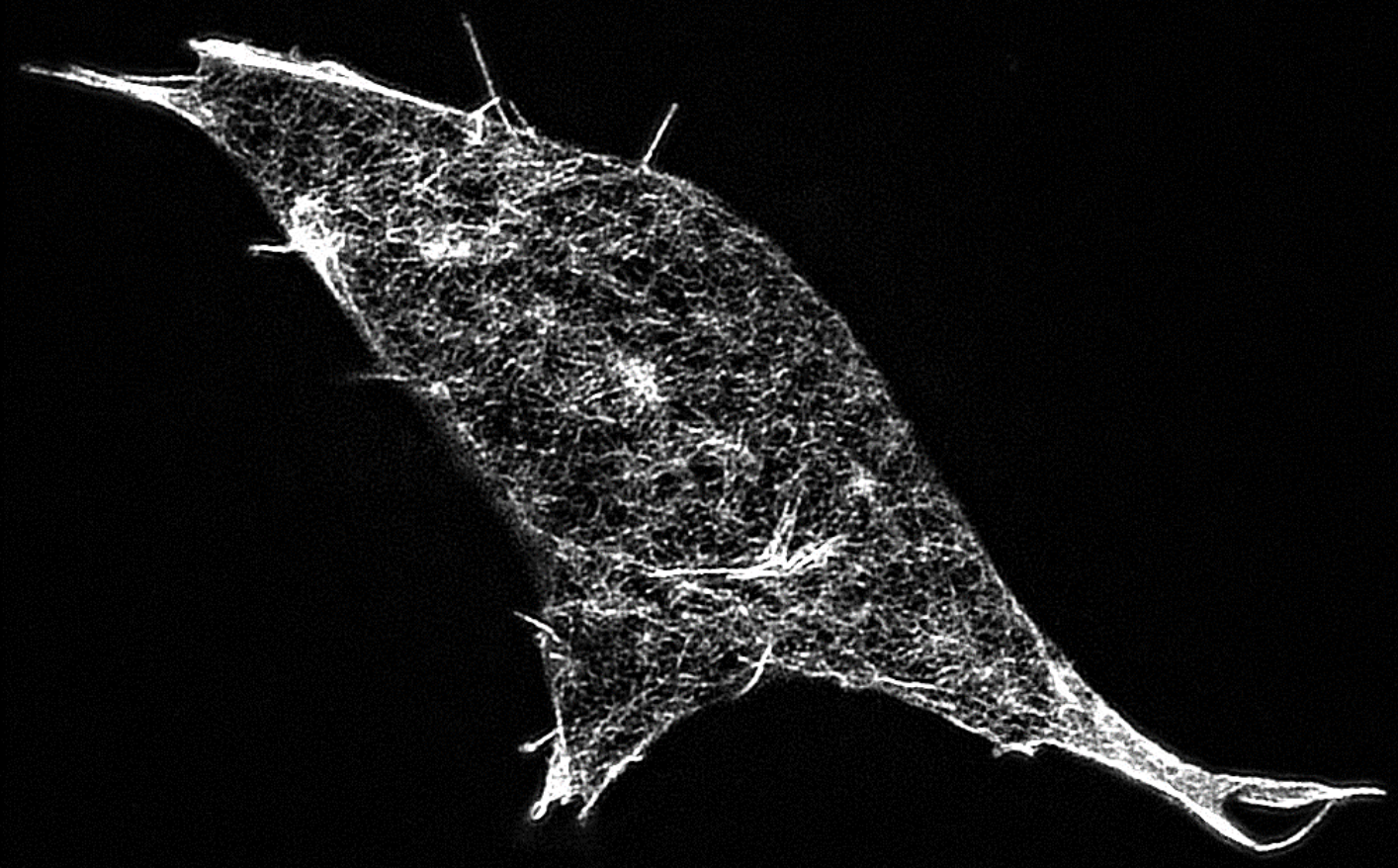
NCCS

National Centre for Cell Science



Annual Report

2022–23

Cover page image:

The image is a confocal micrograph showing a mouse embryonic stem cell (mESC) stained with phalloidin, which binds to F-actin. It shows the complex, detailed organization of the actin meshwork at the basal surface of mESCs, a feature distinctive of these cells.

(*Image credits: Mahak Tiwari, Dr. Deepa Subramanyam and her research group, and the NCCS bio-imaging facility team*)

National Centre for Cell Science

Annual Report for the year 2022–2023

CONTENTS Page No.

VISION OF NCCS

To carry out cutting-edge research in cell and disease biology and contribute to national development through capacity-building and value-added services that facilitate cell biology research across India.

MISSION OF NCCS

- To carry out basic research in the area of cell and disease biology.
- To serve as a national cell repository.
- Human resource development through training and teaching.

MANDATE OF NCCS

1. To receive, identify, maintain, store, grow and supply:
   a) Animal and human cells/cell cultures & cell lines: currently existing (typed) as well as newly developed at NCCS.
   b) Hybrid cells including hybridomas.
   c) Unicellular obligate pathogens and parasites, plasmids, genes and genomic libraries.
2. Research & development in the area of cell biology, and cell culture & cell line-related materials and products.
3. To establish and conduct courses, workshops, seminars, symposia and training programmes in related fields.
4. To serve as a National Reference Centre for tissue culture in the country.
5. To provide and promote effective linkages between various scientific and research agencies/laboratories and other organisations, including industries working in the country.
6. To collaborate with foreign research institutions & laboratories, and other international organisations working in the areas relevant to the objectives of NCCS.
7. To participate in such programmes as required for the betterment of society in the country and advancement of science and technology.

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Summary of NCCS Activities for the Unacquainted

NCCS carries out research in cell biology, which involves the study of cells, the 'basic unit of life'. The bodies of all animals, including humans, are composed of trillions of different types of microscopic cells. These cells, in turn, are composed of a variety of molecules, including DNA, RNA, proteins, and several others, which determine the structure, properties and biological activities of the cell. Cellular activities are also influenced by other determinants, including interactions between these molecules, as well as interactions of the cells with the environment and molecules outside the cell, with each other, and with microorganisms that they encounter. All these molecules, interactions and other factors that influence the functioning of cells, collectively determine the functioning of the animal as a whole. Consequently, to gain essential insights into how the body functions under conditions of health and disease, it is necessary to study the nuances of how cellular activities operate at the molecular level and decipher all the determinants involved. We carry out such studies at NCCS to address challenging questions about human health, especially those related to cancer, diabetes, infectious diseases, functioning of the immune system, regeneration of bone and other tissues, gut microorganisms in health and disease, stem cell biology, etc. Through achieving the proximal goal of understanding the basic biology of cells, we aspire to eventually contribute towards improvements in methods for diagnosis, and treatment regimens / therapeutics for management of diseases. Our studies hold special relevance for this purpose, since they are mainly focused on the Indian population. While engaging in basic research, we also explore possibilities for translating our promising breakthroughs into tangible benefits for the people through collaborations with clinicians. The details of the research carried out at NCCS over the past year are described in the research reports of the individual scientists in the annual report that follows.

NCCS also has service-oriented components which play a big role in facilitating high quality research not only at NCCS, but also at other organizations. One of the aims of NCCS is to function as a national

cell repository for animal cell cultures, which are essential to study the biology of cells. Cell cultures are different types of cells obtained from animals, including humans, which are grown and maintained under laboratory conditions. This cell repository provides these cell cultures to cell biologists from academic and research institutions across the country. Therefore, a significant proportion of cell biology research in India is dependent on the cell repository at NCCS, and is also supported by the training and guidance provided by NCCS to develop the skills required to handle cell lines.

The NCCS Centre of Excellence, National Centre for Microbial Resource (NCMR), project, plays a big role in preserving the nation's microbial biodiversity, by serving as a national depository for microorganisms. It has successfully undertaken the enormous task of obtaining several different microorganisms from a variety of environments across India, preserving them in the laboratory in the form of microbial 'cultures', and characterizing them to identify them and to explore their potential for application in biotechnology. The NCMR is the largest individual collection of microorganisms in the world and is instrumental in India being internationally ranked among the top few countries with the largest collections of microbial cultures. It also facilitates high-quality research in microbiology in universities, colleges, other research institutions, and industries all over the country, by supplying authentic microbial cultures and providing related services, such as identifying microorganisms using cutting-edge techniques. Further, NCMR was recognized by the World Intellectual Property Organization (WIPO) in Switzerland, as an International Depository Authority (IDA) for the deposit of microorganisms to fulfill the requirements of the patent procedure in 55 countries.

In addition to carrying out research and extending services as mentioned above, NCCS also contributes immensely to capacity building of the nation and human resource development through several teaching, training & outreach activities that benefit students, researchers & academicians from various organizations across the country, as well as the general public. NCCS conducts the Ph.D. coursework for students registered with the S. P. Pune University and RCB, Faridabad. The NCCS scientists also deliver lectures and provide hands-on training for students at various educational organizations. Furthermore, the scientists at NCCS provide valuable mentorship and training in research to Ph.D. students and other students who carry out short-term research projects at NCCS every year as summer trainees (selected from among the Indian Science Academies' Summer Research Fellows) and project trainees (from various academic institutions).

NCCS serves to educate the general public and students about diverse topics in science through various outreach activities. These include public talks by eminent scientists, including Nobel laureates; open days at NCCS on the National Science Day and on other occasions (including public talks by eminent speakers); display of exhibits at various science exhibitions like the India International Science Festival, 'Kutuhal', 'Vigyan Rail' (the science exhibition on wheels initiated by the Government of India); articles published in newspapers and magazines in English as well as Indian languages; science-themed talks & discussions broadcast through All India Radio, podcasts and TEDx talks; participation in science documentaries for telecast on channels like the BBC Marathi, DD National channel, DD Bharati, Lok Sabha TV & Rajya Sabha TV; etc.

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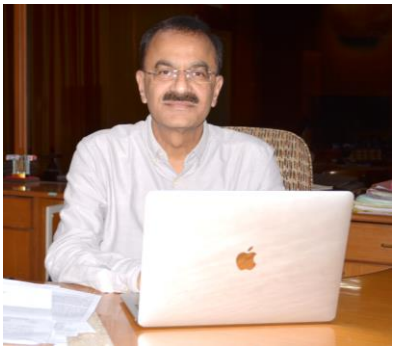
From the Director's Desk



It is my pleasure to present the first Annual Report as Director of the National Centre for Cell Science (NCCS), Pune. This report will offer a bird's eye view of our contributions to the scientific progress, through the financial year 2022-23.

NCCS owes its existence to India's visionary scientist and our Founder Director, the late Dr. Ulhas Wagh, who passed away on 11th March 2022. He was instrumental in introducing to the nation the concept of human tissue/organ bank way back in the mid-1980s. We began the year with the 'Dr. Ulhas Wagh Memorial Oration' instituted in his memory, to honour his invaluable contributions to the field of cell biology in India. Dr. Shekhar Mande, former Director of NCCS, and former DG, CSIR and Secretary, DSIR delivered a lecture on, 'How atomic details have enhanced our view of the biological world', to commemorate this occasion on 20 May 2022.

As one of India's leading research institutions, we continued our explorations of the biology of cellular processes involved in health and disease, to address issues like cancer, metabolic disorders, infectious diseases and immunity, neurological disorders, stem cells and regeneration, and the role of the human microbiome. Our research yielded over a hundred papers being published in leading international journals, including European Journal of Immunology, Journal of Investigative Dermatology, Journal of Leukocyte Biology, FEBS Journal, FASEB Journal, PLOS Pathogens, Microbiology Spectrum, etc. The value and impact of our research also received recognition in the form of prestigious awards and grants won by our scientists. Our students too, did us proud by winning awards for their papers presented at national and international conferences, as well as by earning very competitive travel awards.

NCCS plays a significant role in capacity building of the nation through various academic initiatives via which we provide high-quality training in research to budding young talent. This includes our PhD programme, as well as summer training via the Indian Science Academies' Summer Research Fellowship and project training for college students. We encourage and facilitate our PhD students to share their work widely with the scientific community by providing financial support to attend national and international conferences, meetings and workshops. During the year under report, eight students attended international events, and six students attended national events with the help of this support. Additionally, we also facilitate postdoctoral and other early career scientists to embark on their careers by providing them with space and other resources, as well mentorship from our faculty. We supported eleven such researchers this year, including a DBT- Wellcome Trust /India Alliance Early Career Fellow, M. K. Bhan Young Researcher Fellows, a DBT-RA, DST Inspire Faculty Fellows, a CSIR-RA, ICMR-RAs, and a SERB-N-PDF.

Given the importance of collaborations between scientists and clinicians, we organized various events this year, such as the EMBO Lecture Course on: 'Complement in Kidney Diseases', in association with Imperial College London, and AIIMS, New Delhi. This served as a platform for discussions between clinicians and complement biologists on the recent research advances in this field, and to facilitate collaborations between them. We also hosted at NCCS a symposium on 'Integrative Health & Personalised Medicine' in association with the Maharashtra University of Health Sciences (MUHS),

Nashik. Furthermore, we initiated an academic exchange programme this year, through which students enrolled in the MBBS programme spent a few weeks at NCCS shadowing our scientists in the research laboratory.

We are also aligning our endeavours with the current national needs, such as the demand for bio-based circular carbon economy through bio-manufacturing, as emphasized by the Department of Biotechnology. During this year, we have initiated discussions with the industry to explore possibilities to leverage our microbiology-related expertise and resources for this purpose, which we hope to fruitfully take forward in the coming years.

In addition to research and capacity building, we are also committed to bridging the gap between science and society via public engagement. Our outreach activities during this year included public talks by two Nobel laureates, Sir Richard Roberts (1993 Nobel Laureate in Physiology or Medicine) and Prof. Harold Varmus (1989 Nobel Laureate in Physiology or Medicine).

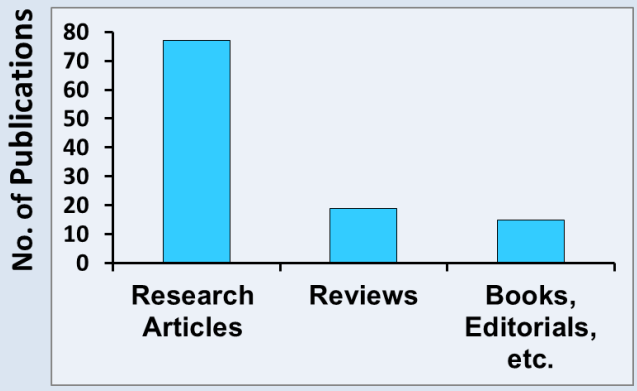
Moving forward, NCCS plans to expand its horizons and has initiated this journey by scoping property in another area of Pune, for this purpose. We have also welcomed several young scientists into the NCCS family in recent times, who bring in fresh perspectives on science. We look forward to having them take the initiative, and chart a path that keeps NCCS at the leading edge of scientific discovery, in alignment with the national needs, as well as global sustainable development goals (SDGs).

I invite you to learn more about our research and other activities, which are covered in the annual report that follows.

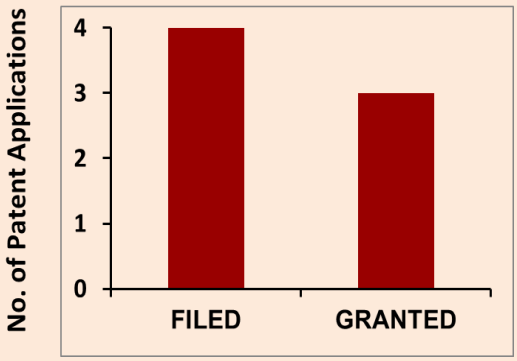
Mohan R. Wani
Director, NCCS

MAJOR HIGHLIGHTS (2022–23)

PUBLICATIONS



PATENTS



GRANTED – USA: 1, India: 2 FILED – India: 3, PCT: 1

REPRESENTATIVE PUBLICATIONS

JID Journal of INVESTIGATIVE DERMATOLOGY

Vγ2⁺ γδ T Cells in the Presence of Anti-CD40L Control Surgical Inflammation and Promote Skin Allograft Survival

European Journal of Immunology Basic·Clinical·Translational

IL-3 regulates the differentiation of pathogenic Th17 cells

Microbiology Spectrum — AMERICAN SOCIETY FOR MICROBIOLOGY

Two-Dimensional Cell Separation: a High-Throughput Approach to Enhance the Culturability of Bacterial Cells from Environmental Samples

The FEBS Journal

Balance between autophagy and cell death is maintained by Polycomb-mediated regulation during stem cell differentiation

JLB JOURNAL OF LEUKOCYTE BIOLOGY

In vitro-induced Foxp3⁺CD8⁺ regulatory T cells suppress allergic IgE response in the gut

The FASEB Journal

DNAJB8 facilitates autophagic-lysosomal degradation of viral Vif protein and restricts HIV-1 virion infectivity by rescuing APOBEC3G expression in host cells

BENEFICIARIES OF THE ACADEMIC & POSTDOCTORAL PROGRAMMES

Students awarded with a Ph.D. degree	23
Science Academies' Summer Research Fellows & Project Trainees	75
Students enrolled in the PhD coursework at NCCS	65
Students who received financial support from NCCS to attend international events	8
Students who received financial support from NCCS to attend national events	6
Postdoctoral fellows & other early-career scientists supported at NCCS	11

HUMAN RESOURCE DEVELOPMENT

The beneficiaries of the NCCS academic programmes during the year 2021-22 are as follows:
40 Research Fellows joined NCCS, and 35 research scholars registered for a Ph.D. with the University during this year, taking the total number of registered Ph.D. students to 124, as on 31st March, 2023. 17 students submitted their theses to the University for evaluation and 23 students were awarded with a Ph.D. degree during the said year.

NCCS also conducts training programmes for students every year, as given below:
a) Project training is imparted either over 6-months' twice a year (during January-June and July-December), or over one year.
b) Summer training is conducted for 2 months during May-June. The summer trainees are selected from among the Indian Academy of Sciences Summer Research Fellows, IIT's etc. of the respective year.

The number of students who received training under these programmes during 2022-23 is as follows:
Project Trainees: 62 Summer Trainees: 13

Conferences, workshops, etc. attended by the students

(i) International
* Number of conferences, workshops, events attended: 8
* Number of students who received financial support from NCCS: 8

(ii) National:
* Number of conferences, workshops, events attended: 26
* Number of students who received financial support from NCCS: 6

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CELL REPOSITORY

The Team
Dr. Punam Nagvenkar
Scientist E (Repository In-charge)
Dr. Rahul Patil, Scientist D
Mrs. Tanuja Bankar, Technical Officer C
Dr. Varsha Shepal, Technical Officer C
Mrs. Nivedita Bhave, Technical Officer C
Mrs. Anjali Patekar, Technical Officer C
Mr. Dharmendra Bulbule, Technical Officer B
Dr. Bhimashankar Utage, Technical Officer A
Mr. Vikas Mallav, Technician C
Mr. Yogesh Kumbhar, Assistant Technician

NCCS has been serving as a National Cell Repository for cell lines in India, wherein we perform the expansion, cryopreservation and distribution of cell lines to researchers in academia and government as well as private research institutions and industry in the country. In the year 2022-23, four thousand five hundred and two cell cultures have been provided to 2422 users in the country across five hundred thirty-two organizations. Besides, we have also supplied one hundred and thirty cell cultures (including NCI cell lines) to scientists in NCCS. Moreover, we provide various types of cell culture media to in-house scientists and have supplied 334 litres in the reporting year. The services for cell line authentication by Short Tandem Repeat (STR) analysis and Mycoplasma testing have been given to both in-house scientists and external users. We made efforts to encourage scientists from NCCS and other organizations to deposit their indigenously developed or modified cell lines in Cell Repository. Work towards the establishment of cell lines from different human cancer tissues such as breast, liver, and lung has also been initiated.

We organized national hands-on training workshop on “Basic Cell Culture Technology” from February 20-23, 2023. Training for important cell culture practices related to cell line maintenance, expansion, cryopreservation, revival and other specialized techniques were included in the workshop. Early career researchers including doctoral students, young faculty and technical staff from academic and non-academic institutions from all over the country were selected and imparted training. A total of 20 participants (15 PhD Scholars, 2 Faculty, 3 Technical) from 20 below-mentioned institutes across the nation have been imparted training.

- ICAR- Central Institute of Fisheries Technology, Cochin, Kerala
- Central University of Karnataka, Kadaganchi, Karnataka
- CSIR-National Chemical Laboratory (CSIR-NCL), Pune, Maharashtra
- Tocklai Tea Research Institute, Cinnamora, Jorhat
- All India Institute of Medical Sciences, Kalyani, West Bengal
- Indian Institute of Science Education and Research (IISER), Bhopal Madhya Pradesh
- Savitribai Phule Pune University, Pune, Maharashtra
- Smt. Kasturbai Walchand College of Arts and Science, Sangli, Maharashtra
- D.Y. Patil Education Society Deemed to be University, Kolhapur, Maharashtra
- Indian Institute of Science Education and Research (IISER), Berhampur, Odisha
- Institute of Advanced Study in Science and Technology (IASST), Guwahati, Assam
- CETMS, Institute of Technical Education and Research Siksha ‘O’ Anusandhan, Dhenkanal, Odisha
- B.N. Sarda Science College, Sangamner, Maharashtra
- Parul University, Vadodara, Gujarat
- Venkateshwara Hatcheries Pvt. Ltd., Pune, Maharashtra
- MSJ Government PG College, Bharatpur, Rajasthan
- Institute of Veterinary Biological Products, Pune Maharashtra
- Banaras Hindu University, Varanasi, Uttar Pradesh
- B.P.H.E. Society's, Ahmednagar College, Ahmednagar, Maharashtra
- GITAM (Deemed to be University), Rushikonda, Visakhapatnam

We have participated in outreach programs such as Biotech Startup Expo 2022 from June 9-10, 2022 at New Delhi and India International Science Festival (IISF 2022) from January 21-24, 2023 at Bhopal. Besides out-reach event on National Science Day on February 28, 2023, we also had visit of students from various institutes to Cell Repository:

- Saraswati Vishwa Vidyalaya National School, Pune on August 22, 2022.
- Poona College, Pune on October 10, 2022.
- Shri Shivaji College of Agricultural Biotechnology, Amravati on December 6, 2022.
- Ramniranjan Jhunjhunwala College, Mumbai on December 14, 2022.
- Smt. Kasturbai Walchand College of Arts and Science, Sangli on March 29, 2023.

In all the events, information was provided regarding the importance and usage of cell lines in research along with the services of Cell Repository.

Participants of the national training workshop on ‘Basic Cell Culture Technology’	

Research Reports

RESEARCH REPORTS

Investigating Adult Stem Cells Dynamics in the Infection Scenario

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Lab members
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Nimish Deshpande, JRF
Puja Bharti, Project Assistant

Academic Collaborator(s) – National
Dr. Santosh Mathapati, THSTI, Faridabad
Dr. Gaurav Das, NCCS, Pune
Dr. Santosh Kumar, NCCS, Pune

Background

Tissue-resident adult stem cells (ASCs) play a vital role in maintaining tissue health and promoting tissue regeneration. However, chronic bacterial infections often damage tissue and cause delay in wound healing/regeneration. These delays in healing contribute to increased morbidity and mortality in various conditions such as burn wounds, diabetic foot ulcers, septicemia, pneumonia, and more. Consequently, there is a significant need to develop interventions that can expedite and restore the healing of infected tissues, which holds great biomedical significance.

Objectives of the study

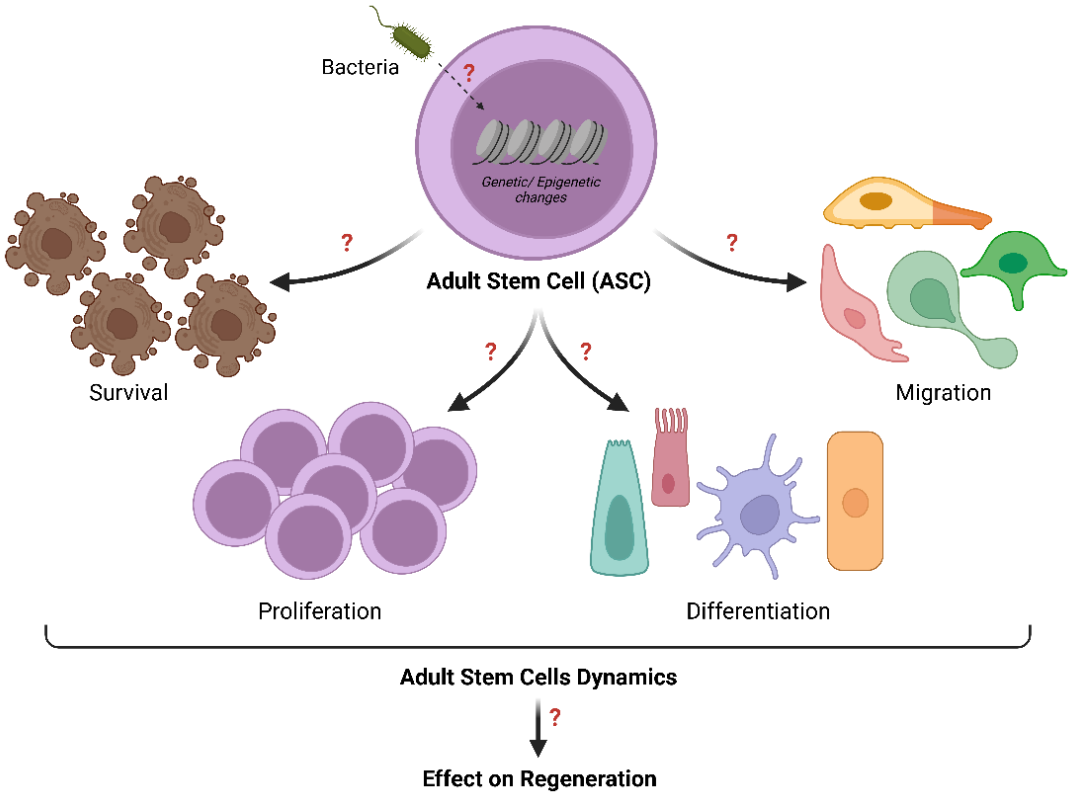
- To investigate the effect of bacterial infection on adult stem cell dynamics and regeneration.
- To investigate the genetic and epigenetic mechanisms regulating adult stem cell dynamics after bacterial infection.

Summary of the proposed research

Adult stem cell dynamics (i.e., survival, proliferation, differentiation, migration) need to be precisely regulated for successful tissue regeneration and maintaining tissue health. Several recent studies have highlighted the adverse impact of different bacterial and viral infections on the dynamics of various types of ASCs. However, the underlying mechanisms through which these pathogens alter the function and dynamics of ASCs remain poorly understood. Therefore, our research aims to investigate how bacterial infections affect the function of ASCs and their role in tissue regeneration. We utilize the planarian model system (Schmidtea mediterranea) to study the in vivo dynamics of ASCs in response to infection. Additionally, we employ a mouse model to examine the impact of bacterial infections on the functionality and dynamics of hematopoietic stem cells (HSCs). Our objective is to uncover the mechanisms by which bacterial pathogens impair the functionality of ASCs and hinder tissue regeneration. Furthermore, we will explore the genetic, epigenetic, and metabolomic changes that regulate ASC dynamics in the context of infection.

We envision that the knowledge gained from this study will play a vital role in the future development of interventions aimed at expediting and restoring the healing of infected tissues. Additionally, we expect that this research will enhance our ability to counteract the adverse effects of chronic bacterial infections on hematopoiesis, ultimately strengthening the overall functionality of the immune system.

Graphical Abstract



Identification of a Novel Transcript Variant of ITGB8 and Its Functional Contribution to Ovarian Cancer

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Lab members
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Amruta Jadhav, SRF
Aravindan Narayanan, SRF
Ritika Gupta, JRF
Sushmita Sahoo, Project JRF
Darphan Phagiwala, JRF
Vinay Boya Sannannagari, Project JRF
Avinash Mali, Technical Officer B

Background

Transcript variants and protein isoforms are central to the unique functions of cells and contribute to maintenance of tissue homeostasis; these are also associated with aberrant states such as cancer. Our previous ovarian cancer RNA-sequencing data analyses had identified three novel splice variants. In the present report, we validated these and further chose to elucidate the biological effects of the Integrin Subunit Beta 8 (ITGB8) variant, which we termed ITGB8-206, in ovarian cancer.

Objectives of the study

- Identification and characterization of a novel transcript variant of ITGB8
- Elucidation of functional contribution of this novel variant to ovarian cancer

Work Done

We identified a novel ITGB8 103bp sequence that localized to Exons 2 and 4 (47bp and 86bp respectively) of which, Exon 2 is absent in the canonical and reported variants. This novel sequence was expressed across all ovarian cancer cell lines screened at varying levels. We elucidated its full-length sequence (FL;2316 bp) through rapid amplification of 5' and 3' cDNA ends (RACE). An exclusive feature associated with FL_ITGB8-206 was the presence of a unique 88bp 5' UTR sequence (from Exon 1 and not associated with any of the other variants), while the 3' UTR sequence was identical across all variants.

Extensive cell cycle profiling, stemness and metabolic assays further established that ITGB8-206 expression appears to perturb cell growth, cycling and metabolism (increased glycolysis and enhanced energy generation), and perhaps may also contribute to self-renewal of ovarian cancer cells. More importantly, overexpression of ITGB8-206 is associated with replicative stress through increased genomic and mitotic instabilities. The most significant of these were chromosomal segregation errors including lagging chromosomes, anaphase bridges and mitotic cortical blebbing that is associated with cytokinesis failure characterized by cleavage furrow regression leading to mitotic catastrophes; other nuclear aberrations such as a significantly increased frequency of micronuclei along with emergence of notched, ring, blebbed and lobed nuclei. Detailed karyotyping of cells overexpressing ITGB8-206 revealed an increased number of marker chromosomes.

Strikingly, these effects were associated with an increased resistance to apoptosis induced by γ-irradiation. These pathways were further reflected in the global transcriptomics and proteomics profiles (datasets) of cell derivatives that overexpressed or were deleted for ITGB8-206.

Conclusively, we have identified a novel, conserved transcript variant of *ITGB8*. A detailed functional annotation of this variant indicates that it induces replicative stress and aneuploidy associated with a diversity of structural and numerical chromosomal aberrations in cancer cells. The aneuploid phenotype also leads to an increased demand of energy for cellular homeostasis, and can contribute to self-renewal and resistance to apoptosis through enhanced DNA repair.

Figure

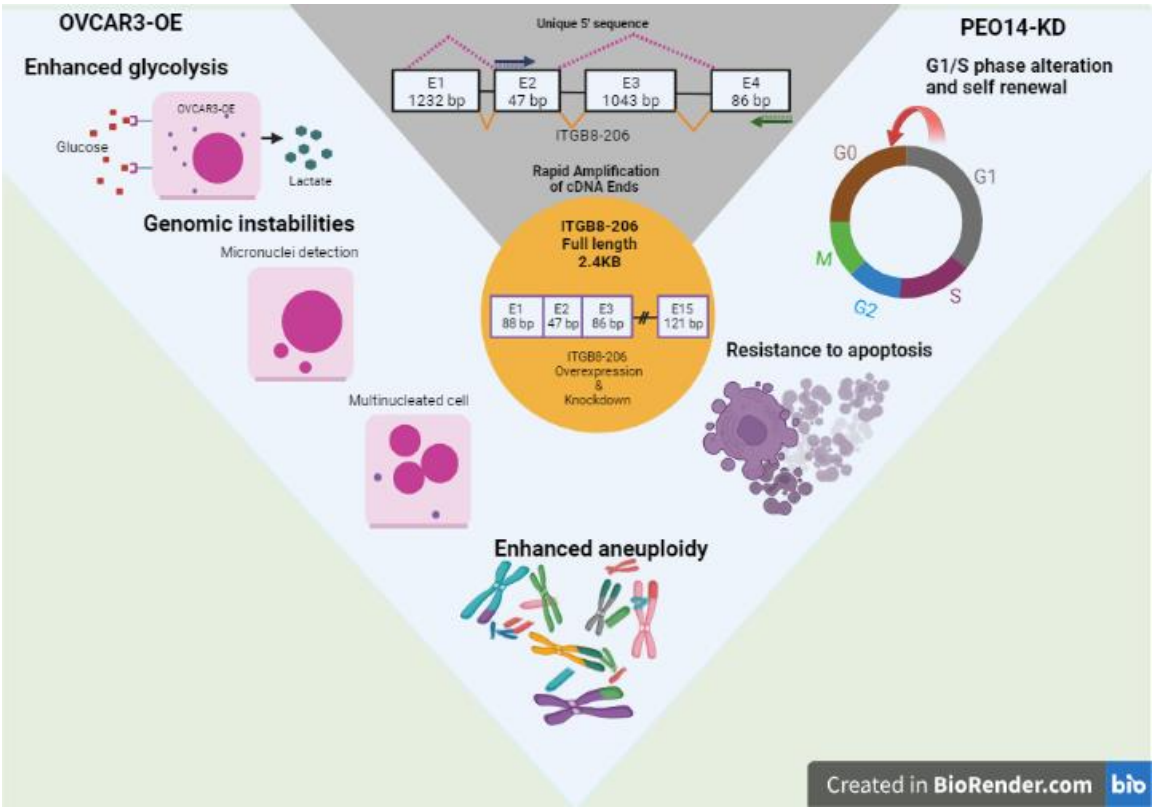

Fig. Legend: Functional Effects of a novel variant of *ITGB8* (ITGB8-206) in ovarian cancer

Dynamics and Diversity in B cell Responses upon Infection and Vaccination

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Hariom Goswami, JRF
Spriha Ghosh, JRF
Girish Malagi, M.Sc. Student
Anuradha Bulbule, Technical Officer B

Academic Collaborator(s) – National
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Dr. Vishal Rai, IISER Bhopal
Dr. Ram Kumar Mishra, IISER Bhopal
Dr. Satyendra Kumar, KGMU, Lucknow
Dr. Santosh Kumar, CCMB Hyderabad
Dr. Radha Chauhan, NCCS, Pune

Collaborator(s) – Clinicians
Dr. Saurabh Bobdey, AFMC, Pune, India
Dr. Sourav Sen, MUHS, Nashik, India
Dr. Santosh Karade, AFMC, Pune, India
Dr. Sandip Bertekke, Surya Hospital, Pune, India

Collaborator(s) – Industry
PredOmix Technologies Private Limited, Gurgaon, Haryana, India
Bharat Biotech International Limited, Hyderabad, Telangana, India
Enzene Private Limited, Pune

Background

Increasing awareness of broadly neutralizing antibodies for HIV, influenza and other pathogens in human patients and their therapeutic potential has brought B cells to the forefront of immunology research. B cells are now the major targets of current vaccines and therapeutics. Therefore, it is of utmost importance that we gain a complete understanding of the spatial and temporal activation of B cells in a context-dependent manner. B cells are crucial player of the adaptive immune system that recognize antigens through clonally expressed B cell receptors (BCR) on their surface and secrete highly specific antibodies against them. BCR is the central antigen recognition receptor and the BCR repertoire is highly diverse. Following infection, the diversity in BCR repertoire is further amplified by somatic hypermutation and affinity maturation. Our lab tries to understand the changes in the BCR repertoire, selection of specific BCR clones and their dynamics during transition from naive to memory B cell population in response to vaccination and infection.

