' *Press Information Bureau*. 16<sup>th</sup> August 2021. <https://bit.ly/2ZxnhC1>
- ② 'VP Naidu calls for more research in agriculture, health sectors.' *Deccan Herald*. 16<sup>th</sup> August 2021. <https://bit.ly/3mNpxx2>
- ② Tweet by @IndiaDST. 16<sup>th</sup> August 2021. <https://bit.ly/3mOiRid>, <https://bit.ly/3xtaaz7>
- ② Tweet by @jncasr. 17<sup>th</sup> August 2021. <https://bit.ly/3zDULyq>
- ② 'Bengaluru lakes degrading due to neglect: VP Naidu.' *Hindustan Times*. 17<sup>th</sup> August 2021. <https://bit.ly/3MNhkUq>
- ② 'V-P: Translating research to improve lives of people is key'. *The Hindu*. 17<sup>th</sup> August 2021. <https://bit.ly/3aSgybk>
- ② 'Vice President asks scientists to come up with out-of-the-box solutions to address challenges faced by mankind.' *DD News*. 16<sup>th</sup> August 2021. <https://bit.ly/3MKjROX>
- ② Tweet by @jncasr. 17<sup>th</sup> August 2021. <https://bit.ly/3aNsJWV>

# MEDIA REPORTS



Photograph of all august attendees of the Inauguration of the Innovation and Development Centre at JNCASR

Image credits: JNCASR team

## JNCASR SCIENTIST WINS SHANTI SWARUP BHATNAGAR PRIZE FOR GROUND-BREAKING DISCOVERIES ABOUT ALZHEIMER'S DISEASE AND LUNG CANCER



Prof. T. Govindaraju

Prof. T. Govindaraju from JNCASR has received the prestigious Shanti Swarup Bhatnagar Prize for Science and Technology 2021 in Chemical Science for his ground-breaking discoveries, which have significant potential for the diagnosis and treatment of Alzheimer's disease and lung cancer, among other health problems. His innovative work on small molecules, peptides, and natural products offers both diagnostics as well as therapeutics, opening doors to personalized medicine.

- 📧 Tweet by @jncasr. 27<sup>th</sup> September 2021. <https://bit.ly/3xLjmAc>
- 📰 'JNCASR Scientist wins Shanti Swarup Bhatnagar Prize for ground-breaking discoveries for treatment of Alzheimers and lung cancer.' *Department of Science and Technology Vigyan Samachar*. 4<sup>th</sup> October 2021. <https://bit.ly/3CCYn2B>
- 📰 'JNCASR Scientist wins Shanti Swarup Bhatnagar Prize for ground-breaking discoveries for treatment of Alzheimer's and lung cancer.' *Press Information Bureau*. 4<sup>th</sup> October 2021. <https://bit.ly/3nBnyMD>

## MEDIA REPORTS

### JNCASR SCIENTIST DEVELOPING INNOVATIVE STRATEGIES TO MAKE HIGH-PERFORMANCE THERMOELECTRIC MATERIALS WINS SHANTI SWARUP BHATNAGAR PRIZE



Dr. Kanishka Biswas

Dr. Kanishka Biswas, Associate Professor, JNCASR, received the prestigious Shanti Swarup Bhatnagar Prize for Science and Technology 2021 in Chemical Science, for his research on a fundamental understanding of the relationship between the structure and properties of inorganic solids to develop lead-free high-performance thermoelectric materials, which can efficiently convert waste heat into energy and are being translated into cost-effective technologies.

- 📍 Tweet by @jncasr. 27<sup>th</sup> September 2021. <https://bit.ly/3xLjmAc>
- 📍 'JNCASR Scientist developing innovative strategies to make high-performance thermo-electrics materials wins Shanti Swarup Bhatnagar Prize.' *The Department of Science and Technology Vigyan Samachar*. 4<sup>th</sup> October 2021. <https://bit.ly/3jJ1Hl4>
- 📍 'JNCASR Scientist developing innovative strategies to make high-performance thermo-electrics materials wins Shanti Swarup Bhatnagar Prize.' *Press Information Bureau*. 4<sup>th</sup> October 2021. <https://bit.ly/3vUzcpj>
- 📍 'An electrifying discovery'. *The Hindu-BusinessLine*. 10<sup>th</sup> October 2021. <https://bit.ly/3GtTKdi>

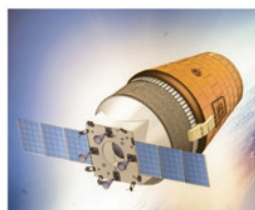
### BHARAT RATNA PROF. C. N. R. RAO CONGRATULATED BY THE PRIME MINISTER FOR RECEIVING THE INTERNATIONAL ENI AWARD 2020

Prime Minister Shri Narendra Modi congratulated Bharat Ratna Prof. C. N. R. Rao for receiving the International Eni Award 2020 for research in renewable energy sources and energy storage. The award ceremony was held at the Italian Presidential Palace Palazzo del Quirinale in Rome in the presence of the President of the Italian Republic. Due to the pandemic, the Indian Ambassador to Italy, Neena Malhotra, received the prize on behalf of Prof. Rao.

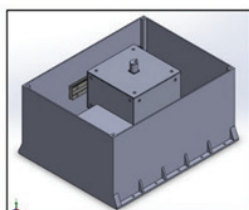
- 📍 'PM congratulates CNR Rao for receiving int'l award in energy research'. *Times of India*. 12<sup>th</sup> October 2021. <https://t.co/x3w03bt8m6>

### JNCASR STUDY PART OF ISRO GAGANYAAN UNCREWED MISSIONS

A study led by Dr. Diwakar S. Venkatesan, of the Engineering Mechanics Unit of JNCASR, on fluid mixing characteristics under microgravity conditions has become part of the Gaganyaan unmanned mission by the Indian Space Research Organisation (ISRO). These studies are in preparation for the manned mission scheduled in 2023.



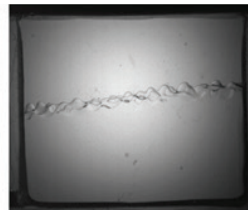
Gaganyaan Capsule



JNCASR Payload



Faraday instability in microgravity



Dr Diwakar S Venkatesan

Payload by Dr. Diwakar S. Venkatesan, EMU, JNCASR, for ISRO Gaganyaan unmanned mission, to study fluid mixing characteristics under microgravity conditions



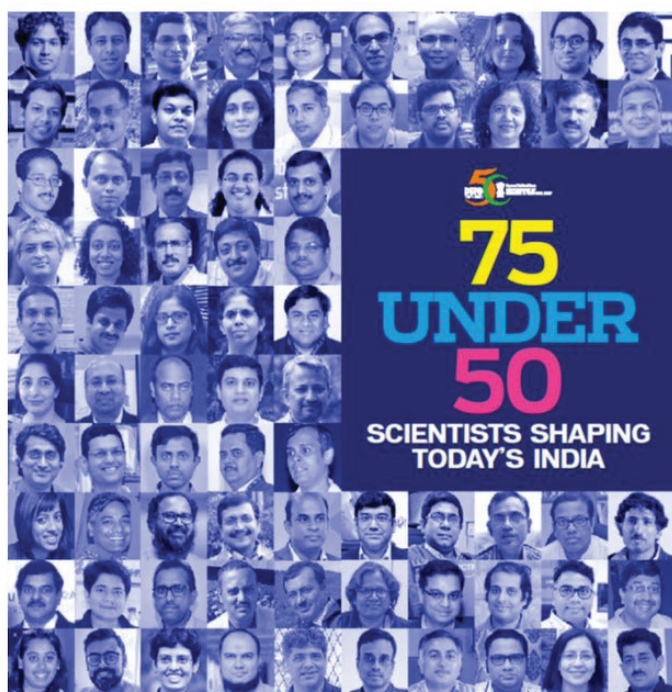
# MEDIA REPORTS

- ② 'Kidney stone formation to gene marking: 5 experiments shortlisted for ISRO mission; MoUs in place.' *Times of India*. 21<sup>st</sup> October 2021. <https://bit.ly/3mledT3>
- ② Tweet by @jncasr. 27<sup>th</sup> October 2021. <https://bit.ly/3zyrZiC>

## JNCASR SCIENTISTS FEATURED IN "75 UNDER 50: SCIENTISTS SHAPING TODAY'S INDIA"

Seven of our scientists were featured in "75 Under 50: Scientists Shaping Today's India", the coffee table book released by the Union Minister Dr. Jitendra Singh, which is published by Department of Science and Technology, India.

- ② Tweet by @jncasr. 16<sup>th</sup> March 2022. <https://bit.ly/3HgCCII>



### HEARTY CONGRATULATIONS!

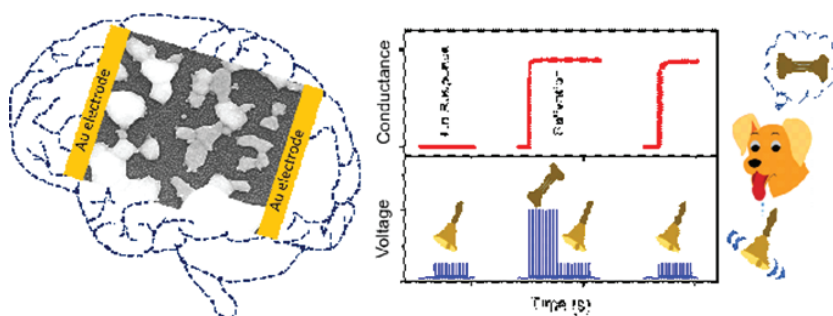


Top row (left to right) Dr. Sheeba Vasu and Dr. T. N. C. Vidya;  
Middle row (left to right) Dr. Kanishka Biswas, Dr. Sebastian C. Peter, and Prof. Rajesh Ganapathy;  
Bottom row (left to right) Prof. Tapas K. Maji and Prof. Subi J. George

# MEDIA REPORTS

## RESEARCH NEWS

### IN A FIRST OF ITS KIND, JNCASR SCIENTISTS DEVELOP NOVEL SELF-FORMING ARTIFICIAL SYNAPTIC NETWORK THAT CAN EMULATE COMPLEX HUMAN BEHAVIOURS



Scanning electron microscope image of the artificial synaptic network device resembling a bio-neural network. Associative learning is demonstrated by emulating Pavlov's dog, where, post training, the dog salivates upon hearing the bell.

Image credits: Prof. G. U. Kulkarni and Bharath Bannur from JNCASR

Prof. G. U. Kulkarni and Bharath Bannur (Ph.D. student) from JNCASR have created a novel unprecedented neuromorphic device that can emulate several human behaviour patterns involving complex synaptic functions, such as memories, depression, learning, and supervision. The device self-forms with heat, which makes its fabrication much simpler, more scalable, and more cost-effective than that of conventional devices.

This study was published in *Mat. Horiz.* 7(11): 2970–2977. doi: 10.1039/D0MH01037E

- ④ 'Scientists develop efficient Artificial Synaptic Network that Mimics Human Brain.' *Department of Science and Technology*. <https://bit.ly/3c3LLtz>
- ④ 'JNCASR develops artificial synaptic network that mimics human brain.' *BioSpectrum*. 1<sup>st</sup> June 2021. <https://bit.ly/3FbQ8LL>
- ④ 'Indian Scientists Develop Artificial Synaptic Network That Mimics the Human Brain.' *OpenGov Asia*. 1<sup>st</sup> June 2021. <https://bit.ly/3oLVXiG>
- ④ 'Bengaluru Scientists Develop Device That Mimics Human Brain's Cognitive Actions Better than AI.' *News18*. 2<sup>nd</sup> June 2021. <https://bit.ly/3F3SGLI>
- ④ 'Indian scientists develop efficient Artificial Synaptic Network that mimics human brain.' *The Statesman*. 2<sup>nd</sup> June 2021. <https://bit.ly/3krscfr>
- ④ 'Indian scientists construct a powerful artificial synaptic network to imitate the human brain.' *Analytics Insight*. 3<sup>rd</sup> June 2021. <https://bit.ly/3n5icu0>
- ④ 'Bengaluru Scientists Develop Device That Mimics Human Brain's Cognitive Actions.' *NDTV Gadgets 360*. 7<sup>th</sup> June 2021. <https://bit.ly/3D1tSmZ>
- ④ Telegram News Message by Prasar Bharati News Service. 18<sup>th</sup> June 2021. [https://t.me/pbns\\_india/12739](https://t.me/pbns_india/12739)
- ④ Tweet by @IndiaDST. 1<sup>st</sup> June 2021. <https://bit.ly/3aLGFk7>
- ④ Tweet by @jncasr. 1<sup>st</sup> June 2021. <https://bit.ly/3zveosx>

### MOBILE OXYGEN CONCENTRATOR DEVELOPED BY JNCASR SCIENTISTS AIMS TO CATER TO ACUTE AND CHRONIC OXYGEN NEEDS AT THE GRASSROOTS LEVEL

Dr. Diwakar S. Venkatesan, Dr. Meher Prakash, Prof. Santosh Ansumali, and Ritwik Das (M.S. student) from



## MEDIA REPORTS

JNCASR—and collaborators Prof. Arvind Rajendran from the University of Alberta and Arun Kumar from Eiwave Digitech—designed a robust zeolite-based mobile group oxygen concentrator named OxyJani, which can be used in rural settings and be rapidly deployed in emergencies at any location.

- 🌐 'Robust, mobile OxyJani can cater to acute & chronic oxygen needs at grassroots level.' *Department of Science and Technology Vigyan Samachar*. 1<sup>st</sup> July 2021. <https://bit.ly/2Zv7L9s>
- 🌐 'Robust, mobile OxyJani can cater to acute & chronic oxygen needs at grassroots level.' *Press Information Bureau*. 1<sup>st</sup> July 2021. <https://bit.ly/3w0dWyD>
- 🌐 'Bengaluru scientists develop off-grid mobile oxygen concentrator.' *Indian Science News, Vigyan Prasar*. 2<sup>nd</sup> July 2021. <https://bit.ly/3pM8myU>
- 🌐 'Jawaharlal Nehru Centre's researchers develop OxyJani.' *BioSpectrum India*. 2<sup>nd</sup> July 2021. <https://bit.ly/3149AuR>
- 🌐 Tweet by @PIB\_India. 1<sup>st</sup> July 2021. <https://bit.ly/3xigdGk>
- 🌐 Tweet by @jncasr. 2<sup>nd</sup> July 2021. <https://bit.ly/39o2EgE>
- 🌐 'New oxygen concentrator can tackle woes in rural areas.' *Times of India*. 18<sup>th</sup> August 2021. <https://bit.ly/3xmt3ni>
- 🌐 Tweet by @jncasr. 18<sup>th</sup> August 2021. <https://bit.ly/3NOxpuk>

## LATEST FINDINGS FROM ANIMAL BEHAVIOUR STUDIES



Researchers from JNCASR studied associations among male Asian elephants by collecting and analysing data on the behaviour of identified nonmusth wild Asian elephants at Nagarahole and Bandipur National Parks in Karnataka. This study was published in *Front. Ecol. Evol.* 9: 616666. doi: 10.3389/fevo.2021.616666

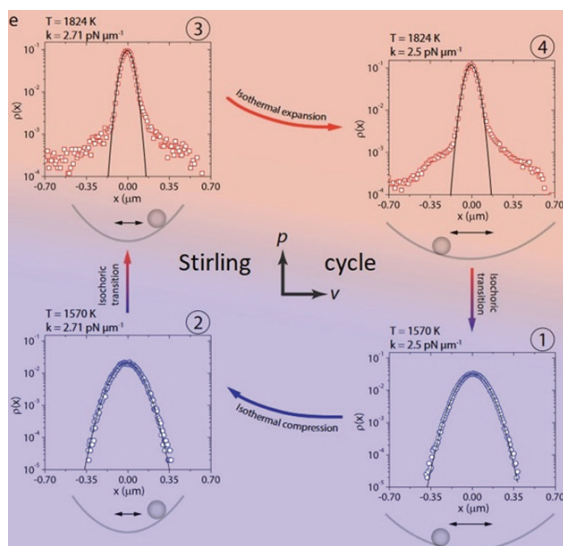
*All-male group with two adult males associating in female absence. One of the males here is tuskless (location of the photograph study area).*

*Image credits: Kabini Elephant Project*

- 🌐 'Male Asian elephants association with each other depends on their age and presence of females.' *Department of Science and Technology Vigyan Samachar*. 2<sup>nd</sup> July 2021. <https://bit.ly/3Cpa5O2>
- 🌐 Tweet by @jncasr. 2<sup>nd</sup> July 2021. <https://bit.ly/3mG5f8Q>
- 🌐 Tweet by @IndiaDST. 2<sup>nd</sup> July 2021. <https://bit.ly/3mmNdJl>
- 🌐 NewsOnAIR. 2<sup>nd</sup> July 2021, <https://bit.ly/3QmvjTZ>
- 🌐 Tweet by @DDNewslive. 2<sup>nd</sup> July 2021. <https://bit.ly/3mGuvvB>
- 🌐 'Social structure differs in Asian and African elephants, find researchers.' *The Hindu*. 3<sup>rd</sup> July 2021. <https://bit.ly/3nFNoyQ>
- 🌐 'Asian young male elephants prefer to be solitary.' *Indian Science News, Vigyan Prasar*. 6<sup>th</sup> July 2021. <https://bit.ly/3mksHZZ>

## MEDIA REPORTS

### JNCASR SCIENTISTS COLLABORATE TO CONSTRUCT A MICROMETRE-SIZED STIRLING ENGINE



Schematic diagram of the Stirling engine cycle: An isothermal compression is performed in presence of Gaussian noise at lower temperature ( $T = 1570\text{ K}$ ) from state 1 with minimum stiffness to state 2 with maximum stiffness of the laser trap.