Objectives of the study

- Understanding the diversity and dynamics in B cell response upon infection and vaccination
- Generation of novel human monoclonal antibodies against the SARS-CoV2
- Generation of murine monoclonal antibodies against NIPAH virus for diagnostics

Work Done

The COVID pandemic has resulted in huge health and economic burden across the globe. My laboratory is trying to understand the B cell responses against SARS-CoV2 and other pathogens that have the potential to cause pandemic. We are trying to identify specific BCR clones that are crucial in fighting against different pathogens. Numerous specific antibodies are generated following pathogen encounters that neutralize the pathogen and result in its eventual removal. In all recent virus outbreaks, broadly

neutralizing human monoclonal antibodies have been found to be most effective and timely for both prophylactic and therapeutic use. During our efforts to understand the antibody response in COVID-19 patients, we have generated human monoclonal antibodies against Spike protein many of which are able to neutralize the SARS-CoV2 both Wuhan and Delta strain. We have transferred a few clones to Bharat Biotech for further development. In addition to generating antibodies against spike, my lab has also generated clones against Nucleocapsid protein, another highly immunogenic protein of SARS-CoV2. These clones have the potential to be utilized for diagnostics and therapeutics.

In collaboration with AFMC we looked at the durability, and quality of SARS-CoV2 specific antibody responses upon Covishield vaccination in COVID-19 naive and experienced individuals. We find that the Wuhan, Delta and Omicron specific antibodies wane between 4 to 6 months of second dose of Covishield in both COVID-19 naive and experienced individuals. However, waning is relatively slower in SARS-CoV2 experienced individuals. Moreover, booster dose significantly increases the antibodies specific against Wuhan, Delta and Omicron Spike and neutralizing antibody titres to Wuhan and Delta strain. Neutralizing antibody titres to Omicron and XBB1.5 remain very low even after third/booster dose or breakthrough infections. This study is useful in tracking the durability and the nature of the antibody responses against variants of concerns in vaccine recipients.

Structural and Functional Studies on Components of the Nuclear Pore Complex

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Lab members
Priyanka Dutta, Inspire faculty
Shrankhla Bawaria, SRF
Jyotsna Singh, DBT project SRF
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Aswathy LB, JRF
Virashree Jamdar, Technician C

Collaborator(s) – National
Sharmistha Banerjee, University of Hyderabad, Hyderabad, India
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Background

Nuclear pore complexes (NPCs) function as the exclusive gateways between the nucleus and the cytoplasm to facilitate bi-directional nucleocytoplasmic transport, and is composed of the 32-34 different type of protein known as the nucleoporins (Nups), which are present in multiple copies (8, 16, 32, or up to 48) to form a highly modular and dynamic structures. These Nups are arranged in various sub-complexes namely; cytoplasmic ring (CR), inner ring (IR; Nup93 subcomplex), Y-shaped complex, nuclear ring (NR) and a central transport channel (CTC). Among them, Nup62 is known as an essential component of the various subcomplexes; (1) CTC complex (Nup62•Nup54•Nup58) which forms the central transport channel of the NPC, thus regulating the nucleocytoplasmic transport across the NPC and (2) cytoplasmic ring Nup88 complex (CR; Nup88•Nup62•Nup214), which is positioned over the CTC complex, exclusively involved in the mRNPs remodelling and mRNA export. The unusually large size together with its conformational plasticity poses challenges for its 3D structure determination at atomic resolution. Moreover, the complete interaction network of these sub-complexes, their biochemical behaviour, role in the NPC assembly and transport activity remain unanswered till date.

Objectives of the study

- Reconstitution of minimally interacting regions of Nup93 subcomplex to understand their roles in assembly of the NPC.
- X-ray crystallographic and/or cryo-EM studies on reconstituted complexes of Nups.
- Analysis of the Nups in regulating transport activity and NPC assembly.

Work Done

We developed several tools to decipher protein-protein interactions of NPC, such as a novel computational pipeline for the prediction of protein-protein interaction interfaces from the amino acid sequence information named CoRNeA.

We employed this tool to demonstrate crosstalk among the members of the human Nup93 subcomplex that consists of the five proteins viz., Nup93, Nup188, Nup205, Nup35, and Nup155 as well as with their neighbouring complexes: the CTC and CR complexes. We have delineated the interacting regions and performed biochemical reconstitution and structural characterization of the mammalian Nup88 complex to reveal its intrinsic dynamic behaviour and a distinct ‘4’ shaped architecture resembling the mammalian CTC complex. Briefly, our in vitro reconstitution data demonstrate that the Nup62 coiled-coil domain is critical to form both Nup62•Nup88 and Nup62•Nup88•Nup214 heterotrimers and both can bind to the Nup93. We therefore propose that Nup93 act as a 'sensor' to bind to Nup62 shared heterotrimers including Nup62•Nup54 heterotrimer of the CTC, which was not shown previously as an interacting partner. We further determined the low-resolution 3D structure of Nup88•Nup62•Nup214 complex and revealed that the beta propeller domain of Nup8 and Nup214 interact with each other under biochemical conditions. The cryo-EM based atomic resolution structure determination work is under progress. Similar studies with Nup155 and Nup93 are under progress.

Significance: Our study establishes that the Nup62 is a hub protein and its coiled-coil domain is central to form compositionally distinct yet structurally similar hetero-trimers, and the Nup93 anchors these diverse hetero-trimers by recognizing them non-selectively, which may play a role in regulating the nucleocytoplasmic transport. All these studies are leading us to understand the roles of Nup93 and Nup62 in various human health conditions such as cardiovascular diseases and genetic diseases.

Graphical abstract

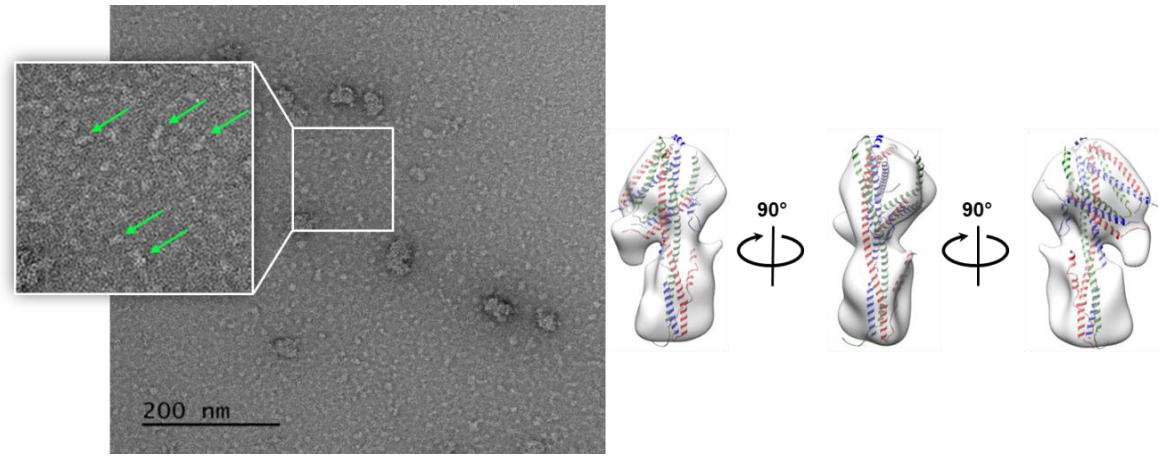

Figure: Electron microscopy-based 3D reconstruction of mammalian Nup62•Nup88•Nup214 complex.

A: negatively stained micrograph with zoom section showing single protein complex.

B. 3D density map of the coiled-coil domain of the Nup62(red)•Nup88(green)•Nup214(blue) complex

The Gut-Brain-Gut Axis in Neural Regulation of Feeding and Emesis in *Drosophila*

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Background

Proper gut-brain communication is critical for multiple aspects of human health and behavior. Nutrient sensing versus toxin sensing in the gut will activate distinct neuronal pathways involving the endocrine cells in the gut, the gut-innervating neurons, and then relevant neuronal circuits in the brain. Nutrient sensing pathways will influence metabolism, hunger, satiety, memory formation, and ultimately feeding behavior. Sensing toxin or toxin-induced visceral malaise, will trigger protective behavior like vomiting and could also reinforce learning and memory formation that leads to subsequent avoidance of the toxic food source. Cytotoxic drug treatments in cancer patients and other drugs too causes similar effects. This could lead to strong avoidance of treatment. Gut disorders, like irritable bowel syndrome or inflammatory bowel disease, could also affect mood, behavior and cognition via the same pathways. Hence, we need a good understanding of such pathways to design drugs and interventions that could reverse feeding and metabolism disorders or ameliorate the effect of gut pathology on the brain and the rest of the body.

Objectives of the study

- Gut-brain-gut circuitry for naive emesis, learned emesis, and regurgitation.
- Nutrient specific memory maps and how chronic diets affect feeding.

Work Done

We have established *Drosophila* as a novel genetic model for studying the neural circuitry of toxin ingestion-induced (quinine, caffeine, copper sulphate, lithium chloride, etc.) emesis/vomiting. Using pharmacological and neurogenetic approaches, we have found that, like in mammals, emesis in flies is also dependent on serotonin and dopamine signaling. We see that serotonergic neuron (5HTNs) signals to dopaminergic neurons (DANs) via a serotonergic receptor in causing emesis. We have narrowed this signaling to a small group of dopaminergic neurons that are known to innervate the fly brain structures involved in learning and memory, the mushroom bodies (MBs). These DANs are known to reinforce aversive signals from diverse aversive modalities like bitter taste, heat, and electric shock.

We have also identified gut innervations that are involved in emesis through a genetic screen. These neurons innervate a muscular pouch called the crop, a stomach equivalent in insects. We have evidence that the crop is essential for emesis. When we genetically (acutely) silence these crop innervating neurons, emesis is inhibited, even though the flies feed.

We have developed a fly model of anticipatory/learned emesis, where an odor cue previously associated with an emetic episode, later triggers emesis even without toxin ingestion. Our ongoing works suggest that the internal sickness/malaise state caused by toxin ingestion provides the aversive teaching signal that reinforces long lasting memory of malaise. We have evidence that the memory relevant MB circuitry is involved in learned emesis. This model will be an excellent system to understand how anticipatory emesis occurs in patients undergoing chemotherapy. Emesis is triggered in such patients merely at the sight and sound of the clinic where they had received chemotherapy.

We have also observed that flies show regurgitation of ingested as a result of excessive feeding. This is not caused by toxin ingestion. Unlike emesis or learned emesis above, this behavior is sexually dimorphic. This could be an excellent model for conditions like rumination syndrome, where patients unintentionally and repeatedly bring up semi-digested food in their mouth.

Individual nutrient components of food are remembered discretely from complex food. Operationally, this means that if flies are exposed to an odor, when they are feeding on a rewarding nutrient like a sugar, they form an associative memory between the two. The odor becomes predictive of the sugar reward and flies exhibit an increased approach to the odor when later exposed to it. Work from my postdoctoral laboratory and others has shown that sweet taste, and the nutrient value of sugar, and water can reinforce appetitive memories. My own work as a postdoc showed that bitter taste can also reinforce aversive memories; flies show avoidance of the paired odor. Such reinforcement of memories is entirely dependent on a distinct set of DANs, all of which innervates the MBs. This means that temporally silencing these distinct DANs prevents the flies from forming a memory with the specific food component. Incidentally, the same DANs are responsible for learning bitter taste and also for emesis/learned emesis. To further extend this dopaminergic 'map' for other nutrients, we wanted to develop learning and memory assays reinforced with other major macronutrients, like proteins/amino acids and fatty acids.

Graphical Abstract

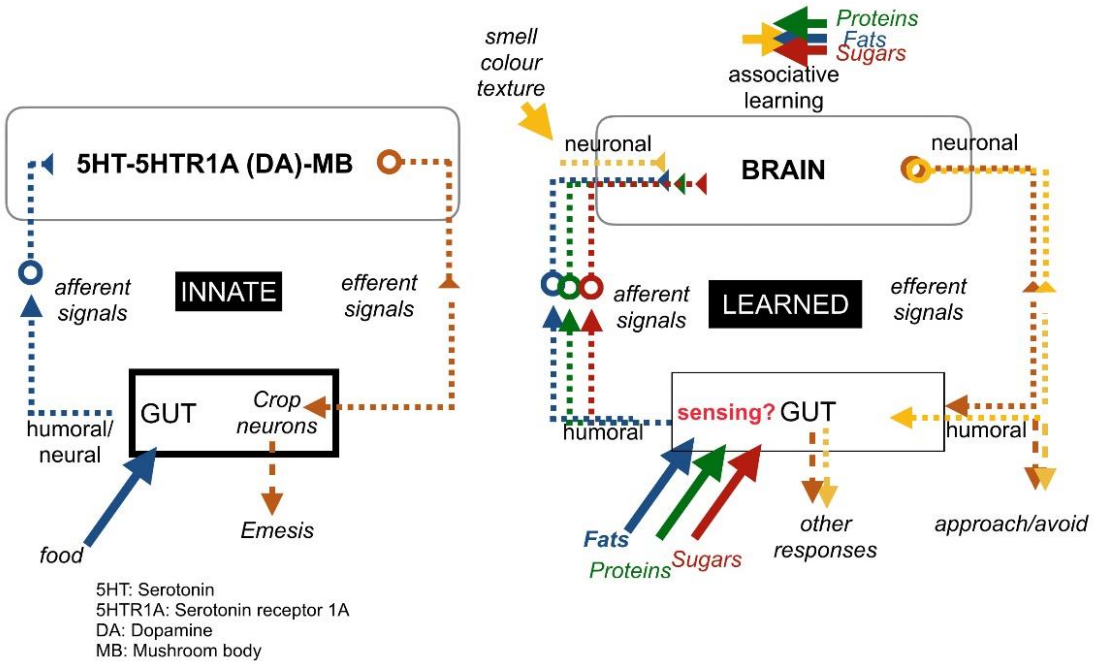

Fig. Legend:
Left Panel: Serotonin and Dopamine, like in mammals, control emesis in flies: We have established the link between neurons expressing serotonin and dopamine in controlling emesis.
Right Panel: We are studying the neural pathways of fat taste memory formation in the fly brain: This could help us understand how nutrient-specific memories guide food choice.

Human Microbiome Initiative of Select Endogamous Populations of India

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Background

The human microbiome is a national flagship program of DBT and NCCS which was initiated with the vision to map a reference microbiome of healthy individuals across the country. With the vision of our scientist and strong support from DBT, we have initiated this program to map the reference microbiome of 3400 healthy individuals across 11 non-tribal and 6 tribal communities spread across the country. It is a multi-institutional project led by NCCS and you can see in the figure different communities and institutes involved in sample collection. As of now, we have finished sampling 3451 healthy individuals across the country. We have finished sequencing more than 13000 libraries and 3380 full microbiomes for these samples. Modern computational analysis tools like Next generation sequencing technology,

machine learning, R programming, and Python programming are involved in analyzing this huge amount of data. Approximately 100,000 sequencing reads are analyzed from every library. Also, the high usage of spices and condiments plays an important role in shaping the microbiome of the Indian population. Similarly, people with vegetarian and non-vegetarian diets have different microbiomes indicating the impact of specific diet groups on the microbiome. It will be interesting to know how these changes affect the general health of an individuals.

Objectives of the study

- To characterize and generate baseline gut microbiome data for selected endogamous communities with varied dietary and lifestyle patterns.
- To harmonize/standardize the protocol for sample collection, transportation, sample processing, and sample preservation.
- To decipher the influence of diet and lifestyle on the gut microbial community composition and structure.

Work Done

The human microbiome project aimed to map the reference microbiome of 3500 healthy individuals across 11 non-tribal and 6 tribal communities spread across the country. It is a multi-institutional project led by NCCS and you can see in the figure different communities and institutes involved in sample collection. As of now, we have finished sampling 3451 healthy individuals across the country. We have finished sequencing more than 13000 libraries and 3380 full microbiomes for these samples. Modern computational analysis tools like Next generation sequencing technology, machine learning, R programming, and Python programming are involved in analyzing this huge dataset. Approximately 4 lakh bacterial sequences are analyzed from every library.

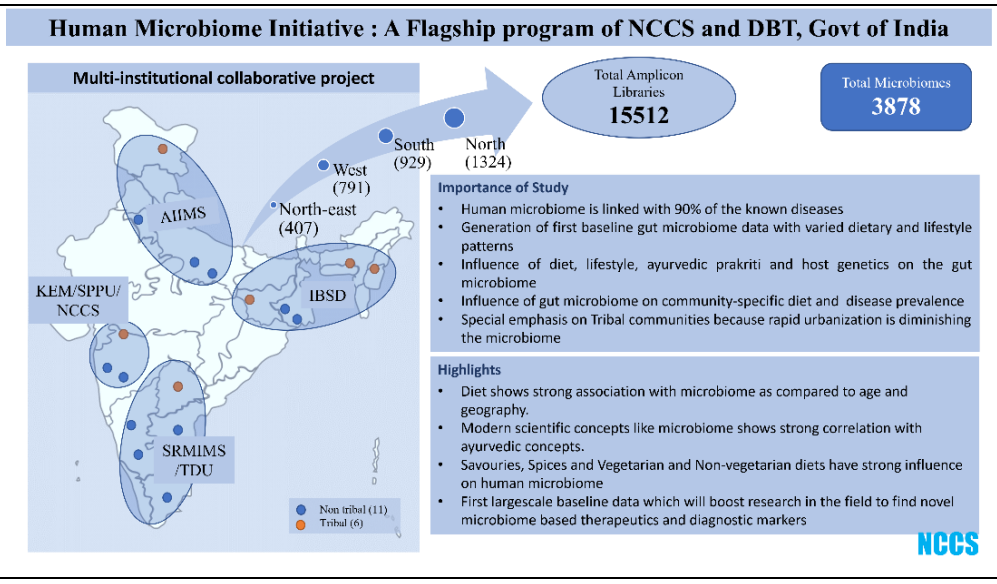
India is a highly diverse country in many aspects including ethnicity and diet. A strong correlation between microbiomes is observed with dietary habits, unlike in other countries where ethnicity and geography have a major impact on the microbiome. We have also assessed Ayurvedic Prakriti of a subset of these individuals and surprisingly, modern science has shown a strong association with concepts of Ayurveda.

Also, the high usage of spices and condiments plays an important role in shaping the microbiome of the Indian population. Similarly, people with vegetarian and non-vegetarian diets have different microbiomes indicating the impact of specific diet groups on the microbiome. It will be interesting to know how these changes affect the general health of individuals.

In the future, we are planning to expand this study to include specific disease models and see their association with the microbiome. This will help us develop future microbiome-based therapeutics, precision probiotics, and microbiomes as an indicator of preventive health.

Figure

Graphical abstract of the complete study and research highlights, and expected outcomes.



SUMOylation Modulates the Function of DDX19 in mRNA Export

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Background

Nuclear export of mRNAs is a critical regulatory step in eukaryotic gene expression. The mRNA transcript undergoes extensive processing, and is loaded with a set of RNA-binding proteins (RBPs) to form export-competent messenger ribonucleoprotein particles (mRNPs) in the nucleus. During the transit of mRNPs through the nuclear pore complex (NPC), the DEAD-box ATPase - DDX19 - remodels mRNPs at the cytoplasmic side of the NPC, by removing a subset of RNA-binding proteins to terminate mRNP export. This requires the RNA-dependent ATPase activity of DDX19 and its dynamic interactions with Gle1 and Nup214. However, the regulatory mechanisms underlying these interactions are unclear.

Objectives of the study

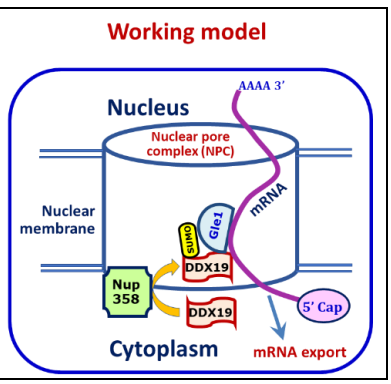
- To determine how DDX19 is involved in interaction with multiple partners during mRNA export cycle.
- To determine whether post-translation modifications play any role.

Work Done

We find that DDX19 gets covalently attached with a small ubiquitin-like modifier (SUMO) at lysine 26, which enhances its interaction with Gle1. Furthermore, a SUMOylation-defective mutant of human DDX19B, K26R, failed to provide a complete rescue of the mRNA export defect caused by DDX19 depletion. Collectively, our results suggest that SUMOylation fine-tunes the function of DDX19 in mRNA export by regulating its interaction with Gle1. This study identifies SUMOylation of DDX19 as a modulatory mechanism during the mRNA export process.

Figure

Fig. 1: Working model for SUMO-dependent regulation of DDX19 in mRNA export at the nuclear pore complex. DDX19 plays a crucial role in the termination of mRNA export at the nuclear pore complex. We find that SUMOylation enriches DDX19 at the nuclear envelope, facilitates its interaction with Gle1 and modulates the mRNA export function. Nup358, a nucleoporin present at the cytoplasmic side of the nuclear pore complex (NPC) is important for the SUMOylation of DDX19.



In vitro Selection of Bacterial Populations Against Isoniazid did Prevent Onset of Infection

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Background

Isogenic populations growing in an environment are assumed to represent identical population members. However, this notion is slowly changing as the presence of biological noises is imminent due to intrinsic or extrinsic influences resulting in 'noisy' population members. The presence of significance of these noisy populations adds value to the population in the environment they are being subjected to. In vitro selection of bacteria against the first line drug Isoniazid helped us understand the presence and enhancement of subpopulation members that have the ability to infect tissues. The population members may express several molecules like Mh3867, TlyA and Esat6 on their cell surface. Our results suggest that immunization with these proteins together can prevent adverse outcomes against infection with *M. marinum* wild-type.

Objectives of the study

- To understand the establishment of *M. marinum* select populations under various drug-selections.

Work Done

Infection of TlyA and Esast-6 immunized with by *M. marinum*

Several Groups of mice immunized with TlyA and Esat-6 were infected with *M. marinum* WT grown in 7H9 medium at 28˚C. The uninfected control group upon with infection with *M. marinum* wild type exhibited full scale symptoms of infection of tissue and bone erosion (Fig 1). The pathological symptoms gradually worsened from 8 days post infection (DPI) to 22 DPI. While both the immunized mice groups exhibited significantly reduced pathological symptoms compared to the unimmunized control group. This was evident through the physical appearance of the various well-characterized virulence symptoms such as tail lesion size, multiplicity of the lesions, tail deformation and tail tip loss to complete tail loss. The histopathology of the sagittal sections of the infected tails were undermined to analyse the extent of the immune cells infiltration at the site of the lesion 22-DPI which suggest there was lesser infiltration in both the immunized groups mice tails compared to the un-immunized control group, whereas the bone erosion is substantially less in the both immunized group of the mice, which is further re-affirmed by the micro-CT imaging. These observations suggest that the Esat-6 and TlyA immunization is able to elicit protective response at late onset of the *M. marinum* WT infection

Mice infection with IRP and *M. smegmatis* Mc2155

C57(Bl/6) mice groups were infected with Isoniazid Resistant Population (IRP) and *M. smegmatis* Mc2155 to ascertain their virulence potential. The mice infected with IRP exhibited similar onset of symptoms emergence as that of *M. marinum* WT and the mice tail(s) developed lesions all across the tail. While, the mice infected with *M. smegmatis* Mc2155 didn't developed any pathological features as observed with the IRP and *M. marinum* WT infected mice.

Micro-CT imaging of the infected mice tails

The ability to induce bone erosion by IRP and *M. smegmatis* Mc2155 was further validated through micro-CT examination of IRP infected mice tails *M. smegmatis* Mc2155 as compared to *M. marinum* WT. The mice tails of IRP infected mice exhibited loss of vertebral architecture and significant bone

erosion (Fig. 7D). Though, the nature of bone erosion was slightly different as the bone become porous and lead to a decrease in the bone mass as, evident through the cross-sectional image of the vertebrae which subsequently resulted in the bone intensity below the normalization cut-off selected for the 3-D model preparation. The quantification of the bone erosion in terms of the bone mineral density (BMD) suggests a significant drop in the BMD of the IRP infected mice tails. Whereas, the *M. smegmatis* Mc2155 infected mice tails exhibited normal bone aperture with no bone loss.

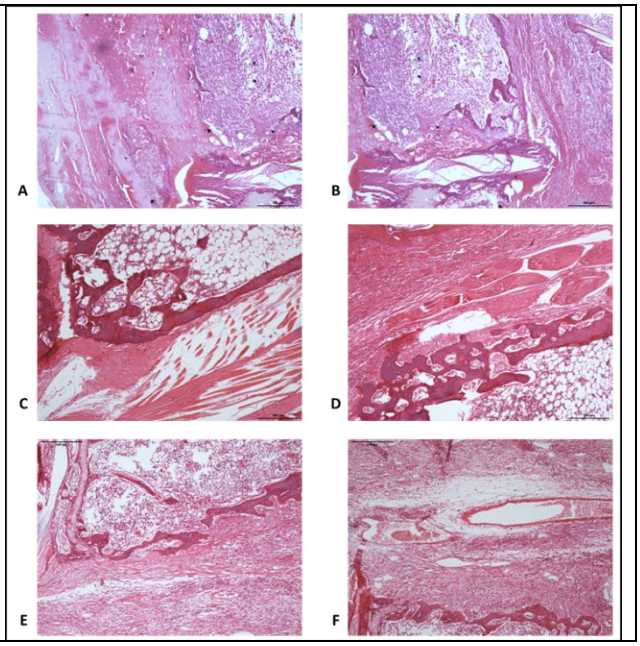
Conclusion

Various results based on cell surface expression of Rv3867 in Mtb H37Ra and Mh3867 in different *M. marinum* strains viz. *M. marinum* WT, M1 and M2 and TlyA and Esat-6 in *M. marinum* WT suggest the presence of EspH (Rv3867 and Mh3867), Esat-6 and TlyA protein on the cell surface. Although only a small fraction of the cells expressed these proteins on their cell surface which might be due to the noisy expression at the population level. The dual staining visualization suggested the co-localization of Esat-6 and TlyA noises at the population level like the Mh3867 and TlyA expression and were also co-localized to the cell surface of the *M. marinum* and Mtb H37Ra. The in-vivo infection studies on the Mh3867 immunized mice suggested that Mh3867 protein is not able to elicit the protective immune response against *M. marinum* infection in mice model, whereas the pathological features of the bone have been near normal in the immunized mice in comparison to the un-immunized control mice. Nevertheless, the bone erosion had been substantially reduced in the immunized mice that suggests the immunization is able to protect the bone erosion. Whereas the in-vivo infection studies carried on TlyA and Esat-6 immunized mice suggest that the mice immunized with these proteins are not able to protect against early on-set of infection by *M. marinum* but are able to control further progression of infection as evident through 22 DPI mice tail images. The subcellular fractionation study of *M. marinum* WT for TlyA and Mh3867 proteins shows that the TlyA protein is majorly localized to the cell surface that confirms it as a cell surface protein whereas the Mh3867 protein is present in all the fractions.

The IRP has retained its virulence potential and was able to inflict soft tissue damage as well as the bone erosion. The Micro-CT analysis of the IRP infected mice tails revealed the bone erosion, but the topology of the bone erosion is different form the bone erosion caused by the *M. marinum* WT which is further confirmed by the H&E staining. The H&E staining of the mice tails of the IRP infected mice tails showed very less infiltration of the immune cells in the bone marrow space; whereas, the soft tissues showed the infiltration of the immune cells. The lung pathology of the *M. marinum*, and *M. smegmatis* infected lungs is normal with normal and well space alveolar space. Similarly, the tail sections of the *M. smegmatis* infected mice are normal with no infiltration of the immune cells to the soft tissue as well as the bone marrow space and no bone erosion was observed. TlyA and Esat-6 immunization is not able to elicit protective immune response in the IRP infected mice.

Figures

Fig 1: Histopathology of the Esat-6 and TlyA immunized mice infected with *M. marinum* WT. The sagittal sections of the infected mice tails were stained with haematoxylin and eosin to ascertain the immune cells infiltration and the bone erosion and the image is captured at 10X. (A and B): Representative image of the sagittal sections of the Un-immunized control mice. (C and D): Representative image of the sagittal sections of the Esat-6 immunized mice and (E and F): Representative image of the sagittal sections of the Esat-6 immunized mice.



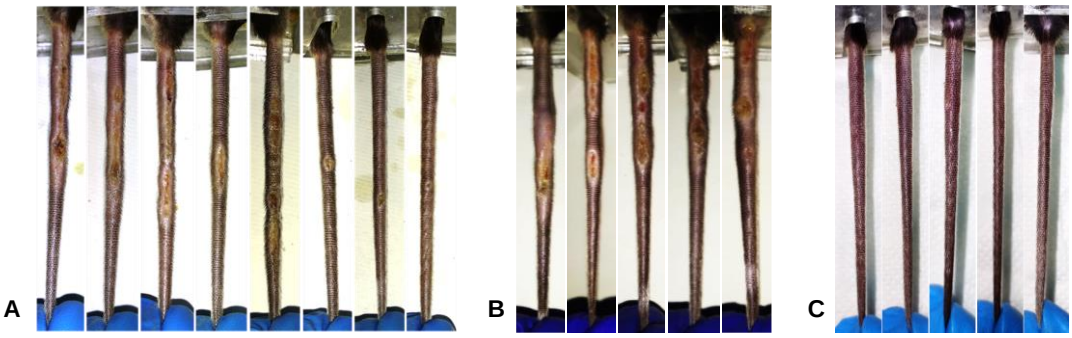


Fig. 2: Infection of Mice tails with mycobacterial strains (A): *M. marinum*, (B): INH resistant *M. marinum* population (IRP) and (C): *M. smegmatis* mc2 155: C57BL/6 mice were infected with 1*108 bacterial cells via tail-vein injection. Mice were partially restrained using standard restrainer and the injections were performed as described in methods section.

Functional Implications of the Exon 9 Splice Insert in GluK1 Kainate Receptors

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Background

Kainate receptors are key modulators of synaptic transmission and plasticity in the central nervous system. Different kainate receptor isoforms with distinct spatiotemporal expression have been identified in the brain. The GluK1-1 splice variant receptors, which are abundant in the adult brain, have extra fifteen amino acids inserted in the amino-terminal domain (ATD) of the receptor resulting from alternative splicing of exon 9. However, the functional implications of this post-transcriptional modification are not yet clear.

Objectives of the study

- Functional investigations into the role of splice residues in modulation of GluK1 kainate receptors.
- Insights into modulation of GluK1 splice variants by auxiliary Neto proteins.

Work Done

We employed a multi-pronged approach using cryogenic electron microscopy, electrophysiology, and other biophysical and biochemical tools to understand the structural and functional impact of this splice insert in the extracellular domain of GluK1 receptors. Our study reveals that the splice insert alters the key gating properties of GluK1 receptors and their modulation by the cognate auxiliary Neuropilin and tolloid-like (Neto) proteins 1 and 2. Mutational analysis identified the role of key splice residues that influence receptor properties and their modulation. Furthermore, cryoEM structure of the variant shows that the presence of exon 9 in GluK1 does not affect the receptor architecture or domain arrangement in the desensitized state. Our study thus provides the first detailed structural and functional characterization of GluK1-1a receptors, highlighting the role of the splice insert in modulating receptor properties and their modulation.

Our work on understanding the kainate receptor modulation by its auxiliary proteins has a significant impact on unravelling the basic biology of these receptors and mechanisms of their action. Our study emphasizes the need to investigate all possible combinations of KAR splice variants and better appreciate their contributions at different developmental stages. This comprehensive understanding of the distribution and functional diversity is essential for a rational therapeutic approach involving kainate receptors.

Figure

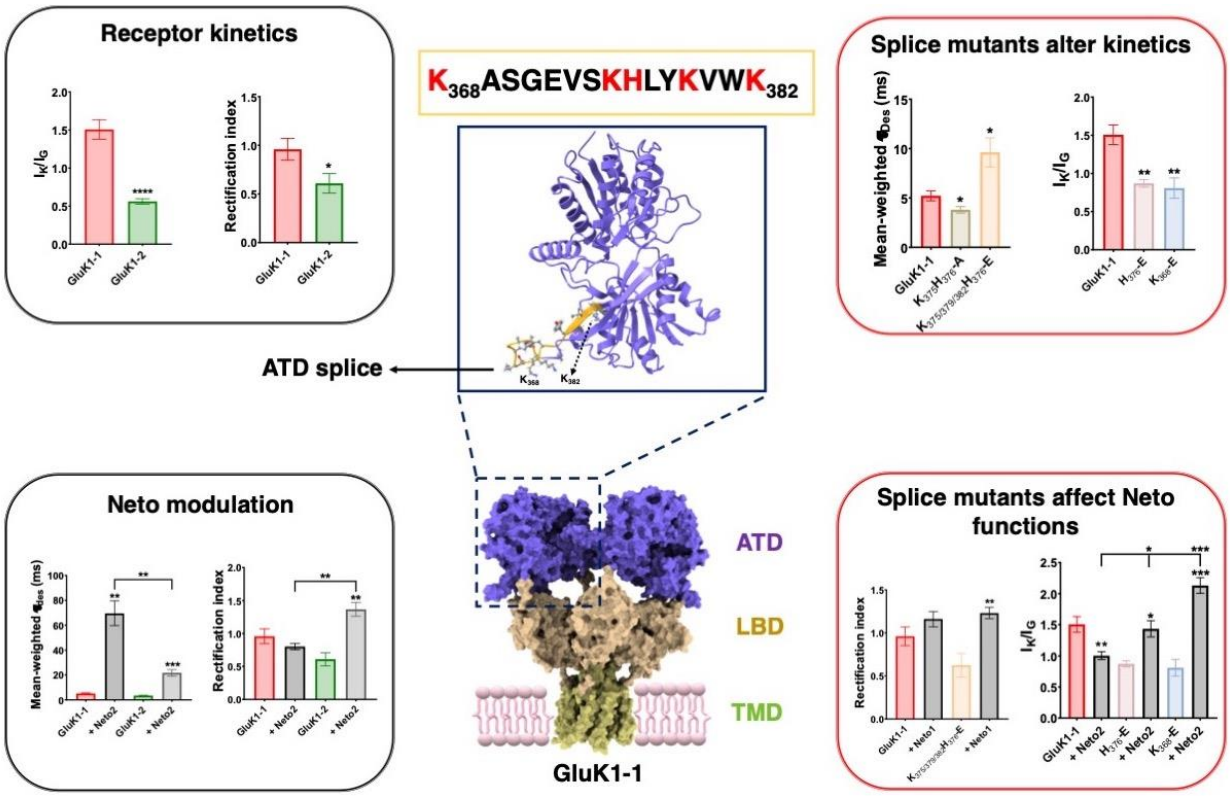

Fig. 1: Splice insert influences GluK1 receptor properties and its modulation by Neto proteins. Summary figure highlights the role of 15 amino acids inserted into amino terminal domain of GluK1 receptors. Splice residues not only influence the key gating properties of these receptors but also affect its modulation by auxiliary Neto 1 and Neto2 proteins. Mutational analysis identified K368, K375, H376, and K382 as key splice residues.

Understanding the Molecular Mechanism of Biogenesis of Lysosome-Related Organelles Using the *Tetrahymena thermophila* Model System

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Background

Dense core granules (DCGs) are specialized secretory vesicles playing key tissue-specific roles in animals and other eukaryotic lineages. In the Tetrahymena, formation of secretory organelles (mucocyst) shares striking similarities to insulin granule formation in animals. However, recent studies have suggested unexpected similarities between DCGs and lysosome-related organelles (LROs), making the study of LROs even more important for advancing human health. The studies of mucocysts in Tetrahymena, including my previous work have indicated that mucocysts are belong to the family of LROs, while parallel studies in animal cells have hypothesized DCGs to be LROs. This proposal is based on the idea that the wide set of tools and approaches available in Tetrahymena, a powerful model system, offer a unique opportunity to deepen our understanding of pathways leading to DCG/LRO formation. Moreover, proposal leverages the remarkable power of transcriptional profiling to dissect cellular pathways in Tetrahymena. Previous work had established VPS10-family receptor in Tetrahymena, called Sor4, to play a key role in transporting cargo proteins to mucocysts. Because VPS10-family receptors are involved in DCG/LRO biogenesis in animals, understanding the details of Sor4 trafficking and cargo binding should provide generalizable insights into mechanisms of DCG/LRO biogenesis.

Objectives of the study

- To provide direct evidence that Sor4 acts as a transport receptor for multiple ligands, and to determine the key parameters of Sor4-ligand binding. This will include determining which compartmental conditions affect binding and dissociation, and dissecting the Sor4 ligand-binding domain by site-specific mutagenesis.
- To dissect motifs in the cytoplasmic tail of Sor4, a single-pass transmembrane domain protein, to determine their contributions to Sor4 trafficking

- To identify the relevant compartments for Sor4p ligand binding and delivery.
- To analyze the roles of interacting proteins in this pathway, identified by expression profiling and/or mass spectrometry.

Work Done

In this study, we proposing to analyze dense core granules (DCG)/ lysosome-related organelles LRO biogenesis and function, and its dependence on trafficking of sortilins receptor, in a tractable single-cell model organism, *Tetrahymena thermophila*. The main goal of our proposal is to exploit expression profiling, including expanding the database and using new screening strategies, to identify genes, which are linked with disease and involved in DCG/LRO formation. We will develop an emerging model for LROs/DCGs formation, and that will also advance the understanding of how transcriptional profiling in *Tetrahymena* can be used to dissect cellular pathways to understand the large number of systematic and developmental diseases such as diabetes, cancer, Alzheimer's, Parkinson's disease and other neurodegenerative congenital disorders.

- Last year, we processed twenty genes (co-regulated with known mucocyst-associated genes) to generate knockout strains. Vector pNeo4 was used as the backbone for the construct. 5'UTR (~1500bp) and 3'UTR (~1500bp) portions of genes were amplified by PCR. After PCR, 5'UTR and 3'UTR fragments were subcloned into NotI and XhoI sites of the pNeo4 vector, respectively, using an In-Fusion cloning kit (Takara Bio, USA). The construct was finally confirmed by PCR and DNA sequencing.
- So far, four knockout constructs (V-type-ATPase, P-type ATPase, MFS8 and MFS9) out of twenty were transformed into *Tetrahymena* by Gene gun based method to generate knockout (KO) cell lines. The KO cell lines were confirmed by one-step RT-PCR (Qiagen).
- In addition, we successfully cloned and expressed full-length Sor4, vps10 domain of Sor4, and Grt1 into BL21 bacterial cells. Next, we will purify Sor4 and Grt1 and perform the in-vitro binding assay.
- We have also developed a fully functional protozoan culture and experimental facility at NCCS, Pune.

Neuroimmune Communication of Tachykinin Receptor 1 (Tacr1) Signaling in Gut Inflammation and Autoimmunity

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Background

Neuroimmune communication is the bidirectional crosstalk between the nervous and immune systems. These communications are either maintained by direct cell-to-cell contact or through neurotransmitters. Several studies suggested the involvement of neuro-immune communications in different autoimmune diseases. Immune cells express wide arrays of neurotransmitter receptors, allowing them to respond to signals from neuronal circuits in the tissue microenvironment. Neuroimmune communication of the enteric nervous system plays a key role in relaying psychological stress to intestinal inflammation and colitis. Among the several neurotransmitters, tachykinins (also known as neurokinins) have been linked to pain, inflammation, cancer, depression, gut function, hematopoiesis, sensory processing, and hormone regulation. The tac gene encodes the major tachykinin family members and gives rise to substance P (SP), neurokinin A (NKA), neurokinin B (NKB), neuropeptide K (NPK), and neuropeptide-γ (NP- γ). SP is one of the prominent members of the tachykinin family and is identified as the first of many 'brain-gut neuropeptides' and binds to its receptor known as the tachykinin receptors (TACRs) or neurokinin receptors (NKRs). SP is expressed by enteric neurons and enterochromaffin cells, and nerves in the brain and is known to control various physiological functions. Tachykinin receptors (TACRs) are G protein-coupled receptors encoded by the tacr gene and have three different types (TACR1, TACR2, and TACR3) that bind to its ligand SP. TACR1 is expressed on T and B cells, macrophages in the Peyer's patch, and spleen and is crucial in modulating immune responses. TACR2 is mostly expressed by myocytes, neuronal varicosities, and epithelial cells, whereas TAR3 is mostly localized in the neuronal compartment. SP-expressing nerve fibers are present at the dermis and epidermis as well as innervate the dermal blood vessels, keratinocytes, mast cells, DC, and hair follicles, and respond to various external stimuli (heat, ultraviolet light, allergen, and scratching) or internal stimuli (cytokines, proteases, and prostaglandins).

In humans, activated T cells express the preprotrachykinin (PPTA) gene, which transcribes and translate into inactivated-SP, which is further processed by an enzyme peptidyl glycine α-amidating monooxygenase (PAM) to form activated-SP. An enzyme called angiotensin-converting enzyme (ACE) degrades the circulating SP. The resting T cells do not express SP or TACRs. Activated T cells in rodents also synthesize SP and modulate T cell response in an autocrine manner. TACR signaling has been shown to have increased disease-enhancing effects in psoriasis, rheumatoid arthritis, inflammatory

bowel disease (IBD), and other inflammatory diseases. A recent study found that simultaneous TACR1 and TCR activation is required for Ca+2-dependent TCR signaling and T cell survival, particularly in Th1 and Th17 cells. TACR1 antagonist aprepitant and its pro-drug fosaprepitant are approved for clinical use to control chemotherapy-induced nausea and vomiting and postoperative nausea and vomiting. A phase II clinical trial with dual TACR1/TACR2 antagonist DNK333 in women with diarrhea-predominant IBS showed relief with symptoms compared to control. However, the detailed molecular mechanism of TACR1-antagonism and control of gut inflammation is not well characterized.

Objectives of the study

- To understand TACR1 expression on various subsets of CD4 T cells.
- To study how TACR1 signaling affects gut inflammation and autoimmunity.

Work Done

Neuroimmune communication of the enteric nervous system (EMS) in gut-associated lymphoid tissues helps to maintain the fine balance between gut inflammation and tolerance. Substance P (SP) is a brain-gut neuropeptide neurotransmitter produced by EMS and enteroendocrine cells, lymphocytes, and macrophages in the gut and neurons in the brain. SP binds to tachykinin receptors (TACRs, also known as neurokinin receptors). Inflammatory bowel disease (IBD) and irritable bowel syndrome (IBS) patients are known to have altered TACRs expression and strongly correlate with the pathogenesis of these diseases. How SP-TACR interaction modulates the inflammatory CD4 T cells (Th1, Th17) and regulatory CD4 T cells (Foxp3+Tregs and Th2 cells) in gut inflammation is clearly understood. We showed that mouse secondary lymphoid tissues express TACRs, and splenic Tregs and Th17 cells have the highest expression of TACRs. Agonizing the TACR1 with SP in the dextran sodium sulfate-induced colitis model exacerbated the disease, which was inhibited by TACR1 specific antagonist. TACR1 antagonist promoted the differentiation of Foxp3+ Tregs cells in vitro and in vivo. TACR1-treated Tregs showed increased expression of LAP1, PD-L1, CD62L, Helios, and CD73 molecules and suppressed the proliferation of effector CD4 T cells and skin and gut inflammation in mice. Together, we showed that antagonizing the TACR1 signaling promotes the differentiation of regulatory Foxp3+ Tregs, controls skin and gut inflammation, and suggests that antagonizing the TACR1 provides a clinical advantage in preventing gut inflammation and colitis.

Figure

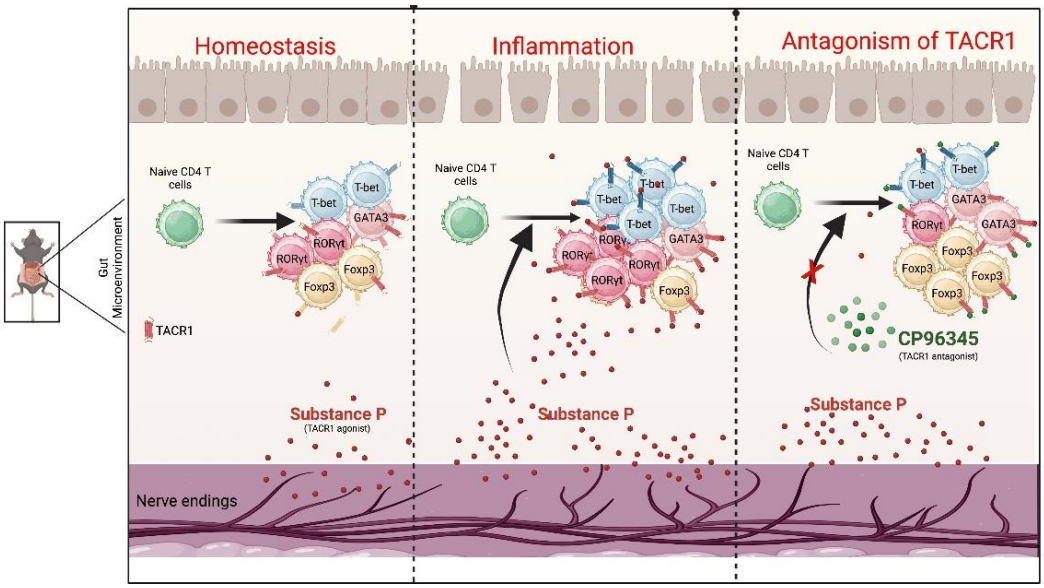

Fig. Legend: Under homeostatic conditions in the gut, substance P (and agonist of the TAC receptor) does not significantly alter the inflammatory and regulatory CD4 T cells. During gut inflammation caused by infection or autoimmunity, substance P production increases several folds and drives the differentiation of pathogenic Th17 cells and inhibits the regulatory CD4 T cells. This alteration in the CD4 T cell profile contributes to severe gut inflammation. Treatment with TACR1 antagonist CP96345 inhibits the differentiation of pathogenic CD4 T cells, drives the differentiation of regulatory CD4 T cells, and inhibits the ongoing inflammation and control of the disease.

Investigating the Chemo-preventive and Therapeutic Efficacy of Oltipraz (Olt), a Dithiolethione, in Targeting Glioblastoma Stem Cells and Containing GBM

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Background

Brain tumor poses unique challenges due to its distinct biology, genetics, treatment response, and survival. Glioblastoma multiforme (GBM) is the most aggressive and devastating cancer of the central nervous system. The median survival is about 12–15 months in these patients even after surgery, chemotherapy and radiotherapy. Thus, the treatment options are severely limited for a patient with GBM. Chemotherapeutics rarely reach these tumors, mainly due to the selective trafficking monitored by the blood-brain barrier and are also accompanied by the non-specific targeting of normal brain cells. They also induce genotoxic, carcinogenic effects in non-tumor cells. Also, the recurrence rate of GBM is very high due to the presence of rare cells with stem-cell-like properties (cancer stem cells: CSCs) that are intrinsically resistant to available treatments. Hence, efforts are being made worldwide to identify novel strategies to increase their sensitivity with plausible clinical implications. Phytochemicals carrying specificity and low cytotoxicity may serve as either adjuvants or potent and safer alternatives to conventional chemotherapy for treating GBM. Accordingly, we have evaluated the anti-cancer effects of various phytochemicals to assess whether those can be repurposed to target GBM-associated CSCs and thereby contain GBM.

Objectives

- To investigate the influence of Oltipraz (Olt), a synthetic dithiolethione, on GBM cell growth and differentiation in vitro and mechanistic underpinning.
- To assess the efficacy of Olt in targeting GBM-specific cancer stem cells in vitro.
- To investigate the efficacy of Olt in containing GBM tumor growth in vivo by establishing ectopic xenograft mouse model.
-

Work Done

Our findings suggested that Olt exposure remained refractive to normal cells. However, it impaired cell growth by causing cell cycle arrest in three different GBM cell lines. Olt-exposed GBM cells displayed the hallmarks of antitumorigenic efficacy by inducing reactive oxygen species (ROS), mitochondrial depolarization, caspase 3/7-mediated apoptosis, nuclear condensation, and DNA fragmentation. On the contrary, there was a decrease in the expression of vimentin and β-catenin, the EMT-associated markers, and glutathione, a natural ROS scavenger in the GBM cells indicating that Olt may attenuate epithelial to mesenchymal transition, a characteristic associated with tumor metastasis. Its effect on a subpopulation of GBM cells exhibiting glioblastoma stem cell (GSCs)-like characteristics revealed reduced expression of the stem cell markers (Oct4, Sox2, CD133, CD44), and a decrease in ALDH+, Nestin+ and CD44+ cells. In contrast, there was an increase in the expression of GFAP (mature astroglial marker), and GFAP+ cells. In fact, its efficacy was found to be better than the conventional GBM drug,

Temozolomide. Olt also significantly impaired the GBM cell migration and suppressed the oncosphere-forming ability of cells. Further, its efficacy in vivo was studied by establishing ectopic xenografts for GBM in SCID mice. Oral administration of Olt, while suppressing the overall tumor growth, it showed no signs of toxicity to other organs as revealed by no change in body organ weight ratio, hematological, and biochemical parameters. Taken together, our findings could demonstrate that Olt is a promising chemotherapeutic agent having potential implications in serving as an adjuvant for treating GBM.

Graphical Abstract

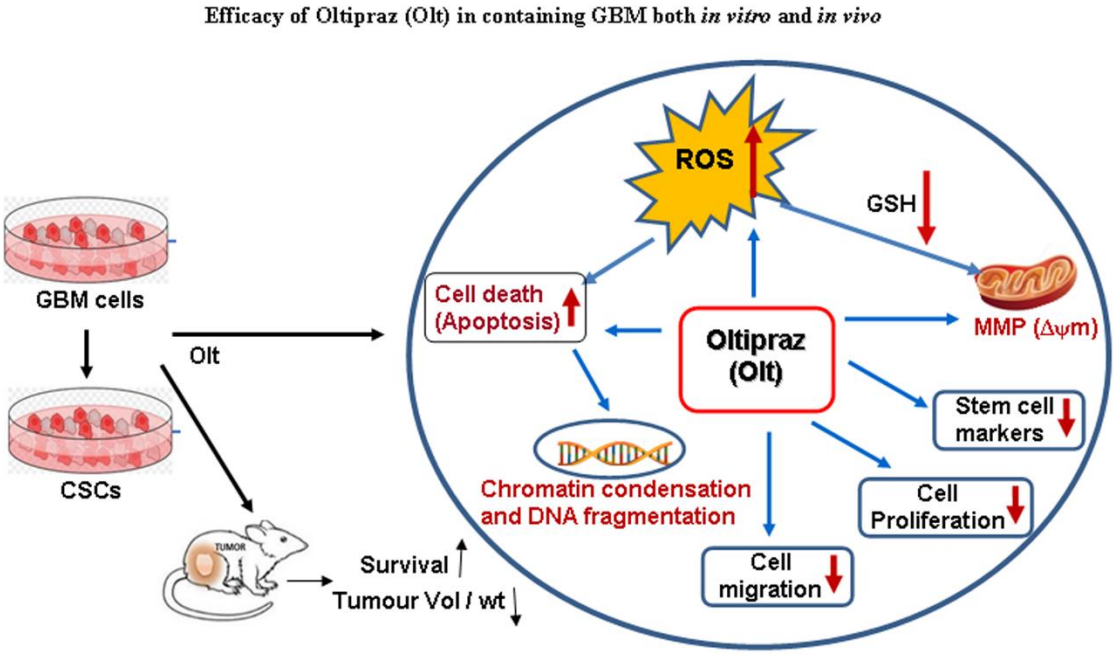

Figure Legend: Efficacy of Oltipraz (Olt) in containing GBM both in vitro and in vivo.

Understanding the Molecular Mechanism of Persistence of Memory

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Background

Memory disorders are a hallmark of several neurodegenerative diseases and ageing conditions. As per census 2011, the population over 60 years of age is 104 million or 8.6% of the total population and it is expected a good number of this will suffer from memory disorders. This brings a huge burden to the families as well as to the healthcare system and needs to be addressed. To find probable cures for such conditions, one needs to first understand how long-term memory persists over time. The central question is how proteins in the brain, which have a limited half-life can maintain memory for life time's duration.

Towards this aim our lab works on a protein synthesis regulator Orb2, which is the Drosophila homolog of mammalian Cytoplasmic adenylation element binding protein (CPEB). Previously this protein was identified to have prion-like nature and was needed as a regulator of maintenance of memory.

Objectives of the study

- To understand what regulates the oligomerization of the prion-like protein, Orb2.
- To understand whether this regulator plays any role in the regulation of long-term memory.

Work Done

Orb2 the Drosophila homolog of Cytoplasmic polyadenylation element binding protein (CPEB) forms prion-like oligomers. These oligomers consist of Orb2A and Orb2B isoforms and their formation are dependent on the oligomerization of the Orb2A isoform. Drosophila with a mutation diminishing Orb2A's prion-like oligomerization forms long-term memory but fails to maintain it over time. Since, this prion-like oligomerization of Orb2A plays a crucial role in the maintenance of memory, here we aim to find what regulates this oligomerization. In an immunoprecipitation-based screen, we identify interactors of Orb2A in the Hsp40 and Hsp70 families of proteins. Amongst these, we find an Hsp40 family protein Mrj as a regulator of the conversion of Orb2A to its prion-like form. Mrj interacts with Hsp70 proteins and acts as a chaperone by interfering with the aggregation of pathogenic Huntingtin. Unlike its mammalian homolog, we find Drosophila Mrj is neither an essential gene nor causes any gross neurodevelopmental defect. We observe a loss of Mrj results in a reduction in Orb2 oligomers. Further, the knockdown of Mrj in the mushroom body neurons results in a deficit in long-term memory. Our work implicates a chaperone Mrj in mechanisms of memory regulation through controlling the oligomerization of Orb2A and its association with the translating polysomes.

Identification of Candidate Targets and Biomarkers for Acute Myeloid Leukemia Using Global Proteomic Analysis and Molecular Approaches

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Background

Acute Myeloid Leukemia (AML) is a malignant clonal disorder in which the cells from the myeloid lineage fail to differentiate into mature functional cells affecting immune function. It is the second most common form of leukemia and the most frequent form for leukemia-related mortalities. According to the cancer facts sheet Surveillance Epidemiology and End Results (SEER), every year 4.3 per 100000 new cases arise out of which 2.3 deaths occur worldwide. In India, the AML incidence rate is 3.2 per 100000 with 1.2 per 100000 deaths and the overall survivability rate has been noted as 55.6-66.8% in patients aged between 15-60 years. AML is caused by a variety of recurrent and unique mutations. Signs and symptoms of this disease are haemorrhage, infections and fever with pallor fatigue, and dyspnea due to a decrease in RBCs, platelets, and WBCs. Leukemic blasts are visible in blood and infiltrate into other tissues or organs like the liver (hepatomegaly), spleen (splenomegaly), skin (leukemia cutis), lymph nodes (lymphadenopathy), and central nervous system, there by leading to severe complications. Cytogenetic abnormalities include deletion of chromosomes 5 or 7, chromosomal translocations and rearrangements in critical regions of proto-oncogenes and gene mutations in FLT3, KIT, NPM1, CEBPA, in turn increase the possibility of malignancy. FLT3-ITD mutations, have a high treatment resistance rate during induction chemotherapy, with an increased likelihood of relapse, and low disease-free survival. The current diagnosis of this disease is based on symptoms and, invasive technique of bone marrow aspiration to assess the cytogenetics and molecular abnormalities that are considered as important prognostic factors in predicting risk and overall survival of patients. Hence, identifying suitable targets/markers in AML is important to predict the disease progression and early response of disease to the chemotherapy. In turn, these markers will have the potential to serve as prognostic biomarkers and can correspondingly be used as new targets in drug therapy.

Mass spectrometry (MS) based quantitative proteomics serves as an excellent approach that provides information about protein markers including alterations and modifications in the protein levels of a patient's tissues and body fluids. Globally, many research groups have tried to explore and identify different potential biomarkers and targets for various cancers using MS-based proteomic approaches. However, limited studies explored the identification and understanding of the potential candidate markers using mass spectrometry based proteomic approaches in AML. In the present study, we aimed

to identify and functionally validate the potential markers for AML using mass spectrometry based quantitative proteomics and molecular approaches.

Objectives of the study

- Investigation of proteome alterations associated with Acute Myeloid Leukemia using bone marrow interstitial fluid and serum samples.
- Identification of candidate targets in Acute Myeloid Leukemia mononuclear cells using label-free quantitative proteomic approach.

Work Done

i) Investigation of proteome alterations associated with Acute Myeloid Leukemia using bone marrow interstitial fluid and serum samples

Bone marrow is the primary site of hematopoiesis and is also the origin of hematological malignancies such as AML. Bone marrow constitutes a microenvironment of bone marrow interstitial fluid (BMIF) which supports the growth and development of the hematopoietic system. Investigating the proteome alterations in BMIF is a relatively better source for understanding AML pathophysiology. We analyzed proteome alterations in the AML patients' BMIF compared to non-hematological malignancy controls using two proteomic approaches namely iTRAQ and LFQ. We identified a total of 176 statistically significant differentially expressed non-redundant proteins using multipronged proteomic approaches, out of which 90 proteins were upregulated and 86 proteins showed downregulation. Since serum is an important body fluid that reflects any change in physiology therefore studying the proteomic pattern of AML serum compared to healthy serum will be beneficial in theranostic application hence we used the same approaches such as iTRAQ and LFQ from the same cohort of samples. Using multipronged proteomic approaches, 126 non-redundant serum proteins were found to be differentially regulated in AML out of which 59 proteins were upregulated and 67 proteins were downregulated. Bioinformatic analysis of both BMIF and serum proteins revealed their role in biological regulation, cellular/metabolic processing, organic substances metabolic processes etc. Further, we identified a panel of six common proteins serum amyloid A-1 protein (SAA1), fibrinogen gamma chain (FGG), CD44 antigen (CD44) which were upregulated whereas apolipoprotein B (APOB), apolipoprotein E (APOE), platelet factor 4 (PF4) were down-regulated in AML serum and BMIF with the same pattern of expression. This panel of six proteins could be a potential bio-signature that could discriminate AML from controls (Fig. 1). We believe that this panel of proteins could help in future AML disease management and thereby improve the survival expectancy of AML patients. However, there is a need to further validate these signature proteins in a larger cohort of well-characterized samples which could strengthen the specificity and sensitivity of the panel of signature proteins.

ii) Identification of candidate targets in Acute Myeloid Leukemia mononuclear cells using label-free quantitative proteomic approach

Further, we hypothesized that proteomic alteration in AML mononuclear cells (MNCs) i.e., the actual site of AML disease origin may play a crucial role in disease occurrence and progression. To achieve this, we undertook the label-free quantitative (LFQ) proteomic approach and profiled the global proteomic changes in AML MNCs. We identified a panel of proteins that altered in patient-derived AML MNCs as compared to the MNCs of non-haematological malignancies. Proteomic analysis identified 266 differentially abundant proteins where 245 proteins showed increased abundances while 21 proteins were downregulated. Bioinformatics data using ingenuity pathway analysis (IPA) suggested that the majority of the differentially expressed proteins were involved in key biological functions like cell viability, cell survival, metabolism of proteins, apoptosis, metabolism of nucleoside triphosphate, survival of stem cell lines, senescence of cells etc. Similarly, altered proteins are associated with top canonical pathways including EIF2 signalling, spliceosomal cycle, TCA cycle II, NRF2-mediated oxidative stress response etc. Among these differentially regulated proteins, interleukin enhancer binding factor 2 (ILF 2), cell division cycle 5 like protein (CDC5L), SUB1 regulator of transcription (SUB1), complement C1q binding protein (C1QBP), Calmodulin 3 (CALM3) were significantly upregulated in patient-derived AML MNCs in comparison with controls (Fig. 2). We are currently undergoing studies to decipher the role of these putative markers in AML at molecular level using molecular biology approaches.

Figures

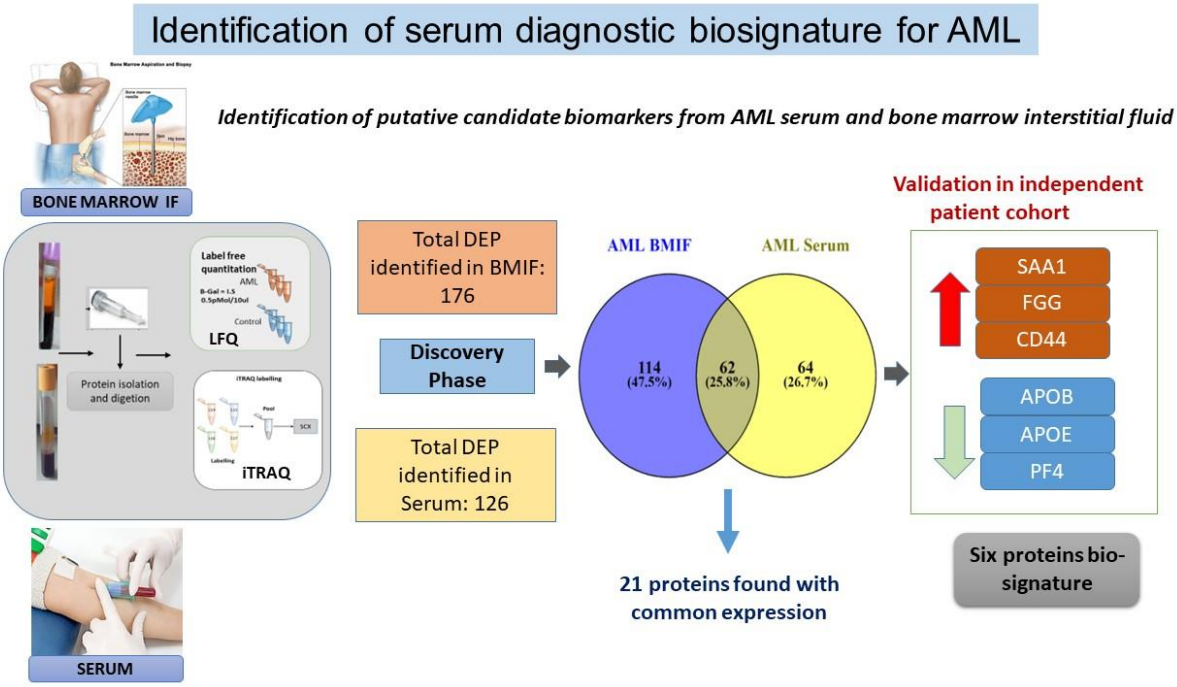

Fig. 1: An experimental design and overall results obtained for quantitative proteomic analysis of BMIF and serum samples of AML and controls. In the discovery phase, 176 and 126 non-redundant differentially expressed proteins were identified for BMIF and serum respectively using multipronged quantitative proteomic approaches. Further, a common BMIF and serum protein signature consisting of 6 significant proteins was validated using MRM in a fresh cohort of samples.