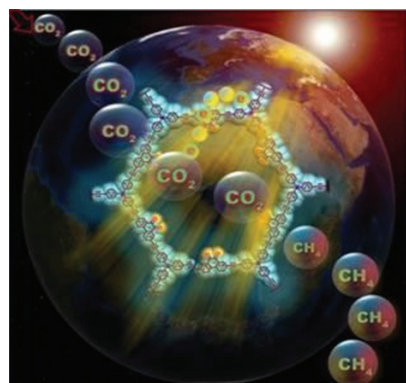
An isothermal expansion is performed in presence of the non-Gaussian noise at higher temperature ( $T = 1824\text{ K}$ ) by broadening the trap from maximum stiffness (state 3) to minimum stiffness (state 4). Two isochoric transitions connect the two isothermal transitions. During the isochoric transitions, the trap stiffness is held fixed while the noise statistics and temperature is altered.

Image credits: Niloyendu Roy, Nathan Leroux, A. K. Sood, and Prof. Rajesh Ganapathy from JNCASR

A research team led by Prof. Rajesh Ganapathy from JNCASR, along with researchers from IISc, constructed a micrometre-sized Stirling engine by confining a single colloidal particle with a laser trap. This insight will be essential for the future construction of micro-machines that operate in complex biological environments and are becoming increasingly important in biomedical engineering. This study was published in *Nat. Commun.* 12: 4927. doi: 10.1038/s41467-021-25230-1.

- ④ 'Insight into response of single-particle engine to environmental noise can help construct micro-machines useful in biomedical engineering.' *Department of Science and Technology Vigyan Samachar*, 20<sup>th</sup> September 2021. <https://bit.ly/2XVcjFR>
- ④ Tweet by @MIB\_India. 20<sup>th</sup> September 2021. <https://bit.ly/39kVzh9>
- ④ 'The noise connection to biomedical engineering.' *Bio Voice News*. 21<sup>st</sup> September 2021. <https://bit.ly/3xL5fuz>
- ④ 'Micro-machines Can Be Constructed With Help of single-particle Engine: JNCASR Study.' *Republicworld.com*. 22<sup>nd</sup> September 2021. <https://bit.ly/39qsWPw>
- ④ Tweet by @jncasr. 21<sup>st</sup> September 2021. <https://bit.ly/3MQzpRo>

### NEW NON-TOXIC ORGANIC PHOTOCATALYST EFFICIENTLY CAPTURES CO<sub>2</sub> AND CONVERTS IT INTO METHANE



Prof. Tapas K. Maji and his team designed a cost-effective metal-free catalyst to convert CO<sub>2</sub> to the value-added product methane by absorption of visible light. The heterogenous catalyst is prepared from donor (tris-4-ethynylphenylamine)-acceptor (phenanthraquinone) assembly via C-C coupling. This work has been accepted for publication in *J. Am. Chem. Soc.* 143 (39): 16284-16292. doi: 10.1021/jacs.1c07916.

Schematic showing CO<sub>2</sub> capture and visible light-driven conversion of CO<sub>2</sub> to solar fuel CH<sub>4</sub> using a metal-free redox-active conjugated microporous polymer

Image credits: Prof. Tapas Kumar Maji from JNCASR

## MEDIA REPORTS



Prof. Tapas. K. Maji

Dr. Soumitra Barman

Dr. Ashish Singh

Faruk Ahamed Rahimi

Image credits: Prof. Tapas Kumar Maji from JNCASR

- ② 'New non-toxic organic photocatalyst can efficiently capture CO<sub>2</sub> and convert it into methane.' *Department of Science and Technology*. <https://bit.ly/3CYnZ9g>
- ② 'New non-toxic organic photocatalyst can efficiently capture CO<sub>2</sub> and convert it into methane.' *Ministry of Science and Technology*. 27<sup>th</sup> October 2021. <https://bit.ly/3rbVrXy>
- ② 'Indian Scientists Find Way to Capture CO<sub>2</sub> And Turn it Into Eco-Friendly Methane.' *India Times*. 27<sup>th</sup> October 2021. <https://bit.ly/3d5Tjsp>

### A STEP TOWARD FINDING A CURE FOR AUTISM SPECTRUM DISORDER

Dr. James Chelliah's lab and collaborators developed a compound called "6BIO" that shows potential to treat autism spectrum disorder/intellectual disability in the *Syngap*<sup>1+/-</sup> pre-clinical mouse model. 6BIO can potentially restore neuronal function not only when administered during development (up to 6 years) but also after mid-childhood (7-11 years). These findings have been published in *Exp. Brain Res.* 240: 289-309. doi: 10.1007/s00221-021-06254-x.

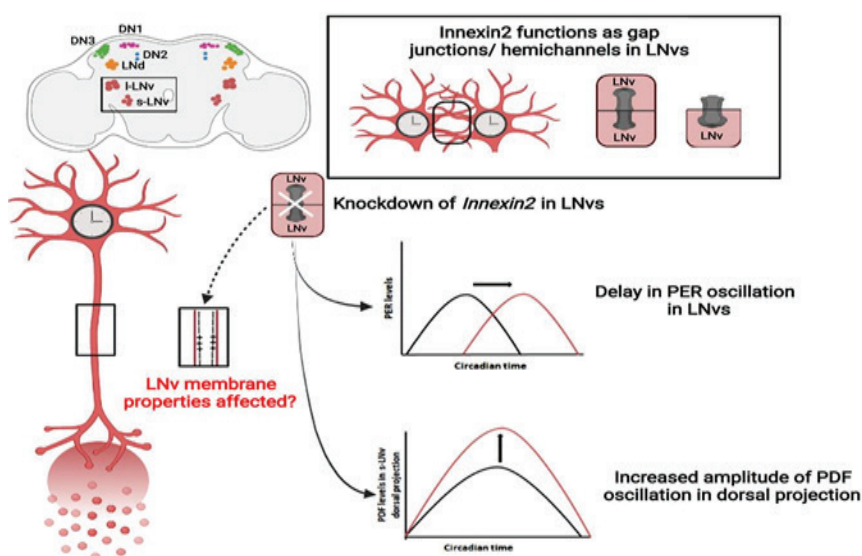
- ② 'Indian researchers develop better therapeutics to treat Autism Spectrum Disorder.' *Department of Science Technology*. <https://bit.ly/3xoWODq>
- ② 'Indian researchers develop better therapeutics to treat Autism Spectrum Disorder.' *Siasat Daily*. 17<sup>th</sup> November 2021. <https://bit.ly/3r9dmy2>
- ② 'Researchers develop new compound to treat Autism.' *Vigyan Prasar*. 17<sup>th</sup> November 2021. <https://bit.ly/3r8nY07>
- ② 'Researchers develop compound for autism treatment.' *The Times of India*. 18<sup>th</sup> November 2021. <https://bit.ly/3FMHcfZ>

### INNEXIN2 MODULATES ADULT *DROSOPHILA* ACTIVITY RHYTHMS

Dr. Sheeba Vasu and her team revealed that Innexin2 can modulate the speed of activity-rest rhythm in *Drosophila melanogaster*, with involvement of the core-clock protein PERIOD and the output molecule pigment dispersing factor. Specifically, their study indicated that Innexin2 may function as hemichannels or gap junctions in the clock circuit. This work was published in *iScience* 24 (9): 103011. doi: 10.1016/j.isci.2021.103011.



# MEDIA REPORTS

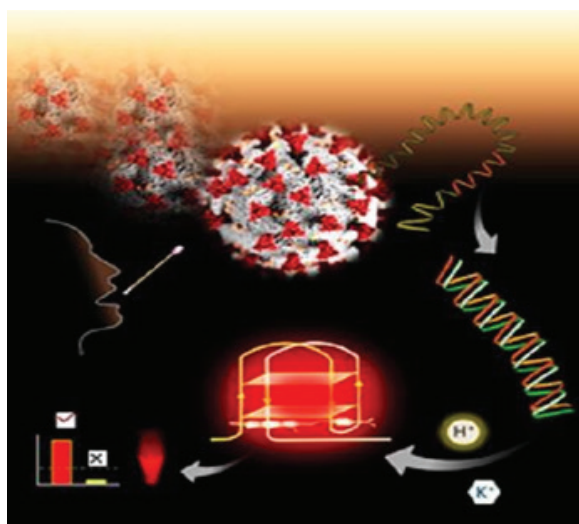


*A summary of the study in graphical form.*

*Image credits: Aishwarya Ramakrishnan and Dr. Sheeba Vasu from JNCASR*

## RELIABLE DETECTION OF SARS-COV-2 BY FLUORESCENCE READOUT

A new platform for efficient fluorometric detection of pathogens such as viruses, including SARS-CoV-2, HIV, and Zika, and bacteria, was developed by Prof. T. Govindaraju and his team. This noncanonical nucleic acid-based G-quadruplex (GQ) topology targeted reliable conformational polymorphism (GQ-RCP) platform can be integrated into field-deployable isothermal amplification assays. This work was published in *ACS Sens.* 7 (2): 453–459. doi: 10.1021/acssensors.1c02113.



*Schematic of the novel technology platform, which can detect DNA/RNA pathogens such as SARS-CoV-2, HIV, influenza, Ebola, and other bacteria and viruses.*

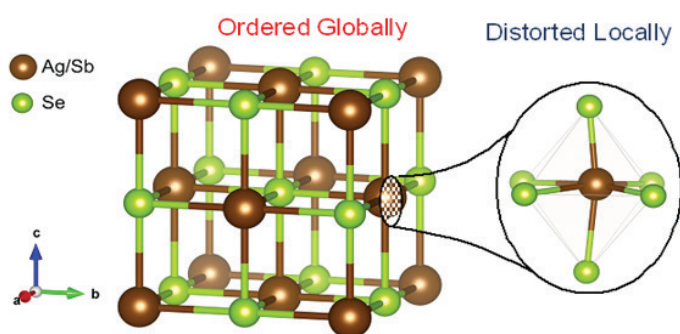
*Image credits: Prof. T. Govindaraju, JNCASR*

- 🌐 'Scientists develop new technology platform to detect SARS-COV-2 by fluorescence readout.' *Ministry of Science and Technology.* 9<sup>th</sup> February 2022. <https://bit.ly/3GVAhBj>
- 🌐 'Coronavirus: Indian scientists develop new tech platform for detection of virus.' *Times of India.* 8<sup>th</sup> February 2022. <https://bit.ly/3rQOVp1>
- 🌐 'Scientists develop new tech platform to detect coronavirus by fluorescence readout.' *Pune Mirror.* 10<sup>th</sup> February 2022. <https://bit.ly/3sNxTHG>
- 🌐 'Scientists develop way to detect Covid using fluorescence readout.' *Deccan Herald.* 15<sup>th</sup> February 2022. <https://bit.ly/3GVCahn>
- 🌐 Tweet by @jncasr. 15<sup>th</sup> February 2022. <https://bit.ly/3QunCvg>

# MEDIA REPORTS

## ORIGIN OF ULTRALOW THERMAL CONDUCTIVITY IN SILVER ANTIMONY COMPOUND

Silver antimony selenide ( $\text{AgSbSe}_2$ ), although crystalline in nature, exhibits thermal conductivity like amorphous materials. While investigating this anomaly, Dr. Kanishka Biswas and his student Dr. Moinak Dutta observed that  $\text{AgSbSe}_2$  actually shows distortion in the local scale, with the cation Sb off-centred from its ideal position. This break in symmetry locally results in ultra-low thermal conductivity. This discovery was published in *Angew. Chem.* 61 (15): e202200071. doi: 10.1002/anie.202200071.



*Globally ordered crystalline  $\text{AgSbSe}_2$  contains locally distorted Sb/Ag, which results in glass-like thermal conductivity.*

*Image credits: Dr. Kanishka Biswas from JNCASR*

- ② 'Ultra-low Thermal Conductivity in Crystalline Solid with promising thermoelectric applications trace to their Local Structural Distortion.' *Department of Science and Technology*. <https://bit.ly/3pYtBge>
- ② 'Indian Scientists Find Origin of Ultralow Thermal Conductivity in Silver Antimony Compound.' *News18.com*. 8<sup>th</sup> March 2022. <https://bit.ly/3hZpETX>





# 04. FELLOWSHIPS AND OUTREACH

Access to scientific knowledge and research lie at the core of societal change and development in any country. JNCASR recognises this need and engages with the community via outreach programmes, events and fellowships at the school and collegiate levels. By fostering excellence in research and knowledge sharing, the Centre seeks to encourage and inspire people to contribute to scientific discovery. The outreach and fellowship programmes at JNCASR are conducted by the Education Technology Unit and Office of Fellowships and Extension Programmes. This section outlines the achievements of the outreach wing of JNCASR.

# FELLOWSHIPS AND EXTENSION PROGRAMMES

In addition to providing opportunities to pursue academic degrees in various areas, the Centre offers a range of fellowship programmes to school and undergraduate students studying science, and scientists working in research and development (R&D) institutes. A brief description of the different fellowship programmes is given below.



## STUDENT BUDDY PROGRAMME FOR CLASS 11 AND 12 STUDENTS

This programme aims to help school and junior college students (class 11 and 12) learn about the latest advances in science and engineering, in addition to giving them a taste of the researcher 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 toward 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. 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 sciences, physical sciences, mathematics, and engineering. Selection is based on merit on an all-India basis. About 150 fellowships are offered each year. The admitted students are given a fellowship of ₹10,000/- per month. The programme is highly acclaimed in the Centre, and the students are very appreciative of its benefits. It enables them to get inspired towards scientific research at an early stage in their education. Several SRFP fellows have later pursued a career in science, mathematics, or engineering, and have held positions of great responsibility in India and abroad. The programme was suspended in March 2020 owing to the COVID-19 pandemic and reopened in September 2021. Since its inception in 1991, 2,445 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. Since its inception in 2004, about 136 students have benefited from this programme.

# FELLOWSHIPS AND EXTENSION PROGRAMMES



## PROJECT ORIENTED BIOLOGY EDUCATION (POBE)

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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. Since its inception in 2006, 100 students have benefited from this programme.



## VISITING FELLOWSHIPS PROGRAMME

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### 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, behavior, and neurobiology);
- Materials science (including nanoscience);
- Chemical sciences (including chemical biology, interfaces of chemical science with materials, solid-state chemistry, theoretical/computational chemistry, inorganic, physical and organic chemistry);
- Physical sciences (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); and
- 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. Since its inception in 2006, 113 research scientists/faculty members have benefited from this programme.



## INSTITUTIONAL VISITS

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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. Since its inception in 2019, 776 students and teachers from 16 different schools/colleges have participated in this programme.



## GRADUATE RESEARCH INTERNSHIP PROGRAMME (GRIP)

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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/MBBS 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. Under this programme, four students have completed the project work and 13 students are currently working on their projects.

# FELLOWSHIPS AND EXTENSION PROGRAMMES

## MAJOR EVENTS ORGANISED BY FELLOWSHIPS AND EXTENSION OFFICE



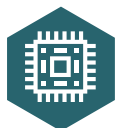
### NATIONAL SCIENCE DAY CELEBRATION

As part of Azadi Ka Amrit Mahotsav (AKAM), JNCASR celebrated National Science Day on 28<sup>th</sup> February 2022. About 250 students and teachers from various colleges and schools participated in the celebration. The celebration began with an address by Bharat Ratna Prof. C. N. R. Rao. As part of the open day programme, the participants then visited JNCASR's state-of-the-art research facilities, live experiment demonstrations, a top-notch chemical heritage exposition, Bharat Ratna Prof. C. N. R. Rao's archives, and the gallery. There were on-the-spot quiz competitions awarding exciting prizes for winners. Participants were guided by research scholars during their visit to the campus.



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

Under the DBT-ISRF-INSA Scheme, Bhoj Raj Poudel, Lecturer, Tribhuvan University, Nepal, carried out research project work under the guidance of Dr. Kanishka Biswas from the New Chemistry Unit (NCU), JNCASR, for three months from 1<sup>st</sup> December 2021 to 28<sup>th</sup> February 2022.



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

Under SERB-VAJRA Faculty Scheme, Prof. Mukundan Thelakkat, University of Bayreuth, Germany, has joined as Adjunct Faculty at the Centre's Chemistry and Physics of Materials Unit (CPMU). He will work with Prof. G. U. Kulkarni, the lead Indian collaborator, to undertake the research titled: "Towards affordable semi-transparent solar cells based on solution-processed semiconductors and hybrid TCEs."






## MEMBERS OF FELLOWSHIPS AND EXTENSION OFFICE

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

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	 <b>SUMMER RESEARCH FELLOWSHIP PROGRAMME (SRFP)</b>	<b>2,445</b> Students
2004	 <b>PROJECT ORIENTED CHEMISTRY EDUCATION (POCE)</b>	<b>136</b> Students from colleges across India
2006	 <b>PROJECT ORIENTED BIOLOGY EDUCATION (POBE)</b>	<b>100</b> Students from colleges across India
2006	 <b>VISITING FELLOWSHIP PROGRAMME (VSF)</b>	<b>113</b> Research scientists and faculty members
2015	 <b>STUDENT BUDDY PROGRAMME</b>	<b>434</b> Students <b>33</b> Teachers



# EDUCATION TECHNOLOGY UNIT

The Education Technology Unit (ETU), in collaboration with C. N. R. Rao Hall of Science, continued to perform its science outreach activities with a combination of virtual and in-person sessions, workshops, and events over the year. Programmes that ran from one to three hours, or were spread out over a few days, and day long events, spanned the length and breadth of the country and were facilitated by experts for teachers and students. Online sessions were conducted utilising Google Meet, WebEx, and YouTube Live.

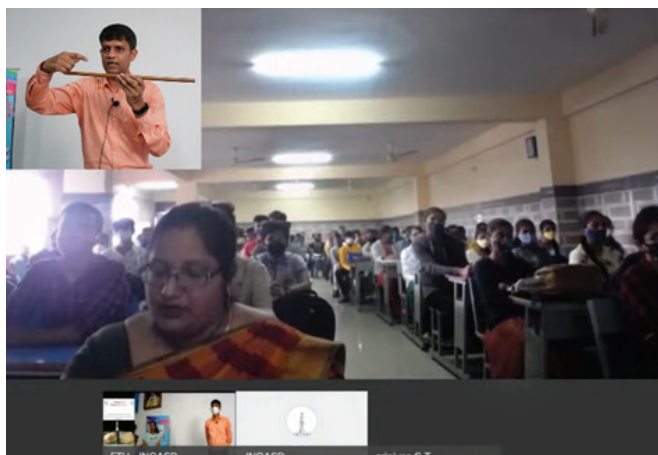
The following are the programmes:

## LEARNING PHYSICS THROUGH EXPERIMENTS

A 1-hour visual session on 12<sup>th</sup> August 2021, featured lectures by Prof. Vidhyadhiraja N.S. and Vinayak Pattar from JNCASR. 4 teachers and 60 students from classes 9 and 10 attended, from School Chandan, Laxmeshwar, Gadag District, in Karnataka.