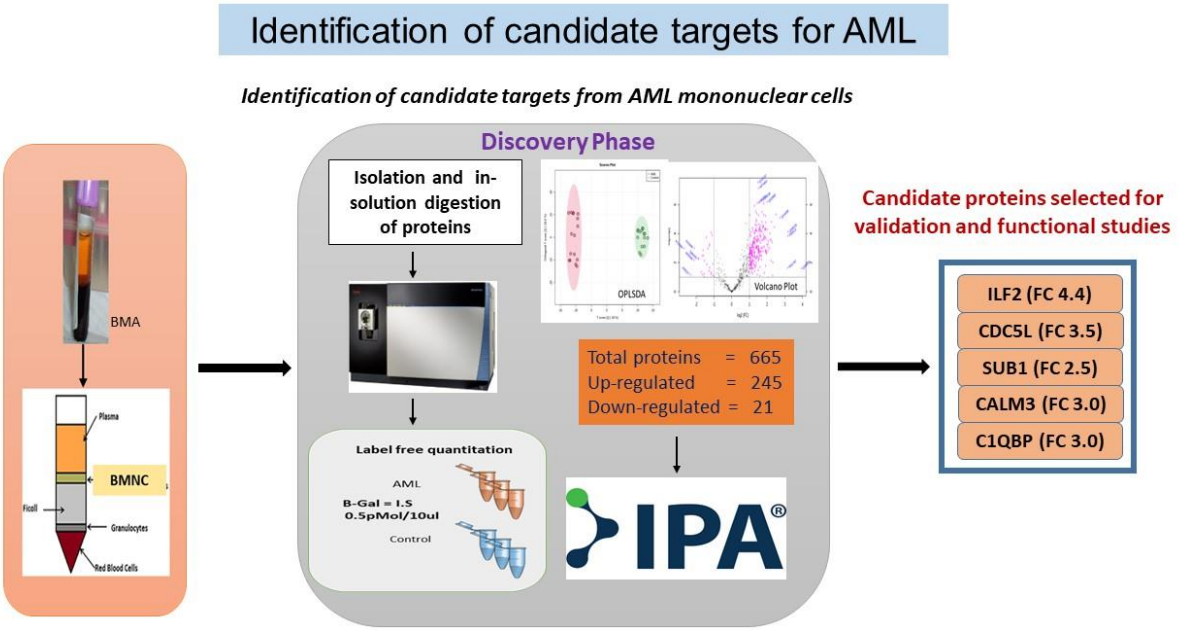

Fig. 2: A flowchart depicting experimental design and overall results obtained for AML MNCs proteomic analysis. In the discovery phase, 266 differentially expressed proteins were identified using LFQ-based proteomic analysis. Among these altered proteins, ILF2, CDC5L, C1QBP, CALM3 and SUB1 were selected for validation and functional studies to understand their crucial role in AML disease progression.

Role of T cells and Non-T cells in Leishmaniasis

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Background

Leishmania parasites reside and replicate within host macrophages. IFN-γ mediated macrophage activation eventuates in *Leishmania* elimination. However, *Leishmania* has a suppressive effect on macrophages IFN-γ responsiveness.

Objective

- We aim to study the IFN-γ responsiveness in thioglycolate elicited peritoneal macrophages as well as in BALB/c mice infected with virulent and avirulent *L. donovani* parasites.

Work done

In *Leishmania*-infected macrophages, reduced IFN-γRα/β expression, impaired IFN-γRα and IFN-γRβ hetero-dimerization due to altered membrane lipid composition, reduced JAK-1 and STAT-1 phosphorylation but increased STAT-1 degradation and impaired ISGs induction collectively determine the IFN-γ responsiveness and the efficacy of IFN-γ-induced antileishmanial function of macrophages.

The macrophages of resistant DBA/2 which naturally show inflammatory (via p38) response to *Leishmania* infection, shows skewing of signaling towards the EKR pathway after overexpression of LD-MAPK4, which suggests that the outcome of infection depends on relative modulation of the signaling. By overexpression, when relative expression of LD-MAPK4 was increased than regular infection with *L. donovani*, the resistant trait of DBA/2 macrophages was changed to susceptible.

- IFN-γ promoted killing of amastigotes in mouse peritoneal MΦs in dose dependent manner (0.1ng, 1ng, 10ng IFN-γ) as assessed by parasite count/100 amastigotes. The LP parasites were observed to be more resistant to killing than HP parasites.
- Macrophages infected with avirulent parasites released more nitric oxide compare to virulent parasites.
- IFN-γRα and IFN-γRβ expression was downregulated in LP/HP infected MΦs as assessed by FACS and qPCR; however, more downregulation was observed in case of LP infected MΦs as a function of time (6 hrs, 36hrs, 72hrs, 120 hrs).
- Mouse peritoneal MΦs infected with LP parasites exhibited higher levels of IL-10 and lower levels of IL-12, whereas the opposite was observed in the case of HP.
- We studied the induction of ISGs in BALB/c mice infected with virulent and avirulent parasites and treated with 75ng or 150ng/mouse rIFN-γ.
- Mouse strain BALB/c was susceptible and DBA/2 was resistant to *L. donovani.*
- LD-MAPK4 was downregulated in the avirulent strain, suggesting its importance in virulence.
- Inhibition of LD-MAPK4 by the custom synthesized inhibitor significantly reduced parasite load and overexpression of LD-MAPK4 significantly increased parasite load in susceptible hosts.
- In *L. donovani* infected susceptible BALB/c and resistant DBA/2 macrophages, CD40 and TLR signaling were skewed towards ERK and p38 signaling pathways, respectively.
- Overexpression of LD-MAPK4 resulted in a skewing of CD40 and TLR signaling towards the ERK pathway resulting in increased expression of immune suppressive IL-10 and reduced expression of inflammatory IL-12.
- Immunoprecipitation and analysis of complex by tandem MS showed that LD-MAPK4 interacts with many different signaling molecules of the host which regulate important cellular functions.

Role of Locally Expressed Complement Anaphylatoxins in Viral Infection

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Background

The complement system is a constituent of innate immunity that serves as a vital link between innate and adaptive immunity. It has the ability to recognize and eliminate varied invading pathogens, including viruses. The elimination of viruses by the complement system is owing to direct neutralization of cell-free viruses as well as the lysis of the virus-infected cells. Additionally, activation of complement during viral infections has been shown to boost virus-specific immune responses.

A substantial quantity of complement produced by the immune and non-immune cells is present at the site of infection. It is, therefore, conceivable that viruses activate local complement during infection. Thus, the complement activation products generated in the infection locale may play a critical role in mounting immune response against viruses. A corroboration to this premise is that viruses encode complement regulators to inhibit complement present in the infection locale, and disabling it results in the attenuation of virus pathogenicity. Therefore, we sought to investigate: do C3a and C5a generated in infection habitat participate in controlling viral infection and whether they aid in enhancing adaptive antiviral immunity generation.

Objectives of the study

- Role of complement anaphylatoxins C3a and C5a expressed in the infection locale in protection against viral infection.
- Delineation of the immune mechanisms responsible for locally generated anaphylatoxin-mediated protection against viral infection.

Work Done

As described above, the complement system is expected to be activated by viruses in the infection milieu, we therefore designed this study to test the hypothesis that local generation of anaphylatoxins and sensing of these along with the antigen by the immune cells is essential for generating tailored immune responses to viral infections.

We thus first developed a model system for the expression of C3a and C5a in the viral habitat, which would allow the delineation of the role of these complement activation products in controlling viral infection owing to the induction of virus-specific immune responses. For this, we generated recombinant vaccinia viruses (VACVs) expressing mouse C3a or C5a and employed them for infection studies in

complement null mice (C3-/- mice). In this model, anaphylatoxins are synthesized and secreted by the infected cells at the site of infection, and their expression is regulated by the viral load.

To generate C3a and C5a encoding VACVs, we replaced the ORF of vaccinia virus complement regulator VCP with mouse C3a or C5a constructs by homologous recombination. An EGFP tag was fused at the N-terminus of anaphylatoxins to ease the screening of recombinant viruses. A control virus (VACVΔVCP) was also generated, wherein the VCP gene was replaced with a LacZ cassette. The recombinant VACVs generated (Fig. 1) were characterized for their replication competence (by single-step and multi-step growth curves) as well as their ability to express anaphylatoxins (by Western blot and ELISA). As expected, the insertion of the genes did not affect VACV replication, and infected cells secreted anaphylatoxins in the medium.

To examine the role of locally expressed C3a and C5a in protection against viral infection, we intranasally infected C3-/- mice (on C57BL/6 and BALB/c background) with the standardized dose of VACVΔVCP (control virus), C3a-VACVΔVCP or mC5a-VACVΔVCP. We observed significant body weight loss and 100% mortality in the control virus and C3a-VACVΔVCP infected mice groups. The mC5a-VACVΔVCP infected mice group, however, showed ~80% survival. These data thus suggested that C5a, but not C3a, generated in the infection locale is protective against VACV infection. Examination of lung virus titres in these infected mice groups demonstrated that the initial virus load (day 4 p.i.) was higher. It, however, decreased substantially (day 7 p.i.) in mice infected with mC5a-VACVΔVCP but not in VACVΔVCP and C3a-VACVΔVCP infected mice. We, therefore, concluded that the effective clearance of the virus by C5a is likely due to its ability to induce virus-specific immune responses efficiently.

A comparison of bronchoalveolar lavage (BAL) immune cells in the infected mice groups revealed no difference at day 4 post-infection. On day 7 post-infection, CD8+ T cells were clearly increased in the mC5a-VACVΔVCP group compared to the VACVΔVCP group. B cells and NK cells remained the same in both the infected groups. Analogous to this, the frequency of the tetramer-positive CD8+ T cells was also increased in BAL of mC5a-VACVΔVCP compared to the VACVΔVCP infected group. Additionally, the C5a group also demonstrated augmentation of early anti-VACV neutralizing antibodies compared to the control group. Next, we examined the contribution of antibodies and CD8+ T cells in C5a-mediated protection from VACV infection. Depletion of B cells and CD8+ T cells by injecting anti-CD20 and anti-CD8 antibodies, respectively, in the infected mice groups indicated that CD8+ T cells are the primary cells involved in C5a-mediated protection against VACV infection.

In summary, our data revealed the importance of C5a generated in the infection locale in pulmonary VACV infection. It indicated that the presence of C5a in the infection milieu (Fig. 2): i) reduces overall lung virus load and thereby the infection-associated death, ii) induces effective T cell and neutralizing antibody responses, iii) the induced effector CD8+ T cell response is necessary and sufficient for protection.

Figures

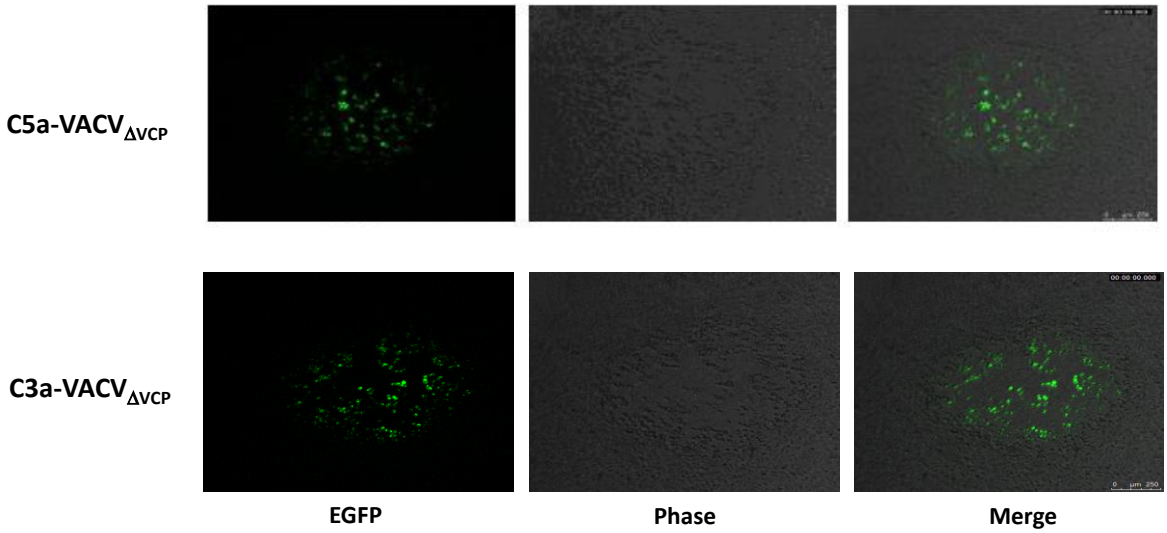

Fig. 1 Legend: Recombinant VACV plaques showing EGFP positivity.

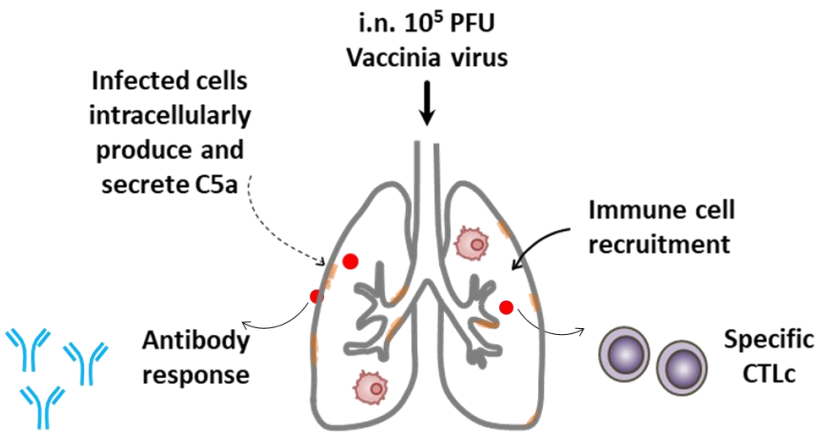

Fig 2. Legend: A model illustrating the enhanced effector functions induced by C5a expressed in the infection milieu during VACV infection.

To Understand the Role of F-box Proteins in Cancer Pathogenesis

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Background

Human genome encodes genes for 69 F-box family proteins. Each member of this family has conserved F-box motif typically present at the N-terminal domain of the protein. This class of proteins facilitates the ubiquitination of their substrates through forming SCF (SKP1, Cullin1, and F-box protein) complex and thereby plays vital roles numerous cellular processes like cell cycle progression, cell division, cellular signaling, cell death, DNA damage response and repair process etc. F-box proteins facilitate different types of ubiquitination and therefore nature of ubiquitination decides the fate of the ubiquitinated proteins. Ubiquitination of proteins may increase or decrease their stability. Therefore, deregulation of F-box proteins is closely associated with pathogenesis like cancer. However, cellular function of most of the F-box proteins remains elusive.

Objective of the study

- To understand the role of F-box proteins in cancer pathogenesis

Work Done

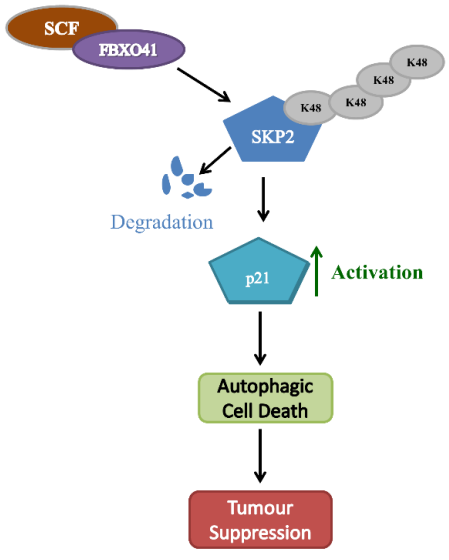
During cancer development, tumor growth suppressive genes (tumor suppressor) are mostly inactivated by several mechanisms like genetic mutation, epigenetic silencing, loss of heterozygosity, transcriptional and post-transcriptional silencing. In contrast, another set of genes gain function during cancer development due to genetic mutation, epigenetic modification, gene duplication etc. They are the

driver of cancer progression and they are classified as oncogene. We have identified F-box protein FBXO41 as potent tumor suppressor in breast cancers. We show that FBXO41 suppresses cancer cell proliferation and tumor growth by inducing autophagic cell death through an alternative pathway (Figure 1). Results revealed that FBXO41-mediated autophagic cell death induction is dependent on accumulation of cell cycle checkpoint protein p21 but independent of p53. We found that FBXO41 increases the expression levels of cell cycle checkpoint protein p21 at the post-translational level by directing the proteasomal degradation of SKP2, an oncogenic F-box protein. Mechanistically, FBXO41 along with p21 disrupts the inhibitory BCL2 (anti-apoptotic protein)-Beclin1 (autophagy initiating factor) complex of autophagy induction to release Beclin1. Then, Beclin1 initiates the autophagy induction through formation of the pre-autophagosomal structure. Overall, the present study establishes a non-canonical FBXO41-SKP2-p21 axis for the induction of autophagic cell death to prevent cancer progression, which could be explored to develop promising cancer therapeutics. This part of the work is published peer reviewed international journal (Int J Biochem Cell Biol. 2022).

Arsenic trioxide (ATO), a potent anti-neoplastic drug, is known to prevent cancer cell growth through induction autophagic cell death. However, molecular mechanism of autophagic cell death by ATO is poorly understood. Using biochemical and immunofluorescence techniques, we showed that FBXO41 plays a critical role in anti-proliferative activity of ATO. Our study reveals that FBXO41 plays an important role in induction of autophagic death of cancer cells by ATO. Further, we showed that the autophagic cell death induced by FBXO41 is independent of apoptosis and necrosis, showing that FBXO41 may play vital role in inducing autophagic death of apoptotic resistant cancer cells. Overall, our study elucidates the importance of FBXO41 in autophagic cell death to prevent cancer progression, which could be explored to develop promising cancer therapeutics. This part of the work is published in peer reviewed international journal (Toxicol Appl Pharmacol. 2022).
We are collaborating with several national and international scientists. Our laboratory has contributed immensely to understand the ubiquitin signaling pathway in host-pathogen response. Through collaboration, we showed that SCF-FBXW7 E3 ubiquitin ligase is crucial for effective detection and clearance of phylogenetically diverse bacterial pathogen. This part of the work is published in peer reviewed international journal Science Advances (Sci. Adv. 2023).

Intervertebral disc (IVD) degeneration is the primary cause of back pain in humans. However, the cellular and molecular pathogenesis of IVD degeneration is poorly understood. Through collaboration we have elucidated the molecular mechanism of IVD using zebrafish model system. We showed that cellular communication network factor 2a (Ccn2a) plays a central role in IVD homeostasis and regeneration Mechanistically, we showed that Ccn2a maintains IVD homeostasis and promotes IVD regeneration by enhancing outer annulus fibrosus cell proliferation and suppressing nucleus pulposus cell death through augmenting FGFR1-SHH signaling. This work is published in peer reviewed international journal Development (Development 2023).

Figure

Fig. Legend: Model depicts that FBXO41 inhibits breast cancer progression through induction autophagy.	

Role of RNA-protein Interactions in Gene Regulation

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Background

The research in my lab is focused on understanding how specific RNA-protein interactions regulate gene expression. We have reported a novel role for PIP4K2A in regulating gene expression in malaria parasite. We show that the Human RBC protein PIP4K2A is imported into malarial parasite. We have shown that the RNA binding activity of PIP4K is conserved and have also identified specific sequence motif in the RNA that is essential for this interaction. The RNA Binding and kinase function of PIP4K2A may be independent as kinase mutants still show RNA binding activity. We further show that the RNA binding activity of PIP4K2A is conserved and it may play a distinct function in gene regulation. We have used drosophila as a model system to identify the upstream regulators and downstream targets of PIP4K RNA binding activity, and have identified Mon1 as a regulator of PIP4K expression and GluRIIA as one of the target transcripts. Further studies are underway to understand the molecular details of this regulation in neuronal function.

Objectives of the study

- To characterize the RNA binding activity of PIP4K protein and characterize its role in gene regulation.
- To identify other potential targets of PI4K2A to delineate the functional role of PIP4K2A in gene regulation.

Work Done

It is believed that the main role of PIP4K2A is in regulating the levels of PI5P in mammalian cell. PIP4K2A is predominantly a cytoplasmic protein, however its substrate is membrane bound. We have identified a novel role for PIP4K as an RNA binding protein that can interact with several transcripts in the cell. More recently PIP4K was also shown to be interacting with specific lncRNA SMADS11 and this interaction seems to be playing an important role in promoting endometrial decidualization. We have shown that drosophila PIP4K can interact with GluRIIA transcripts. This interaction is dependent on the UUGU motif present in the RNA. We have characterized the specific sequences in the RNA that may be essential for its interaction with PIP4K2A. We show that the UUGU-motif present in the RNA is important for this interaction. We also observe that PIP4K levels are reduced in drosophila Mon1 mutant embryo which also have increased expression of GluRIIA. We have previously shown that PIP4K knock down results in increased expression of GluRIIA. These results suggests that Mon1 regulates the levels of PIP4K2A which in turn can regulate the expression of GluRIIA. Now we show by RNA immunoprecipitation that drosophila PIP4K2A interacts directly in GluRIIA mRNA (Fig 1A), and also by competitive EMSA we show that apart from GluRIIA, PIP4K can interact with eIF4E mRNA (Fig 1B). We have performed proximity biotinylation assay (BioID) to identify specific interacting proteins to PIP4K2A in mammalian cell lines. We are still in the process of analyzing the

data but preliminary results suggests that PIP4K may interact with the mRNA deadenylating and translation machinery in these cell lines. These results suggest that the RNA binding activity of PIP4K2A may be an important function of PIP4K2A in regulating gene expression apart from its role in phospho inositides metabolism (Fig 1C).

Figure

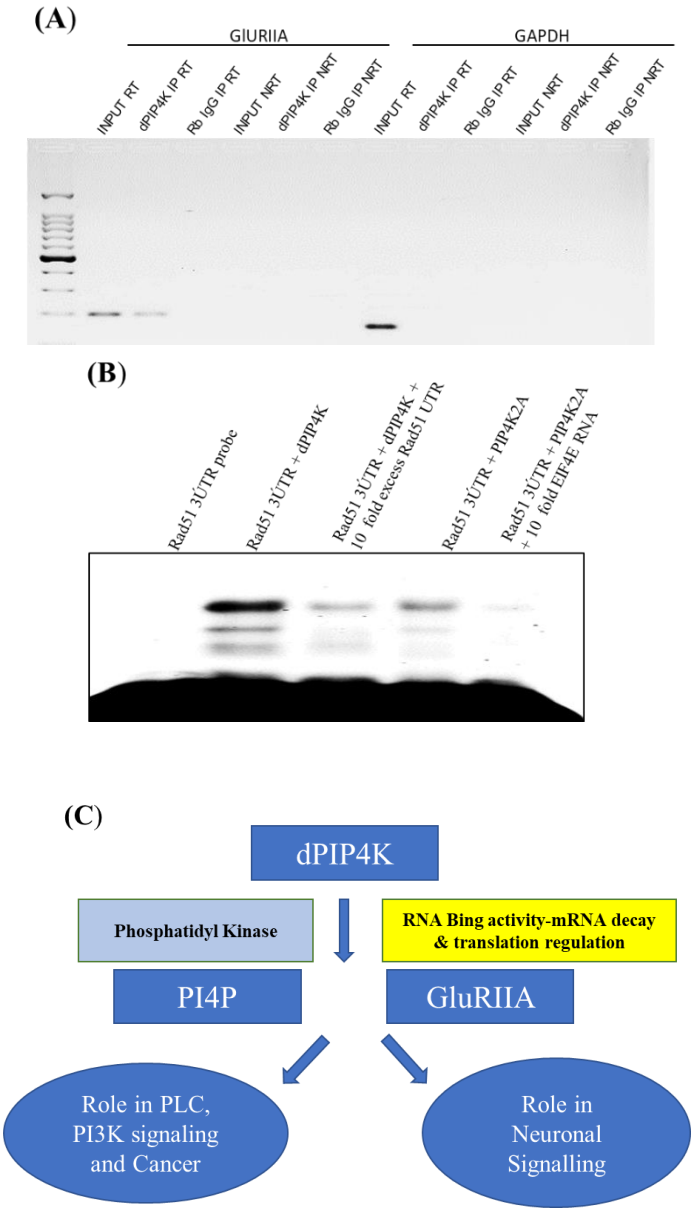

Figure 1. DPIP4K in regulation of gene expression.
A. RNA immunoprecipitation of PIP4K associated RNA followed by RTPCR for GluRIIA or GAPDH (negative control), The template used for the PCR reactions are as indicated.
B. Competitive RNA EMSA of PIP4K and RAD51 UTR in the presence of molar fold excess of various competitors (as indicated).
C. Role of PIP4K as a Phosphatidyl kinase and RNA binding protein.

Mycobiome Profiling and Oral Dysbiosis in SARS-CoV-2 Infection: Exploring the Nasopharyngeal and Oral Linkages

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Background

Studying the mycobiome profiling of the nasopharyngeal region in SARS-CoV-2 infected individuals is crucial as it allows us to understand the impact of the infection on fungal diversity and abundance, providing insights into potential fungal pathogens and their role in disease progression. Exploring oral dysbiosis and its linkage with SARS-CoV-2 infection is also important as it helps identify risk factors and susceptibility patterns, particularly related to opportunistic pathogens. By investigating these aspects, we can gain a better understanding of the role of the oral microbiome in disease suppression and the potential for secondary infections due to the prevalence of opportunistic pathogens.

Objectives of the study

- To investigate the impact of SARS-CoV-2 infection on the mycobiome of the nasopharyngeal region.
- To explore the correlation between oral dysbiosis, including alterations in the oral microbiome and mycobiome, and the risk, susceptibility, and severity of SARS-CoV-2 infection in individuals.

Work Done

(a) Mycobiome profiling of nasopharyngeal region of SARS-CoV-2 infected individuals:
This study highlights the importance of understanding the fungal community in the nasopharyngeal region of SARS-CoV-2 infected individuals. The infection significantly impacted the mycobiome diversity, with a higher abundance of Cladosporium and Alternaria noted in infected individuals. This demonstrates the importance of monitoring the mycobiome during viral disease progression, as inter-individual variation was also observed. The decrease in Aspergillus abundance in infected patients across all age groups further emphasizes the importance of studying the mycobiome in relation to viral infections. This study highlights the need for continuous investigation of fungal infections in SARS-CoV-2 infected individuals.

(b) Oral dysbiosis and its linkage with SARS-CoV-2 infection:
This study aims to understand the altered oral microbiome and mycobiome in SARS-CoV-2 infected patients and its correlation with risk factors compared to non-infected individuals. The results showed a reduction in species richness, an elevated abundance of opportunistic pathogens, and impaired metabolic pathways in COVID-19 patients, indicating their susceptibility to SARS-CoV-2. The study also demonstrated an altered oral mycobiome with enrichment of known respiratory disease-causing pathogenic fungi in infected individuals. Elderly infected patients were found to be highly vulnerable to SARS-CoV-2 infection and disease severity. The study suggests that SARS-CoV-2 infection triggers

the prevalence of specific pathobionts, indicating the importance of monitoring oral microbiome and mycobiome in COVID-19 patients.

Figures

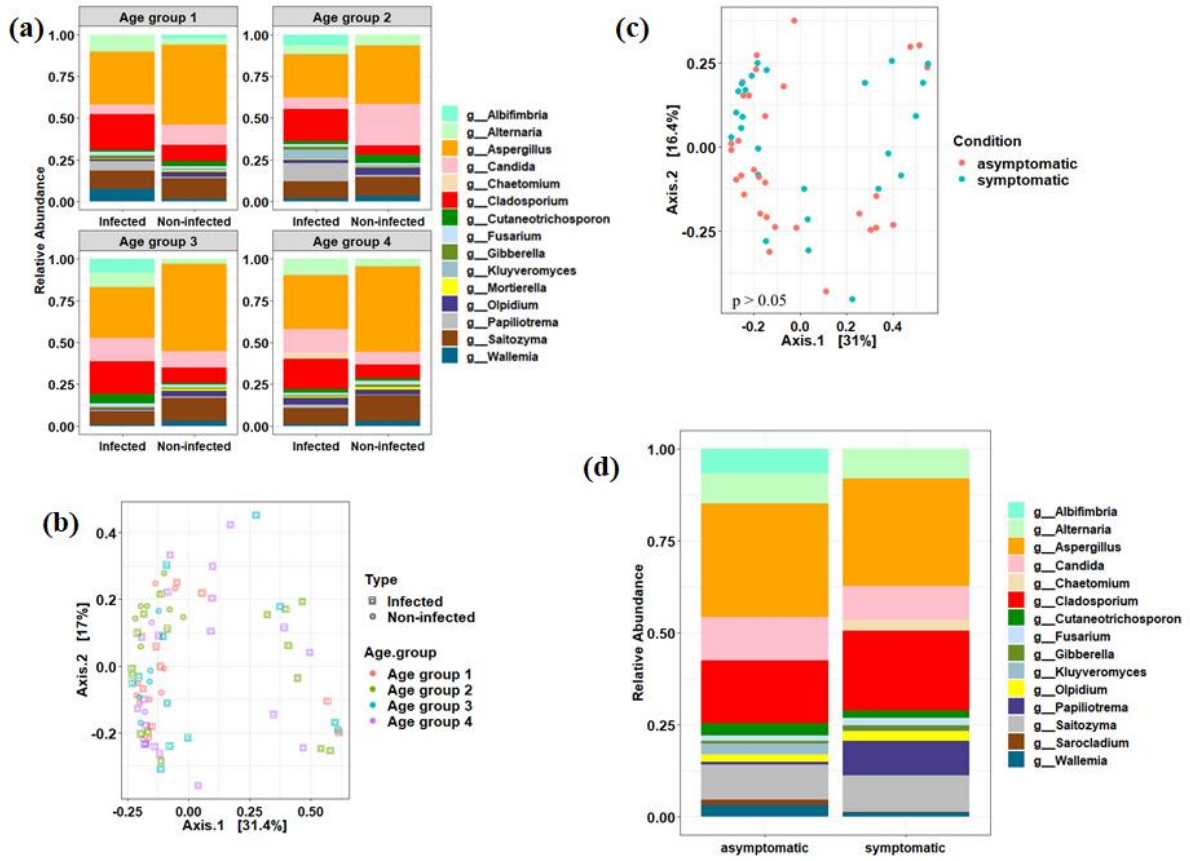

Figure 1: Association between mycobiome and host types (age and conditions).
Mycobiome profile of major genera in SARS-CoV-2 infected and non-infected individuals across different age groups (a). PCoA based analysis to assess the difference in fungal community composition across different age groups (b). PCoA based analysis to assess the difference in fungal community composition between asymptomatic and symptomatic SARS-CoV-2 infected individuals (c). Relative abundance of major genera between asymptomatic and symptomatic SARS-CoV-2 infected individuals (d). Number of individuals belonged to each age category: [Infected ones: Age group 1: 8; Age group 2: 16; Age group 3: 12; Age group 4: 20] and [Non-Infected ones: Age group 1: 9; Age group 2: 7; Age group 3: 5; Age group 4: 3].

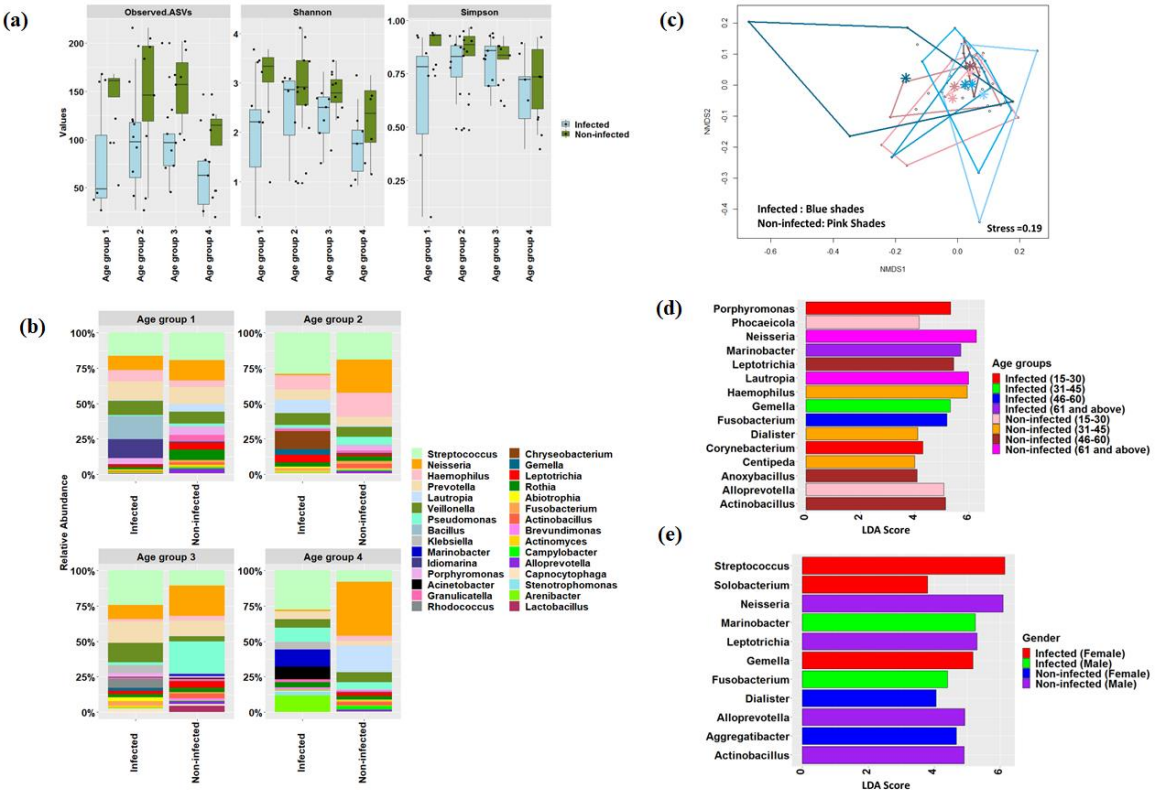

Figure 2: Dynamics of microbial community and its association with host age and gender.
(a) Changes in alpha diversity parameters based on different age groups. (b) Microbial community composition at genera-level across the different age groups. (c) Non-metric multidimensional scaling based on a Bray-Curtis dissimilarity matrix at different age groups. Blue and pink shades represented the infected and non-infected patients. Lighter to darker shades showed age group 1 to 4. Centroid was also denoted in each age category. (d) Identification of differentially-abundant genera in various age groups. (e) Identification of differentially-abundant genera among infected and non-infected male and female individuals.