On 3<sup>rd</sup> September 2021, Vinayak Pattar from ETU, JNCASR facilitated another 1-hour virtual session for 8 teachers and 150 students from classes 10, 11, and 12 at the Nisarga PU College, Nelagadaranahalli, Karnataka.

C.N.R. RAO HALL OF SCIENCE & EDUCATION TECHNOLOGY UNIT, JNCASR  
Science Outreach Program : *Learning Physics Through Experiments*



## LEARNING CHEMISTRY THROUGH EXPERIMENTS

On 26<sup>th</sup> August 2021, 80 students from classes 9 and 10 and 5 teachers attended a 1-hour virtual session by Dr. Pramoda K., from Project Oriented Chemistry Education (POCE) at JNCASR. The students were from 4 different schools and the Parikrma Learning Center in Bengaluru, Karnataka.

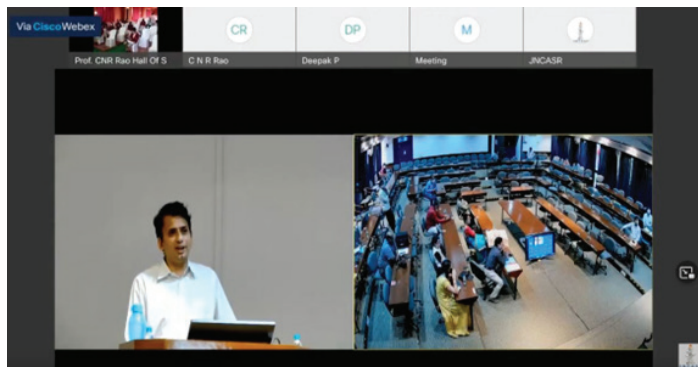
Dr. Pramoda K. from Jain University, Bengaluru, facilitated another 1-hour virtual session on 28<sup>th</sup> October 2021 for 25 teachers and 200 students of classes 10, 11, and 12 across Karnataka. (Bagalakot, Gadag, Vijayapura, Shimoga, Bengaluru Urban and Rural)



# EDUCATION TECHNOLOGY UNIT

## 2019 PRIZES FOR OUTSTANDING SCIENCE TEACHER'S AWARD PROGRAMME LECTURE

This virtual session was delivered over 1.5 hours on 23<sup>rd</sup> September 2021 by Dr. Sridhar Rajaram of JNCASR to 50 teachers and 400 students of classes 10, 11, and 12 from schools and colleges across Karnataka.



## LEARNING SCIENCE THROUGH EXPERIMENTS AT SAGAR

This 2-hour workshop was facilitated in person on 24<sup>th</sup> September 2021 at V. S. Highschool, Nisrani Village, Sagar, Shimoga district, Karnataka, by Vinayak Pattar from ETU, JNCASR. 20 teachers and 75 students from class 10 participated in this session.



# EDUCATION TECHNOLOGY UNIT

## TEACHER'S TRAINING WORKSHOP ON CHEMISTRY

This workshop was conducted over 8<sup>th</sup>, 15<sup>th</sup>, 22<sup>nd</sup>, and 29<sup>th</sup> September 2021 for 22 teachers of classes 9 and 10, from Sagar Taluk. The sessions were facilitated by a resource person sponsored by the Royal Society of Chemistry as a part of the Sagar Science Forum, Sagar, Shimoga district. The session was sponsored by the C. N. R. Rao Education Foundation.



## SCIENCE OUTREACH PROGRAM

On 10<sup>th</sup> December 2021, Prof. S. M. Shivaprasad of HEA Dharwad and JNCASR and Prof. Vidhyadhiraja N. S. of JNCASR delivered a 2-hour program both virtually and in person at the Hall of Science at JNCASR, to 37 teachers and 685 students from classes 10, 11, and 12. The session's participants spanned JNV Bengaluru Rural, Bengaluru Urban, Andaman and Nicobar Islands, Udupi, Vijayapur, Dharwad, Laxmeshwar, and eight colleges across Bengaluru.

## NANOSCIENCE AND TECHNOLOGY

On 18<sup>th</sup> December 2021, Vinayak Pattar of ETU, JNCASR, delivered this 1.5-hour session in person to 3 teachers and 116 First Year B.E. Physics and Chemistry students of EastWest College, Yelahanka, Bengaluru.

## 'LIFE UNDER A MICROSCOPE': INTERACTIVE LECTURE PROGRAM IN BIOLOGY

Prof. Deepak K. Saini of MRDG, IISc, Bengaluru, delivered this 1-hour virtual lecture on 28<sup>th</sup> January 2022 to 43 teachers and 411 students of classes 10, 11, and 12 from JNV Bengaluru, Rural VVS PU College, Vidhyavardhaka, Parikrma Learning Centre, and Govt. PU College, Bengaluru.



# EDUCATION TECHNOLOGY UNIT

## 'STEM CELLS': INTERACTIVE LECTURE PROGRAM IN BIOLOGY

Prof. Ravi Muddashetty from the Centre for Brain Research, IISc, Bengaluru, delivered this 1-hour virtual lecture on 4<sup>th</sup> February 2022 to 71 teachers and 490 students of classes 10, 11, and 12 from JNV Bengaluru Urban and Rural, Vijaya Composite, VVS PU College, Carmel PU College, Karnataka, and JNV schools in Andhra Pradesh, Telangana, Uttarakhand, and Uttar Pradesh.

## LEARNING SCIENCE THROUGH EXPERIMENTS

On 18<sup>th</sup> February 2022, Vinayak Pattar of ETU, JNCASR facilitated this 1.5-hour session in person, for 5 teachers and 90 students of class 10, from BEL School, Bengaluru.



## NATIONAL SCIENCE DAY (JNCASR OPEN DAY)

This day-long event was held offline on 28<sup>th</sup> February 2022 in association with the Fellowships and Extensions Office at JNCASR. It was attended by 30 teachers and 270 school (classes 10, 11, and 12) and M.Sc. students from Bengaluru.



# EDUCATION TECHNOLOGY UNIT

Online and Offline

**3350** Participants



**13**

Programmes



**323**

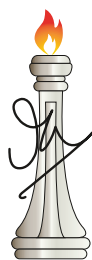
Teachers



**3027**

Students

## OUR OUTREACH



J N C A S R

### Karnataka

- Gadag
- Nelagadaranhalli
- Shimoga
- Bagalakot
- Vijayapura
- Bengaluru Urban and Rural
- Mysuru
- Udupi
- Dharwad
- Laxmeshwar

### Rest of India

- Andhra Pradesh
- Telangana
- Uttarakhand
- Uttar Pradesh
- Andaman & Nicobar Islands



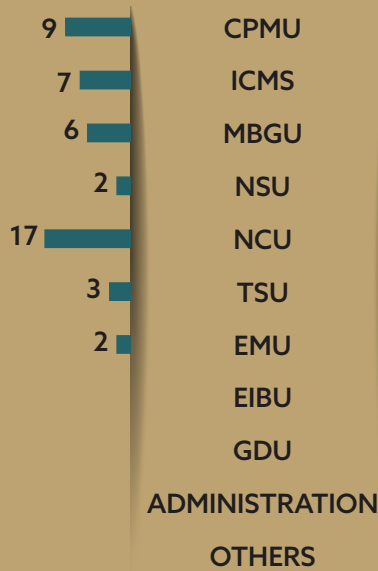


# 05. FUNDING

JNCASR recognises that the backbone of scientific advancement and discovery is the funding. Funding is a key component of maintenance and upgradation of equipment and facilities, progress of research work, and stipends for researchers. In 2021-2022, JNCASR has acquired considerable funding for a variety of new and ongoing research projects, from a range of Indian and global corporate and academic bodies. This section outlines these projects and their sponsorships.

# SPONSORED PROJECTS

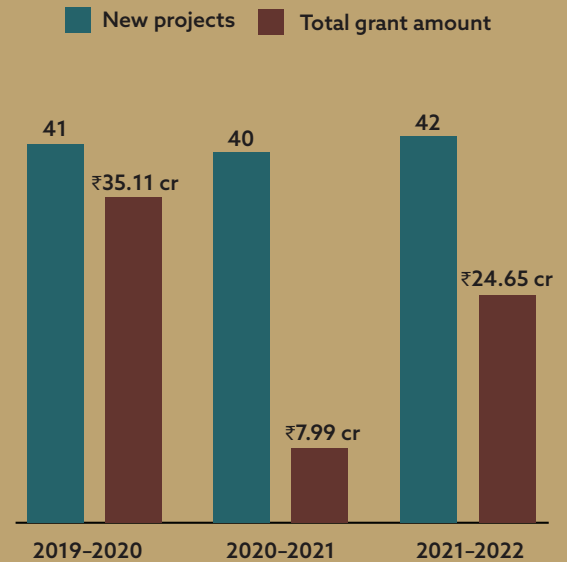
**NEW PROJECTS 2021-2022**



**ONGOING PROJECTS 2021-2022**



**GRANTS RECEIVED FOR NEW PROJECTS (PAST 3 YEARS)**



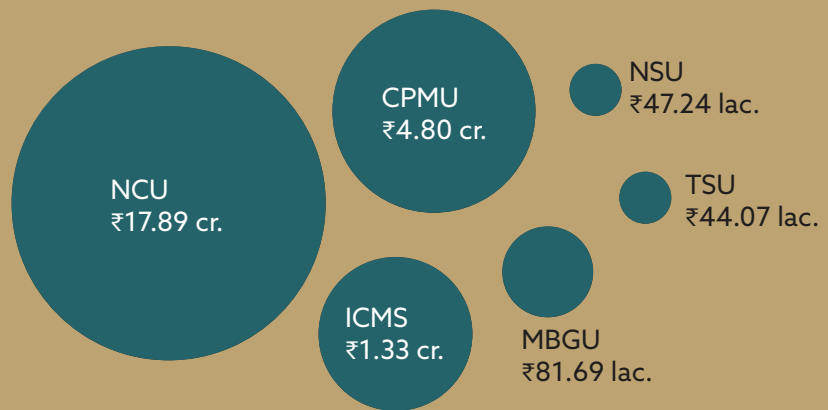
## GRANTS RECEIVED BY UNITS (2021-2022)

**NEW SPONSORED PROJECTS**

**42**

**TOTAL GRANT RECEIVED FOR NEW PROJECTS**

**₹24.65 cr.**

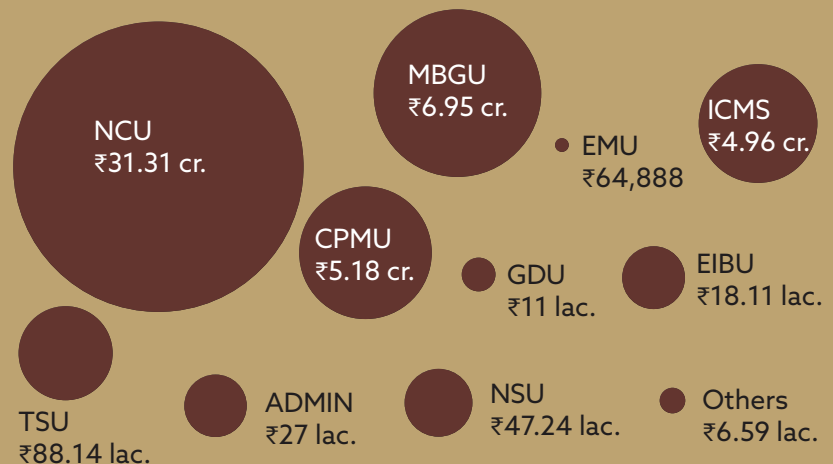


**ONGOING SPONSORED PROJECTS**

**133**

**TOTAL GRANT RECEIVED FOR ONGOING PROJECTS**

**₹ 49.28 cr.**



# SPONSORED PROJECTS

## NUMBER OF NEW PROJECTS PER FUNDING PARTNER 2021-2022



Science and Engineering Research Board (SERB)



Sheikh Saqr Laboratory



Department of Science and Technology (DST)

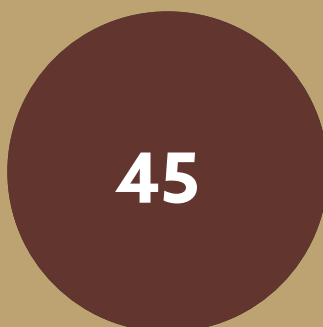


Department of Biotechnology (DBT)



Central Mine Planning and Design Institute Ltd.  
 Cookson India Pvt. Ltd.  
 Gennova Biopharmaceuticals Ltd.  
 Regional Center for Biotechnology  
 Shell India Markets Pvt. Ltd.  
 Tata Steel Ltd.

## NUMBER OF ONGOING PROJECTS PER FUNDING PARTNER 2021-2022



SERB



DST



DBT



SERB–J. C. Bose Fellowship



Shell India Markets Pvt. Ltd.  
 Indian Institute of Science  
 SERB–TARE



Department of Atomic Energy–  
 Board of Research in Nuclear Sciences

- 2 Tata Steel Ltd.  
 Indo-Korea Science and Technology Center  
 Indo French Centre for the Promotion of Advanced Research  
 DST–Swarnajayanti Fellowship  
 Asian Office of Aerospace Research and Development  
 Sheikh Saqr Laboratory

- 1 European Union  
 Gennova Biopharmaceuticals Ltd.  
 Human Spaceflight Centre–ISRO  
 Bangalore International Airport Ltd.  
 Central Mine Planning and Design Institute Ltd.  
 Cookson India Pvt. Ltd.  
 DBT– Wellcome Trust  
 Wellcome Trust/DBT India Alliance  
 The World Academy of Sciences  
 Tata Institute for Genetics and Society  
 University of Reading  
 Society for Research and Initiative for Sustainable Technologies and Institutions  
 Indo–US Science and Technology Forum  
 Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR)  
 Regional Center for Biotechnology  
 Indian National Science Academy





## 06. CENTRAL FACILITIES

JNCASR has been at a forerunner in resources and facilities since its inception, which is crucial to maintaining the momentum of research. Each research unit has its own labs equipped with the necessary infrastructure and facilities. The Centre also maintains a wide range of common facilities such as its well-stocked library, with a collection of over 9000 books and several user-oriented services, and the health centre for everyone's medical needs. Moreover, the Centre ensures that these are constantly upgraded along with the changing needs of the JNCASR community. This section details the latest developments of these various facilities.

# LIBRARY

The JNCASR library is well-stocked, with 9837 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 2021–2022, 120 books were newly added. Also, 81 new patrons became part of the library, increasing the total to 704 current patrons.

The total expenditure this year was ₹67,433 for procuring books and ₹69,62,309 for access to scientific journals.

## LIST OF USER ORIENTATION PROGRAMMES ORGANISED

1. Webinar on “Your key to unlocking R&D productivity using SciFinder-n Discovery Platform” conducted by National Knowledge Resource Consortium (NKRC) on 9<sup>th</sup> April 2021.
2. Science communication workshop conducted by Devayani Khare, a science communicator on 9<sup>th</sup> and 10<sup>th</sup> April 2021.
3. Webinar on “Use of SCOPUS analytics for journal selection” conducted by Elsevier and NKRC on 26<sup>th</sup> May 2021.
4. Webinar on the plagiarism detection tool iThenticate conducted by NKRC on 15<sup>th</sup> July 2021.
5. Online training session on “Managing academic integrity in research with iThenticate” conducted by Turnitin India Pvt. Ltd. on 8<sup>th</sup> September 2021.
6. Online publishing workshop organised by Wiley Research and NKRC on 22<sup>nd</sup> and 23<sup>rd</sup> September 2021.
7. Webinar on “Your key to unlocking R&D productivity using SciFinder-n Discovery Platform” conducted by the American Chemical Society on 23<sup>rd</sup> September 2021.
8. Online training on “Web of Science” conducted by Clarivate Analytics on 26<sup>th</sup> October 2021.

## STAFF MEMBERS OF THE LIBRARY

Senior Library cum Information Officer: **Nabonita Guha**

Senior Library cum Information Assistant Grade I: **Dr. Nandakumari E., Nagesh Hadimani**

Senior Helper: **Rajeeva J.**

Library Assistant Trainee (On Contract): **Shruti Kude**



# LIBRARY



**120**

New books added

**9837**

Total books in collection



**81**

New patrons

**704**

Total no. of patrons



**149**

Number of journal subscriptions

**4000+**

Number of resources supported by the National Knowledge Resource Consortium (NKRC)

**1124**

Books issued

**740**

Books renewed

**1231**

Books returned



**3095**

Total books circulated

Article requests fulfilled

**25**

**8**

User orientation programmes organised

# COMPUTER LABORATORY (COMPLAB)

The CompLab team in JNCASR has strived hard to modernise the existing network, security, and email system in the past year. The team made the following upgrades:



## NETWORK

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JNCASR has a high-speed Local Area Network (LAN), which can support up to 10 Gbps Intranet connectivity. During 2021-2022, efforts have been made to ensure the availability of an integrated internet bandwidth of 600 to 700 Mbps, to improve the internet speed for users. In the coming years, we plan to increase the internet bandwidth to 1 Gbps.



## EMAIL

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One of the major changes addressed last year was migrating from the outdated Zimbra to the professional email client, Microsoft Outlook. It is more user-friendly, and Microsoft products such as Teams, OneDrive, Word, PowerPoint, and Excel have common sign-in credentials allowing easy sharing of information with collaborators/students/faculty/offices. By moving to Outlook, we have moved to a new spam filter system, which is one of the best available with Microsoft. Besides, to maintain security and avoid spam experienced during Zimbra, several new policies have been implemented to ensure the proper functioning of the email facility. Further, the Outlook desktop/mobile app provides a single platform to access multiple email IDs independently at any given time, which eases the workload on the user, unlike earlier days when the user had to log out and log in with different login credentials.



## FIREWALL

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We have replaced the firewall security system with a new one, and upgraded the PAN-OS version 8 to PAN-OS version 10, to secure the entire network and utilise all security features. An integrated new SSL certificate has been added to the firewall to provide a secure connection using VPN.



## ENHANCED SECURITY FOR SYSTEM AND NETWORK

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We have upgraded the OS from Windows 7 or older to Windows 10 or 11 in computers across the campus to secure/prevent the computers and the network from threats and malicious attacks. Many computers were not compatible with Windows 10 and were prone to hacking or virus attacks. They were replaced with the latest ones. Besides, antivirus was installed in each of them for an enhanced layer of security.



## FREE SOFTWARE LICENSE FOR FACULTY AND STUDENTS

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We have a free campus license policy where all faculty members and students get access to Mathematica, MATLAB, Intel Parallel Studio, and Microsoft Office 365 licenses which support up to 5 device installations per user and provide 5 TB cloud storage for each user.

# COMPUTER LABORATORY (COMPLAB)

## MEMBERS OF COMPLAB

Head, CompLab:

**Prof. Subir K. Das** (until August 2021)

**Dr. James Premdoss Clement Chelliah** (since September 2021)

Web Developer:

**Chandan N.**

Onsite Engineers:

**Vinoth P., Madasamy S., Pandurang Bugade**





# DHANVANTARI (JNCASR HEALTH CENTRE)

**Activities and initiatives:** JNCASR's health centre, Dhanvantari, caters to the medical needs of the permanent staff, their dependents, students, retired staff, and their spouses who are covered under the contributory medical scheme (CMS). It also gives free consultations to the temporary staff—who work in security, gardening, and housekeeping—and guests at JNCASR.

Dhanvantari offers daily outpatient services, including daycare treatment and online emergency services. Its facilities include a clinical laboratory, a minor OT service unit, ECG, and a physiotherapy unit. Further, a new ward has been commissioned to admit and treat patients with infectious diseases, including COVID-19.

The health centre has three doctors, including one Chief Medical Officer and two Medical Officers. Additionally, the centre has a physiotherapist in the physiotherapy unit and a clinical psychologist for online consultations via platforms including Your Dost. Dhanvantari has four nurses who work round the clock and two lab technicians.

CMS members are eligible to avail of the cashless option while buying medicines from designated medical stores with prescriptions from Dhanvantari doctors. CMS members can also avail cashless facilities at OPDs, laboratories, and X-ray services (except dental services) at Aster C. M. I. Hospital, M. S. Ramaiah Memorial Hospital, Baptist Hospital, and Manipal Hospital Malleshwaram upon referrals by Dhanvantari doctors. They must show their identity cards to use these facilities. This has been made possible by an MoU between JNCASR and these hospitals. At present, only Aster C. M. I. hospital is offering contributory health services scheme (CHSS) rates to JNCASR CMS members. Students and retired staff are not entitled to cashless benefits in these hospitals.

An MoU has also been signed with R. V. Metropolis Laboratory Malleshwaram to provide CHSS rates and cashless facilities to JNCASR CMS members for various tests, even those that involve biochemistry and culture. As per the MoU, blood samples collected at Dhanvantari during working hours will be sent to the R. V. laboratory for testing, and the report will be made available the next day.

Finally, Dhanvantari conducts annual orientation programmes for new students, which include sessions on first aid, laboratory safety measures, etc. The programmes also advise on preventive health measures during emergencies and conduct vaccination services for COVID-19.



# DAY CARE

An independent day care facility with a play area for the children of our staff members started operating in June 2010 in the JNCASR campus. The facility is open for children in the age group of 1-10 years.

The interior of this building has beautiful wall stickers, toys, bookshelves, children's lockers, two rooms, a kitchen, and two washrooms.

This year, the Day Care facility at the Centre has been augmented with the construction of an additional room.

Prof. G. U. Kulkarni, President, JNCASR, inaugurated the facility on 10<sup>th</sup> March 2022, with the Day Care facility staff and committee members.



The Day Care facility was reopened, by following COVID-19 guidelines. It started functioning again in a limited capacity with existing children. Following the success of this reopening, it is now decided that the facility will be opened at full capacity at the earliest. The recoating of old infrastructure has been completed, and the Day Care facility is now ready for the new children.

The facility grounds have a tiny playground with swings and slides, free spaces, and lush greenery, with grass mats for children to play and move around. This playground is surrounded by fences to ensure the safety of the kids. A CCTV camera helps the staff keep an eye on the children at all times.

After the facility was reopened, a new committee was reconstituted, and the committee members convened for two meetings to discuss the opening of the facility at full capacity and other matters.

The facility will follow the rules and COVID-19 related protocols implemented by the Centre from time to time. Further, 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.

We organised dance classes, art sessions, and extracurricular activities like fancy dress events. We also celebrated festivals and special days curated for children's engagement, such as "colours day".

The Day Care facility currently consists of four staff members, one in-charge, and three caregivers to look after the needs of 16 children.



# CAMPUS INFRASTRUCTURE

## INFRASTRUCTURAL DEVELOPMENT KEY UPDATES 2021-2022

STATUS	PROJECTS
<b>Work Completed and Handed-over</b>	<ul style="list-style-type: none"> <li>• Construction of Hostel Block-V at JNCASR, Jakkur Campus</li> </ul>
<b>Work Completed</b>	<ul style="list-style-type: none"> <li>• Construction of Estate Office Block at JNCASR, Jakkur Campus</li> <li>• RCC Drain and Kerb Stone for JNCASR Approach Road on the north side of Arkavathi Campus, Shivanapura</li> <li>• MS Gate, Grating, and Drain at north-west corner entrance of JNCASR at Arkavathi Campus, Shivanapura</li> <li>• Concrete Road (white topping) for Approach Road on the north side of Arkavathi Campus, Shivanapura</li> <li>• Chain-link Fencing Along Approach Road and periphery of new lab block at Arkavathi Campus, Shivanapura</li> <li>• Construction of first floor at Estate Office for the Electrical and Health Department at JNCASR, Jakkur Campus</li> <li>• AR/SR works for President Office and Central Court at IISc Campus</li> <li>• AR/SR works for President House at IISc Campus</li> <li>• Construction of Record Room at JNCASR, Jakkur Campus</li> </ul>
<b>85% Complete, Finishing Work in Progress</b>	<ul style="list-style-type: none"> <li>• Construction of Pre-Fab Innovation and Development Centre at Arkavathi Campus, Shivanapura</li> </ul>
<b>Work in Progress</b>	<ul style="list-style-type: none"> <li>• Interior of Hostel Block-V at JNCASR, Jakkur Campus</li> </ul>
<b>Work to be Taken Up</b>	<ul style="list-style-type: none"> <li>• Renovation of SBS-A Lab No. 001 of Pauling Building</li> <li>• Renovation of SBS-A Lab No. 002 of Pauling Building</li> <li>• Renovation of SBS-A Lab No. 005 of Pauling Building</li> <li>• Renovation of SBS-A Lab No. 007 of Pauling Building</li> <li>• Renovation of SBS-A Lab Nos. 009 and 010 of Pauling Building</li> <li>• Alteration and improvements to the Lobby Electrical Court Area, Etc.</li> </ul>

# CAMPUS INFRASTRUCTURE

## COVID-19 RELATED MEASURES

- The Centre has improved its quarantine facilities by increasing bed capacity (total 39 beds) to contain COVID-19 infection.

## FLOOD IN THE CAMPUS

### Cause: Heavy rains at the Jakkur Campus

From the evening of 21<sup>st</sup> November 2021, the Jakkur Campus and surrounding areas witnessed unprecedented rains that lasted for about 10 hours, amounting to 153 mm of total precipitation. Although the Centre had experienced flooding in the past and has preventive measures in place, the amount of water that flooded the campus on this day was beyond anticipation.



The Centre lies between two big lakes, and an upper stream that connects to about 15 lakes. During its establishment in 1989, design engineers and architectural experts had recommended scientifically analysing the water levels of these surrounding water bodies. Accordingly, all the necessary water drains and sewage connections had been put in place, along with other civil and electrical work-related precautions. These precautions continued to be taken and systems upgraded accordingly over the years. Particularly, in the last decade, the threat of floods to the campus was noted and preventive measures were taken with the help of government authorities to improve the water drainage during heavy rains and avoid flooding.

On 16<sup>th</sup> August 2021, during a visit by the Vice President of India, Prof. G. U. Kulkarni, President of the Centre, appealed to the Chief Minister of Karnataka for the State Government's help. The Vice President, in his address, also instructed the government to take necessary measures to preserve the water bodies. Accordingly, and upon the Chief Minister's assurance, various works have been planned, some of which are in the implementation stage.

In the recent flood, rainwater mixed with sewage overflowing from the lakes in the upper stream caused inundations on the campus. Some of the waste weirs in the upper regions were also damaged by some residents, resulting in further flooding in the JNCASR campus. The primary building that houses important laboratories of the Molecular Biology and Genetics Unit, neurobiology, and evolutionary biology; and the Library and Administrative wings were severely affected. Sophisticated equipment, storage units, and other associated peripherals got submerged in water. Computers with valuable data, peripheral devices, office documents, and various office equipment and furniture were also impacted. Residential quarters also suffered severe flooding, forcing people to vacate their houses and move to safer places.

## CAMPUS INFRASTRUCTURE

On seeing the severity of the situation, the Chief Minister of Karnataka along with senior officers and engineers representing various civic bodies visited the Centre on 23<sup>rd</sup> November 2021. They assessed the damages caused due to flooding. During the campus tour, Prof. G. U. Kulkarni explained the magnitude of losses to the Chief Minister.



The Chief Minister assured support to the Centre and directed the officials to formulate immediate and long-term plans to prevent future flooding of the campus.

As of this date, the Centre has taken all necessary measures to assess the losses and salvage the situation through insurance and other means and has made extensive effort to resume all normal activity.

# NEW RESEARCH FACILITIES

JNCASR aims to obtain state-of-the-art technologies, facilities, equipment, and software for its researchers to support them in being at the forefront of their research field. Some of the latest additions to the list are:



## CHEMISTRY AND PHYSICS OF MATERIALS UNIT (CPMU)

Chiller 9KW for XRD System; Polarizing optical microscope; High pressure autoclave with 50 ml volume, make: Alloy 276; Gas chromatography; thin film HR-XRD; UV-VIS-NIR spectrometer; SuperK white light laser; AccuFlo standard tank micro-abrasive blaster; upgradation of Xplora Plus System with Stage ScanPlus and other accessories; upgradation of the Magnetron and Thermal Evaporation System; upgradation of Xplora Plus System with laser kit and liquid cell accessories; monochromator for Raman Spectrometer; thermal evaporation system; ZEN 2.3 system basic license for Elyra PS1; Avantage software for K-Alpha X-Ray Photoelectron Spectroscopy (XPS) System; Originlab Professional V2022; Silvaco TCAD Omni Bundle (University) software; Synopsys QuantumATK.



## INTERNATIONAL CENTRE FOR MATERIALS SCIENCE (ICMS)

Installation of gas line at ICMS building; uniaxial vacuum induction hot press unit; nitrogen generator; K-Alpha High Performance X-Ray Photoelectron Spectroscopy (XPS) System; 930 Compact IC Flex ChS/PP, Metrohm IC Pump; Voltas1.5Tr inverter hiwall split AC with cordless remote control, Qty.: 15 nos.; SuperK white light laser; computer 'matrix ready' Sphera/EA125; Comsol Multiphysics.



## MOLECULAR BIOLOGY AND GENETICS UNIT (MBGU)

IVC ventilators to animal facility; upgrade for 2 LSM microscope with Airyscan fast module; Bio Safety Cabinet 1300 Series; IBright CL1500 Imaging System, Pallet; clean room: stem cell lab; wall panel: 100 mm panel (clean room); storage unit; ultrasonicator for fragmentation of DNA in the NGS protocol; MicroCaIT PEAQ-ITC System; annual software FlowJo Academic; academic perpetual license for Graphpad Prism 9; Carl Zeiss digital microscope software; permanent academic license for SnapGene.



## NEW CHEMISTRY UNIT (NCU)

Fluorescence spectrometer; thermogravimetric analyser, TGA; Mossbauer sources; stereomicroscope with HD camera transmitted and reflected light; upgradation of Microcal iTC200 System;  $\mu$ BenchCAT reactor system; quadrupole mass spectrometer; 8890 GC analyser; Originlab Professional V2022; ChemDraw Professional, 21.x academic license; MNOVA EXPERT, 14.x academic license; Neurolucida360, Qty.: 2 nos.; GPA 64bit license; materials science suite.



## NEUROSCIENCE UNIT (NSU)

Ultrasonicator for fragmentation of DNA in the NGS protocol; Neurolucida360. Qty.: 2 nos.; IBM SPSS; pclamp software; BioRender software.



## ENGINEERING MECHANICS UNIT (EMU)

SankhyaSutra Vividh software.

# NEW RESEARCH FACILITIES



## COMPUTER LAB (COMPLAB)

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Renewal of Matlab campus software license; Windows server OS and supporting software license.



## ADMIN

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Multi-Debit-Head process automation; Aruba network switches.



## STUDENT RESIDENCE

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Furniture to 5<sup>th</sup> Block: Cots, wardrobes, study tables, and chairs.



## CENTRE-WIDE FACILITY

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Replacement of non-energy-efficient systems; UPS system: 20 KV UPS; air conditioners with accessories, Qty.: 89 nos.





# 07. FINANCIAL STATEMENTS

Management of the financial aspects of running a world-class institution plays a key role in the institution's sustainability, growth, and resilience. JNCASR holds itself to the highest standards of transparency and accountability in all its operations and to this end, in this section, it presents independently audited reports on the Centre's income, expenditures, assets, and liabilities for this financial year.



**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 31<sup>st</sup> 2022, 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 at March 31<sup>st</sup>, 2022, 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. B of the 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 and the Current Liabilities are subject to confirmation and reconciliation by the parties.

**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.

**Head Office** : #29, 1st Floor, Parijatha Complex, Race Course Road, Bengaluru - 560 001. Ph. : 91-80 4123 9157/4120 2519/5280 8934  
**Davanagere Branch** : No. 25, Akkamahadevi Samaj Complex, 2nd Main, 6th Cross, P J Extension, Davanagere -577 002. Mob. : +91 99010 73095  
**Mysore Branch** : No. 52, Gravity One, Disha Layout, Near Vijayanagar 4th Stage, Mysore - 570 026. Mob. : +91 81058 90095  
info@mallyamallya.com, Website : www.mallyamallya.com  
PAN : AABFM8893Q GSTIN : 29AABFM8893Q1Z5





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.
- 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

**CA CS Prashanth**  
Partner  
Membership No: 218355  
UDIN: 22218355APCKQS6805

Place: Bengaluru  
Date:15-07-2022

**JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH  
BALANCE SHEET AS AT 31ST MARCH 2022**

Amount in Rs.

Description	Schedule No.	Current year 2021-22	Previous year 2020-21
<b>Liabilities</b>			
Capital/Centre's Development Fund	1	93,96,88,488	70,21,71,319
Reserves & surplus	2	2,32,42,31,402	2,16,05,50,118
Earmarked and endowment funds	3	1,00,10,46,838	96,15,48,728
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	15,07,63,387	7,65,65,959
<b>Total</b>		<b>4,41,57,30,115</b>	<b>3,90,08,36,124</b>
<b>Assets</b>			
Fixed assets	8	2,32,42,31,402	2,16,05,50,118
Investments-From earmarked/endowment funds	9	52,90,31,760	46,95,31,760
Investment - Others	10	6,12,30,215	28,30,20,013
Current assets, loans, advances etc.	11	1,50,12,36,738	98,77,34,233
<b>Total</b>		<b>4,41,57,30,115</b>	<b>3,90,08,36,124</b>
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**  
Partner

Membership No.: 218355  
UDIN:22218355APCKQS6805  
Place : Bengaluru,  
Date :15-07-2022



  
Sampad Patra  
Accounts Officer



Prof. G.U. Kulkarni  
President

  
Joydeep Deb  
Administrative Officer





**JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH  
INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH 2022**

Amount in Rs.