Molecular Simulation to Biochemical Network Perturbation in Infectious Disease

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Background

Leishmaniasis is a neglected tropical disease caused by parasites of the Leishmania genus. The current treatment options for leishmaniasis have limitations, including toxicity and drug resistance. Autophagy, a cellular process involved in the degradation and recycling of cellular components, plays a significant role in leishmaniasis. The interaction between Leishmania parasites and the host's autophagy machinery is complex. Autophagy can be exploited by the parasites to survive within the host cells, but it can also act as a defense mechanism against infection. Targeting autophagy has emerged as a potential therapeutic strategy. Modulating autophagy could enhance host defense mechanisms and eliminate the parasites. Researchers are exploring various approaches, such as autophagy-inducing compounds and inhibition of autophagy regulators, to develop effective therapies. However, further research is needed to fully understand the mechanisms and develop safe treatments. Targeting autophagy as a key regulator in leishmaniasis holds promise for future treatment options. Thus, in this study we focused on the mechanistic aspect of autophagic processes in host and parasite to shade a light on its implication in therapeutic development.

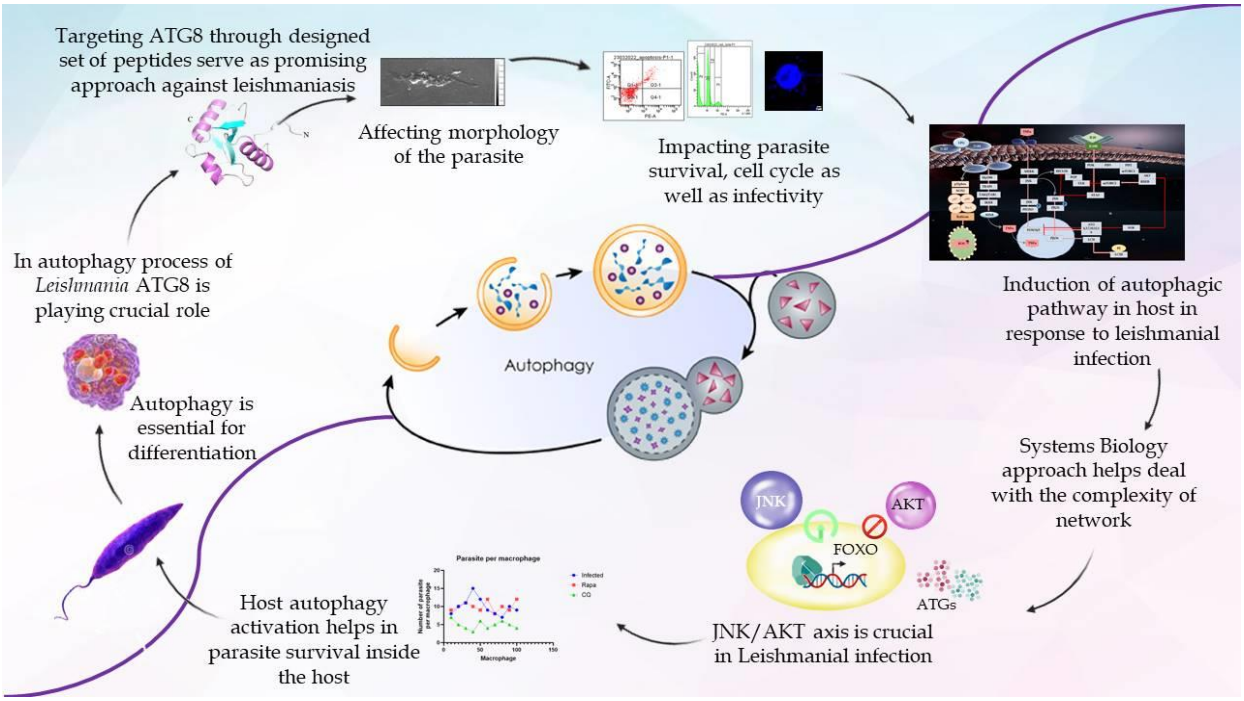
Objectives of the study

- To analyze the autophagic network in-silico in host and churn out the major components involved in infection or resistance of leishmaniasis.
- Deciphering small molecule modulator for targeted autophagy protein identified for leishmaniasis from the reconstructed autophagic network.

Work Done

Systems biology approach was employed to validate the intricate autophagic network implicated in leishmaniasis. A mathematical model underscored the significance of the JNK/AKT axis in the infection dynamics of the autophagic process during leishmaniasis. Furthermore, the LC3 homologue ATG8 was found to be present in Leishmania major, and its role was considered crucial for parasite survival and infectivity. Exploiting the indispensability of ATG8 for parasite survival and infectivity, we targeted non-conserved motifs of ATG8 from Leishmania major. The peptides designed specifically displayed a binding affinity with purified ATG8 and exhibited notable anti-leishmanial activity in in vitro and in vivo models by perturbing the cell cycle, morphology and parasite survival.

Graphical Abstract



Biphasic Cell Cycle Defect Causes Impaired Neurogenesis in Down Syndrome

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Background

Down syndrome (DS), trisomy 21, is a common cause of intellectual disability (ID) (Chapman and Hesketh, 2000). ID in DS is due to dysfunction at various stages of neurodevelopment. Among them, reduced neurogenesis, dendritic hypotrophy and connectivity, imbalance of excitatory glutamatergic, and inhibitory GABAergic system play a significant role (Haydar and Reeves, 2012).

At the microscopic level, the DS cortex shows fewer neurons, decreased neuronal densities, and abnormal neuronal distribution, especially in cortical layers II and IV (Wisniewski et al., 1984; Wisniewski, 1990). Examination of the visual cortex found a significantly reduced number of neurons at the time of birth, followed by recovery in the number of neurons in the DS brain compared to the control brain (Wisniewski et al., 1984). Further analysis of fetal DS brain found ~20-50% fewer neurons in the entorhinal cortex, the dentate gyrus of the hippocampus, hippocampal pyramidal layers, lateral parahippocampal gyrus, and presubiculum compared to the control brain (Guidi et al., 2008). In contrast to the reduced number of neurons, an increased number of astrocytes in the fetal DS brain entorhinal cortex, hippocampus, parahippocampal gyrus, and presubiculum were observed (Guidi et al., 2008; Zdaniuk et al., 2011). Additionally, the emergence of lamination is delayed and disorganized in DS (Golden and Hyman, 1994).

In addition to the development of newer mouse models (Kazuki et al., 2020), human induced pluripotent stem cells (hiPSCs) (Takahashi and Yamanaka, 2006) (Takahashi et al., 2007) generated by reprogramming of the DS patient somatic cells have been used to explore DS impaired neurogenesis. Although earlier studies using human iPSCs have benefited us in understanding DS neurological disorder, they have generated conflicting results for impaired neurogenesis in DS, perhaps due to a lack of standardized in vitro neural differentiation protocols (Shi et al., 2012; Briggs et al., 2013; Lu et al., 2013; Weick et al., 2013; Hibaoui et al., 2014; Sobol et al., 2019) or variations in hiPSC lines (Rouhani et al., 2022). For instance, initial studies reported synaptic deficit in DS neurons (Weick et al., 2013) and detected amyloid plaques (Shi et al., 2012) but found normal neurogenesis in DS cells compared to control cells. Another study reported normal neural differentiation of DS cells, but at a later time point, DS cells generated more astroglia (Briggs et al., 2013). In contrast, two studies found reduced neurogenesis in DS cells (Jiang et al., 2013) (Hibaoui et al., 2014). Both of these studies found a reduced proliferation of DS cells. Jiang et al. showed that silencing of extra chromosome 21 by XIST reversed proliferation deficit and neural rosette formation (Jiang et al., 2013). Hibaoui et al. found that treatment with EGCG, an inhibitor of DYRK1A kinase activity or shRNA against DYRK1A before starting neural induction of hiPSCs rescued DS neural differentiation (Hibaoui et al., 2014). However, these observations do not fully explain several observations like increased glial cell production, delayed cortical lamination, and recovery of the number of neurons in the visual cortex in individuals with DS postnatally. Interestingly, Hibaoui et al. also found that EGCG treatment failed to rescue DS neurogenesis when applied during neuronal differentiation. This observation indicated that molecular mechanisms causing DS impaired neurogenesis might differ at the late phase compared to the early

phase of neurogenesis.

Objectives of the study

- Development of in vitro human iPSCs based Down syndrome neurogenesis model and identify its cellular and molecular mechanisms.

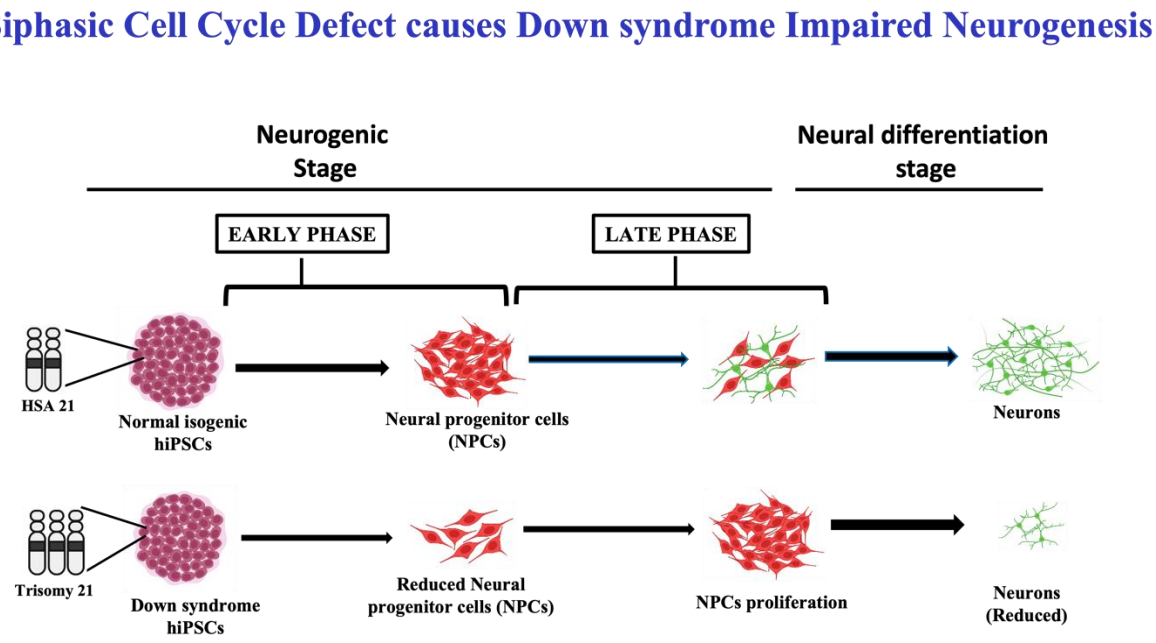
Work Done

We carried out investigations in mouse and human iPSC cells. We found that Ts65Dn mouse iPSCs and DS human iPSCs demonstrated reduced neuronal differentiation compared to control iPSCs, consistent with in vivo observations. Strikingly we found that during the early phase of neural differentiation of iPSCs, DS cells undergo reduced proliferation, but at the late phase, DS neural progenitor cells show increased proliferation compared to control cells. While the reduced proliferation of neural progenitor cells at an early phase will cause a reduction in the number of DS neural progenitors, the increased proliferation causes delayed cell cycle exit leading to impaired generation of post mitotic neurons. Further, global transcriptomic analysis of late-phase human DS cells revealed widespread differences concerning isogenic euploid cells with increased expression of genes that encourage entry into and maintenance of cells in the S-phase, upregulation of the Notch, Wnt, and Interferon pathways, and upregulation of REST. In contrast, there was downregulation of the expression of genes whose products are involved in chromatin remodeling, including components of the BAF complex. Consistently, there was downregulation of the neurogenic genes NFIB and POU3F4, suggesting decreased activation by the PAX6 and BAF complex and marked differences in PAX6 genomic binding with reduced promoter occupancy.

In summary, our studies point to biphasic dysregulation of the cell cycle in both human and mouse model cells during neurogenesis, which may account for reduced neurons, increased glial cells, and delayed cortical lamination during DS brain development. The human DS platform established in this study will enable future studies to discover phase-specific mechanisms of defective neurogenesis in DS.

Figures

GRAPHICAL ABSTRACT



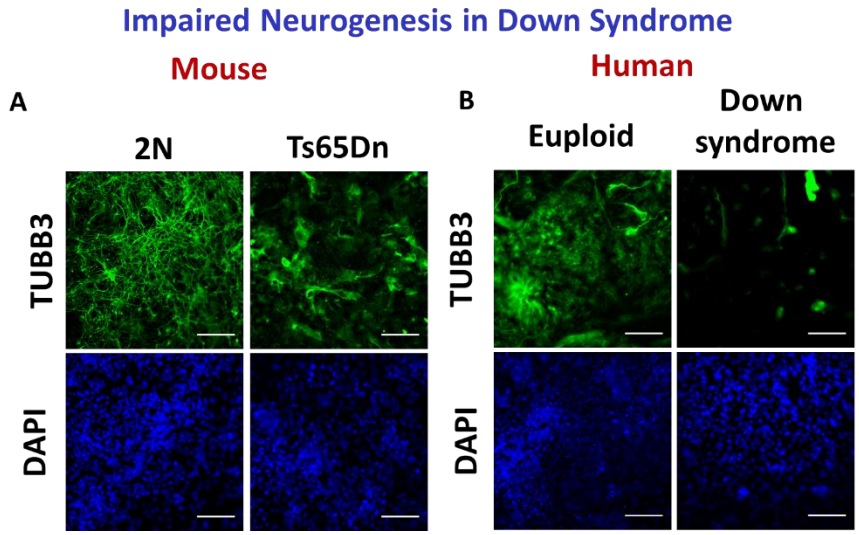


Figure 1: Analysis of monolayer based neural differentiation of 2N and Ts65Dn mouse iPSCs. (A) Representative images of TUBB3 (Green) expressing cells and counterstained with DAPI (Blue). Ts65Dn cells show reduced differentiation compared to 2N cells. (B) Representative images of TUBB3 (Green) expressing human cells counterstained with DAPI (Blue). Human Down syndrome cells show reduced neural differentiation compared to isogenic euplid cells.

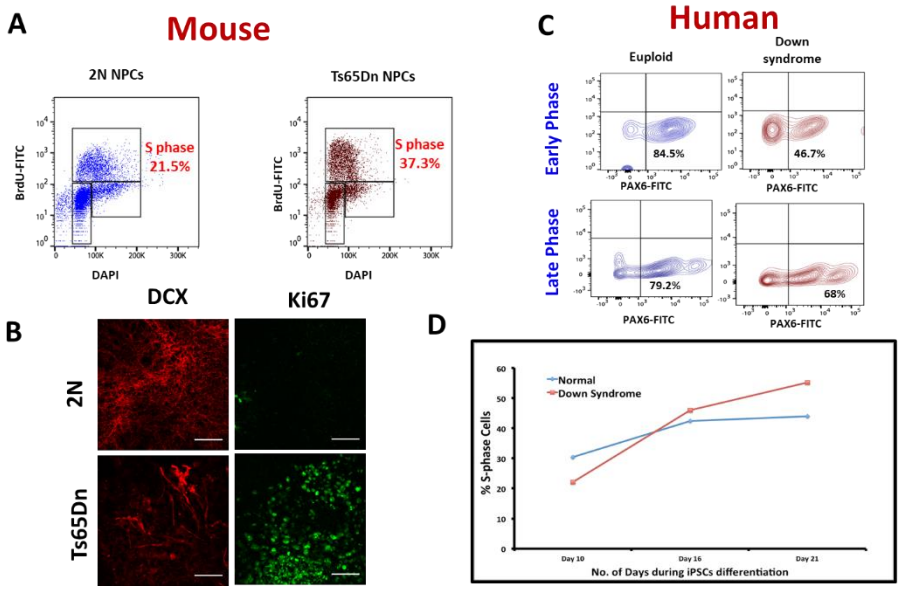


Figure 2: Cell cycle analysis during neural differentiation (A) Mouse cells were analyzed using BrdU incorporation during late stage of neural differentiation. BrdU labeled cells were stained with anti-BrdU FITC antibody and DNA content was analyzed using DAPI staining. Percentage of cells in each phase of cell cycle is shown in the figure. (B) Representative images of cells stained with Doublecortin (DCX) (Red) and Ki67 (Green) at the end stage of neural differentiation. Ts65Dn cells show presence of Ki67+ cycling cells and the absence of DCX+ neural cells indicating delayed neural differentiation of Ts65Dn miPSCs. (C) Quantification of PAX6+ neural progenitor cells at early phase and late phase of neural differentiation. (D) Cell Cycle analysis during neural differentiation of human DS iPSCs and isogenic human iPSCs. Percentage of S-phase cells have been plotted in the graph.

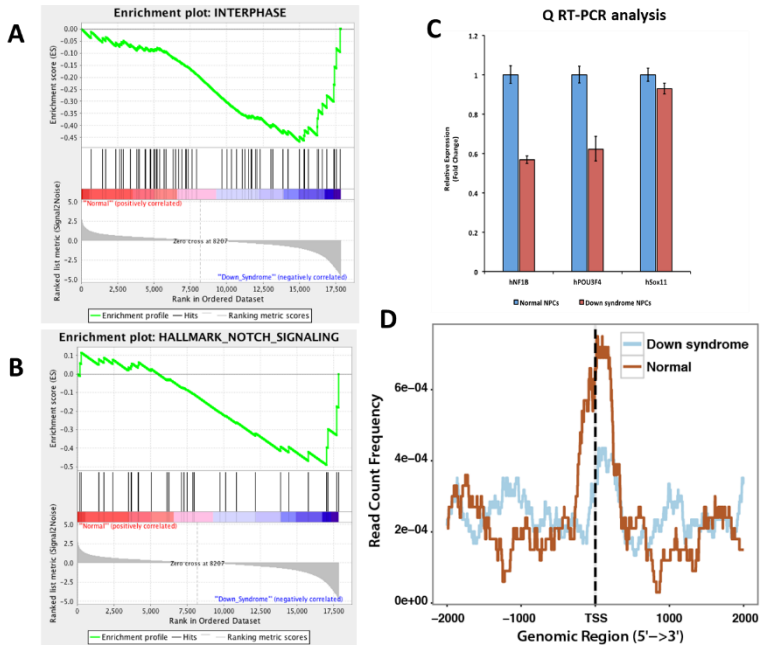


Figure 3: Molecular analysis at late phase of neural differentiation. (A) Transcriptomics data was analyzed using GSEA. Shown is the data for interphase and Notch signaling. (B) Quantitative RT-PCR analysis for the expression of hNF1B, hPOU3F4 and hSox11, genes activated by interaction of Pax6 and BAF complex. (C) ChIPseq analysis of global PAX6 binding profile in isogenic normal and Down syndrome cells.

Understanding the Role of DNA Methylation and Hydroxymethylation Patterns in Diabetic Cardiomyopathy

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Background

Diabetic cardiomyopathy (DCM) is a leading cause of death in diabetic patients. Hyperglycemic myocardial microenvironment significantly alters chromatin architecture and the transcriptome, resulting in aberrant activation of signaling pathways in a diabetic heart. Epigenetic marks such as DNA methylation play vital roles in transcriptional reprogramming during the development of DCM. In DNA, cytosine is methylated at the 5' position, forming 5' methylcytosine (5mC), present mainly in CpG dinucleotides which is catalyzed by maintenance methyltransferase (DNMT1) and de novo methyltransferase DNMT3A and DNMT3B. Methylated DNA is recognized and is bound by methylated DNA binding proteins (MBDs and MeCP2) which prevent the binding of the transcription factors and RNA polymerase II to the DNA. Demethylation of DNA is catalyzed by α-ketoglutarate (AKG)-dependent dioxygenases i.e., TET enzymes which oxidize 5mC into 5'-hydroxymethyl cytosine (5hmC), 5'-formyl cytosine (5fC), 5'-carboxy cytosine (5caC), and further to unmodified cytosine.

The molecular mechanisms involved in transcriptional reprogramming during the development and progression of DCM are largely unknown. The current study is thus aimed to profile genome-wide DNA (hydroxy) methylation patterns in the hearts of control and streptozotocin (STZ)-induced diabetic rats and decipher the effect of modulation of DNA methylation by alpha-ketoglutarate (AKG), a TET enzyme cofactor, on the progression of DCM.

Objectives of the study

- To study the global DNA methylation and hydroxymethylation patterns in diabetic cardiac tissue.
- To investigate the effect of hyperglycemia on the methylation/hydroxymethylation status and transcript levels of important genes involved in the progression of DCM.
- To investigate the mechanism of differential methylation patterns and the effect of its modulation in the pathogenesis of DCM.

Work done

Major outcomes & Significance: We found increased expression of DNMT3B, MBD2, and MeCP2 with a concomitant accumulation of 5mC and 5hmC, specifically in gene body regions of diabetic rat hearts compared to the control. Calcium signaling was the most significantly affected pathway by cytosine modifications in the diabetic heart. Additionally, hypermethylated gene body regions were associated with Rap1, apelin, and phosphatidyl inositol signaling, while metabolic pathways were most affected by hyperhydroxymethylation. AKG supplementation helped in ameliorating these aberrant methylation patterns, increased the binding activity of TET at gene-specific sites, and enhanced the process of DNA demethylation. This, in turn, may result in decreased cardiac fibrosis and restoration of cardiac function by reversing the gene expression changes and pathological signaling imposed by diabetes on the heart tissue. Our in vitro experiments also showed that the hyperglycemia increased 5mC and 5hmC levels in H9c2 cells, which was normalized by DNMT3B knockdown or AKG treatment in these cells.

Although a few studies have already shown methylation maps in diabetic cardiac tissue, this is the first study, to our knowledge, giving a comprehensive understanding of diabetes-induced genome-wide alterations in hydroxymethylation patterns during the progression of DCM. Conventional therapies although, restore blood glucose levels, they fail to improve the progression of DCM. The current study, however, suggests the potential use of epigenetic drug therapies such as AKG for the effective management of chronic complications of diabetes and for delaying the disease progression.

Figure

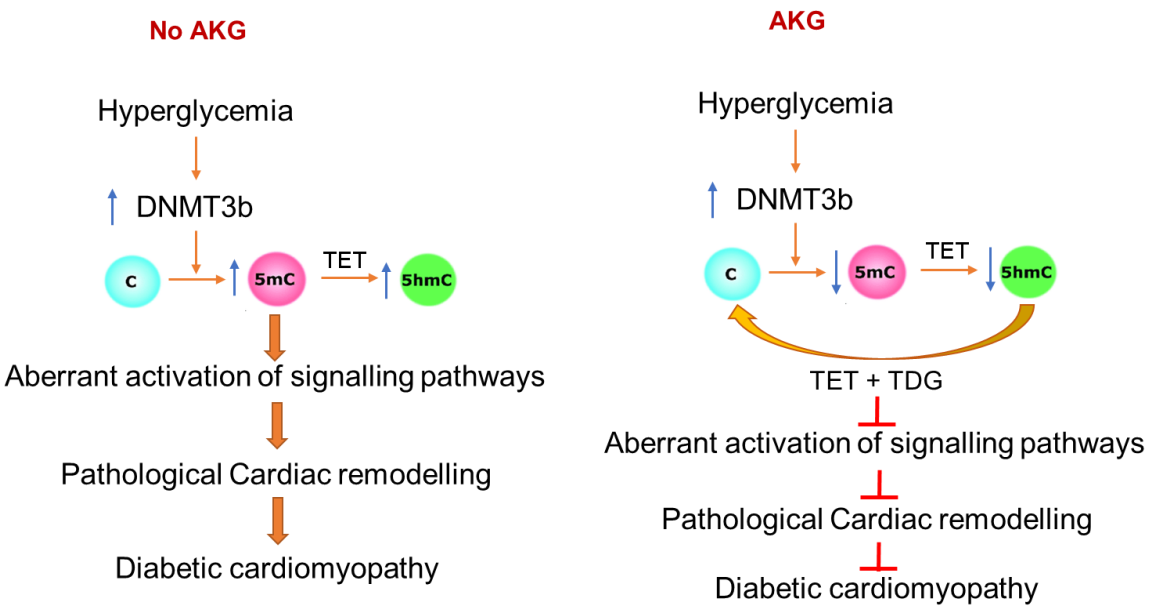

Fig. Legend:
Schematic representation of epigenetic mechanisms involved in the progression of DCM and its restoration by AKG supplementation.

Understanding the Role of Clathrin-mediated Endocytosis in Development and Disease

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Background

Vesicular transport or trafficking is required for the accurate transport of molecules within a cell. A number of studies have shown that alterations in the process of intracellular trafficking can affect development of an organism. Pluripotent embryonic stem cells possess the ability to differentiate into cell types belonging to all three germ layers. These cells provide a useful model system to study cell fate changes and choices in early mammalian development. Pluripotency in embryonic stem cells is regulated by numerous factors, including epigenetic modifications, small non-coding RNAs, and more recently, the process of intracellular trafficking. Our research aims to understand the role of intracellular trafficking in the context of embryonic stem cell differentiation. Additionally, we are also interested in understanding how this process in affected in the context of diseases such as neurodegenerative disorders.

Objectives of the study

- To determine the role of clathrin-mediated endocytosis in embryonic stem cells, in lineage-specific differentiation and during development.
- To determine the function of E-cadherin in embryonic stem cells.

Work Done

Our previous work has shown that embryonic stem cells lacking the clathrin heavy chain (CLTC) lose their stemness and resemble differentiated cells (Narayana et al, 2019, Stem Cell Reports; Mote et al, 2020, J Biol Chem). One of the molecules, whose trafficking is affected in the absence of clathrin heavy chain, is the cell-cell adhesion molecule, E-cadherin. In a bid to understand the effects of loss of E-cadherin in embryonic stem cells, we generated E-cadherin knockout embryonic stem cells. Our results demonstrated that loss of E-cadherin resulted in a destabilization of beta-catenin and an alteration in the expression of its downstream targets in a manner that was dependent on the differentiation status of the

cell, the presence or absence of E-cadherin and whether the cells were treated with a pharmacological inhibitor against GSK3β. Our findings hint at hitherto unknown roles played by E-cadherin in regulating the activity of β-catenin in ESCs (Bhattacharyya et al, 2022; FEBS Letters) (Figure 1). We have also defined a role for the actin cytoskeleton in regulating the stiffness and viscoelastic properties of cells expressing aggregating, pathogenic forms of Huntingtin protein, a central player in the development of the neurodegenerative disorder, Huntington's disease. We have also determined that in such diseased cells, clathrin mediated endocytosis is severely compromised. Together, work from our lab identifies a critical role for intracellular trafficking in regulating normal development.

Figure

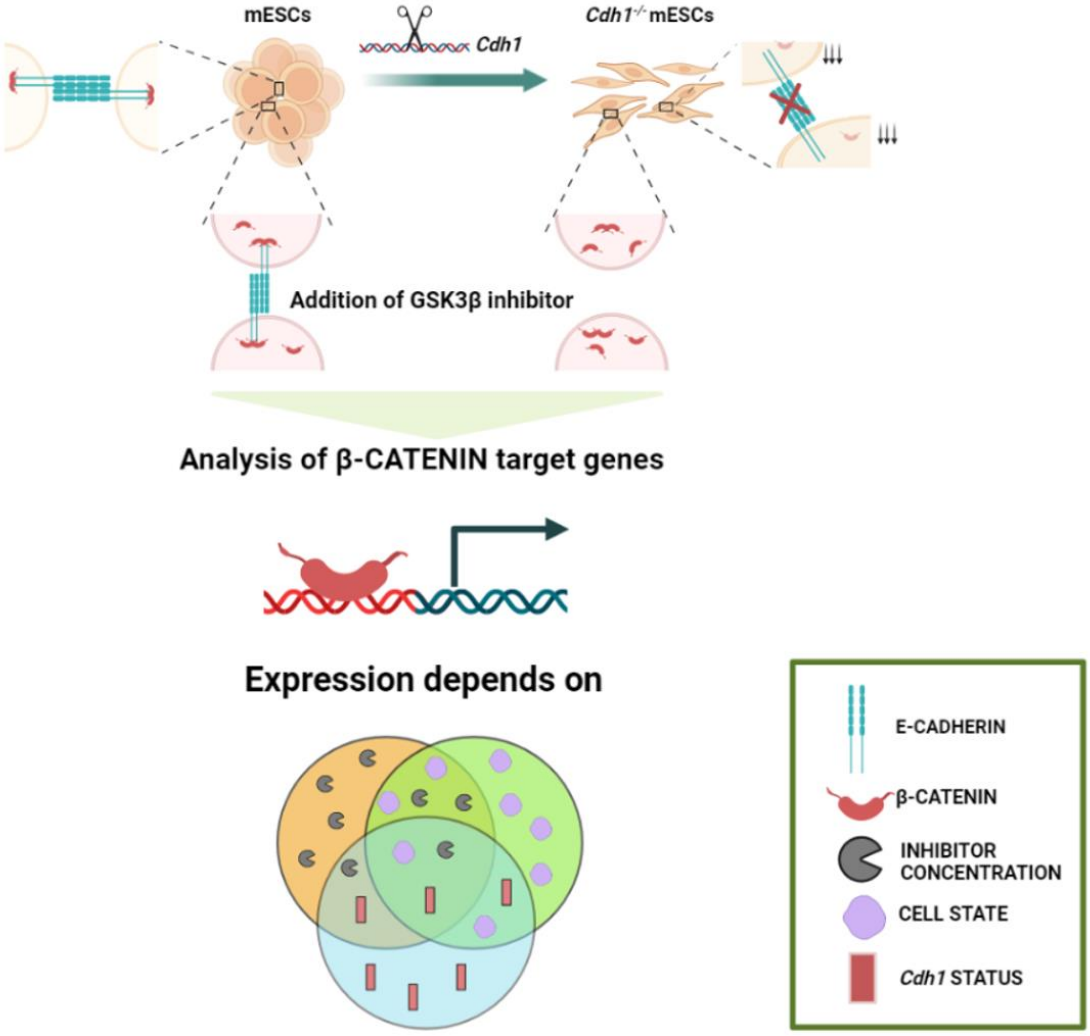

Fig. 1: E-CADHERIN loss causes mESCs to display a scattered morphology along with a reduction in β-CATENIN levels. Bhattacharyya el al. show that the expression of genes driven by β-CATENIN cannot be restored by the stabilisation of the protein alone. Rather, the expression depends on the cell state and/or the presence of E-CADHERIN along with the level of GSK3β activity.

Mechanistic Elucidation of Biomolecular Condensation in Neurodegeneration and Cancer

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Background

Biomolecular condensation is a modern concept that explains the mechanisms of functions and diseases driven by unstructured proteins. Detailed mechanistic evaluation of this process remains a challenge due to the heterogeneity of unstructured protein ensembles within condensates. Our lab employs advanced solution NMR spectroscopy and biophysical techniques to obtain high-resolution view of disease condensates. We complement these in vitro findings with cell-based metabolomics to capture the altered biochemical events that occur due to specific protein condensation. We are also interested in developing simplified cell models of disease using the principles of microencapsulation. This will allow us to rapidly screen for potential condensate modifiers for therapeutic intervention. Incidence of protein condensation diseases like neurodegeneration and cancers is rapidly increasing in India.

Objectives of the study

- Structural evaluation of human Tau protein condensates in various Tauopathies in isoform specific manner.
- To understand condensate driven structural switching of Nucleophosmin in Acute myeloid leukemia.
- To investigate therapeutic potential of SMN protein condensates in Spinal Muscular Atrophy (SMA)

Summary of the Proposed Research

Our lab is focused on delineating the mechanisms of protein condensation in Tauopathies and Acute Myeloid Leukemia. In 2021, Spinal Muscular Atrophy (SMA) was classified as a rare disease by the Ministry of Health and Family Welfare, due to high infant mortality and exorbitant treatment costs. Clinical manifestation of SMA is presumed to be driven by condensation of Survival Motor Neuron (SMN) protein in neurons. Our lab is interested in evaluating the role of critical SMA-specific mutations in the SMN c-terminal region. The structural role of these mutations in SMA pathobiology is less explored. Taken together, protein condensates are the most vulnerable disease states for rational therapeutic intervention, specifically involving unstructured proteins. Condensate-targeted drug discovery has drawn major attention of pharma giants in the western world, with few drugs in clinical trials.