Description	Schedule No.	Current year 2021-22	Previous year 2020-21
<b>Income</b>			
Income from sales/services	12	0	0
Grants/subsidies	13	82,72,00,000	71,67,00,000
Fees/subscriptions	14	60,19,246	53,00,708
Income from investments	15	0	0
Income from royalty, publication, licence fee etc.	16	2,68,649	3,01,954
Interest earned	17	16,26,943	13,67,228
Other income	18	82,59,195	95,38,080
Increase/decrease in stocks	19	0	0
<b>Total (A)</b>		<b>84,33,74,032</b>	<b>73,32,07,970</b>
<b>Expenditure</b>			
Establishment expenses	20	48,94,02,558	47,16,69,598
Other administrative expenses etc.	21	20,61,00,923	18,54,69,066
Expenditure on grants, subsidies etc.	22	0	0
Interest & bank charges	23	11,815	8,477
Depreciation		15,62,83,312	13,45,00,697
Less: Transferred from Capital Reserve		15,62,83,312	13,45,00,697
<b>Total (B)</b>		<b>69,55,15,295</b>	<b>65,71,47,141</b>
Balance being excess of income over expenditure (A-B)		14,78,58,737	7,60,60,829
Less: Prior period expenses		4,60,776	0
<b>Balance being surplus/deficit carried to Capital Fund</b>		<b>14,73,97,961</b>	<b>7,60,60,829</b>
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**  
Partner

Membership No.: 218355  
Place : Bengaluru,  
Date :15-07-2022



  
**Sampad Patra**  
Accounts Officer

  
**Prof. G.U. Kulkarni**  
President

  
**Joydeep Deb**  
Administrative Officer



**JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH**  
Schedules forming part of the accounts for the year ended 31st march 2022

Description	2021-22 Amount in Rs.	2020-21 Amount in Rs.
<b>SCHEDULE 1- Capital Fund :</b>		
<b>A: Capital fund</b>		
Opening balance	27,43,79,975	19,83,19,146
Add : Surplus/deficit in income and expenditure account	14,73,97,961	7,60,60,829
<b>Sub total</b>	<b>42,17,77,936</b>	<b>27,43,79,975</b>
Less : Funds-utilisation/expenditure incurred	95,44,089	0
<b>Total (A)</b>	<b>41,22,33,847</b>	<b>27,43,79,975</b>
<b>B: Centre's Development Fund</b>		
Opening balance	35,54,49,284	31,54,87,424
Additions during the year	1,46,59,120	1,76,08,195
Income from investments out of Centre's Development Fund	3,02,07,847	2,39,99,439
<b>Sub total</b>	<b>40,03,16,251</b>	<b>35,70,95,058</b>
Less : Funds-utilisation/expenditure incurred	213	16,45,774
<b>Total (B)</b>	<b>40,03,16,038</b>	<b>35,54,49,284</b>
<b>C: Grants for creation of Capital Assets</b>		
Opening balance	7,23,42,060	6,87,77,339
Add : Grants received during the year	37,47,61,139	31,00,00,000
<b>Sub total</b>	<b>44,71,03,199</b>	<b>37,87,77,339</b>
Less: Transferred to Capital Reserve upon acquisition of fixed assets	31,99,64,596	30,64,35,279
<b>Total (C)</b>	<b>12,71,38,603</b>	<b>7,23,42,060</b>
<b>Total (A+B+C)</b>	<b>93,96,88,488</b>	<b>70,21,71,319</b>
<b>SCHEDULE 2- Reserves and surpluses :</b>		
<b>A: Capital Reserve</b>		
Balance as at the beginning of the year	2,16,05,50,118	1,98,73,86,731
Add : Fixed assets addition during the Year out of Core grant	31,99,64,596	30,63,42,033
Add : Fixed assets addition during the Year out of Earmarked and endowment funds	0	13,22,051
<b>Sub total</b>	<b>2,48,05,14,714</b>	<b>2,29,50,50,815</b>
Less : Depreciation for the current year transferred to Income and Expenditure account	15,62,83,312	13,45,00,697
<b>TOTAL</b>	<b>2,32,42,31,402</b>	<b>2,16,05,50,118</b>



*Sampad Patra*  
Sampad Patra  
Accounts Officer

**JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH**  
Schedules forming part of the accounts for the year ended 31st march 2022

	FUND - WISE BREAK UP				TOTAL	
	Scheme Funds	Endowment Others	Student Residence, VSH& Dinning Hall	2021-22	2020-21	
<b>A) Opening balance of the funds</b>	<b>80,18,21,024.66</b>	<b>16,59,13,282</b>	<b>26,60,444</b>	<b>97,03,94,751</b>	<b>1,00,68,80,776</b>	
<b>B) Additions to the funds:</b>						
i. Donations/grants	55,29,79,473	0	0	55,29,79,473	26,42,53,539	
ii. Income from investment made on account of funds	2,46,58,250	1,05,16,946	0	3,51,75,196	4,35,66,570	
iii. Others	0	0	1,65,43,786	1,65,43,786	1,03,80,628	
<b>Total (A+B)</b>	<b>1,37,94,58,748</b>	<b>17,64,30,228</b>	<b>1,92,04,230</b>	<b>1,57,50,93,206</b>	<b>1,32,50,81,513</b>	
<b>C) Utilisation/expenditure towards objectives of funds</b>						
<b>i. Capital expenditure</b>						
- Fixed assets	14,99,02,737	0	0	14,99,02,737	13,58,78,670	
- Others	4,76,46,835	34,68,892	0	5,11,15,727	2,66,72,432	
<b>Total</b>	<b>19,75,49,572</b>	<b>34,68,892</b>	<b>0</b>	<b>20,10,18,464</b>	<b>16,25,51,102</b>	
<b>ii. Revenue expenditure</b>						
- Salaries, wages & allowances etc	5,90,31,098	0	0	5,90,31,098	7,32,25,476	
- Other administrative expenses	29,65,67,048	0	1,74,29,758	31,39,96,806	12,77,56,207	
<b>Total</b>	<b>35,55,98,146</b>	<b>0</b>	<b>1,74,29,758</b>	<b>37,30,27,904</b>	<b>20,09,81,683</b>	
<b>Net balance as at the year end (A + B - C)</b>	<b>55,31,47,718</b>	<b>34,68,892</b>	<b>1,74,29,758</b>	<b>57,40,46,368</b>	<b>36,35,32,785</b>	
	<b>82,63,11,030</b>	<b>17,29,61,336</b>	<b>17,74,472</b>	<b>1,00,10,46,838</b>	<b>96,15,48,728</b>	



Sampad Patra  
Accounts Officer

**JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH**  
Schedules forming part of the accounts for the year ended 31st march 2022

Description		2021-22 Amount in Rs.	2020-21 Amount in Rs.
<b>SCHEDULE 4- Secured loans and borrowings:</b>		0	0
<b>SCHEDULE 5- Unsecured loans and borrowings:</b>		0	0
<b>SCHEDULE 6- Deferred credit liabilities:</b>		0	0
<b>Total</b>		<b>0</b>	<b>0</b>
<b>SCHEDULE 7- Current liabilities and provisions</b>			
<b>A. Current liabilities</b>			
<b>1. Sundry creditors :</b>			
a. For goods	8,13,81,324		
b. Others - EMD/security deposit	1,19,77,991	<b>9,33,59,316</b>	<b>3,25,25,188</b>
<b>2. Advances received :</b>		<b>14,51,117</b>	<b>3,11,698</b>
<b>3. Statutory liabilities :</b>		<b>67,82,592</b>	<b>28,70,167</b>
<b>4. Other current liabilities:</b>		<b>4,00,65,833</b>	<b>3,15,05,368</b>
<b>5. Intra-Group Payables</b>			
<b>a) Scheme Funds</b>			
Scheme payable write-off a/c	95,44,089		
Payable to Scheme Account 18520	7,121		
	<b>95,51,210</b>		
<b>Less: Receivables from centre</b>	-95,51,210	<b>0</b>	<b>0</b>
<b>b) Endowment</b>			
Payable to Endowment Account	1,12,200		
<b>Less: Receivable From Grant Account</b>	-1,12,200	<b>0</b>	<b>0</b>
<b>Total (A)</b>		<b>14,16,58,858</b>	<b>6,72,12,421</b>
<b>B. Provisions</b>			
Stipend/salary payable		<b>36,83,259</b>	<b>31,83,664</b>
Expenses Payable		<b>54,21,271</b>	<b>61,69,874</b>
<b>Total (B)</b>		<b>91,04,530</b>	<b>93,53,538</b>
<b>Total (A+B)</b>		<b>15,07,63,387</b>	<b>7,65,65,959</b>



*Sampad Patra*  
Sampad Patra  
Accounts Officer

**JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH, JAKKUR POST, JAKKUR, BANGALORE 560 064**  
Schedules forming part of the accounts for the year ended 31st march 2022

**SCHEDULE 8 - FIXED ASSETS**

DESCRIPTION	GROSS BLOCK				DEPRECIATION				NET BLOCK		
	Rate	Cost/Value as at beginning of the year 2021-22	Additions during the year 2021-22	Dedn. during the year 2021-22	Cost/Value at the end of the year 2021-22	Depre. as at the beginning of the year 2021-22	Depre. during the year 2021-22	On Dedn. during the year 2021-22	Total upto the year end 2021-22	as at the Current year - end 2021-22	as at the Previous year - end 2020-21
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
Free hold land											
<b>Buildings:</b>											
Buildings	1.63	8,84,53,507	1,11,91,045	0	9,96,44,552	3,72,97,506	15,33,999	0	3,88,30,505	6,08,14,047	5,11,56,001
Hostel building	1.63	1,56,60,055	0	0	1,56,60,055	68,12,145	2,55,259	0	70,67,404	85,92,651	88,47,910
Advanced material research lab	1.63	2,59,30,339	0	0	2,59,30,339	75,92,272	4,22,665	0	80,14,936	1,79,15,403	1,83,38,067
Animal house	1.63	67,88,701	0	0	67,88,701	29,12,235	1,10,656	0	30,22,891	37,85,810	38,76,466
Staff housing	1.63	43,19,353	0	0	43,19,353	15,14,855	70,405	0	15,85,261	27,34,092	28,04,498
ETU building	1.63	30,91,348	0	0	30,91,348	8,62,074	50,389	0	9,12,463	21,78,885	22,29,274
Other buildings like extn. of hostel, college etc	1.63	1,19,83,626	0	0	1,19,83,626	31,49,623	1,93,703	0	33,43,326	85,40,300	87,34,003
Nano science lab	1.63	65,95,209	0	0	65,95,209	15,85,298	1,07,502	0	16,92,800	49,02,409	50,09,911
Engineering & mechanical lab	1.63	74,26,272	0	0	74,26,272	16,91,551	1,21,048	0	18,12,600	56,13,672	57,34,721
Dining hall & kitchen block	1.63	1,43,43,962	0	0	1,43,43,962	28,27,617	2,33,807	0	30,61,424	1,12,82,538	1,15,16,345
Hostel phase II	1.63	1,95,52,377	0	0	1,95,52,377	44,61,853	3,18,704	0	47,80,557	1,47,71,820	1,50,90,524
Lecture hall & academic block	1.63	96,36,712	0	0	96,36,712	21,81,493	1,57,078	0	23,38,571	72,98,141	74,55,219
Intl. centre for material sciences	1.63	5,01,48,316	0	0	5,01,48,316	1,06,49,293	8,17,418	0	1,14,66,711	3,86,81,605	3,94,99,023
International house	1.63	2,31,42,418	0	0	2,31,42,418	49,94,512	3,77,221	0	53,71,733	1,77,70,685	1,81,47,906
Hostel phase III	1.63	2,75,01,103	0	0	2,75,01,103	57,64,232	4,48,268	0	62,12,500	2,12,88,603	2,17,36,871
Prof. CNR Rao hall of science	1.63	1,03,33,669	0	0	1,03,33,669	21,69,087	1,66,439	0	23,37,526	79,96,144	81,64,582
Extension to HIV lab	1.63	10,16,085	0	0	10,16,085	2,15,307	16,562	0	2,31,870	7,84,215	8,00,778
Security office building	1.63	21,01,625	0	0	21,01,625	1,74,051	34,256	0	2,08,307	18,93,317	19,27,574
Radio activity - lab II	1.63	30,35,391	0	0	30,35,391	3,46,168	49,477	0	3,95,645	26,39,746	26,89,223
Sewage treatment building (STP)	1.63	2,91,699	0	0	2,91,699	66,566	4,755	0	71,321	2,20,378	2,25,133
Residential quarters - Adm. Officer	1.63	36,59,034	0	0	36,59,034	6,64,532	59,642	0	7,24,174	29,34,860	29,94,502
Child care centre	1.63	9,36,699	0	0	9,36,699	1,40,441	15,268	0	1,55,709	7,80,990	7,96,258
Extension to biology lab -2009	1.63	1,94,24,005	0	0	1,94,24,005	30,52,937	3,16,611	0	33,69,548	1,60,54,457	1,63,71,068
Animal house - Additional block	1.63	82,92,632	0	0	82,92,632	17,18,992	1,35,170	0	18,54,162	64,38,470	65,73,640
Hoster phase IV (62 rooms)	1.63	2,59,34,842	0	0	2,59,34,842	43,20,334	4,22,738	0	47,43,072	2,11,91,770	2,16,14,508
Extension to paulling building - Bio block	1.63	47,66,109	0	0	47,66,109	22,80,002	77,688	0	23,57,690	24,08,419	24,86,107
SCADA-DG room	1.63	2,40,660	0	0	2,40,660	35,306	3,923	0	39,228	2,01,432	2,05,354
President's residence	1.63	77,88,054	0	0	77,88,054	11,30,981	1,26,945	0	12,57,926	65,30,128	66,57,073
Visiting students hostel	1.63	3,39,82,070	0	0	3,39,82,070	49,55,107	5,53,908	0	55,09,015	2,84,73,055	2,90,26,963
Health centre	1.63	32,43,422	0	0	32,43,422	4,75,811	52,868	0	5,28,678	27,14,744	27,67,611
Nano institute-Shivanapura	1.63	37,09,242	0	0	37,09,242	5,44,147	60,461	0	6,04,608	31,04,634	31,65,095
Matr. science block - CCMS	1.63	5,54,31,961	0	0	5,54,31,961	76,53,924	9,03,541	0	85,57,465	4,68,74,496	4,77,78,037
Post doc housing- Srirampura	1.63	1,54,86,086	0	0	1,54,86,086	16,98,817	2,52,423	0	19,51,241	1,35,34,845	1,37,87,269
New auditorium	1.63	2,20,24,759	0	0	2,20,24,759	24,28,111	3,59,004	0	27,87,115	1,92,37,644	1,95,96,648
New auditorium phase II	1.63	4,99,08,687	0	0	4,99,08,687	32,36,050	8,13,512	0	40,49,561	4,58,59,126	4,66,72,637





**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 2022 (SCHEDULE 8 - FIXED ASSETS - Contd...)

1.63	EOBU lab block	2,09,11,646	0	2,09,11,646	28,39,228	3,40,860	0	31,80,087	1,77,31,559	1,80,72,418
1.63	Modern Biomedical Science Research Laboratory	6,91,88,143	0	6,34,53,166	22,23,536	10,34,287	0	32,57,823	6,01,95,343	6,69,64,607
1.63	Chemical Heritage Exposition	2,04,76,876	0	2,04,76,876	6,33,942	3,33,773	0	9,67,715	1,95,09,160	1,98,42,933
1.63	Extension to Engineering & Mechanical Unit (EMU)	1,46,16,712	0	1,46,16,712	3,81,996	2,36,252	0	6,20,249	1,39,96,463	1,42,34,716
1.63	Extension to Hall of Science	9,64,309	0	9,64,309	31,436	15,718	0	47,155	9,17,154	9,32,873
1.63	Infrastructure facility- Road, street lights, partitions etc	12,85,96,484	55,68,192	13,41,64,656	2,28,18,352	21,48,469	0	2,49,66,821	10,91,97,835	10,57,78,112
1.63	Basic Infrastructure Facilities -New Campus- Chokkanalli	2,90,95,819	0	2,90,95,819	0	4,74,262	0	4,74,262	2,86,21,557	2,90,95,819
1.63	Hostel Phase - V	7,49,82,263	37,10,841	7,86,93,104	12,52,454	0	0	12,52,454	7,74,40,650	7,49,82,263
1.63	Child Care Centre - Additional Room	8,39,868	5,58,799	13,98,667	0	22,798	0	22,798	13,75,869	8,39,868
1.63	Computer Lab - Pre Fab Structure	4,98,715	0	4,98,715	0	8,130	0	8,130	4,90,585	4,98,715
1.63	Estate Office	2,85,526	20,26,354	23,11,880	0	28,765	0	28,765	22,83,115	2,85,526
4.75	<b>Equipments:</b>	1,37,50,10,585	18,53,99,327	1,55,85,07,364	1,55,85,07,364	7,14,04,053	0	63,60,02,173	92,25,05,191	81,04,12,465
4.75	Plant/machinery/scientific equipments	3,42,21,009	0	3,42,21,009	0	3,42,21,008	0	3,42,21,008	1	1
4.75	Equipments carbon & nano materials	98,78,095	0	98,78,095	0	98,78,094	0	98,78,094	1	1
4.75	Equipments physics & chemistry of matr.	26,87,514	0	26,87,514	0	26,87,513	0	26,87,513	1	1
4.75	Equipments cluster studies	2,02,02,562	0	2,02,02,562	0	2,02,02,561	0	2,02,02,561	1	1
4.75	Equipments advance technology lab	70,90,855	0	70,90,855	0	70,90,854	0	70,90,854	1	1
4.75	Equipment magnet	39,93,37,774	0	39,93,37,774	0	14,28,46,239	1,89,68,544	16,18,14,783	23,75,22,990	25,64,91,534
4.75	ICMS-lab equipment/ lab facilities	61,63,340	0	61,63,340	0	56,84,439	4,78,900	61,63,339	1	4,78,901
9.50	Vehicles	11,72,88,739	2,51,80,893	14,24,64,787	4,845	9,78,03,920	82,84,760	10,60,88,680	3,63,76,106	1,94,84,819
6.33	Furniture and fixtures	2,71,59,940	18,54,404	2,90,14,344	0	1,68,54,007	13,37,345	1,81,91,352	1,08,22,992	1,03,05,933
4.75	Office equipments	10,05,12,762	71,56,412	10,76,69,174	0	9,65,84,899	45,94,778	10,11,79,677	64,89,497	39,27,863
16.21	Computer/peripherals	12,93,39,694	8,03,609	13,01,43,303	0	2,34,81,692	21,14,786	2,55,96,478	10,45,46,825	10,58,58,002
1.63	Electrical installations	2,33,56,842	0	2,33,56,842	0	7,38,305	3,80,717	11,19,021	2,22,37,821	2,26,18,537
1.63	Electrical installations - 2000 KVA DG SEI	2,95,55,246	1,37,444	2,96,92,690	0	2,12,44,910	14,09,214	2,26,54,125	70,39,565	83,10,336
4.75	Library Journals	22,09,84,696	71,32,489	22,81,17,186	0	10,95,81,708	1,06,70,176	12,02,51,884	10,78,65,302	11,14,02,988
4.75	Library Books	2,73,587	0	2,73,587	0	72,265	4,459	76,725	1,96,862	2,01,322
1.63	Tubewells & water supply	4,94,13,483	6,97,58,431	11,91,71,924	0	4,24,44,205	2,10,93,499	6,35,37,704	5,56,34,220	69,69,288
40.00	Other fixed assets	25,960	0	25,960	0	0	0	0	0	25,960
	Intangible assets-Softwares	3,42,164	0	3,42,164	0	0	0	0	3,42,164	3,42,164
0.00	Capital work in progress	0	0	0	0	0	0	0	0	0
0.00	Sports Complex	0	0	0	0	0	0	0	0	0
0.00	Library Renovation - Pre Fab Construction	0	0	0	0	0	0	0	0	0
0.00	Pre - Fab Innovation & Development Centre - Arkavathi Campus	0	0	0	0	0	0	0	0	0
	<b>Total</b>	3,51,70,96,578	32,76,32,926	3,83,70,61,174	76,68,330	1,35,65,46,460	15,62,83,312	1,51,28,29,772	2,32,42,31,402	2,16,05,50,118
	Previous year	3,20,94,32,493	30,77,57,330	3,51,70,96,578	93,245	1,22,20,45,763	13,45,00,697	1,35,65,46,460	2,16,05,50,118	1,98,73,86,731



**Sampad Patra**  
Accounts Officer

**JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH**  
Schedules forming part of the accounts for the year ended 31st march 2022

Description	2021-22 Amount in Rs.	2020-21 Amount in Rs.
<b>SCHEDULE 9- Investments - Earmarked /endowment funds (Long term)</b>		
Fixed deposits - Housing development finance corporation limited	9,35,90,265	8,10,90,265
Fixed deposits - PNB housing finance limited	37,24,41,495	32,54,41,495
Fixed deposits - Stock holding corporation of india	6,30,00,000	6,30,00,000
<b>Total</b>	<b>52,90,31,760</b>	<b>46,95,31,760</b>
<b>SCHEDULE 10- Investments - Others (Current)</b>		
Short term deposits	6,12,21,325	28,30,11,123
Others	8,890	8,890
<b>Total</b>	<b>6,12,30,215</b>	<b>28,30,20,013</b>
<b>Schedule 11- Current assets, loans, advances etc., Cash &amp; bank balances (Schemes)</b>		
Cash in hand	0	0
Cash at bank - Canara bank	13,74,32,500	12,33,34,649
Fixed deposits - Canara bank	6,09,57,745	17,45,79,761
Fixed deposits - Housing development finance corporation limited	28,78,60,000	20,98,60,000
Fixed deposits - PNB housing finance limited	28,50,00,000	22,20,00,000
<b>Sub total</b>	<b>77,12,50,245</b>	<b>72,97,74,410</b>
<b>Loans and advances (Schemes)</b>		
Interest accrued on fixed deposits	81,72,294	85,13,753
TDS receivable	74,04,388	70,58,630
Receivables from centre	0	0
Receivables from various funding agencies	2,99,32,893	5,64,74,232
<b>Sub total</b>	<b>4,55,09,575</b>	<b>7,20,46,614</b>
<b>Total of Schemes</b>	<b>81,67,59,820</b>	<b>80,18,21,025</b>
<b>Cash &amp; bank balances</b>		
Cash in hand -Student Residence & VSH	13,126	10,674
Cash in hand - Dinning Hall	503	34,227
Cash in hand - Grant account	0	29,040
Cash at bank - Canara Bank - Grants account	27,83,98,526	5,47,58,948
Cash at bank - Canara Bank - FCRA account	1,22,632	1,19,140
Cash at bank - Canara Bank - Endowments account	1,10,78,303	4,53,10,513
Cash at bank - SBI	1,88,223	1,84,445
Cash at bank - HDFC	9,62,91,851	1,37,45,650
Cash at bank - Student Residence & VSH	7,60,770	9,55,458
Cash at bank - Dinning Hall	6,31,370	8,66,749
<b>Sub total</b>	<b>38,74,85,304</b>	<b>11,60,14,845</b>
<b>Loans and advances</b>		
Advances to staff	1,39,312	30,781
Deposits	39,98,967	39,98,967
Interest accrued on earmarked/endowment funds	4,28,181	1,87,558
Other advances & receivables	24,54,36,495	1,71,33,309
Receivables- CSIR, UGC, DBT, DST	3,50,16,793	3,31,40,232
Endowment account - Receivables	22,68,000	46,62,000
TDS receivable - Grant account	42,35,561	40,83,785
TDS receivable - Endowment account	16,70,735	16,70,735
Imprest balance	20,000	20,000
Student Residence & VSH - Receivables	18,77,767	30,10,794
Dinning Hall -Receivables	11,80,071	8,97,042
Prepaid Expenses	7,19,733	10,63,160
<b>Intra-Group Receivables</b>		
<b>a) Endowment</b>		
Receivables From Endowment	2,72,720	0
<b>Less: Payable to Grant Account-13474</b>	<b>-2,72,720</b>	<b>0</b>
<b>Sub total</b>	<b>29,69,91,614</b>	<b>6,98,98,363</b>
<b>Total of other than Schemes</b>	<b>68,44,76,918</b>	<b>18,59,13,208</b>
<b>Total</b>	<b>1,50,12,36,738</b>	<b>98,77,34,233</b>



*Sampad Patra*  
Sampad Patra  
Accounts Officer

**JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH**  
Schedules forming part of the accounts for the year ended 31st march 2022

Description	2021-22 Amount in Rs.	2020-21 Amount in Rs.
<b>SCHEDULE 12- Income from sales/services</b>	<b>0</b>	<b>0</b>
<b>SCHEDULE 13- Grants/subsidies :</b>		
Grants - DST	82,72,00,000	71,67,00,000
Grants - From government agencies/travel grants etc.	0	0
Grants - From other institutes	0	0
Grants - Other international agencies	0	0
<b>Total</b>	<b>82,72,00,000</b>	<b>71,67,00,000</b>
<b>SCHEDULE 14- Income from fee/subscriptions etc.:</b>		
Income from fee, subscriptions, medical contribution etc.	60,19,246	53,00,708
<b>Total</b>	<b>60,19,246</b>	<b>53,00,708</b>
<b>SCHEDULE 15- Income from investments;</b>	<b>0</b>	<b>0</b>
<b>SCHEDULE 16- Royalty income, publication, licence fee etc:</b>		
From royalty	0	3,230
Licence fee	2,68,649	2,98,724
<b>Total</b>	<b>2,68,649</b>	<b>3,01,954</b>
<b>SCHEDULE 17- Interest earned:</b>		
From term deposits	11,67,759	7,75,974
Interest earned - Others	4,59,184	5,91,254
<b>Total</b>	<b>16,26,943</b>	<b>13,67,228</b>
<b>SCHEDULE 18- Other income:</b>		
From visitors house, guest rooms, students residence etc.	20,44,958	14,92,028
Prior year receipts	21,25,979	64,93,015
Miscellaneous income	32,82,214	15,40,712
From others (tender fee & other fee collected)	8,06,044	12,325
<b>Total</b>	<b>82,59,195</b>	<b>95,38,080</b>
<b>SCHEDULE 19- Increase/decrease in stock:</b>	<b>0</b>	<b>0</b>



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**JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH**  
Schedules forming part of the accounts for the year ended 31st march 2022

Description	2021-22 Amount in Rs.	2020-21 Amount in Rs.
<b>SCHEDULE 20- Establishment expenses:</b>		
Salaries & scholarship to students	30,70,99,323	27,93,37,858
Wages	13,72,48,081	11,91,35,718
Allowances (Medical reimbursements etc.,)	92,70,942	88,21,841
Contribution to CPF	21,13,332	23,11,006
Contribution to new pension scheme	2,51,81,759	1,37,00,098
Contribution to group gratuity scheme	2,28,481	4,43,20,269
Leave encashment benefits	74,87,589	20,87,614
LTC	7,73,051	19,55,194
<b>Total</b>	<b>48,94,02,558</b>	<b>47,16,69,598</b>
<b>SCHEDULE 21- Other Administrative expenses</b>		
Electricity & power	5,51,33,905	5,88,79,083
Water charges	33,35,997	30,83,003
Insurance	11,56,219	10,36,637
Repairs & maintenance	7,47,94,089	5,78,81,630
Rents, rates & taxes	1,20,470	1,56,855
Vehicles running & maintenance	8,90,163	7,90,997
Postage, telephone & communication	17,00,742	30,61,026
Printing, stationery, books	56,24,883	42,73,522
Travelling and conveyance	6,90,681	11,86,304
Expenses on seminars/workshops/discussion meetings	97,71,302	53,69,457
Membership & subscriptions	23,68,180	12,83,525
Professional / Legal charges	52,52,892	1,72,140
Laboratory consumables	4,23,97,715	4,52,82,687
Advertisement & publicity	19,84,159	19,89,643
Student residence, guest house, I house, etc	4,47,076	8,07,262
Statutory audit fee	1,18,000	1,29,800
POBE & POCE programme	65,000	0
Summer research fellowship & student programme	75,640	80,000
Loss on Asset Disposal	1,73,312	0
Foreign Exchange - Loss	499	5,496
<b>Total</b>	<b>20,61,00,923</b>	<b>18,54,69,066</b>
<b>SCHEDULE 22- Expenditure on grants, subsidies etc:</b>	<b>0</b>	<b>0</b>
<b>SCHEDULE 23- Interest and bank charges:</b>	<b>11,815</b>	<b>8,477</b>



*Sampad Patra*  
Sampad Patra  
Accounts Officer

**JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH SCHEDULES FORMING PART  
OF THE ACCOUNTS FOR THE YEAR ENDED 31 MARCH 2022**

**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 160 days during the year.

#### 4. Government Grants / Other Grants:

- Grants are recognized in the accounts on realisation basis.
- 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.
- Revenue Grants are directly recognised in the Income and Expenditure Account upon receipt.

#### 5. Retirement Benefits:

- 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.
- 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

- Income from fee, subscriptions, medical contribution etc. are recognised on accrual basis on billing
- Royalty/ Licence fee is recognised on time proportion basis, based on the terms of agreement.
- 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	2021-22 (Amount)	2020-21 (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.



5. Schedule 1 to 25 are annexed to and form an integral part of the Balance Sheet as at 31<sup>st</sup> March 2022 and the Income and Expenditure Account for the year ended on that date.



Prof. G.U. Kulkarni  
President



Joydeep Deb  
Administrative Officer



Sampad Patra  
Accounts Officer



For **Mallya & Mallya**  
Chartered Accountants  
FRN: 001955S



**CA CS Prashanth**  
Partner  
Membership No: 218355

Place: Bengaluru  
Date: 15-07-2022



**JAWAHARLAL CENTRE FOR ADVANCED SCIENTIFIC RESEARCH  
RECEIPTS AND PAYMENT ACCOUNT FOR THE YEAR ENDED 31ST MARCH 2022**

	2021-22	2020-21	2021-22	2020-21
<b>OPENING BALANCES &amp; RECEIPTS</b>				
<b>I. Opening Balances:</b>				
- Cash in hand & imprest at Centre	49,040	75,000		
Bank balances:				
<i>In savings bank Accounts:</i>				
- Canara Bank - Grant A/c	5,47,58,948	2,03,09,314		
- Canara Bank (Grant A/c) FCRA	1,19,140	11,31,185		
- Canara Bank - Endowment A/c	4,53,10,513	2,41,90,411		
- State Bank Of India	1,84,445	2,14,63,667		
- HDFC BANK	1,37,45,650	1,12,05,263		
<b>Sub Total :</b>			66,10,56,474	68,83,79,198
<b>II. Deposit accounts:</b>				
- At HDFC Trust	8,10,90,265	6,50,25,000		
- At PNB	32,54,41,495	23,85,67,000		
- At SHC of India	6,30,00,000	6,30,00,000		
- At Canara Bank (Grant A/c)	28,30,11,123	29,25,00,000		
<b>Sub Total :</b>	86,67,10,619	73,74,66,841		
<b>III. Grants Received:</b>				
- From DST-Grant in aid	1,02,71,00,000	1,02,67,00,000		
- On behalf of endowments/Centre's Development Fund,others	0	0		
<b>Sub Total :</b>	1,02,71,00,000	1,02,67,00,000		
<b>IV. Income on Investments:</b>				
<i>Interest on FD's:</i>				
- From earmarked/endowment funds	2,10,30,175	4,55,04,010		
- From own funds	6,68,526	7,41,375		
<b>Sub Total :</b>	2,16,98,701	4,62,45,385		
<b>V. Interest received on SB accounts:</b>				
- From grant in aid	1,47,84,095	1,26,37,548		
<b>Sub Total :</b>	1,47,84,095	1,26,37,548		
<b>VI. Other Income:</b>				
- Collections from visitors, guest room etc	9,98,711	9,60,782		
- From fee, subscription etc	33,53,135	18,34,720		
- CSIR fellowships,UGC, DBT, SRFPP	4,25,51,587	3,65,23,945		
<b>Sub total :</b>	4,69,03,413	3,96,19,447		
<b>Balance carried forward</b>	1,97,71,96,828	1,86,28,69,221		
<b>PAYMENTS &amp; CLOSING BALANCES</b>				
<b>I. Expenses:</b>				
- Establishment Expenses	44,25,50,446	44,25,50,446		
- Administrative Expenses	21,79,36,404	21,79,36,404		
- Expenditure out of Endowments	5,71,625	5,71,625		
<b>Sub Total :</b>	66,10,56,474	66,10,56,474		
<b>II. Expenditure on Fixed assets and Capital Work-in-progress:</b>				
- Purchase of fixed assets	26,19,26,682	26,19,26,682		
<b>III. Refund of surplus money/loans</b>				
	0	0		
<b>IV. Finance charges(Bank charges)</b>				
	21,066	21,066		
<b>V. Other payments:</b>				
- Earnest money deposit returned	5,10,366	5,10,366		
- Staff advances (Festival adv. etc.)	1,63,168	1,63,168		
- Other advances	20,03,18,117	20,03,18,117		
- Security deposit returned	11,11,863	11,11,863		
- TDS payments	5,49,77,713	5,49,77,713		
- Professional tax	6,74,200	6,74,200		
- Provident fund	4,87,62,161	4,87,62,161		
- Advances to faculty	18,55,984	18,55,984		
- Payment to sundry creditors	1,07,47,691	1,07,47,691		
- Advances to CPF Account	1,13,89,601	1,13,89,601		
<b>Sub Total :</b>	33,05,10,864	33,05,10,864		
<b>VI. Closing Balances:</b>				
- Cash in hand & Imprest at centre	20,000	20,000		
Bank balances:				
<i>In savings bank accounts at:</i>				
- Canara Bank - Grant A/c	27,83,98,526	27,83,98,526		
- At Canara Bank (Grant A/c) FCRA	1,22,632	1,22,632		
- Canara Bank - Endowment A/c	1,10,78,303	1,10,78,303		
- State Bank Of India	1,84,223	1,84,223		
- HDFC BANK	9,62,91,851	9,62,91,851		
<b>Sub Total :</b>	38,60,99,535	38,60,99,535		
<b>Balance carried forward</b>	1,63,95,95,555	1,63,95,95,555		
	49,040	49,040		
	5,47,58,948	5,47,58,948		
	1,19,140	1,19,140		
	4,53,10,513	4,53,10,513		
	1,84,445	1,84,445		
	1,37,45,650	1,37,45,650		
	11,41,67,736	11,41,67,736		
	1,40,95,06,441	1,40,95,06,441		




**JAWAHARLAL CENTRE FOR ADVANCED SCIENTIFIC RESEARCH**  
**RECEIPTS AND PAYMENT ACCOUNT FOR THE YEAR ENDED 31ST MARCH 2022 (Contd...)**

	2021-22	2020-21	2021-22	2020-21	Amount in Rs.
<b>OPENING BALANCES &amp; RECEIPTS</b>					
Balance Brought Forward	1,97,71,96,828	1,86,28,69,221			1,40,95,06,441
<b>VI. Other receipts:</b>					
- Income tax refunds	14,12,859	10,39,768			8,10,90,265
- From Sundry Creditors	0	0			32,54,41,495
- Staff advances recovered	0	0			6,30,00,000
- Settlement of advance to faculty	1,23,267	2,64,757			28,30,11,123
- Earnest money received	8,20,000	7,29,000			
- Project funding received	4,52,18,260	9,00,04,299			
- GSLI receipt	85,92,341	24,35,523			
- Support to meetings	30,72,288	96,21,985			
- Other	19,34,12,797	19,50,84,771			
<b>Sub Total :</b>	<b>25,26,51,812</b>	<b>29,91,80,103</b>	<b>Sub Total :</b>	<b>59,02,53,085</b>	<b>75,25,42,883</b>
<b>TOTAL</b>	<b>2,22,98,48,640</b>	<b>2,16,20,49,324</b>	<b>TOTAL</b>	<b>2,22,98,48,640</b>	<b>2,16,20,49,324</b>


For Jawaharlal Nehru Centre for Advanced Scientific Research

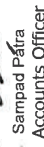
As per our report of even date,  
**For Malliga & Malliga**  
 Chartered Accountants  
 FRN : 0019555

  
**S. PRASHANTH**  
 Partner  
 Membership No.: 218355  
 Place : Bengaluru,  
 Date : 15-07-2022



  
 Prof. G.U. Kulkarni  
 President

  
 Joydeep Deb  
 Administrative Officer

  
 Sampad Patra  
 Accounts Officer





**JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH**  
**STATEMENT OF ENDOWMENT, CENTRE'S DEVELOPMENT FUND & OTHER FUNDS BALANCES AS ON 31/03/2022**  
**(2021- 22)**