Gene Regulatory Functions of Mammalian Long Noncoding RNAs [lncRNAs] During Quiescence Proliferation Axis

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Background

The eukaryotic cell cycle is composed of two main functionally distinct phases, the synthesis (S) phase where the DNA is replicated and the mitosis (M) phase where the duplicated DNA is distributed into two-daughter nuclei. These two phases are interlinked with Gap phases (G1 and G2) where the cell grows and prepares for DNA replication and cell division respectively. Progression through the cell cycle is controlled at distinct checkpoints, mainly at G1-S entry and G2-M entry. This complete process is orchestrated through a temporal gene expression program guided by specific proteins. The most crucial phase of the cell cycle is the DNA replication step, which is tightly controlled to ensure all the chromosomes replicate once and only once per cell cycle. Initiation of replication at origins occurs throughout the S phase according to a temporal program and consists of origin recognition, assembly of pre-replication (pre-RC) initiative complexes, helicase activation, and replisome loading[2]. Broadly, the cell cycle is tightly controlled by two sets of mechanisms, a cascade of protein phosphorylations that relay a cell from one stage to the next and a set of checkpoints that monitor the completion of critical events and delay progression to the next stage if necessary. A highly regulated family of kinases (CDKs) associates with periodically and transiently expressed proteins, Cyclins, to create active cyclin-CDK complexes and drive the progression of the cell from one stage to other. The activity of these complexes is fine-tuned by their regulatory phosphorylation and dephosphorylation at specific phases of the cell cycle. Checkpoints are more supervisory, as they sense flaws in the critical events e.g., incomplete replication of DNA or DNA damage, during the cell cycle. Checkpoint regulation maintains high fidelity by stabilizing replication forks and preventing cell cycle progression during replication stress or damage by relaying signals to the cell cycle-progression machinery. The deregulations in the cell cycle machinery or the abrupt functioning of the cell cycle regulatory genes are the critical determinants of cancer progression. Additional molecular definition of the cell cycle may lead to a more intricate explanation. Recent studies indicate that various miRNAs and long noncoding RNAs (lncRNAs) regulate many critical cell cycle proteins such as cyclins, CDKs, CDK inhibitors, p53 etc. Long noncoding RNAs are regulatory RNAs of various sizes ranging from 20 nucleotides to >100kb and comprise more than 50% of the eukaryotic transcriptome. Recently, many roles for lncRNAs as RNP complexes that regulate various stages of gene expression are becoming clear. Several studies suggest that lncRNAs are involved in the initiation and progression of cancer. Since it has been shown that cell cycle gene expression serves as a tumor signature, identification of the cell cycle regulated transcripts and their mechanistic studies would greatly advance the understanding of this program and the development of diseases. Several studies strongly suggest that lncRNAs have potentially important roles in mediating cell cycle progression and their aberrant expression may lead to dysregulation in cell cycle. It is important to systematically dissect the cell cycle process and identify lncRNAs that may participate in coordinating this highly complex and delicately regulated program.

Objectives of the study

- Characterize complete lncRNA signature associated with cellular quiescence and proliferation.
- Delineate regulatory mechanisms through which lncRNAs orchestrate these processes.

Work Done

We have generated a catalog of lncRNAs that display a cell cycle stage specific expression. The differential expression during cell cycle could implicate their role in progression of cells from one stage to other, and perturbation in their expression could disrupt the cell cycle program. The rationale is that a comprehensive loss-of-function analysis to determine a robust cell cycle defect phenotype will lead to identification of lncRNAs that have essential role in cell cycle regulation. The general strategy is to perform a comprehensive loss-of-function screen, determine their subcellular localization and temporal regulation during specific stages of the cell cycle. This detailed analysis would confirm the existence of essential lncRNA loci crucial for cell cycle, a finding that has important implications for their involvement in both normal biology and disease.

The cell cycle is a strictly regulated event that is known to be mainly regulated through cyclin-dependent kinases (CDKs) and cyclins. However, the cell cycle is a more complex phenomenon that is coordinated through multiple layers of regulation driven by proteins as well as a wide array of non-coding RNAs (LncRNAs, miRNAs). We are particularly interested in discovering the previously unidentified roles of lncRNAs in cell cycle regulation. One of our comprehensive studies identified a set of cell cycle-related lncRNAs with most of these lncRNAs displaying cell cycle phase-specific expression patterns. LNC-NORM is one such lncRNA which showed G2 phase-specific expression in cell cycle synchronized HeLa cells. LNC-NORM is approx. 4.0 kb long majorly nuclear non-coding transcript located on chromosome 18 *(chr18:5,232,875-5,290,608 (GRCh38/hg38))*, which is actively transcribed across different cell types. Quantitative real-time PCR (qRT-PCR) analysis revealed that the transcript levels of LNC-NORM remain low during G1 and S phase, but there is a steady increase in the transcript levels during the G2 phase with a subsequent decrease in the M phase. Based on the CPAT score obtained using the sequence of LNC-NORM, it was confirmed that LNC-NORM might definitely be a noncoding transcript. We further confirmed that LNC-NORM is a nuclear-retained lncRNA by subcellular fractionation followed by qRT-PCR analysis. Cell cycle phase-specific expression of lncRNAs is often associated with their role in that specific phase. An elevated level of *LNC-NORM* in the G2 phase suggests its potential role in regulating G2 to M progression. To examine the functional relevance of LNC-NORM, we depleted the lncRNA in asynchronously growing HeLa cells followed by cell cycle progression analysis. Anti-sense oligonucleotide (ASO) based depletion of LNC-NORM caused significant G2/M arrest in asynchronously growing HeLa cells. We further confirmed the effect of LNC-NORM depletion on G2/M progression by synchronizing the LNC-NORM depleted HeLa cells in the M phase followed by their subsequent release. It is evident from the cell cycle analysis that the absence of LNC-NORM causes significant G2/M arrest indicating the importance of LNC-NORM for driving the cells through the G2/M phase. As the DNA content-based cell cycle analysis is incapable of distinguishing the G2 and M- phase population, we employed H3ser10 phosphorylation-based cell cycle analysis. The H3 ser10 phosphorylation serves as a mitotic phase marker and it can be easily quantitated through flow cytometry analysis using an anti- phospho H3 ser10 antibody. A close look at G2 and M phase population revealed that LNC-NORM depletion leads to an increase in the G2 phase population with a substantial decrease in mitotic phase population indicating failure of the cells to progress from G2 to M phase.

We employed γ-H2AX immuno-fluorescence to confirm any sort of DNA damage in LNC-NORM depletion condition. Immuno-fluorescence data showed higher γ-H2AX foci formation per nucleus in LNC-NORM depleted cells than that in control cells, indicating elevated DNA damage in LNC-NORM absence. Additionally, depletion of LNC-NORM resulted in a prominent increase in p53 and p21 protein levels. We next sought to investigate the mechanism of action of LNC-NORM in cell cycle regulation. We incubated the *in-vitro* transcribed full-length biotinylated LNC-NORM with cell lysate, followed by a pull-down of the LNC-NORM-protein complex using streptavidin beads. LNC-NORM showed interaction with numerous proteins, out of which polo-like kinase 1 (PLK1) seemed to be interesting as PLK1 is required for entry of cells into mitosis and our previous results suggest a defect in G2/M transition in LNC-NORM depletion conditions. The LNC-NORM- PLK1 interaction was confirmed by significant enrichment (~3 fold) of LNC-NORM in PLK1 IP. Interestingly, we also observed a significant decline in PLK1 protein levels upon LNC-NORM depletion. PLK1 is essential for proper

spindle assembly, centrosome maturation, and microtubule-kinetochore attachment. Hence, we next investigated the effect of LNC-NORM depletion on chromosome segregation. We observed that depletion of LNC-NORM leads to defective chromosome segregation marked by misalignment of the chromosomes during mitosis. A significantly higher number of cells showed lagging chromosomes at the spindle pole. Next, we investigate PLK1 localization at kinetochores, we checked the level of PLK1 at kinetochores in control vs LNC-NORM depletion condition. We used CREST as the kinetochore marker. Interestingly we observed upon LNC-NORM depletion intensity of PLK1 at kinetochores was significantly reduced as compared to control cells suggesting that LNC-NORM depletion affected the PLK1 localization at kinetochores. Next, to elucidate the mechanism of reduced localization of PLK1 at kinetochores, we checked the effect of LNC-NORM depletion on some key regulatory proteins of mitosis. It has been well established and proven that Bub1 is one of the major kinases of mitosis and is required for proper chromosome segregation. It has been studied that the interaction between Bub1 and PLK1 is important for the localization of PLK1 at kinetochores. So, we checked the effect of LNC-NORM on the interaction between PLK1 and Bub1. Interestingly we observed that when we immunoprecipitated PLK1 it was able to co-immunoprecipitated Bub1 along with it but when LNC-NORM was depleted interaction between PLK1 and Bub1 was hampered as PLK1 failed to co-immunoprecipitated Bub1[Fig-4H]. It was validated by performing reverse Co-immunoprecipitation in which an antibody against Bub1 was used to immunoprecipitate Bub1 and the level of Bub1 and PLK1 was checked. Similar to the previous result in reverse Co-IP it was observed that upon LNC-NORM depletion interaction between PLK1 and Bub1 was hampered. Suggesting that LNC-NORM may act as a scaffold, and it is important in regulating the interaction between PLK1 and Bub1.

Figure

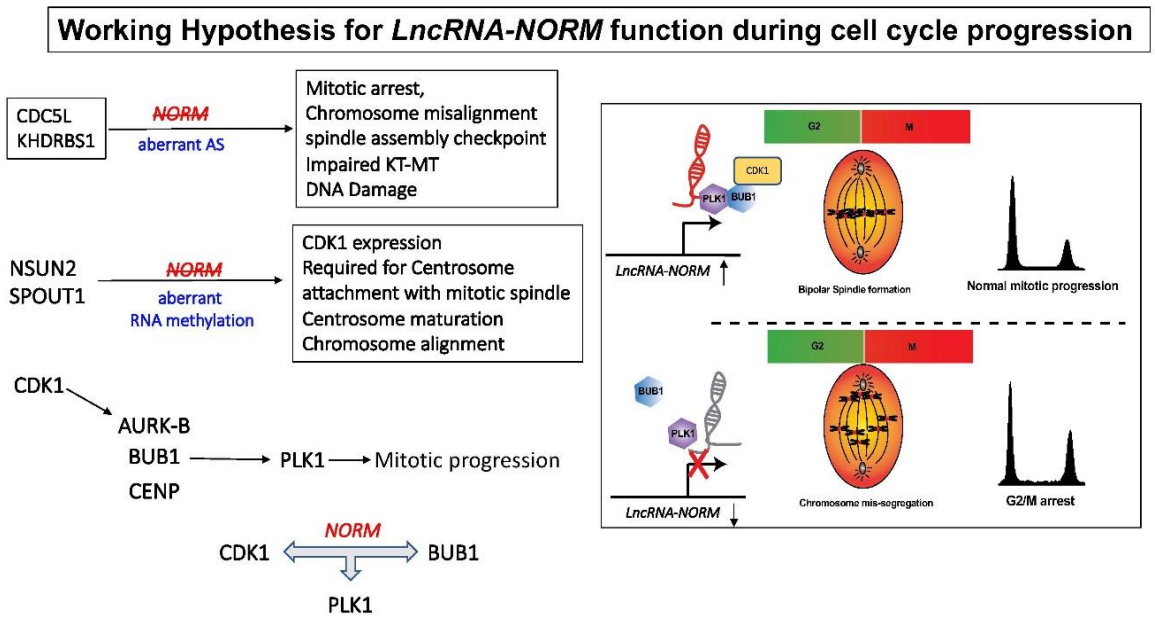

Fig. Legend: Schematic representation of LNC-NORM function during Cell Cycle progression.

Studies on in vivo role of IL-3 on bone remodeling

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Background

Bone remodeling which is necessary for maintenance of bone homeostasis is a continuous process. It is regulated by integrated activity of bone resorbing osteoclasts and bone forming osteoblasts. An imbalance in activities of these two cell types leads to pathological bone loss in osteoporosis and other musculoskeletal diseases. The pathophysiology of osteoporosis is regulated by various osteotropic factors including interleukins. We have previously reported that interleukin-3 (IL-3), secreted by activated T cells, inhibits osteoclast differentiation and promotes osteoblast differentiation. Moreover, IL-3 protects bone and cartilage degeneration in arthritic mice. However, the role of IL-3 in post-menopausal osteoporosis is not yet known. In the present studies, we used ovariectomized (OVX)-induced mouse model of osteoporosis to examine the potential of IL-3 treatment for osteoporosis. We implemented both preventive and therapeutic approaches to understand the overall impact of IL-3 on osteoporosis. Recently, we have shown that when IL-3 was given as preventive therapy at the onset of osteoporosis, it protects bone loss in OVX mice by targeting osteoclast differentiation. In further studies, we examined the therapeutic potential of IL-3 in fully developed osteoporosis in OVX mice.

Objectives of the study

- To investigate the in vivo role of IL-3 on bone resorption and bone formation using mouse model of human osteoporosis.
- To evaluate the level of IL-3 in serum samples of human osteoporotic patients.

Work done

To address the therapeutic potential of IL-3 in treatment of osteoporosis, IL-3 was administered in OVX mice from day 30 when osteoporosis was fully developed. On day 60 femur and tibia bones were examined by µ-CT analysis to assess the trabecular bone parameters. We observed that IL-3 significantly improved most of the trabecular bone indices including bone volume (BV), BV/tissue volume (BV/TV), bone surface (BS), BS/BV, BS/TV, trabecular thickness, trabecular number and trabecular pattern factor in both femur and tibia bones. The trabecular bone mineral density was also significantly increased by IL-3 in both femur and tibia bones. These results underscore the therapeutic potential of IL-3 in promoting trabecular bone regeneration. In the early stages of osteoporosis, trabecular bone experiences primary loss, while cortical bone remains relatively unaffected. However, as osteoporosis progresses to later stages, substantial bone loss is seen in both trabecular and cortical bones. A significant cortical bone loss was observed in OVX mice on day 60. Interestingly, IL-3 successfully restored cortical bone loss in both femur and tibia bones further supports its potential in stimulating bone formation even during later stages of osteoporosis. Notably, IL-3 therapeutic treatment had no adverse effects on general haematopoiesis or vital organs of OVX mice. Our study suggests that IL-3 in a preventive manner suppresses bone resorption by targeting osteoclast differentiation, while in therapeutic manner it

promotes bone formation by targeting osteoblast differentiation (Figure 1). In further studies serum samples of human osteoporotic patients will be evaluated for determining the level of IL-3 along with other cytokines.

Figure

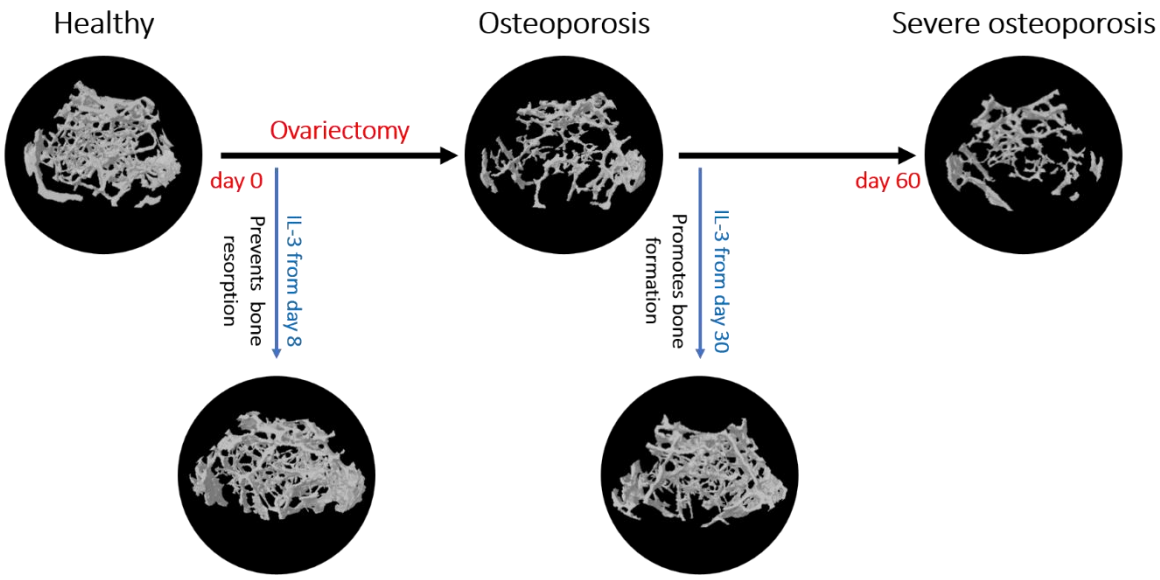

Fig. 1: IL-3 alleviates pathological bone loss in mouse model of osteoporosis under both the treatment strategies, preventive and therapeutic.

Genomic Perspectives, Transmission Dynamics of Exploring Sandal Spike Disease, and Inclusive Strategies for Phytoplasma Classification

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Background

Phytoplasmas (class Mollicutes, genus '*Candidatus* Phytoplasma') are not yet cultivated, endophytic bacterial pathogens associated with hundreds of plant species leading to extensive crop yield losses every year worldwide. Phytoplasmas secrete unique effector proteins to modulate the plant response to their infection to help themselves to get transmitted through sap-sucking insect vectors. These effector proteins hijack the plant developmental processes by modulating the expression of crucial housekeeping genes. The whole-genome sequencing provides detailed and precise aspects of organism biology and helps understand the wide range of virulence factors possessed and executed by the pathogen.

Objectives of the study

- Isolation, enrichment, sequencing, assembly and analysis of the genome of 'Saldal Spike' phytoplasma strains associated with *Santalum album* L. Identification of putative effector genes governing pathogenicity, mobile elements and virulence factors. Understanding the evolutionary aspect of the phytoplasma genome through comparative genomics.
- Understanding the transmission of sandal spike phytoplamsa through vertical (seeds) and horizontal (insect vectors) transmission.
- To review the role of genome sequences in phytoplasma taxonomy and overall development of phytoplasma taxonomy so far and its mimitations.

Work Done

'*Ca*. Phytoplasma asteris' (16SrI-B) associated with sandal spike disease (SSD) has adversely affected sandalwood production in India and pushed it into a 'vulnerable (vu) list of IUCN. Seldom efforts have been made to elucidate the epidemiology of SSD and the nature of the pathogen. In this attempt, the sandal spike phytoplasma (strain SW86) genome was sequenced using Illumina and Oxford Nanopore Technology platforms, followed by the construction of the targeted hybrid metagenomic assembly. The genome assembly generated 20 scaffolds totaling 554,025 bp, containing 436 protein-coding genes, 27 tRNA, and one rRNA operon. The SW86 genome possesses homologs of various SAPs and other putative effector proteins, including SAP11 and TENGU. Pathogenesis-related proteins like hemolysin III and the SodA genes were also found in the SW86 genome. The availability of this genome adds value to understanding the genomics of the aster yellows (AY) group of phytoplasmas, especially the factors related to the pathogenicity.

The Sandalwood Spike disease (SSD) related to '*Ca*. Phytoplasma asteris' has almost wiped out the sandalwood population from the forests of southern India. It is known that sap-sucking insect vectors

transmit phytoplasmas; however, their transmission through seeds needs thorough investigation. We found that 38.66% and 23.23% of one-month and four-month-old seedlings, respectively, tested positive for SSD phytoplasma screened using modified real-time qPCR assays in insect-free environments. Considering the current efforts to reestablish the healthy sandalwood population and its commercial importance, these findings are worrisome. The role of some other microbes in the high mortality rates of sandalwood seedlings remains unknown and requires further investigation.

Phytoplasma taxonomy has been a topic of discussion for the last two and half decades. Since the Japanese scientists discovered the phytoplasma bodies in 1967, the phytoplasma taxonomy was limited to disease symptomology for a long time. The advances in DNA-based markers and sequencing improved phytoplasma classification. In 2004, the International Research Programme on Comparative Mycoplasmology (IRPCM) - Phytoplasma/Spiroplasma Working Team – Phytoplasma taxonomy group provided the description of the provisional genus '*Candidatus* Phytoplasma' with guidelines to describe the new provisional phytoplasma species. The unintentional consequences of these guidelines led to the description of many phytoplasma species where species characterization was restricted to a partial sequence of the 16S rRNA gene alone. Additionally, the lack of a complete set of housekeeping gene sequences or genome sequences, as well as the heterogeneity among closely related phytoplasmas limited the development of a comprehensive Multi-Locus Sequence Typing (MLST) system. To address these issues, researchers tried deducing the definition of phytoplasma species using phytoplasmas genome sequences and the average nucleotide index (ANI). In another attempt, a new phytoplasma species were described based on the Overall Genome relatedness Values (OGRI) values fetched from the genome sequences. These studies align with the attempts to standardize the classification and nomenclature of 'Candidatus' bacteria. With a brief historical account of phytoplasma taxonomy and recent developments, this review highlights the current issues and provides recommendations for a comprehensive system for phytoplasma taxonomy until phytoplasma retains 'Candidatus' status.
The extensive collection of sap-sucking insect vectors from soybean and parthenium infected fields revel the presence of many known and unknown vectors transmitting PWB phytoplasmas.

Figure

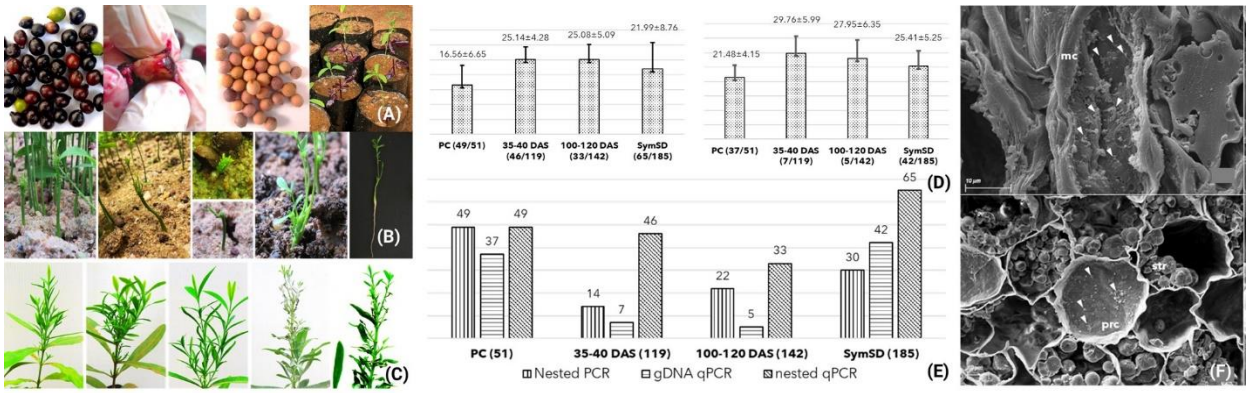


Fig. Legend: Collection of healthy drupe sandalwood fruits, de-pulping of individual fruit, clean and dried seeds ready for sowing, and asymptomatic sandalwood seedlings at 25-35 days after sowing (DAS) (A); Sandalwood seedlings at 35-40 DAS and 100-120 DAS showing SDD symptoms (B & C); Range of Ct values in positive control samples (PC), seedlings collected at 35-40 and 100-120 DAS, and seeds collected from SSD symptomatic sandalwood trees (SymSD). The number positives shown in parenthesis (D); Phytoplasma positivity rate observed among three screening methods used; end-point nested PCR, qPCR using gDNA as a template and nested qPCR in positive control samples (PC), Seedlings collected at 35-40 DAS, Seedlings collected at 100-120 DAS, and seeds collected from SSD symptomatic sandalwood trees (SymSD). The number positives shown in parenthesis (E). SSD phytoplasma cells were observed in symptomatic sandalwood leaf tissue, in fruit mesocarp and hypocotyl tissue of sandalwood seedling using scanning electron microscope (F).

Support Units
&
Other Facilities

EXPERIMENTAL ANIMAL FACILITY

The Team		
Dr. B. Ramanamurthy *(Scientist and Facility In-charge)* *Dr. Rahul M. Bankar* *Mr. Md. Shaikh* *Mr. A. Inamdar* *Mr. Prakash T. Shelke*	*M. Vaishali Bajare* *Mr. Mahavir Rangole* *Mr. Rahul B. Kavitake* *Mr. Ganesh B. Yadav* *Mr. Sanjay Gade* *Mr. Harshal G. Gaonkar* *Mr. Dilip B. Thorat*	

The Experimental Animal Facility (EAF) is a core support facility of the Institute providing a spectrum of services in the area of Laboratory animal Experimentation for Research and Development programs of the Institute. The facility is registered with the "Committee for Control and Supervision of Experiments on Animals" (CCSEA) and operates in compliance with the guidelines laid down by the Committee. The mandate of the facility is the breeding, maintenance, and supply of small laboratory animals viz. inbred and mutant mice, rats, rabbits, etc. for the ongoing research projects of the Institute. The following is the list of various laboratory animals maintained at the facility:

MICE:

BALB/cJ
C57BL/6J
DBA/2J
DBA/1/J
129/SvJ
FVB/NJ
SWISS#
BALB/c*
NZB
AKR#
CF1
CD1
Genetically engineered mutant mice (knock-out, transgenic and mutant mice

RATS:

WISTAR

RABBITS:

NEWZEALAND WHITE

* BALB/c with cataract mutation # Outbred

The total number of mice lines, inbred, outbred, and mutant and hybrids, being maintained at the Experimental Animal Facility stand at 55. The foundation/nuclear colonies of mice are housed in Individually Ventilated Caging systems. Genetic monitoring using standard PCR protocols for mutant mice and select microsatellite markers for the major inbred strains is carried out regularly by PCR.

The breeding program for the propagation of the inbred mice is planned and executed to meet the needs of Scientists of the Institute for the conduct of animal experiments.

R&D support is provided to the various research groups of the Institute. Currently, 65 approved animal use projects are being supported for the conduct of experiments on laboratory animals. Complete scientific as well as technical support and advice is extended as per demand to the Scientists and their group members for the conduct of experiments under their projects.

As a part of human resource development, the facility conducts training/course work (mandatory) for the research fellows of the institute in the area of 'Laboratory Animal Experimentation and Ethics'. During the year 2022-23, a total of **62** fellows underwent the one-credit course which comprised both theory and practical sessions.

As per the rules and regulations framed by the Committee for Control and Supervision of Experiments on Animals (CCSEA) Govt. of India, the EAF provides the requisite oversight on the conduct of experiments on laboratory animals in the Institute. During the reporting period, 4 meetings of the Institutional Animal Ethics Committee (IAEC) were organized for the review and approval of project proposals from the Institute's Scientists.

Lectures/Talks Delivered

Dr. Ramanamurthy delivered a lecture as guest faculty during the One Week National Online Training Programme on "Laboratory Animal Management and Breeding" organized by the Department of Animal Genetics and Breeding, College of Veterinary & Animal Sciences, Parbhani, Maharashtra, between 10-16 January 2023.

PROTEOMICS FACILITY

The Team ***Dr. Srikanth Rapole*** *(Scientist and Facility In-charge)* *Dr. M. V. Vijayakumar, Technical officer* *Mr. Venkatesh Naik, Technician*	

The proteomics facility is a core service facility of the institute with an objective to provide mass spectrometric analysis of biological samples. The facility provides various services including intact protein mass analysis, protein sequencing, proteome analysis, quantitative proteomic analysis, metabolite analysis and PTMs identification etc. It also facilitates comparative analysis of proteins and its levels for comparison with potential application in a wide range of diseases towards biomarker discovery. The facility is being used extensively by in-house users as well as by external organizations for advanced molecular and biomedical research. The following is the list of various instruments available at the facility:

The Orbitrap Fusion Tribrid LC-MS/MS system (Thermo Scientific) combines the best of quadrupole, ion trap and Orbitrap mass analysis in revolutionary tribrid architecture to provide unprecedented depth of analysis and ease of use. The system enables analyzing the most challenging low-abundance, high-complexity samples to identify more compounds faster, quantify more accurately and elucidate structures more thoroughly. This system is capable of multiple dissociation techniques viz. CID, HCD and ETD with ion trap or Orbitrap detection at any level of MS^n maximize flexibility for research applications. The system performs a wide variety of analyses, from in-depth discovery experiments to characterization of complex PTMs and comprehensive qualitative and quantitative workflows. The number of samples analyzed is 227 samples from April-2022 to March-2023.

The 4800 MALDI TOF/TOF system (Sciex) is a tandem time-of-flight MS/MS system used for protein identification and intact mass analysis. The system identifies proteins by determining accurate masses of peptides formed by enzymatic digestion. Additionally, the system can more definitely identify and characterize proteins by isolating and fragmenting a molecular ion of interest and measuring the fragment ion masses. The number of samples analyzed is 36 samples from April-2022 to March-2023.

The 4000 Q-Trap LC-MS/MS system (Sciex) is a hybrid triple quadrupole/linear ion trap mass spectrometer coupled to Eksigent Express Micro LC-Ultra System. The system is used for targeted proteomic applications, metabolomic applications and lipidomic applications. The number of samples analyzed is 55 samples from April-2022 to March-2023.

The Gas Chromatography Mass Spectrometry (GC-MS) system (Agilent) with 7890B GC and 5977A MSD provides unmatched sensitivity for ultra-trace analysis, and increased performance. It is highly suitable for volatile and semi-volatile compounds. GC-MS set-up is used for identifying metabolites involved in various diseases.

Equipment in the Proteomics Facility

	
Orbitrap Fusion Tribrid LC-MS/MS system	**4800 MALDI-TOF/TOF**

	
4000 Q-Trap LC-MS/MS	**AGILENT GC-MS**

Outreach and Training

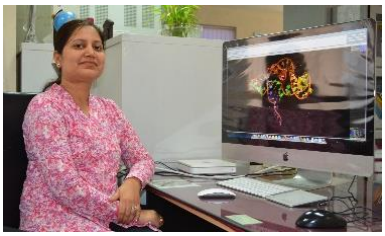
The Facility conducted various training programs for the research fellows of the institute and gave training on sample preparation for MS analysis, protein digestion, peptide desalting followed by MS data acquisition, data analysis and proteomics data-based bioinformatics. During the year 2022-23, a total of 14 research students, 1 technical staff member and 1 scientific staff member underwent extensive one-week training at the proteomics facility. These training programs help them to use advanced mass spectrometry approaches in their projects.

The proteomics facility staff actively participated in the National Science Day open day, NIV scientists' visit, and students' exposure to the facility as part of the PhD coursework, and also demonstrated mass spectrometry instruments and technologies to the students from various schools, colleges and universities, and the general public. During the year 2022-23, a total of 537 students and teachers visited the proteomics facility, and were given exposure to sample processing stages before submitting to advanced mass spectrometry instruments; the staff of proteomics facility also demonstrated its working and applications. The facility staff also gave a lecture on the proteomics facility as part of a lecture series on the central facilities of NCCS, to the scientific staff and students, on 10th March, 2023.

	
Students, technical staff, and scientific staff who attended the 9th Proteomics Workshop 10 - 13 October, 2022	Visit of students from the Department of Microbiology, KWC, Sangli to the proteomics facility on 29th March, 2023

As a part of lecture series on central facilities of NCCS, the proteomics facility staff delivered a talk on the proteomics facility services on 10th March, 2023	

BIOINFORMATICS AND HIGH PERFORMANCE COMPUTING FACILITY

The Team ***Dr. Shailza Singh*** *(Scientist and Facility In-charge)* *Pratibha Patil, Technical Officer 'A'*	

The bioinformatics facility at NCCS provides access to high-performance computing resources and programming expertise. The compute infrastructure serves scientists at NCCS to master the informatics needs of their research in a proficient and cost-effective manner.