Rs. in Lakhs

PARTICULARS	Principal	Opening	Additions	Interest	Interest	Total	Expen- diture	Closing
	Endow. Fund	balance 2021-22	during 2021-22	Received 2021-22	Accrued 2021-22			
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
<b>ENDOWMENT CHAIRS</b>								
Hindustan Lever Ltd. & Gharda Chemicals Chair	32.00	42.14	0.00	2.42	0.00	44.56	3.60	40.96
Astra Zeneca & IBM Chair	20.00	56.64	0.00	1.51	0.00	58.15	0.00	58.15
DAE - Dr.Vikram Sarabhai Chair	22.00	37.62	0.00	1.75	0.00	39.37	0.00	39.37
DRDO & CSIR Chair	30.00	71.57	0.00	2.27	0.00	73.84	0.00	73.84
Silver Jubilee Professorship -Prof. C.N.R. Rao	25.00	31.59	0.00	2.11	0.00	33.70	1.80	31.90
<b>TOTAL- ENDOWMENT CHAIRS</b>	<b>129.00</b>	<b>239.56</b>	<b>0.00</b>	<b>10.06</b>	<b>0.00</b>	<b>249.62</b>	<b>5.40</b>	<b>244.22</b>
<b>RELIANCE INDUSTRIES</b>								
Prof.Linus Pauling Professorship	84.34	63.12	0.00	6.93	0.00	70.05	14.49	55.56
<b>OTHER ENDOWMENT FUNDS</b>								
Contribution from Prof.CNR Rao	4.25	14.79	0.00	0.34	0.00	15.13	0.20	14.93
Shantha Seetharamaiah Award	1.00	3.58	0.00	0.08	0.00	3.66	0.17	3.49
Bapu Narayanaswamy Prize	1.00	3.12	0.00	0.08	0.00	3.20	0.06	3.14
Prof. Roddam Narasimha Prize	2.00	3.24	0.00	0.16	0.00	3.40	0.04	3.36
Prof. M.K.Chandrashekarana Fund	5.43	5.42	0.00	0.32	0.00	5.74	0.00	5.74
Sanjay S R Rao	25.00	27.02	0.00	1.94	0.00	28.96	1.20	27.76
Indumathi Rao	25.00	36.94	0.00	1.94	0.00	38.88	2.16	36.72
Reliance Fund - Sankhyasutra	431.37	476.75	0.00	35.32	0.00	512.07	0.00	512.07
<b>TOTAL - OTHER ENDOWMENT FUNDS</b>	<b>495.05</b>	<b>570.86</b>	<b>0.00</b>	<b>40.19</b>	<b>0.00</b>	<b>611.05</b>	<b>3.83</b>	<b>607.22</b>
<b>LECTURE SERIES</b>								
Dr. A.V.Rama Rao Fund	31.00	33.66	0.00	2.62	0.00	36.28	0.00	36.28
ISRO-Dr. Satish Dhawan	14.00	24.10	0.00	1.04	0.00	25.14	0.30	24.84
DAE-Dr. Raja Ramanna	15.00	18.10	0.00	1.27	0.00	19.37	0.60	18.77
DBT-Prof. V Ramalingaswamy	7.00	12.43	0.00	0.52	0.00	12.95	0.00	12.95
<b>TOTAL - LECTURE SERIES</b>	<b>67.00</b>	<b>88.29</b>	<b>0.00</b>	<b>5.45</b>	<b>0.00</b>	<b>93.74</b>	<b>0.90</b>	<b>92.84</b>
<b>C.N.R. RAO HALL OF SCIENCE FUND</b>	<b>170.00</b>	<b>228.73</b>	<b>0.00</b>	<b>14.27</b>	<b>0.00</b>	<b>243.00</b>	<b>10.07</b>	<b>232.93</b>
<b>MATERIALS RESEARCH FUND</b>	<b>341.45</b>	<b>468.58</b>	<b>0.00</b>	<b>28.28</b>	<b>0.00</b>	<b>496.85</b>	<b>0.00</b>	<b>496.85</b>
<b>CENTRE'S DEVELOPMENT FUND</b>	<b>1,682.07</b>	<b>3554.489</b>	<b>146.59</b>	<b>299.67</b>	<b>2.41</b>	<b>4,003.16</b>	<b>0.00</b>	<b>4,003.15</b>
<b>GRAND TOTAL</b>	<b>2,968.91</b>	<b>5,213.62</b>	<b>146.59</b>	<b>404.84</b>	<b>2.41</b>	<b>5,767.46</b>	<b>34.69</b>	<b>5,732.77</b>



*Sampad Patra*  
**Sampad Patra**  
**Accounts Officer**

**JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH  
CPF STATEMENT OF AFFAIRS FOR THE YEAR ENDED 31ST MARCH 2022**

Particulars	Amount in Rs.	Particulars	Amount in Rs.	Amount in Rs.
<b>Contributory provident fund</b>		<b>Investment of funds:</b>		
<b>Subscription:</b>		Government of India 8 % Bonds (SHCIL)	4,95,00,000	7,05,00,000
Opening balance	4,67,57,056	Fixed Deposits at PNB housing finance	2,10,00,000	
Add : Subscriptions received during the year	52,24,820			
Advances repayments	8,78,374	<b>Cash at Bank:</b>	7,94,037	7,94,037
Interest on subscriptions	19,78,514	Canara Bank, SB A/C No. 06883101017513		
Sub total	5,48,38,764	<b>TDS receivable:</b>		
Less : Advances granted	6,16,746	Gol Bonds (2012-13) receivable	1,48,000	
Less : Part final / Final settlement	1,10,05,516	Gol Bonds (2014-15) receivable	1,48,000	
Sub total	1,16,22,262	Gol Bonds (2015-16) receivable	1,49,400	
Closing balance		Canara Bank (2018-19) receivable	1,40,020	
		Canara Bank (2020-21) receivable	50,906	6,36,326
<b>Contribution:</b>		<b>Accrued interest:</b>		
Opening balance	3,33,74,170	Accrued interest on deposits in Gol 8 % Bonds (SHCIL)	2,35,16,315	2,58,65,415
Add : Contribution during the year	21,26,800	Accrued interest on Deposits in PNB housing finance	23,49,100	
Interest on total contributions	14,89,045			
Sub total	3,69,90,015			
Less : Final settlement	43,44,859			
Closing balance				
<b>Payable to Endowment</b>	22,68,000			
<b>Payable to Centre</b>	1,15,52,715			
<b>Balance surplus/deficit (-)</b>	81,13,405			
<b>Total</b>	<b>9,77,95,778</b>	<b>Total</b>	<b>9,77,95,778</b>	<b>9,77,95,778</b>

For Jawaharlal Nehru Centre for Advanced Scientific Research

**For Malliga & Malliga**  
Chartered Accountants  
FRN : 0019555

*(Signature)*  
C S PRASHANTH  
Partner



Membership No.: 218355  
Place : Bangalore,  
Date :15-07-2022

*(Signature)*  
Prof. G.U. Kulkarni  
President

*(Signature)*  
Joydeep Deb  
Administrative Officer

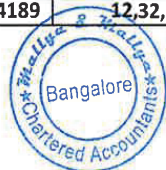
*(Signature)*  
Sampad Patra  
Accounts Officer



JAWAHARLAL NEHRU CENTRE FOR ADVANCED SCIENTIFIC RESEARCH							
Details of Scheme funds for the financial year 2021-22							
Sl. No.	Code	Opening Balance		Additions to the Funds	Utilisation / Expenditure	Closing Balance	
		Debit	Credit			Debit	Credit
1	4037	1,63,516	0	1,63,516	0	0	0
2	4041	0	1,39,376	0	1,39,376	0	0
3	4044	0	2,20,968	0	2,20,968	0	0
4	4048	58,378	0	58,378	0	0	0
5	4051	0	4,000	0	4,000	0	0
6	4052	1,30,972	0	1,30,972	0	0	0
7	4053	3,55,267	0	3,55,267	0	0	0
8	4058	0	5,000	0	5,000	0	0
9	4059	30,526	0	30,526	0	0	0
10	4062	22,445	0	22,445	0	0	0
11	4063	0	7,87,513	0	7,87,513	0	0
12	4064	0	2,61,088	0	2,61,088	0	0
13	4066	3,28,461	0	3,28,461	0	0	0
14	4070	15,075	0	15,075	0	0	0
15	4071	0	3,54,148	0	3,54,148	0	0
16	4072	0	20,71,825	0	20,71,825	0	0
17	4073	0	2,450	0	2,450	0	0
18	4074	0	1,27,700	0	1,27,700	0	0
19	4075	0	10,961	0	10,961	0	0
20	4076	4,615	0	4,615	0	0	0
21	4077	0	335	0	335	0	0
22	4078	5,011	0	5,011	0	0	0
23	4079	36,982	0	36,982	0	0	0
24	4082	0	887	0	887	0	0
25	4083	10,856	0	10,856	0	0	0
26	4084	0	79,865	0	79,865	0	0
27	4085	0	65,891	0	65,891	0	0
28	4086	0	0	0	0	0	0
29	4087	4,50,000	0	4,50,000	0	0	0
30	4089	0	6,99,975	0	6,99,975	0	0
31	4093	2,250	0	2,250	0	0	0
32	4095	0	12,129	0	12,129	0	0
33	4096	0	1,500	0	1,500	0	0
34	4097	0	3,00,492	0	3,00,492	0	0
35	4098	2,75,295	0	2,75,295	0	0	0
36	4099	97,970	0	97,970	0	0	0
37	4100	2,527	0	2,527	0	0	0
38	4102	0	67,035	0	67,035	0	0
39	4104	1,05,343	0	1,05,343	0	0	0
40	4105	301	0	301	0	0	0
41	4106	10,312	0	10,312	0	0	0
42	4107	1,19,464	0	1,19,464	0	0	0
43	4109	5,836	0	5,836	0	0	0
44	4111	0	9,655	0	9,655	0	0
45	4113	0	2,29,542	0	2,29,542	0	0
46	4114	0	5,69,013	0	5,69,013	0	0
47	4115	237	0	237	0	0	0



48	4116	8,548	0	8,548	0	0	0
49	4117	10	0	10	0	0	0
50	4119	17,17,113	0	17,17,113	0	0	0
51	4121	0	72,153	0	72,153	0	0
52	4122	32,794	0	32,794	0	0	0
53	4124	0	13,575	0	13,575	0	0
54	4126	0	1,62,570	0	1,62,570	0	0
55	4127	0	1,41,885	0	1,41,885	0	0
56	4128	74,820	0	4,37,274	3,62,454	0	0
57	4130	0	2,41,551	0	2,41,551	0	0
58	4131	81,231	0	81,231	0	0	0
59	4132	10,338	0	10,338	0	0	0
60	4133	1,64,849	0	1,64,849	0	0	0
61	4134	15,141	0	15,141	0	0	0
62	4136	18,509	0	18,509	0	0	0
63	4137	1,63,923	0	1,63,923	0	0	0
64	4138	65,453	0	65,453	0	0	0
65	4139	38,614	0	38,614	0	0	0
66	4140	0	34,52,216	0	34,52,216	0	0
67	4141	84,400	0	84,400	0	0	0
68	4142	0	3,56,244	0	3,56,244	0	0
69	4143	21,028	0	21,028	0	0	0
70	4144	1,18,646	0	1,18,646	0	0	0
71	4145	1,02,879	0	1,02,879	0	0	0
72	4146	0	6,89,158	0	6,89,158	0	0
73	4147	0	1,82,576	0	1,82,576	0	0
74	4148	0	4,29,860	0	4,29,860	0	0
75	4150	1,94,103	0	1,94,103	0	0	0
76	4152	2,42,382	0	2,42,382	0	0	0
77	4153	0	1,53,454	0	1,53,454	0	0
78	4154	1,64,301	0	1,64,301	0	0	0
79	4155	0	24,063	0	24,063	0	0
80	4157	7,483	0	7,483	0	0	0
81	4158	0	4,26,528	0	4,26,528	0	0
82	4159	0	2,15,630	0	2,15,630	0	0
83	4161	1,05,786	0	1,05,786	0	0	0
84	4163	355	0	355	0	0	0
85	4164	25,813	0	0	0	25,813	0
86	4165	0	0	0	0	0	0
87	4166	42,600	0	42,600	0	0	0
88	4168	18,329	0	18,329	0	0	0
89	4169	3,260	0	3,260	0	0	0
90	4171	0	2,34,213	0	2,34,213	0	0
91	4175	21,016	0	21,016	0	0	0
92	4176	0	1,91,625	0	0	0	1,91,625
93	4178	0	3,35,703	0	3,35,703	0	0
94	4179	0	98,108	0	0	0	98,108
95	4180	0	6,37,635	0	6,37,635	0	0
96	4181	0	52,507	0	52,507	0	0
97	4182	1,483	0	1,483	0	0	0
98	4185	0	74,616	0	74,616	0	0
99	4187	0	5,80,015	0	5,80,015	0	0
100	4189	12,32,132	0	12,32,132	0	0	0





101	4190	0	12,713	0	12,713	0	0
102	4191	12,318	0	12,318	0	0	0
103	4193	0	1,766	0	1,766	0	0
104	4195	94,586	0	94,586	0	0	0
105	4196	0	32,000	0	32,000	0	0
106	4197	0	82,042	0	0	0	82,042
107	4198	37,731	0	37,731	0	0	0
108	4199	50,309	0	50,309	0	0	0
109	4200	0	97,682	0	97,682	0	0
110	4201	0	24,769	0	24,769	0	0
111	4203	13,32,342	0	13,32,342	0	0	0
112	4206	0	0	0	0	0	0
113	4208	3,62,295	0	3,62,295	0	0	0
114	4209	0	4,01,722	0	4,01,722	0	0
115	4210	0	2,48,986	0	2,48,986	0	0
116	4212	39,059	0	39,059	0	0	0
117	4213	36,30,285	0	36,30,285	0	0	0
118	4215	0	10,000	0	0	0	10,000
119	4216	362	0	362	0	0	0
120	4218	4,189	0	4,189	0	0	0
121	4219	48,928	0	48,928	0	0	0
122	4220	9,16,740	0	9,16,740	0	0	0
123	4222	2,51,521	0	2,51,521	0	0	0
124	4223	0	1,22,567	0	1,22,567	0	0
125	4225	2,17,136	0	2,17,136	0	0	0
126	4227	0	7,936	0	7,936	0	0
127	4228	1,57,085	0	1,57,085	0	0	0
128	4229	0	40,831	0	40,831	0	0
129	4230	0	0	0	0	0	0
130	4231	46,243	0	46,243	0	0	0
131	4232	1,52,544	0	1,52,544	0	0	0
132	4233	2,06,789	0	2,06,789	0	0	0
133	4234	0	6,145	0	6,145	0	0
134	4235	0	62,793	0	0	0	62,793
135	4237	33,427	0	33,427	0	0	0
136	4238	0	16,42,830	0	0	0	16,42,830
137	4239	2,49,927	0	2,49,927	0	0	0
138	4240	7,52,659	0	7,52,659	0	0	0
139	4241	36,500	0	36,500	0	0	0
140	4242	6,09,511	0	6,09,511	0	0	0
141	4243	0	4,52,016	0	4,52,016	0	0
142	4247	0	5,47,873	0	5,47,873	0	0
143	4248	6,67,842	0	6,67,842	0	0	0
144	4252	0	0	0	0	0	0
145	4253	75,000	0	75,000	0	0	0
146	4254	3,12,285	0	0	0	3,12,285	0
147	4257	0	5,20,000	0	5,20,000	0	0
148	4258	9,09,065	0	9,09,065	0	0	0
149	4259	1,56,934	0	1,56,934	0	0	0
150	4262	3,60,110	0	3,60,110	0	0	0
151	4263	16,674	0	16,674	0	0	0
152	4266	39,971	0	39,971	0	0	0
153	4267	0	1,62,265	0	0	0	1,62,265





154	4268	0	5,594	0	5,594	0	0
155	4270	0	20,000	0	0	0	20,000
156	4272	3,219	0	0	0	3,219	0
157	4274	5,83,343	0	5,83,343	0	0	0
158	4275	0	8,977	0	8,977	0	0
159	4276	12,352	0	0	0	12,352	0
160	4277	0	6,05,087	0	24,599	0	5,80,488
161	4279	166	0	166	0	0	0
162	4280	3,08,285	0	3,08,285	0	0	0
163	4281	4,19,901	0	4,19,901	0	0	0
164	4282	0	3,14,167	0	0	0	3,14,167
165	4283	0	45,533	0	45,533	0	0
166	4284	0	30,162	0	0	0	30,162
167	4285	25,970	0	25,970	0	0	0
168	4286	33,549	0	0	0	33,549	0
169	4287	0	9,712	0	9,712	0	0
170	4288	6,16,803	0	0	0	6,16,803	0
171	4289	1,80,424	0	1,80,424	0	0	0
172	4290	0	79,002	0	79,002	0	0
173	4291	0	0	0	0	0	0
174	4292	0	6,49,231	6,797	7,10,140	54,112	0
175	4293	0	0	0	0	0	0
176	4294	18,36,463	0	0	0	18,36,463	0
177	4295	0	19,092	0	19,092	0	0
178	4297	99,865	0	0	0	99,865	0
179	4298	7,37,221	0	4,52,032	0	2,85,189	0
180	4300	19,02,409	0	0	0	19,02,409	0
181	4301	1,89,347	0	0	0	1,89,347	0
182	4302	1,07,814	0	0	0	1,07,814	0
183	4307	0	0	0	0	0	0
184	4308	0	2,39,309	0	0	0	2,39,309
185	4312	1,52,000	0	0	0	1,52,000	0
186	4313	0	2,01,186	0	0	0	2,01,186
187	4314	3,77,469	0	0	0	3,77,469	0
188	4318	1,212	0	0	0	1,212	0
189	4319	15,985	0	0	0	15,985	0
190	4320	62,558	0	0	0	62,558	0
191	4324	0	27,09,422	0	2,78,840	0	24,30,582
192	4325	0	24,994	0	0	0	24,994
193	4326	0	0	0	0	0	0
194	4327	47,323	0	0	0	47,323	0
195	4330	0	0	0	0	0	0
196	4333	4,83,351	0	0	0	4,83,351	0
197	4334	5,41,134	0	0	0	5,41,134	0
198	4335	0	1,218	0	1,218	0	0
199	4336	0	6,56,911	0	11,112	0	6,45,799
200	4337	3,02,836	0	0	0	3,02,836	0
201	4339	0	26,693	0	26,693	0	0
202	4340	5,233	0	5,233	0	0	0
203	4342	0	9,29,505	0	2,76,323	0	6,53,182
204	4343	0	10,000	0	10,000	0	0
205	4344	1,09,450	0	0	0	1,09,450	0
206	4346	0	10,18,144	0	77,388	9,40,756	0