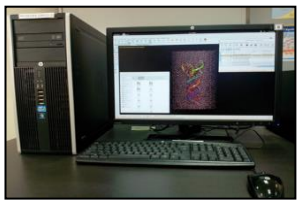
Hardware Infrastructure

SGI Altix XE 1300 Cluster
Head Node:
SGI Altix XE 270 Serve.
Dual Quad Core XEON 5620 @ 2.4GHz / 12MB cache,12GB Memory,5 x 2TB SATA Disk @ 7.2K RPM RAID 5

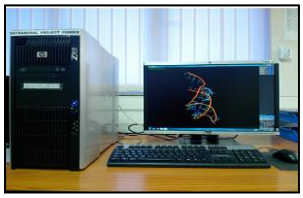
Compute Nodes:
SGI Altix 340 Servers
2 x HEXA Core XEON 5670 @ 2.93GHz / 12MB cache, 24GB Memory, 250GB SATA Disk @ 7.2K RPM, Dual Gigabit Ethernet Card

SGI Cluster Software Stack:
SLES Ver 11
SGI ProPack 7
SGI Foundation Software Ver 2.0
Interconnect:
24-Ports Gigabit Ethernet Switch

GPU Computing HP Proliant SL6500
2x Intel Xeon X5675 @3.06GHz/6 core/12MB L3 Cache
96 GB (8 GB x 12) PC3 – 10600 (DDR3 – 1333) Registered DIMM memory
2 x 1 TB hot Plug SATA Hard Disk @7200 rpm
Integrated Graphics ATI RN50/ES1000 with 64 MB memory
2x NIVIDIA Tesla 2090 6 GB GPU computing module



Specialized Workstations:
HP Elite 8200 CMT PC
Second generation Intel core i7-2600 processor 3.40 GHz, 8M cache, 4 cores/8 threads
Integrated 4 port SATA 6GBs controller
Integrated Intel HD graphics
HP Z800 High End Work Station (2 in number)
2x Intel Xeon E5649 6 core @2.53 GHz, 80-watt 12MB cache
5.86GTs QPI, DDR3 1333 MHz, HT Turbo
NVIDIA Quadro FX380 Graphics with 256MB memory
SATA 6 GBs controllers with RAID 0/105 & 10 support
19" LCD wide Display with Windows OS
HP Z820 High End Work Station



2x Intel Xeon E5-2690@2.9GHz, 8 core/20MB L3 cache
8 GTs QPI, DDR3 1600 HT Turbo 2 with vPro support
NVIDIA Quadro 4000 Graphics with 2GB DDR memory
SATA 6 GBs controllers with RAID 0/105 & 10 support
22" LCD wide Display with Windows OS

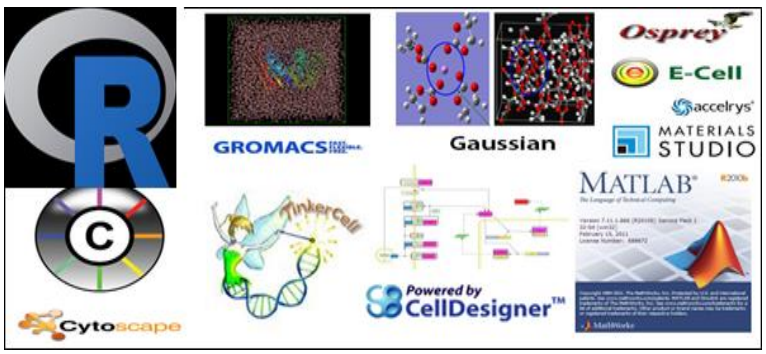
High End Desktop (4 in number)
HP workstations of Intel Core 2 Duo @3.00GHz with 8 GB of DDR2 memory, 320 GB of SATA storage and 19" LCD wide Display with Linux/Windows OS
HP Elite Desktop of Intel i7 processor, 3.4GHz with 16GB RAM, 2TB SATA storage and 21.1" LCD wide display with Windows 8.1 Professional OS.

Desktop Computers
Desktop computers with Intel core 2 duo processor @1.8Ghz to 2.8GHz with 2 GB to 4 GB of DRR2 memory, 160GB to 320GB of SATA storage with 17" wide LCD display and with Windows XP OS
iMAC: For running specialized software like Biojade

Printer: HP Laser jet M1136MFP, Canon Network Printer, HP laserjet pro 8000 color printer

APC UPS 10 KVA for supporting the HPCF

Software infrastructure
The Bioinformatics Facility at NCCS has procured several software for scientific research having commercial and/or academic license. These are:
Sequence analysis: BLAST, CLUSTAL-W, MEGA, Eisen
Molecular Modeling: Modeler
Molecular Docking: AUTODOCK, HADDOCK, ClusPro
Pharmacophore Modeling: Auto Pharmacophore generation, Receptor-ligand pharmacophore generation, 3D QSAR pharmacophore generation, Steric Refinements with excluded volumes.
Network Modeling: Cell Designer
Toxicity Prediction: Molinspiration, DSSTox, PreADMET Toxicity Prediction
QSAR: Create Bayesian Model, Recursive Partioning Model, Multiple Linear Regression Model, partial least squares model, genetic function approximation model, 3D QSAR model. Intelligent QSAR using molecular fragments of interest and their features, evaluation of descriptors from template scaffold to form relationship with the activity.
Molecular Dynamics: CHARMM, GROMACS, NAMD, MOIL
Molecular Visualization: Rasmol, MolMol, WinCoot, Swiss PDB viewer, MolScript, VMD
***ab initio* modeling:** GAUSSIAN
Systems Biology Tools: Virtual Cell, M-cell, Cell Designer, GEPASI, Cytoscape, Osprey, E-Cell, SimBiology
Artificial Intelligence: SVM^{light} and SNNS
Material Modeling and Simulation: Material Studio 5.5
Graphs and Graphics: Sigma Plot, GNU Plot, Corel Draw and Adobe PhotoShop
Statistical packages: MATLAB and R



Workshops conducted at Bioinformatics and High-Performance Computing Facility:

In-house "Applications of Computational Biology" training to graduate students which helps them to develop a computational framework for gene survey of the biological sequences, which includes structure prediction, phylogenetic analyses, motif prediction, network modeling, molecular docking, protein-protein interaction, NGS Data Analysis etc. The workshop helps them to develop inferences of the biological mechanism and hypothesis for further experimental testing.

Training is being conducted regularly for the students enrolled in PhD coursework and in workshops to students.

Dates: 11/08/2022, 18/08/2022, 25/08/2022, 01/09/2022, 08/09/2022, 15/09/2022, 22/09/2022, 24/09/2022, 29/09/2022, 01/10/2022, 06/10/2022, 08/10/2022, 13/10/2022, 20/10/2022, 22/10/2022, 03/11/2022. 06/11/2022, 10/11/2022, 12/11/2022, 17/11/2022, 19/11/2022, 24/11/2022, 26/11/2022

Online training programme for the NCCS students 2022. Online workshops in a) Network Biology b) Homology Modeling c) Docking d) R programming language was organised for students, faculties and industry participants outside NCCS

1) Different types of structure representation and implications – PyMol, Chimera 2) Surface calculation and implications: Hydrophobic, charge representation 3) Secondary structure prediction 4) Structure based alignment 5) Binding pocket prediction – Castp; Glycosylation, phosphorylation sites prediction 6) Modeller – homology modeling, threading 7) Energy Minimisation 8 Validation of models – Procheck, Whatif, Verify 3d 9) Auto dock VINA 10) NGS Data Analysis 11) Genome Browsers 12) AI & ML

LIBRARY

The Team ***Mr. Krupasindhu Behera**, Technical Officer* ***Mr. Rameshwar Nema**, Technical Officer*	

The NCCS library is listed in the Union Catalogue of Biomedical Serials in India created by the National Institute of Science Communication and Information Resources (NISCAIR), New Delhi.

The NCCS library has a collection of publications in frontier areas of biotechnology. The library's priority is to support the research activities of NCCS. Therefore, the collection is expanded in consultation with the NCCS faculty. The library's print collections are growing by approximately 110 volumes per year. The library holds approximately fifteen thousand one hundred seventy-nine bound journals, four thousand one books, and three hundred seventy-one Ph.D. theses of NCCS research students. Nine scientific journals and eighteen other periodicals in print form are subscribed. The online journal consortium of DBT, DeLCON, currently subscribes 980 e-journals from 12 publishers. The staff and students are provided access to online publications, including journals and the online book series, Methods in Enzymology, which are published by various publishers, including Springer, John Wiley, Nature Publishing group, Mary & Libert, Oxford, Elsevier Science Direct, through DeLCON. The library also subscribes five additional online journals in research areas that are of interest to the NCCS faculty. Furthermore, the library regularly purchases books and magazines in Hindi for general reading.

The library has the Linux-based SLIM21 library software for its housekeeping operations and Web-OPAC for online searching of the library documents. Additional facilities in the library include CD-ROMs for a number of books and a local area network providing access to the internet for PubMed search and other associated activities.

The library personnel are involved in providing library-related information for the NCCS website (English), including library holdings, services, useful links and other relevant information. During the period under review, they have created a digital archive of the Ph.D. theses submitted by the NCCS research scholars to the University, and the NCCS publications published during the said year, which are accessible through the NCCS intranet.

In addition to the above, the library also provides in-house services for scanning documents using the iThenticate Anti-Plagiarism Software for scanning Ph.D. theses and publications prior to their submission to the Savitribai Phule Pune University. An open access repository for the research publications of the NCCS faculty has also been set up, which is available through the link: http://nccs.sciencecentral.in.

COMPUTER SECTION

The Team *Mr. Rajesh Solanki (Technical Officer)* *Mr. Shivaji Jadhav (Technical Officer)* *Mrs. Rajashri Patwardhan (Technical Officer)* *Mrs. Kirti Jadhav (Technical Officer)*	

The Computer Section provides various computing and network infrastructure services to NCCS staff, personnel on extra-mural projects and research scholars. Routine support includes configuration and setup of servers, desktops, laptops, printers, scanners, software, network switches and their maintenance.

The section is also responsible for providing secured network services, including the design of campus-wide LAN/WAN, WiFi and intranet solutions, besides making available basic computing infrastructure required for the implementation of ongoing R&D projects. Two internet links are installed at NCCS *viz.* 100Mbps from NKN and 100Mbps from BSNL, Pune. Internet facilities are extended to all institute users, Director's residence, visitors to the guest house, student's hostel, and staff quarters. The present Network security system has been upgraded with the installation of a new Sophos firewall XGS4300 and NetProtector Antivirus for desktops and laptops to provide a cohesive secured working environment.

Technical Support Provided

- Wired and wireless networking solutions & services to servers, workstations, desktops, laptops and mobile phones.
- Setting up temporary wifi network for conferences, seminars and meetings.
  - Provided technical support to the India EMBO Lecture Course 'Complement in kidney disease' organised in the NCCS auditorium between 31st January and 3rd February 2023.
  - Organized live streaming, recording and editing of a public talk by the Nobel Laureate, Prof. Harold Varmus - 17 January 2023.
  - Provided technical support to Indo-Finnish Research Symposium and Workshop on 'Microbiome Research & Data Analysis' organised by the Department of Zoology, S.P. Pune University, Pune, between February 21st to 24th, 2023 in the NCCS meeting room, 'Kanaad'.
  - Provided technical help in organising online interviews for project posts, JRF posts, NCCS staff assessment, NCCS Foundation Day etc.
- Provided internet connectivity to all scientists, staff and students using LAN / Wifi through NKN & BSNL links.
- Computer hardware infrastructure procurement, installation, configuration and maintenance.
- Provided user support services including new desktop specifications, software and hardware installations, printers, scanners and other computer related devices.
- Co-ordinated e-mail service from National Informatics Centre (NIC) to regular and project staff members including scientists, technical and administrative staff and research scholars.
- Management of virtualised high-performance blade servers for hosting services like WWW, DNS, E-mail, ADS, DHCP and Proxy on Linux OS.
- A new security camera was installed and configured in the radioactive laboratory for activity monitoring.
- Management of internet connectivity issues which includes call logging in case of link failure, troubleshooting, link testing, restoring link failure issues etc.
- Web Services – Updation and maintenance of NCCS website, maintenance of DBT-NCCS YouTube channel.
- Antivirus server management and patch updation on all laptops, desktops, Linux servers for security & protection from unknown threats & vulnerabilities.
- Provided technical support in video conferencing (GoTo Meeting, Google meet) / SKYPE / DROPBOX / VPN access and Live YouTube streaming of talks.
- Network management and maintenance of high-speed routers, switches and WL access points.
- Publishing tenders / corrigendum's on CPP Portal.

- Regular management & maintenance of MANAV project servers (2Nos.) - storage hosted in NCCS. The storage server was reconfigured as Network Attached Storage (NAS) mode for smooth accessibility from both servers.
- The Server infrastructure installed on racks were shifted to new data centre.
- Maintaining salary software server in the computer section and regular guidance and administrator help was provided to administration section in making staff salary and all statutory reports.

New Initiatives

1. New NCCS Website launched

The new NCCS website was launched in June 2022 after the domain nameserver configuration and modification at ERNET registry. This new dynamic website has a state-of-the-art design with live twitter and facebook feeds showing the latest events and developments happening in NCCS. It is content management system-based, wherein staff from various section like administration, academics section, project management cell, stores & purchase etc. are provided handle to update latest information on website after proper approval system. This website is currently hosted on cloud servers from Hosting Raja service provider with a 2-year subscription.

2. New Firewall Installed

The existing Sophos firewall was out of warranty & support and also has become end of life on 08/02/2022. So, a new Sophos firewall XGS4300 was installed and configured as per NCCS security policy for secured internet access using LAN and WIFI access points. It is synchronised with the antivirus software installed on each desktop / laptop computers for providing security against new threats and vulnerabilities.

3. New Antivirus Software Installed

A new Net Protector antivirus software with three years subscription was installed on all desktop computers and laptops to provide protection against new viruses and malware.

4. Renewal of Internet Leased Line (ILL) from BSNL

The subscription of fiber optic based ILL connectivity of 100 MBPS (1:1) bandwidth from BSNL, Pune, was renewed for the next year. This internet link caters to the online meetings, seminars, interviews, workshops etc. This direct connectivity link has been extended to the old board room, new board room and auditorium for uninterrupted internet access.

5. Secured SSL Certificate for MANAV website

The GoDaddy SSL certificate already installed on MANAV website was renewed for the next 1 year, i.e., upto December 2023, whereby all website visitors will have secure protected access. This not only affirms MANAV website identity but also provides better search engine ranking and visibility.

6. Project Management Server

A new Computer Server – Storage of Fusionstore brand was installed and configured to run project management software (SFACTS) for project management cell.

7. Subscription of Online Video Conferencing Applications

The subscription of online videoconferencing applications like GoTo-Meeting (single Lic.) and Google Meet (4 users' lic.) were renewed for next 1 year i.e., up to May 2023. These applications are utilised for organising online interviews (regular & project post, employee assessment), foundation day video conference meeting, seminars etc.

Seminars/Meetings Attended:

Mr. R. J. Solanki

1. Attended an online webinar organised by The Economic Times on 14 December 2022: Cybersecurity as a Service- Help to combat Cybercrime & Cybersecurity skills gap.
2. Member of Interview Panel at NCL, Pune, to interview candidates (online mode) for project positions on the CSIR Jigyasa project on 9th February 2023.

BIO-IMAGING FACILITY

The Team ***Dr. Jomon Joseph – Scientist & Facility In-Charge*** *Dr. Ashwini N. Atre – Technical Officer B* *Mrs. Trupti P. Kulkarni – Technician C*	

At the Bio-Imaging facility, graduate and postdoctoral students are trained in microscopic research techniques, including advanced light microscopy, confocal microscopy, digital image processing of microscopic images, and related laboratory techniques. Microscopic image processing and analysis are taught individually. The team comprises full time staff members who, among other things, demonstrate the correct use of the instruments, train students in microscopic techniques required for cell biology research, and help with all aspects of light microscopy and computer image processing and analysis, as well as purchase the consumables and spare parts of various instruments in the facility.

Microscopes available at the NCCS Bio-Imaging Facility

1. Leica SP5 II Confocal Microscope
2. Olympus FLUOVIEW FV3000 Confocal Microscope
3. Thermo Cellinsight CX7 LZR – Confocal based High Content Analysis (HCA) System
4. Zeiss LSM880 Confocal Microscope Airy Scan and ELYRA P.1
5. Olympus SpinSR – Spinning Disk High Resolution Microscope

The above confocal systems are inverted microscopes and have a wide range of lasers. The systems can be used for doing FRET, FRAP, 3D imaging and reconstruction and live cell imaging, which are required for most cell biology research. Different types of software for confocal imaging, 3D imaging and reconstruction, time lapse, colocalization, FRET (SE & AB), FRAP are also available. These are used by in-house researchers as well as those from neighbouring organizations.

Usage of Microscopes during 2022-2023

The numbers of samples imaged during this year were approximately 5721 in-house samples including live samples, plus 256 samples received from other institutes.

Activities of the Bio-Imaging Facility

1. Training Programs

The following training sessions were organized:

S. No.	Training Details	Date(s) of Training	No. of Participants
1	Zeiss LSM880 Confocal microscope with Airyscan and Elyra P1	Oct-Nov-2022	Ph.D students- 6
2	Olympus FV3000 Confocal microscope	Oct-Nov-2022	1 Post Doc 1 Technician 10 PhD students
3	Zeiss LSM880 Confocal microscope with Airyscan and Elyra P1	Jan –June- 2023	6 PhD Students. 1 Technician 1 Faculty members
4	Olympus FV3000 Confocal microscope	Jan –June- 2023	1 Post Doc 8 PhD students

The Bio-Imaging facility staff also conducted an in-house training on the Leica SP5 II microscope for two Ph.D students on 14 February 2023, and delivered technical seminars for Ph.D course-work as well as the above trainings.

2. Image analysis training

Training and assistance were provided to individual students for post-acquisition analysis of images and data using the ImageJ and other software.

3. Outreach

- A talk was delivered to students at "Krantiveer Vasudev Balwant Phadke Smruti Vidyalay, Mu. Ravdi, Post Chikhalgav, Taluka Bhor, Dist. Pune-412206, under NASI, NCCS joint programme on 4th March' 23 as an Introduction to Microscopy and Cell Biology.
- Demonstration was done for 55 B. Voc. Medical Lab Technology students from Poona College.
- Visits to the facility were organized for B Tech (Biotechnology) students of Shri Shivaji College of Agril. Biotechnology, Amravati.
- 50 Biotech students of Ramniranjan Jhunjhunwala College and 33 from MVLU College, Andheri East, Mumbai, visited and were given detailed demonstration of the Facility microscopes.
- M.Sc. Microbiology I and II year from Kasturbai Walchand College of Arts and Science, Sangli also visited the Facility.

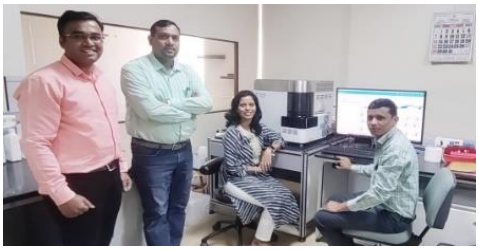
4. Participation in IISF 2022

Information about the Bio-Imaging facility & the services offered by this facility were publicized through posters displayed at the NCCS booth at the Indian International Science Festival (IISF 2022).

FACS FACILITY

The Team

Dr. Girdhari Lal – Scientist 'F' & Facility In-Charge
Mr. Amit Salunkhe – Technical Officer A
Mrs. Ashwini Kore – Technician C
Mr. Dnyaneshwar Waghmare – Technician C



Flow cytometry is a powerful tool for the multiparameter analysis of cells of all types. The flow cytometry core facility is a centralized resource for technical expertise and major equipment. The team from this facility supports and enhances the experimental design and execution of research that requires flow cytometric cell analysis or cell sorting. To achieve this objective, the facility offers the following services:

- Expert consultation is provided by the Facility In-Charge & technical specialists.
- FACS instruments are selected for complementary functions.
- Equipment use is accessible through dedicated technicians.
- Assistance with data analysis can be customized to the needs of individual investigators and research projects.

The facility team is also involved in purchasing spare parts like lasers for the instruments, consumables, etc., to ensure the FACS facility's smooth functioning.

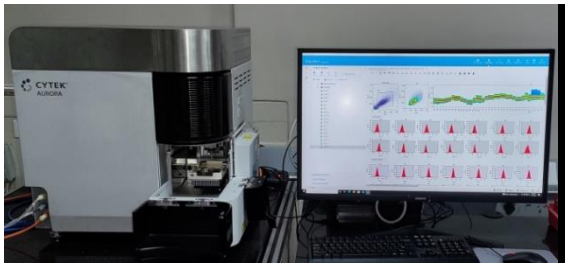
Instruments Available in the FACS Core Facility

Six flow cytometer machines are available in the FACS core facility. These are operated on a rotation basis by three dedicated operators. Of the six flow cytometers, two are analyzers, and four are sorters.

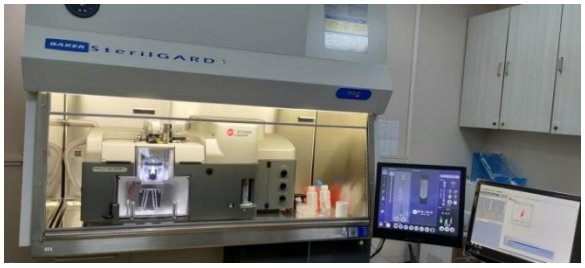
- Advanced spectral Flow cytometer analyzer Cytek Aurora was installed in the facility on 10th August 2022.
- Advanced flow cytometer sorter MoFlo Astrios EQ Instrument was installed in FACS Facility on 23rd December 2022.

Benchtop Analysers:
1. Cytek Aurora: 5 Lasers, 64 Colours. 16uv-16v-14b-10yg-8r (UV 355 nm, Violet 405 nm, Blue 488 nm, Yellow Green 561 nm, Red 640 nm).
2. FACS Canto II: 3 Lasers, 8 Colours. 4b-2r-2v (Blue 488 nm, Red 633 nm, Violet 405 nm).

Cell Sorters:
1. MoFlo Astrios EQ: 7 Lasers, 34 Colours 6uv-7v-6b-5g-3yg-4o-3r (UV 355 nm, Violet 405 nm, Blue 488 nm, Green 532 nm, Yellow Green 560 nm, Orange 592 nm Red 645 nm). 6 ways sorting in tubes. Sorting on 6-well, 12, well and 96 well plates.
2. ARIA II SORP: 4 Lasers, 11 Colours. 5b-2r-2v-2uv. (Blue 488 nm, Red 640 nm, Violet 405 nm, UV 355 nm).
3. ARIA III SORP: 5 Lasers, 16 Colours. 3b-2r-4v-3uv-4yg. (Blue 488 nm, Red 640 nm, Violet 405 nm, UV 355 nm, Yellow Green 561 nm).
4. ARIA III STD: 4/5 Lasers, 11 Colours. 3b-2r-4yg-2 violet/yg. (Blue 488 nm, Red 633 nm, Violet 405 nm / UV 375 nm, Yellow-Green 561 nm).
Rainbow QC and BD FACS Accudrop beads were used for quality control checks.



Cytek Aurora



MoFlo Astrios EQ

The usage of the six instruments for the period 2022-2023 is summarized below-

Immunophenotyping & Cell Cycle Analysis:

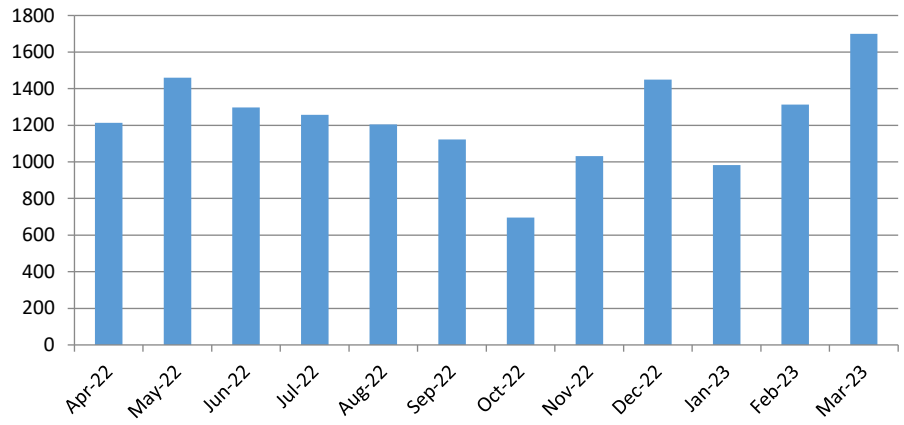
Equipment used	Surface / Intracellular Staining	DNA Cell Cycle Analysis	Usage of Instruments after office Hrs.	Total samples acquired
Cytek Aurora	2509	-	-	2509
FACS Canto II	5972	910	2937	9819
Total =	**8481**	**910**	**2937**	**12328**

Sterile Sorting:

Equipment used	Sorting	Acquisition*	Total samples sorted/Analyzed
FACS Aria II SORP	20	56	**76**
FACS Aria III SORP	215	895	**1110**
FACS Aria III Standard	238	503	**741**
Total =	**473**	**1454**	**1927**

*Includes analysis of samples that require UV laser on sorters.

Figure 1: Monthly usage of FACS facility (samples analyzed)



Samples from outside users:

Considering the increase in workload from outsider samples, NCCS has been following the policy of charging external users since June 2012. The charges are less for academic and research institutes and higher for private companies. Researchers from institutes like ICAR-DOGR Onion and Garlic Research, Rajgurunagar, ICMR-NIV, CSIR-NCL, Biotechnology dept. SP Pune University, Poona College of Pharmacy Bharti Vidyapeeth, and Abeda Inamdar Sr. College, Pune utilized our facility during the year under review. The facility acquired around 462 samples for surface/intracellular staining and DNA cell cycle analysis. Total revenue generated Rs. 60180 during this period.

Other Central Facility Instruments available in the FACS Core Facility

1) **Bio-Plex 200 System from Bio-Rad**
   The Bio-Plex® 200 system is a suspension array system that offers researchers working with protein and nucleic acids a reliable multiplex assay solution that allows the analysis of up to 100 biomolecules in a single sample.
2) **Droplet Digital PCR Systems from Bio-Rad**

Digital PCR is a breakthrough technology that provides ultrasensitive and absolute nucleic acid quantification. It is beneficial for low-abundance targets, targets in complex backgrounds, allelic variants (SNPs), and for monitoring subtle changes in target levels that cannot be detected with real-time PCR.

Activities of FACS core facility

1. Visits to Facility:

Sr. No.	Date	Institute/ College	Number of visitors/ students
1	24/05/2022	ICMR-NIV, Pune	16
2	10/10/2022	1st year, B. Voc. Medical Lab Technology students of Poona College, Pune	55
3	06/12/2022	Shri Shivaji College of Agriculture Biotechnology, Shivaji Nagar, Amravati	67
4	14/12/2022	Ramniranjan Jhunjhunwala College, Biotech Dept. Mumbai	84
5	28/02/2023	Science Day- Visit to NCCS	300
6	29/03/2023	Smt Kasturbai Walchand college of Arts & Science, Sangli	38

2. Training Program for students:

- Hands-on training program on CANTO II Instrument in 3 batches on 9th, 14th & 21st November 2022. Conducted Theory Exam for 13 NCCS Students on 15th December 2022 and Practical exam for 08 Students who have cleared the theory exam on 15th-16th February 2022.
- Hands-on training on Cytek Aurora Instrument in 3 batches on 13th September 2022, 21st October 2022, and 18th November 2022, respectively. A total of 10 NCCS students have been trained. There a continous training conducted to train most NCCS researchers on a regular interval.

3. Training Program for staff:

- Hands-on training of Cytek Aurora spectral flow cytometry analyzer given by Cytek Aurora service and application specialist Dr. Sanjay Mallik to facility staff in 2nd week of August 2022.
- Hands-on training of MoFlo Astrios EQ sorter given by Beckman Coulter service engineer Dr. Amit Bhati and application specialist Dr. Ritesh Kumar to facility staff in January 2023. Staffs were trained to use this machine for NCCS users.

4. Participation of staff:

- Staff member represented NCCS in the 'India International Science Festival' (IISF-2022) organized in MANIT, Bhopal, from 21st - 24th January 2023.

1) Protein crystallization and X-ray diffraction facility

Dr. Radha Chauhan (Scientist and Facility In-charge)

A state-of-the-art X-ray diffraction facility for single crystals was setup in July 2018. This facility is equipped with Rigaku FRX generator with HyPix 600 detector and Oxford cryojet cooling system. This facility is also capable of screening crystals directly from crystallization plates. Additionally, a sophisticated protein crystallization facility is being setup with capabilities of protein crystallization at different temperature, robotic crystallization of proteins including membrane proteins, stereomicroscope for visualization and various tools for freezing protein crystals in liquid nitrogen for either in house X-ray diffraction data collection or at synchrotron.

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2) Surface Plasmon Resonance Facility (SPR) Facility

The Team
Dr. Radha Chauhan (Scientist and Facility In-charge)
Tejashree Dhamale (technical staff)

NCCS has setup state of the art surface plasmon resonance (SPR) Cytiva Biacore T200 in 2018. This facility is highly utilized by NCCS faculties as well as local industries.

Technical Seminars and Training Organized

- 'Introduction to Biacore and its Applications': Technical seminar organized to create awareness about this technology among the faculty, students and staff of NCCS; 14 March 2023.

- In-house training on Biacore T200' (SPR): Organized to familiarize the PhD scholars, project staff and technicians with the Biacore T200 biomolecular interaction analysis system; 14-16 March 2023. 14 participants, which included twelve PhD students, one Project JRF, and one technician benefited from this training.

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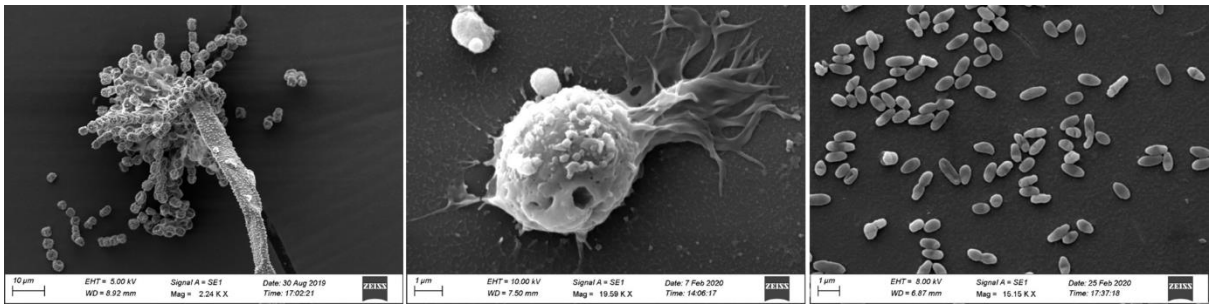
3) Scanning Electron Microscopy

The Team *Dr. Amit Yadav, Scientist & Facility In-charge* *Mr. Lucky Thakkar, Technical officer, NCCS-NCMR*	

The Carl Zeiss EVO 18 is renowned for delivering exceptional imaging results, making it an ideal choice for a wide range of materials, including bio-samples. Equipped with the high brightness upgrade path and utilizing LaB6 as its electron source, the Carl Zeiss EVO 18 ensures optimal performance. Notably, it boasts improved low kV performance and provides enhanced topography information through its 5-segment diode BSE detector. Since its induction at NCCS in 2019, this scanning electron microscope (SEM) has successfully processed over 260 samples from researchers across India and NCCS. These

samples encompass various types, such as bacterial cells, fungal mycelium and spores, archaea, nanoparticles, cancer cells, and more.



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Centre of Excellence: "National Centre for Microbial Resource" (NCMR)

Overview

Microorganisms are a valuable source for the development of biotechnological applications; thus, they hold critical significance in terms of exploration and economic aspects for any country. Especially in the Indian scenario, because of its vast geographical area with varied topology and climate catering to enormous biological diversity, it is highly relevant to establish microbial resources. In the wake of biotechnological advancements and explorations in recent times at the global scale, it is pertinent to judiciously conserve and characterise the microbial diversity of our country and strategically prevent the economic loss thereof. Parallelly, it is of prime importance to build and invest in the development of technological capabilities and enhancement of skills to isolate, preserve and characterize microorganisms in order to accrue a greater share of the benefits from such microbial resources.

Looking at these crucial aspects, Department of Biotechnology (DBT) established "Centre for Excellence, National Centre for Microbial Resource (NCMR)", performing cutting-edge research and providing high-quality services to various industries and academia since its genesis. NCMR being one of the top microbial resource centres worldwide, has microorganisms from different ecosystems, making it a unique repository. For the last decade, NCMR has been furnishing biological samples to various investigators to screen them for various biological activities. The staff of NCMR has a broad range of expertise to handle all the major groups of bacteria, including anoxygenic photoautotrophic bacteria and anaerobes. NCMR is also known for its quality services to institutes/universities and industries like sequencing services (Sanger sequencing, Genome sequencing, amplicon sequencing), other microbial identification services like Matrix-Assisted Laser Desorption Ionization Time-of-Flight Mass Spectrometry (MALDI-TOF MS) , Fatty Acid Methyl Esterase (FAME) and Biochemical characterization etc. NCMR also provides educational services in seminars, hands-on training etc, in colleges and universities. NCMR also accepts the culture for deposition under various categories like General Deposits, Safe Deposits and Patent Deposits.

Mandate of the Project

The (DBT established the Microbial Culture Collection (MCC) in June 2008- which is now called NCMR with a charter to preserve, characterize and authenticate microbial resources. The Mission of the Centre is to serve as a leading world-class Microbial Resource Repository and provide authentic high-quality services for microbial preservation, characterization and authentication and supply to industry and academic institutions. The Centre is built on "Service for Science, Science for Service" model. It will also serve the nation in biodiversity conservation, biotechnological research and education by providing services of the highest international standards and conducting research in the related areas of microbial ecology and systematics, and human resource development. The Centre will also serve as an International Repository Authority (IDA) under the Budapest Treaty and Designated National Repository (DNR) under the Ministry of Environment and Forests. Considering this, the prime objectives of NCMR are:

a. Develop an infrastructure to facilitate services of the highest standard, such as the supply of authentic microbial cultures, identification of microorganisms, a deposit of microorganisms, their long-term protection, and other related areas to researchers at academic institutes and industries.
b. Serve as IDA for deposit of Micro-organisms under the Budapest Treaty for protection of intellectual property rights and serve as DNR under the Biological Diversity Act 2002 of India.
c. Serve as a repository of meta-omics libraries and to develop and maintain a database of information about the 'not yet cultured' organisms generated from high throughput meta-omics studies.
d. Serve as a global reference centre for Anti-Microbial Resistant (AMR) microbes through collection, storage, maintenance, preservation and characterization of AMR microbes across the country following relevant international standards
e. Stimulation of deposit of strains subject to publication and research in India to protect national investments.
f. Become a global leader in the collection of microbial resources, its maintenance and ex situ conservation including patent cultures and thus safeguarding the enormous microbial diversity of our nation.
g. Explore the diverse ecological niches of Indian subcontinent and catalogue the national microbial diversity.

h. Networking to increase range of resources and expertise available to Indian researchers.
i. Develop quality manpower with creative abilities in microbiology/ microbial biotechnology/ technology management by providing both long and short-term training courses and workshops involving experts from across the globe.