207	4351	1,59,277	0	0	0	1,59,277	0
208	4352	2,00,714	0	2,00,714	0	0	0
209	4353	0	30,30,080	0	0	0	30,30,080
210	4354	0	1,46,497	0	1,300	0	1,45,197
211	4355	63,842	0	0	0	63,842	0
212	4357	0	3,85,856	0	0	0	3,85,856
213	4358	0	0	0	0	0	0
214	4359	0	0	0	0	0	0
215	4360	99,682	0	6,120	0	93,562	0
216	4361	6,27,538	0	17,57,229	7,50,379	0	3,79,312
217	4362	0	96,011	0	0	0	96,011
218	4365	41,564	0	0	0	41,564	0
219	4366	13,333	0	13,333	0	0	0
220	4371	2,63,624	0	0	0	2,63,624	0
221	4372	0	4,000	0	0	0	4,000
222	4374	0	0	0	0	0	0
223	4375	2,66,161	0	0	0	2,66,161	0
224	4376	0	8,55,48,886	0	6,26,71,195	0	2,28,77,691
225	4377	0	7,33,452	0	1,73,250	0	5,60,202
226	4378	3,42,097	0	0	0	3,42,097	0
227	4379	0	0	0	0	0	0
228	4382	0	1,05,402	0	1,05,402	0	0
229	4384	0	20,33,596	0	18,49,068	0	1,84,528
230	4385	0	0	0	0	0	0
231	4386	0	4,50,22,213	0	1,91,58,892	0	2,58,63,321
232	4387	0	1,62,79,776	0	19,55,858	0	1,43,23,918
233	4388	14,28,425	0	0	0	14,28,425	0
234	4391	3,02,261	0	3,02,261	0	0	0
235	4393	38,924	0	38,924	0	0	0
236	4394	0	1,00,129	0	0	0	1,00,129
237	4400	90,586	0	0	0	90,586	0
238	4401	0	0	0	0	0	0
239	4402	9,71,693	0	0	0	9,71,693	0
240	4404	2,48,492	0	0	0	2,48,492	0
241	4405	15,401	0	0	0	15,401	0
242	4406	10,31,359	0	0	0	10,31,359	0
243	4407	0	3,51,311	0	3,51,311	0	0
244	4409	40,413	0	0	0	40,413	0
245	4411	8,35,737	0	0	0	8,35,737	0
246	4412	19,25,456	0	0	0	19,25,456	0
247	4413	0	0	0	0	0	0
248	4414	9,35,645	0	0	15,287	9,50,932	0
249	4418	0	0	0	0	0	0
250	4419	0	2,455	0	0	0	2,455
251	4420	7,04,291	0	14,871	0	6,89,420	0
252	4422	0	16,01,682	10,07,664	29,06,440	2,97,094	0
253	4423	0	3,98,617	0	0	0	3,98,617
254	4424	2,48,936	0	0	0	2,48,936	0
255	4425	15,45,524	0	20,01,496	4,55,972	0	0
256	4427	0	15,20,008	0	12,34,268	0	2,85,740
257	4428	28,23,647	0	0	0	28,23,647	0
258	4430	1,72,426	0	0	0	1,72,426	0
259	4431	0	0	0	0	0	0



260	4432	0	1,14,699	0	1,14,699	0	0
261	4433	0	94,061	8,00,000	9,27,417	33,356	0
262	4436	0	2,67,823	0	2,63,801	0	4,022
263	4438	33,063	0	51,967	18,904	0	0
264	4439	1,85,213	0	1,85,213	0	0	0
265	4442	1,22,569	0	0	0	1,22,569	0
266	4444	8,58,625	0	0	0	8,58,625	0
267	4445	1,907	0	0	75,542	77,449	0
268	4446	0	55,263	0	0	0	55,263
269	4447	71,789	0	71,789	0	0	0
270	4448	62,018	0	0	0	62,018	0
271	4450	1,69,039	0	0	0	1,69,039	0
272	4452	0	0	0	0	0	0
273	4455	0	1,71,502	0	1,56,903	0	14,599
274	4456	0	0	0	0	0	0
275	4457	2,57,388	0	0	0	2,57,388	0
276	4458	49,698	0	0	0	49,698	0
277	4459	0	0	0	0	0	0
278	4460	0	0	0	0	0	0
279	4462	33,041	0	0	0	33,041	0
280	4463	0	0	0	0	0	0
281	4464	0	1,25,729	0	1,25,729	0	0
282	4467	4,604	0	0	0	4,604	0
283	4469	0	8,42,885	2,04,515	3,73,201	0	6,74,199
284	4471	16,909	0	0	0	16,909	0
285	4472	61,878	0	0	0	61,878	0
286	4473	0	1,24,667	0	1,24,667	0	0
287	4474	0	0	0	0	0	0
288	4475	0	2,54,437	0	2,60,761	6,324	0
289	4476	13,15,756	0	0	0	13,15,756	0
290	4477	38,243	0	0	45,520	83,763	0
291	4478	12,530	0	0	0	12,530	0
292	4479	0	0	0	0	0	0
293	4483	1,22,931	0	0	0	1,22,931	0
294	4484	0	0	0	0	0	0
295	4487	1,11,522	0	0	0	1,11,522	0
296	4488	2,852	0	0	0	2,852	0
297	4489	0	1,96,014	0	0	0	1,96,014
298	4490	0	0	0	0	0	0
299	4491	0	5,34,718	2,06,640	7,41,358	0	0
300	4492	0	12,22,132	11,69,991	11,68,921	0	12,23,202
301	4493	0	38,499	0	38,499	0	0
302	4494	0	3,63,571	0	24,951	0	3,38,620
303	4495	0	0	0	0	0	0
304	4496	0	5,56,945	0	1,50,000	0	4,06,945
305	4497	1,22,900	0	1,22,900	0	0	0
306	4498	0	2,35,758	0	2,35,758	0	0
307	4499	0	0	0	0	0	0
308	4500	0	32,89,808	0	4,51,726	0	28,38,082
309	4501	0	32,12,399	0	38,75,865	6,63,466	0
310	4502	0	98,200	0	0	0	98,200
311	4503	13,28,516	0	32,99,325	9,06,835	0	10,63,974
312	4504	0	10,82,275	0	16,47,309	5,65,034	0



313	4505	0	4,17,265	39,79,930	51,56,009	7,58,814	0
314	4506	0	24,53,077	0	12,82,631		11,70,446
315	4507	0	0	0	0	0	0
316	4508	5,98,440	0	5,98,440	0	0	0
317	4510	0	0	0	0	0	0
318	4511	0	6,56,084	0	6,56,084	0	0
319	4514	0	7,54,263	18,00,000	17,77,530	0	7,76,733
320	4515	0	3,71,98,917	2,60,56,456	5,53,45,554	0	79,09,819
321	4516	2,33,045	0	14,69,255	12,36,210	0	0
322	4518	0	1,00,515	8,00,000	9,00,515	0	0
323	4519	0	5,45,858	0	5,15,889	0	29,969
324	4549	0	3,45,102	2,50,000	5,95,102	0	0
325	4551	0	1,085	0	0	0	1,085
326	4552	0	2,32,666	18,00,000	13,09,546	0	7,23,120
327	4553	0	13,77,407	32,00,000	12,98,578	0	32,78,829
328	4554	0	1,74,962	17,00,000	16,38,308	0	2,36,654
329	4555	0	0	0	0	0	0
330	4556	0	10,857	0	0	0	10,857
331	4558	20,101	0	3,25,000	2,85,548	0	19,351
332	4559	0	2,11,433	1,60,000	3,95,527	24,095	0
333	4560	0	0	0	0	0	0
334	4562	0	2,40,480	0	2,40,480	0	0
335	4563	0	0	0	0	0	0
336	4564	0	3,16,210	0	3,24,140	7,930	0
337	4565	2,08,819	0	9,00,000	8,38,335	1,47,154	0
338	4566	14,088	0	36,11,000	36,04,159	7,247	0
339	4567	0	7,94,040	10,14,360	20,14,043	2,05,643	0
340	4568	0	19,32,622	5,00,000	15,06,891	0	9,25,731
341	4569	0	15,44,100	0	15,14,672	0	29,428
342	4570	1,19,433	0	0	3,74,764	4,94,197	0
343	4571	0	7,29,617	0	6,76,938	0	52,679
344	4572	0	1,23,235	0	1,23,235	0	0
345	4573	0	0	0	0	0	0
346	4574	0	4,88,878	0	5,19,054	30,176	0
347	4575	0	42,57,120	0	4,82,498	0	37,74,622
348	4576	0	8,13,922	10,00,000	12,77,602	0	5,36,320
349	4577	0	1,01,459	3,35,000	4,36,459	0	0
350	4578	0	11,34,370	0	9,45,649	0	1,88,721
351	4579	0	3,09,899	6,00,000	5,29,678	0	3,80,221
352	4580	0	3,78,750	5,50,000	5,12,773	0	4,15,977
353	4581	0	1,83,779	16,65,369	3,21,632	0	15,27,516
354	4582	0	1,16,51,951	15,00,000	74,15,912	0	57,36,039
355	4583	0	2,93,177	12,85,569	11,55,124	0	4,23,622
356	4584	0	3,94,022	11,25,273	15,19,295	0	0
357	4585	0	10,81,969	0	0	0	10,81,969
358	4586	0	6,22,36,890	11,80,00,000	15,90,10,834	0	2,12,26,056
359	4587	0	32,96,034	0	42,48,278	9,52,244	0
360	4588	0	2,20,034	11,00,000	10,36,602	0	2,83,432
361	4589	1,65,502	0	19,00,000	8,17,796	0	9,16,702
362	4590	0	2,15,12,414	21,10,640	1,57,26,594	0	78,96,460
363	4591	0	5,41,167	3,00,000	7,87,499	0	53,668
364	4592	0	57,33,387	0	59,42,241	2,08,854	0
365	4593	0	2,71,701	14,23,217	5,31,624	0	11,63,294





366	4594	0	2,49,309	4,57,858	4,72,621	0	2,34,546
367	4595	2,40,555	0	27,00,000	24,61,967	2,522	0
368	4596	0	8,34,562	11,00,000	13,71,645	0	5,62,917
369	4597	0	28,51,544	0	28,15,369	0	36,175
370	4598	26,315	0	19,00,000	16,78,039	0	1,95,646
371	4599	0	74,741	4,00,000	5,64,301	89,560	0
372	4600	0	17,799	9,60,000	9,77,799	0	0
373	4601	0	3,25,628	1,00,360	3,74,814	0	51,174
374	4602	0	17,95,700	0	96,595	0	16,99,105
375	4603	0	16,97,544	0	11,91,455	0	5,06,089
376	4604	0	12,49,340	8,50,000	15,94,246	0	5,05,094
377	4605	0	3,48,898	2,50,000	3,08,265	0	2,90,633
378	4606	0	3,90,516	0	8,49,063	4,58,547	0
379	4607	0	3,91,738	14,37,382	9,71,034	0	8,58,086
380	4608	0	15,417	2,00,000	2,06,261	0	9,156
381	4609	0	15,72,706	10,00,000	20,88,513	0	4,84,193
382	4610	0	7,71,146	11,00,000	13,78,280	0	4,92,866
383	4611	0	29,97,925	0	31,31,961	1,34,036	0
384	4614	0	10,32,992	6,00,000	12,71,801	0	3,61,191
385	4615	0	11,05,315	10,00,000	17,17,731	0	3,87,584
386	4616	0	3,40,69,956	30,00,000	3,43,42,764	0	27,27,192
387	4617	0	7,21,342	6,00,000	12,55,506	0	65,836
388	4618	0	5,71,903	16,00,000	18,62,145	0	3,09,758
389	4619	0	15,12,862	0	5,48,716	0	9,64,146
390	4620	0	9,50,950	0	8,19,440	0	1,31,510
391	4621	0	7,41,989	0	85,991	0	6,55,998
392	4622	0	4,37,317	6,59,438	10,74,306	0	22,449
393	4623	0	69,31,538	1,04,00,328	88,83,625	0	84,48,241
394	4624	0	14,50,800	0	2,39,872	0	12,10,928
395	4625	0	10,61,635	0	10,61,635	0	0
396	4627	0	13,70,912	24,191	11,38,328	0	2,56,775
397	4628	0	0	0	0	0	0
398	4629	0	78,953	58,200	56,794	0	80,359
399	4630	0	30,81,060	28,625	30,63,492	0	46,193
400	4631	0	2,36,680	0	2,36,680	0	0
401	4632	0	18,96,542	2,52,631	31,95,518	10,46,345	
402	4633	0	5,16,783	14,574	10,000	0	5,21,357
403	4634	0	18,11,436	45,987	6,06,370	0	12,51,053
404	4635	0	11,81,859	19,496	11,98,665	0	2,690
405	4636	0	7,55,229	0	8,19,058	63,829	0
406	4637	0	10,59,019	8,00,000	16,45,661	0	2,13,358
407	4638	0	15,32,528	15,82,603	22,12,728	0	9,02,403
408	4640	0	11,89,000	0	0	0	11,89,000
409	4642	0	10,79,681	9,00,000	4,66,685	0	15,12,996
410	4643	0	15,81,813	37,181	12,17,739	0	4,01,255
411	4644	0	4,59,457	0	1,75,560	0	2,83,897
412	4645	0	24,54,765	0	6,40,999	0	18,13,766
413	4646	0	8,96,799	0	8,96,799	0	0
414	4647	0	8,27,686	11,733	8,73,113	33,694	0
415	4648	0	9,32,664	10,851	9,55,329	11,814	0
416	4649	0	8,38,378	10,18,400	18,56,778	0	0
417	4650	0	13,27,153	30,186	10,98,454	0	2,58,885
418	4651	0	2,16,598	5,483	39,139	0	67,942





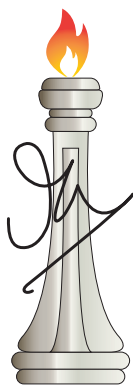
419	4652	0	1,63,757	5,73,336	5,68,364	0	1,68,729
420	4653	0	3,29,090	7,190	3,23,810	0	12,470
421	4654	0	3,19,820	3,35,000	2,55,627	0	3,99,193
422	4655	0	49,48,777	1,12,060	38,84,610	0	11,76,227
423	4656	0	13,49,237	22,237	11,47,301	0	2,24,173
424	4657	0	18,47,754	7,00,000	26,00,512	52,758	0
425	4658	0	22,02,312	48,554	9,88,973	0	12,61,893
426	4659	0	10,46,458	15,909	10,39,110	0	23,257
427	4662	0	37,96,000	0	13,10,000	0	24,86,000
428	4663	0	41,99,920	0	28,28,010	0	13,71,910
429	4664	0	70,32,800	0	44,97,310	0	25,35,490
430	4674	0	17,30,000	1,73,000	8,94,008	0	10,08,992
431	4660	0	0	8,34,372	7,84,103		50,269
432	4661	0	0	11,37,808	10,09,158	0	1,28,650
433	4675	0	0	23,80,000	16,96,253	0	6,83,747
434	4676	0	0	23,93,899	9,19,082	0	14,74,817
435	4677	0	0	2,00,000	1,97,357	0	2,643
437	4679	0	0	15,00,000	11,38,127	0	3,61,873
438	4680	0	0	89,35,400	13,35,731	0	75,99,669
439	4681	0	0	9,97,600	2,56,073	0	7,41,527
440	4682	0	0	7,00,000	2,12,240	0	4,87,760
441	4683	0	0	9,90,000	1,68,362	0	8,21,638
442	4684	0	0	24,72,000	11,18,171	0	13,53,829
443	4685	0	0	15,00,000	1,36,350	0	13,63,650
444	4686	0	0	35,61,280	33,333	0	35,27,947
445	4687	0	0	13,04,23,728	11,98,412	0	12,92,25,316
446	4688	0	0	10,00,000	1,17,095	0	8,82,905
447	4689	0	0	29,97,170	51,521	0	29,45,649
448	4690	0	0	11,18,400	2,02,152	0	9,16,248
449	4691	0	0	11,18,400	1,48,103	0	9,70,297
450	4692	0	0	11,18,400	1,48,103	0	9,70,297
451	4693	0	0	11,18,400	1,17,469	0	10,00,931
452	4694	0	0	11,18,400	67,466	0	10,50,934
453	4695	0	0	11,18,400	11,18,400	0	0
454	4696	0	0	3,38,65,603	0	0	3,38,65,603
455	4697	0	0	13,97,589	0	0	13,97,589
456	4698	0	0	22,58,480	1,33,889	0	21,24,591
457	4699	0	0	11,18,400	0	0	11,18,400
458	4700	0	0	38,31,000	12,815	0	38,18,185
459	4701	0	0	27,37,560	3,000	0	27,34,560
460	4702	0	0	76,77,500	8,851	0	76,68,649
461	4703	0	0	19,99,100	10,283	0	19,88,817
462	4704	0	0	11,18,400	0	0	11,18,400
463	4705	0	0	2,36,49,680	41,667	0	2,36,08,013
464	4706	0	0	0	0	0	0
465	5100	4,10,730	0	4,10,730	0	0	0
466	5101	5,73,994	0	5,73,994	0	0	0
467	5102	0	0	0	0	0	0
468	5103	1,64,610	0	1,64,610	0	0	0
469	5104	29,05,103	0	29,05,103	0	0	0
470	5105	24,28,431	0	24,28,431	0	0	0
471	6001	0	56,75,865	0	0	0	56,75,865
472	6003	0	33,00,847	0	0	0	33,00,847



473	6004	0	6,59,82,928	3,71,05,387	2,02,58,476	0	8,28,29,839
474	6005	0	14,19,550	79,374	2,052	0	14,96,872
475	6006	0	0	79,81,127	0	0	79,81,127
476	P.D.F.	0	42,34,769	24,90,642	10,25,452	0	56,99,959
477	O.C.B.	0	23,85,72,852	10,68,72,790	4,75,68,085	0	29,78,77,557
		5,64,74,232	80,18,21,025	65,98,52,263	60,88,20,918	2,99,32,893	82,63,11,030



*Sampad Patra*  
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Accounts Officer



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