Societal Impact

- NCMR currently holds 1,44,440 microbial cultures used for bioprospecting purpose. These cultures were processed for bioactive compounds for anti-inflammatory, anti-infective, anti-cancer and anti-diabetic activities. During the process, 235 compounds were dereplicated and 51 bioactive compounds were purified. Eighty-two other structures have also been postulated from only 1000 of these active extracts.
- Total 4,279 bacterial and fungal cultures were deposited by various researchers across India in NCMR for their long-term preservation.
- Total 13,874 services were provided by the NCMR in 2022-2023.
- Establishment of antimicrobial resistant (AMR) microorganisms repository: NCMR has started the repository of AMR isolates and in 2022-23, it has received 216 cultures and so far, 634 cultures isolated in total.
- In 2022-23 the NCMR team has published 36 research papers including 6 novel bacterial taxa.

Table 1. Summary of number of holdings preserved at NCMR under each category

Category of Microbial Resource	Number of Holdings (Preserved)
Microbial Mission Cultures	**1,44,440**
General Deposit Cultures	**4,279**
Bacteria + Archaea	2,602
Fungi	1,677
PLSL Microbial Cultures	**2,971**
Fungi	2,036
Bacteria	296
Actinobacteria	639
Secure deposits at IDA	**352**
IDA Deposits	252
Safe Deposits	100
Other Resources	**159**
Genomic DNA	152
Plasmids	7
Total Number of Holdings	**1,52,201**

Major achievements during the year 2022-23

The following is a brief summary of salient achievements of NCMR program area under different sections

- Bioprospecting cultures: During the year 2022-2023, 8,864 bioprospecting cultures were preserved after mix-pure activity and 8,388 cultures were also identified by MALDI-TOF. So far, out of total ~2.0 lakh bioprospecting cultures at NCMR, a total of 1,44,440 are pure cultures which are preserved in deep freezer and liquid nitrogen. A major portion of the microbial mission cultures (86,244) have been processed for identification using rRNA gene sequencing and MALDI-TOF.
- NCMR Services: NCMR actively processes microbial samples received under the various categories of deposits, identification and characterization services for the researchers in academia and industry across the globe. NCMR holds authentic and well characterized microbial strains (wild types, mutants, type strains, genetically modified and engineered and patented) that can be supplied to researchers in academia and industry without any restrictions or under Material Transfer Agreement (MTA). NCMR is actively supplying this collection all over India and abroad. In addition, NCMR is offering its expertise in the fields accurate microbial characterization involving morphological, biochemical, physiological, genotypic, chemotaxonomic traits and genome sequencing.
- Anti-Microbial Focus: In order to establish a central AMR Repository at NCMR, draft MOU's have been sent to various hospitals under the KARSNET (Kerala AMR Surveillance Network) and

MAHASAR (Maharashtra State Antimicrobial Resistance), Armed Forces Medical College (AFMC) Pune and Tertiary care hospitals, Diagnostic labs in and around Pune and Nagpur. Under this program we have received 1200 isolates as Deposits and two AMR/ MDR (Multi-drug resistant) isolates for Genome sequencing.

- NCMR scientists published 36 high quality research papers.
- NCMR published 6 novel bacterial taxa.

Services provided to different stakeholders at NCMR during 2022-23

Beneficiaries: Researchers from academia and industry (including companies, start-ups etc.)

Service at NCCS-NCMR	**No. of beneficiaries (2022-2023)**
General Deposits	391
Bacteria	130
Fungi	125
IDA (International Repository Authority)	8
Safe Deposits	26
Other Services*	
Cultures supplied (Bacteria)	420 (Paid) 59 (Internal) **479**
Cultures supplied (Fungi)	45 (Paid) 9 (Internal) **54**
Freeze Drying	0
16S rRNA gene sequencing	739 (Paid) 7777 (Internal) **8,516**
MALDI-TOF (Matrix-Assisted Laser Desorption Ionization Time-of-Flight Mass Spectrometry)	208 (Paid) 3383 (Internal) **3,591**
Phylogenetic analysis	19
FAME (Fatty Acid Methyl Esterase)	16 (Paid) 16 (Internal) **32**
DDH (DNA-DNA Hybridization)	35
G+C Content	0
Polar lipid analysis	17 (Internal)
Genomic DNA Isolation	36
Phenotypic Characterization (Bacteria)	31 (Paid)
Phenotypic Characterization (Fungi)	1 (Paid)
Culture Purification (Bacteria)	101
Culture Purification (Fungi)	0
API (Analytical Profile Index) (Bacteria)	2 (Paid) 12 (Internal) **14**
API (Fungi)	0
BIOLOG	6 (Paid) 26 (Internal) **32**
Ecoplate BIOLOG	4
VITEK	12 (Paid) 66 (Internal)

Service at NCCS-NCMR	No. of beneficiaries (2022-2023)
	78
Scanning Electron Microscopy (SEM)	15 (Paid) 90(Internal) **105**
Genome Sequencing	87 (Paid) 112 (Internal) **199**
Metagenomics	982 (Internal)
Publications	**36**
Novel Taxa	6 (Bacteria)

COVID-19 Related Initiatives

In 2020, when the entire world faced an unprecedented crisis thrown up by COVID-19, NCCS rose to the challenge and shared its infrastructure and expertise to facilitate the national efforts to tackle the pandemic. We continued to contribute to these efforts through 2022-23 as well, as summarized below.

1] <u>Research Initiatives</u>

COVID-19-related research undertaken at NCCS is summarized below.

a) Research undertaken by Dr. Akanksha Chaturvedi

(i) Aims & Objectives: To understand the antibody response upon Covishield vaccination following three doses in a longitudinal study

Relevance & importance of the work:
This study allowed us to track the durability of the antibody responses in vaccine recipients.

Major outcomes and their significance:
We found that the SARS-CoV2 specific antibodies wane between 4 to 6 months of second dose of Covishield. However, booster dose significantly increases the spike specific antibodies and neutralizing antibody titres to Wuhan and Delta strain. Neutralizing antibody titres to Omicron remain very low even after third/booster dose.

Collaborators:
Dr. Saurabh Bobdey, AFMC
Dr. Mohan Wani, Scientist G, NCCS
Dr. Debasis Nayak, Associate Professor, IISER Bhopal
Source of funding: AFMC, NCCS intramural

(ii) Aims & Objectives: Observational Study on Long-term Immunogenicity of COVID-19 vaccines in vaccine-naïve seronegative and seropositive participants

Relevance & importance of the work:
In this multi-center, multi-institutional, multi-city study we have compared two COVID-19 vaccines, Covaxin and Covishield in inducing antibody and T cell immunity in SARS-CoV2 naive and experienced participants.

Major outcomes and their significance:

We have tested the antibody and T cell responses in seropositive and seronegative individuals. We find that seropositive individuals do not show further increase in Spike or RBD specific antibody levels upon immunization with Covaxin, however a significant increase in antibody levels are observed following Covishield administration. Although, Covishield recipients were able to neutralize Wuhan, Delta and other pre-Omicron strains remarkably better than the Covaxin recipients, however, both Covaxin and Covishield were inefficient in neutralizing Omicron variants. Interestingly, this difference seen in antibody responses was not observed in T cell responses and both Covaxin and Covishield administration resulted in similar effector T cell activation.

For this study, we have also established a biobank for more than 2000 plasma and PBMC samples, in Pune center. Similar biobanks are also created at other participating centers. Samples from these biobanks are extremely useful in studying qualitative and quantitative innate and adaptive immune responses. These studies are also useful in tracking long term immune responses in vaccine recipients and comparing vaccines in inducing humoral and cell mediated immunity.

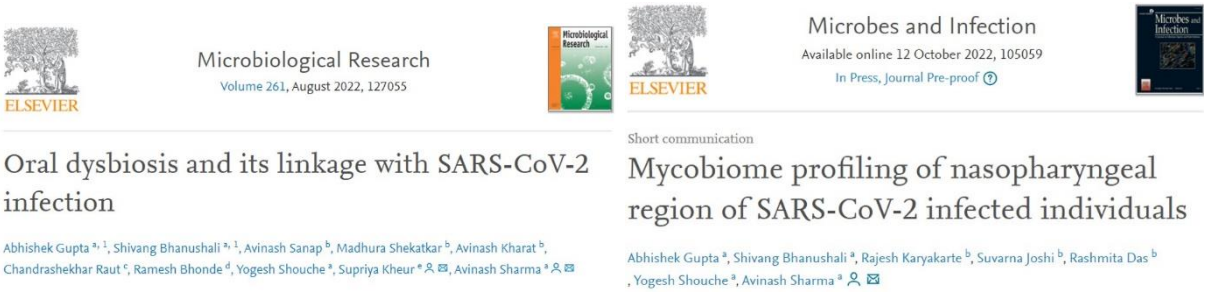
Collaborators:
Dr. Anu Raghunathan, NCL, Pune
Dr. Vineeta Bal, Emeritus Professor, IISER Pune
Dr. Mangai Asokan, Project Co-ordinator, NCBS, Bangalore
Dr. Jeetu Mayor, Professor, NCBS, Bangalore
Dr. L.S. Shashidhara, Director, NCBS, Bangalore
Dr. Gagandeep Kang, Professor, CMC Vellore

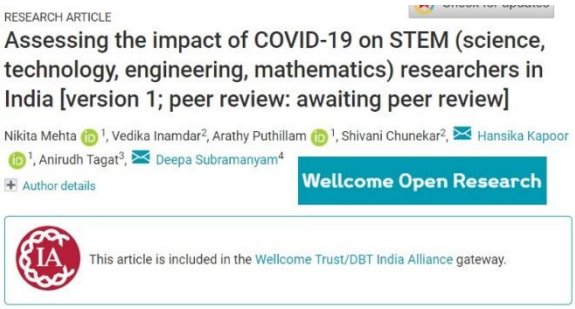
Dr. Annapurna Vyakarnam, St. Johns Medical Institute, Bangalore
Dr. Anand Kawade, KEM Hospital, Vadu

Source of funding: Hindustan Unilever

2] Publications

(details are included in the common publications list at the end of the annual report)





3] COVID-19-related Outreach

These are included under the outreach section in the latter part of the annual report

Other Information

PUBLICATIONS

(with faculty and other researchers from NCCS as corresponding, lead or co-authors)

RESEARCH ARTICLES

1. Agarwal D, Paul S, Lele P, Piprode V, Kawade A, Hajela N, Bavdekar A, Parulekar V, Ginde M, Paranjape G, Matsuda K, Hori T, Juvekar S, Lal G*. Changes in immunological parameters by ageing in rural healthy Indian adults and their associations with sex and lifestyle. Scientific Reports. 2022 Sept; 12: 15012.
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11. Chauhan NS, Joseph N, Shaligram S, Chavan N, Joshi A, Dhotre D, Lodha T. Shouche YS. *Paenibacillus oleatilyticus* sp. nov., isolated from soil. Archives of Microbiology. 2022 July: 204:516.
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BOOKS / BOOK CHAPTERS / EDITORIALS etc.

1. Azhar EI, Hui DS, McCloskey B, El-Kafrawy SA, Sharma A, Maeurer M, Shui-Shan Lee, Zumla A. The Qatar FIFA World Cup 2022 and camel pageant championships increase risk of MERS-CoV transmission and global spread. Lancet – Global Health. 2023 Feb; 11(2):e189-e190. (Comment)
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5. Om Prakash. Lack of kinship with anaerobes is a kind of short-sightedness of agricultural and environmental microbiologists. Environmental Microbiology Report. 2022 May; 14 (3); 330-332. (Opinion)
6. Palazzo AF, Joseph J, Ming Lim, Thakur KT. Workshop on RanBP2/Nup358 and acute necrotizing encephalopathy. Nucleus. 2022 Dec; 13(1):154-169. (Meeting Report)
7. Puri D, Shalmali Bivalkar-Mehla, Subramanyam D*. Autophagy in embryonic stem cells and neural stem cells, In 'Autophagy in stem cell maintenance and differentiation'. Stem Cell Biology and Regenerative Medicine book series (STEMCELL, volume 73), Springer Nature, 2022 Nov.; pg 59-83.
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11. Sharma A, McCloskey B, David S. Hui, Rambia A, Zumla A, Traore T, Shafi S, Sherif A. El-Kafrawy, Azhar EI, Zumla A, Rodrigues-Morales AJ. Global mass gathering events and deaths due to crowd surge, stampedes, crush and physical injuries – Lessons from the Seoul Halloween and other disasters. Travel Medicine and Infectious Disease. 2023 Mar-Apr:52:102524. (Editorial)
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13. Sharma A, Rodriguez-Morales AJ, Traore T, Shafi S, El-Kafrawi AS, Esam I Azhar IE, Zumla A. Globalisation of antibiotic-resistant bacteria at recurring mass gathering events. Lancet. 2022 Nov 15;S0140-6736(22)01995-X. (Comment)
14. Soto-Cruz NO*, Kirchmayr MR, Sharma A (2022). Sustainable production of ethnic alcoholic beverages, In 'Frontiers in Sustainable Food Systems', 2022 April: 6; pp 59. (Editorial)
15. Zumla A, Traore T, Amao L, Ntoumi F, Sharma A, Azhar EI, Abbara A. Reducing the threat of epidemic-prone infections at mass gathering religious events. Lancet. 2022 Jul 9;400(10346):80-82. (Comment)

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PATENTS

Patent Applications Filed / Granted

Sr. No.	Title	Inventors	Applicant(s)	PCT / Country	Patent No./ Application No.	Date of Filing / Grant
1	SARS-COV-2 Neutralization Antibody and its Application Thereof	Chaturvedi Akansha; Chauhan Radha; Sahu Arvind; Rao Kanury; Nayak Debashish	NCCS; IIT, Indore; PredOmix Technologies Pvt. Ltd.	India	202021044304	Provisional filing date: 12.04.2021 Complete Specification filed on 11-04-2022
2	Novel combination of serotonin receptor (5-htr2b) antagonist and an immunomodulatory and chemotherapeutic drugs for inhibition of cancer	Dr. Girdhari Lal, Surojit Karmakar	NCCS	PCT	PCT/IN2022/050873	30.09.2022
3	A Novel peptide-based therapeutics to combat Leishmaniasis	Guhe Vrushali; Singh Shailza	NCCS	India	202221058694 1	Provisional Application filed on 14.10.2022
4	A Novel Anti- Cancer Combination	Athavale, Dipti Anil; Bhat, Manoj Kumar, Bhati Firoz Khan, Yaduvanshi Himanshi	NCCS	India	202217060770	National Phase Application filed on 25.10.2022
5	Novel cell secretomes for wound healing	Prof. Jayesh Bellare, Hemlata Chhabra, Amit Kumar Jaiswal, Dr. Vaijayanti Kale, Dr. Meghana Kanitkar, Richa Shukla	IIT, Bombay & NCCS	India	1951/MUM/2014 / 419521	17.06.2014/ 30.01.2023
6	Protein Based Product From Fenugreek Seeds That Regulates Dyslipidemia And Obesity, And A Process For The Preparation Thereof	Manoj Kumar Bhat, Vimal Pandey, Malepilli Vavachan Vijayakumar	DBT	India	1521/DEL/2008 / 424105	25.06.2008/ 06.03.2023
7	Therapeutic Intervention For Osteoporosis	Mohan Ramchandra Wani; Kanupriya Singh	NCCS	USA	16/208,322 / US 11,478,532 B2	03.12.2018/ 25.10.2022

EXTRAMURAL FUNDING & COLLABORATIONS

Extramurally-Funded Projects / Fellowships of NCCS Faculty & Other Scientists

Sl. No.	PI	Project Name	Collaborators	Funding Agency
1.	Director, NCCS, Pune	Establishment of A Pune Biotech Cluster, "Model Organism to Human Disease.	**IISER, Pune** Dr. Jayant B Udgaonkar	DBT
2.	Dr. Avinash Sharma	Establishment of Center of Excellence for "National Center for Microbial Resource (NCMR)"	**NCCS, Pune** Dr. Dhiraj Dhotre Dr. Amit Yadav	DBT
3.	Dr. Avinash Sharma	Bioprospecting of Marine microbial diversity for various products under the Marine Bioresource and Biotechnology Network Programme	**Periyar University, Salem** Dr. R. Balagurunathan Dr. S. Venkatesan **Central Salt and Marine Chemicals Research Institute, Bhavnagar** Dr. Soumya Haldar Dr. Pramod B. Shinde Dr. Anil Kumar M **Annamalai University, Parangipettai** Dr. S.T. Somasudaram Dr. A. Gopalakrishnan **Satybhama Institute of Science and Technology, Chennai** Dr. M. Radhakrishnan Dr. Wilson Aruni Dr. D Inbakandan Dr. L Stanley Abraham **Goa University, Goa** Dr. Savita Kerkar Dr. Sanjeev C. Ghadi Prof. S.G. Tilve **National Centre for Polar and Ocean Research, Goa** Dr. K.P. Krishnan **Cochin University of Science and Technolgy, Cochin** Dr. Sajeevan T. P. Dr. Rosamma Philip **CDRI, Lucknow** Dr. Narender Tadigoppula **Pondicherry University** Dr. S. Venu **IIT Bombay** Prof. Pramod Wangikar Dr. Yogendra Shastri **National Institute of Ocean Technology, Velacherry** Dr. G. Dharani **Centre for Marine Living Resources and Ecology, Cochin** Dr. N. Saravanan **NCCS, Pune** Dr. Yogesh Shouche Dr. Ajay D Pillai	DBT
4.	Dr. Radha Chauhan	Centre of Excellence in Biomolecular Structure and Function on Host-Pathogens Interactions. (Core Grant)	**NCCS, Pune** Dr. Debashis Mitra Dr. Janesh Kumar **University of Hyderabad, Hyderabad** Dr. Krishnaveni Mishra Dr. Sharmistha Banerjee	DBT
5.	Dr. Radha Chauhan	(R&D -1) Structural perspective of molecular interactions in pathogenicity: Role of regulatory proteins of HIV-1 and heat shock proteins of *M. tuberculosis*	**University of Hyderabad, Hyderabad** Dr. Sharmistha Banerjee **NCCS, Pune** Dr. Debashis Mitra Dr. Janesh Kumar	DBT

6.	Dr. Debashis Mitra	(R&D -2) Cellular Stress Proteins in HIV Infection: Biochemical and functional characterization.	**NCCS, Pune** Dr. Shekhar Mande	DBT
7.	Dr. Radha Chauhan	(R & D-3) Structural & functional role of Nuclear Envelope in HIV infection.	**University of Hyderabad, Hyderabad** Dr. Krishnaveni Mishra Dr. Sharmistha Banerjee	DBT
8.	Dr. Deepa Subramanyam	Role of actin remodelling and membrane fluctuations in regulation of embryonic stem cell pluripotency	**IISER, Kolkata** Dr. Bidisha Sinha	DBT
9.	Dr. Jomon Joseph	Characterization of inter-cellular transport of Ran GTPase	**NCCS, Pune** Dr. Vasudevan Seshadri	DBT
10.	Dr. Kalita Jupitara	Structure and function of trans-synaptic complexes mediated by Neurexin, Cerebellin and GluD receptors		DBT
11.	Dr. Manas Santra	Elucidation of the role of long noncoding RNA-Ginir as a biomarker in lung tumorigenesis	**All India Institute of Medical Sciences, Delhi** Dr. Sachin Kumar Dr. Surendra Kumar Sharawat Dr. Prabhat Singh Malik Dr. Sunil Kumar **NCCS, Pune** Dr. Gaurav Das	DBT
12.	Dr. Santosh Kumar	Identification and characterization of downstream effector proteins for Gao, the major neural G protein in brain tissue	**Panjab University** Dr. Ravi Pratap Barnwal Dr. Bharat Bajaj Dr. Gurpal Singh	DBT
13.	Dr. Vidisha Tripathi	Comprehensive characterization of novel IncRNA-protein network orchestrating the mammalian cell cycle program	**NCCS, Pune** Dr. Jomon Joseph	DBT
14.	Dr. Jomon Joseph	Characterization of acute necrotizing encephalopathy-1(AEN-1) associated mutations in Nup358.	**NCCS, Pune** Dr. Vasudevan Seshadri	DBT
15.	Dr. Deepa Subramanyam	Characterization of the effect of pathogenic Cltc variants in early development	**NIMHANS, Bangalore** Dr. Gautham Udupi Dr. Biju Viswanath, Prof. Chetan GK **NCCS, Pune** Dr. Amitabh Majumdhar	DBT
16.	Dr. Sharmila Bapat	Charatacterization of Pseudogene-like CTs in ovarian cancer	**NCCS, Pune** Dr. Amithabha Majumdar	DBT
17.	Dr. Amitabha Majumdar	Generation of knockout and Gal4 collection using CRISPR and recombineering for studying the in vivo function of DnaJ domain containing proteins in *Drosophila melanogaster*.	**NCCS, Pune** Dr. Shekhar Mande	DBT
18.	Dr. Dhiraj Dhotre	Impact of mass bathing on the natural microbiota of the river Ganges; a concern to human health	**University of Allahabad** Prof. Shanthy Sundaram **NCCS, Pune** Dr. Avinash Sharma	DBT

19.	Dr. M.V. K. Sastry	MANAV Human Atlas Initiative	**IISER, Pune** Dr. N. Balasubramanian Dr. Kundan Sengupta **Persistent Systems Limited, Pune** Dr. Anamika Krishanpal Mr. Vivek Kulkarni	DBT
20.	Dr. Dhiraj Dhotre	Human Microbiome Initiative of select Endogamous Populations of India	**AYUSH - Center of Excellence, SPPU, Pune** Dr. Girish Shreekrishna Tillu Prof. Shaunak Kulkarni Mr. Shantanu Ozarkar **SRM Institutes for Medical Science, Chennai, TamilNadu** Prof. Balakrishnan S Ramakrishna Dr. John Mechenro **IBSD, Imphal** Dr. Sarangthem Indira Devi Dr. Amit Kumar Rai **Institute of Trans-Disciplinary Health Science & Technology, Bangalore** Dr. Subramanya Kumar **KEMHRC, Pune** Dr. Sanjay Kamlakar Juvekar **All India Institute of Medical Sciences, New Delhi** Prof. Govind K Makharia Prof. Vineet Ahuja Dr. Anand Krishnan **NCCS, Pune** Dr. Arvind Sahu Dr. Vasudevan Seshadri Dr. Amit Yadav	DBT
21.	Dr. Vasudevan Seshadri	Development of a stable and inducible CRISPR-Cas9 system for high throughput site specific genome editing in *Plasmodium falciparum*	**IISER, Pune** Dr. Krishanpal Karmodiya **University of Hyderabad, Hyderabad** Prof. Mrinal Kanti Bhattacharyya	DBT
22.	Dr. Nikhil Ghate	To understand the role of histone H2A post-translational modification in cell proliferation, survival and tumorgenesis.		DBT
23.	Dr. Arvind Sahu	Role of complement anaphlyatoxins C3a,C4a and C5a generated intracellularly in the infection locale in providing protection against viral infection.	**NCCS, Pune** Dr. Girdhari Lal	DBT
24.	Dr. Dhiraj Dhotre	Genomic Surveillance for SARS-CoV-2 in India: Indian SARS-CoV-2 Genomics Consortium (INSACOG) - Phase - II	**Component A: Sentinel Surveillance** **RCB, Faridabad** Prof. Sudhanshu Vrati Dr. Arup Banerjee **NIBMG, Kalyani** Prof. Arindam Maitra Dr. Sreedhar Chinnaswamy Dr. Nidhan K Biwas Dr. Anup Mazumder **ILS, Bhubaneswar** Dr. Sunil Raghav Dr. Punit Prasad **NCCS, Pune** Dr. Vasudevan Seshadri **InSTEM/NCBS, Bangalore** Dr. Dasaradhi Palakodeti Prof. Colin Jamora Dr. Uma Ramakrishnan Dr. Aswin Sai Narain Seshasayee **CCMB, Hyderabad** Dr. Divya Tej Sowpaty, Dr. T. Karthik Bharadwaj	DBT

			NIMHANS, Bangalore Dr. Anita Desai Dr. Reeta S Mani Dr. Ashwin Belludi **IISER, Pune** Dr. Krishanpal Karmodiya Prof. Aurnab Ghose **IGIB, New Delhi** Dr. Sridhar Sivasubbu Dr. Vinod Scaria **CDFD, Hyderabad** Dr. K. Thangaraj Dr. Murali Bashyam Dr. Ashwin Dalal **B.J Medical College, Pune** Dr. Rajesh Karyakarte Dr. Suvarna Joshi Dr. Rashmita Das **ILBS, New Delhi** Dr. Shiv Sarin Dr. Ekta Gupta Dr. Chhagan Bihari **RGCB, Thiruvananthapuram** Dr. Radhakrishnan R Nair Prof. Chandrabhas Narayana **GBRC, GandhiNagar** Dr. Madhvi Joshi Dr. Ramesh Chandra Pandit Dr. Apurvasinh Puvar **THSTI, Faridabad** Dr. Bhabatosh Das Dr. Pallavi Kshetrapal **NII, New Delhi** Dr. G Aneesh Kumar Arimbasseri Dr. Arnab Mukhopadhyay **CBR-IISc, Bangalore** Dr. Bratati Kahali Dr. Khader Valli Rupanagudi **IBSD, Imphal** Dr. Nanaocha Sharma Dr. S Indira Devi **Component B: Sewage Surveillance** **IISc Bangalore** Prof. Utpal Tatu Prof. Nagasuma Chandra **CIIMS, Nagpur** Dr. Rajpal Singh Kashyap Dr. Amit Nayak Dr. Aliabbas Husain **NCCS, Pune** Dr. Amit Yadav **VNSGU, Gujarat** Dr. Rajesh Patel Dr. Pravin Dudhagara **ILS, Bhubaneswar** Dr. Punit Prasad Dr. Shanti Bhusan Senapati **CSIR-IICT, Hyderabad** Dr. S. Venkata Mohan Dr. A Kiran Kumar **THSTI, Faridabad** Dr. Bhabatosh Das Dr. Shakti Kumar **GBRC, GandhiNagar** Dr. Madhvi Joshi Dr. Bhumika Prajapati **NIBMG, Kalyani** Souvik Mukherjee Prof. Arindam Maitra Dr. Nidhan K Biwas Dr. Anup Mazumder **IBSD, Imphal** Dr. Nanaocha Sharma	

			Dr. Pradeep Kumar Bhardwaj Dr. S Indira Devi Dr. Amit Kumar Rai Dr. Jitendra Kumar Shukla	
25.	Dr. Dhiraj Dhotre	Genomic surveillance for SARS-CoV-2 in India: Indian SARS-CoV-2 Genomics Consortium (INSACOG)	**NIBMG, West Bengal** Dr. Arindam Maitra Dr. Shreedhar Chinnaswamy **ILS, Bhubaneshwar** Dr. Sunil K. Raghav **Institute of Stem Cell Biology and Regenerative Medicine (InSTEM),** Dr. Dasaradhi Palakodeti Dr. Aswin Sai Narain Seshasayee Dr. Uma Ramakrishnan **CDFD, Hyderabad** Dr. K Thangaraj Dr. Murali Dharan Bashyam Dr. Ashwin Dalal **NCCS, Pune** Dr. Yogesh Shouche, Dr. Ajay Pillai **IGIB, Delhi** Dr. Sridhar Sivasubbu Dr. Vinod Scaria **CCMB, Hyderabad** Dr. Karthik Tallapaka Dr. Divya Tej Sowpati **NIMHANS, Bengaluru** Dr. Anita Sudhir Desai Dr. Chitra Pattabiraman Dr. Manjunatha M.V Dr. Reeta s. Mani Dr. Gautam Arunachal Udupi **NIV, Pune** **NCDC, New Delhi**	DBT
26.	Dr. Priyanka Dutta	Dissecting Formin-2 Function and Regulation: Insights into Novel Modalities of Cytoskeleton Remodeling		DST
27.	Dr. Deepika Puri	Epigenetic mechanisms of regulation of autophagy in development, differentiation, and disease.		DST
28.	Dr. Girdhari Lal	Effect of neuro-immune communication in the gut inflammation and auto-immunity		DST
29.	Dr. Prasad Abnave	Investigating molecular mechanisms governing the proliferation - differentiation balance in adult stem cells during chronic infections		DST
30.	Dr. Janesh Kumar	Development of Nanobodies as prophylactic and therapeutic candidates against SARS-CoV-2 virus.		SERB

31.	Dr. Akanksha Chaturvedi	Precision antibodies engineering CEntre (PACE)	**IIT, Indore** Dr. Debasis Nayak **IISER, Bhopal** Dr. Ram Kumar Mishra Dr. Sanjeev Shukla **King George Medical University, Lucknow** Dr. Satyendra Kumar Singh	SERB
32.	Dr. Amitabha Majumdar	Studying the liquid-liquid phase separation properties associated with a transcriptional co-activator	**NCCS, Pune** Dr. Deepa Subramanyam	SERB
33.	Dr. Arvind Sahu	J C Bose Fellowship		SERB
34.	Dr. Deepa Subramanyam	Identifying interactors of E-cadherin in embryonic stem cells	**NCCS, Pune** Dr. Vidisha Tripathy	SERB
35.	Dr. Gaurav Das	The neurophysiological pathways of emesis in *Drosophila melanogaster*		SERB
36.	Dr. Janesh Kumar	Structural investigations of GluK2 and GluK3 kainate receptors in lipidic environment		SERB
37.	Dr. Jomon Joseph	Understanding the functions of Annulate Lamellae, an underexplored cell organelle		SERB
38.	Dr. Manas Santra	To understand the immunosuppressive activity of secretory PD-L1 and its regulation by F-Box proteins to develop potent immunotherapeutic leads for cancer		SERB
39.	Dr. Avinash Sharma	Specific adaptations and metabolic potentials of previously unknown psychrophilic prokaryotes from the antarctic environment		SERB
40.	Dr. Santosh Kumar	Delineation of the major brain G protein, G o mediated signaling pathway using C. elegans model system	**Panjab University** Dr. Gurpal Singh Dr. Ravi Pratap Barnwal	SERB
41.	Dr. Gopal Kundu	A CRISPR-Based Gene Therapy Approach For Targeting The Breast Cancer Stem Cells *in vivo*	**NCCS, Pune** Dr. Srikanth Rapole	SERB
42.	Dr Priyanka Dutta	Functional Characterization of the Novel Actin-Interacting Protein Kaptin and its Regulation of Cytoskeleton Dynamics in Neurons.	**IISER, Kolkata, West Bengal** Dr. Sankar Maiti **IISER, Pune** Dr. Aurnab Ghose	SERB
43.	Dr. Sharmila Bapat	Proteogenomics based identification and Characterization of a novel ITGB8 isoform in ovarian cancer and elucidation of its functional relevance.		SERB
44.	Dr. Vidisha Tripathi	Deciphering the role of long noncoding RNAs (IncRNAs) in mediating replication stress response during cell division		SERB
45.	Dr. Akanksha Chaturvedi	Elucidating the role for Toll-like receptor 9 mediated extracellular vesicle release from B cells		SERB

46.	Dr. Prasad Abnave	Investigating histone methylation changes induced in adult stem cells during bacterial infections.		SERB
47.	Dr. Gaurav Das	Neurobiology of food choices driven by nutrient specific memories and high calorie diet.		SERB
48.	Dr. Bhaskar Saha	JC BOSE Fellowship		SERB
49.	Dr. Debashis Mitra	Host Cell Factors in HIV Pathogenesis		SERB
50.	Dr. Punam Nagvenkar	Establishment of GMP-Compliant National Repository for banking, safe deposit, and supply of characterized mammalian cells for use in biopharma		BIRAC
51.	Dr. Punam Nagvenkar & Dr. Yogesh Shouche	DBT - NCCS CDL Vaccine Testing Facility		BIRAC
52.	Dr. Amit Yadav	Genomic based approaches for characterization of the microbial antibiotic resistance and resistome in dairy production system	**ICAR-NDRI, Karnal** Dr. Rashmi H M **NCCS, Pune** Dr. Dhiraj Dhotre	ICMR
53.	Dr. Manas Santra	To develop therapeutic leads to counter PD-L1 mediated suppression of immune system in cancer microenvironment	**NCCS, Pune** Dr. Srikanth Rapole Dr. Janesh Kumar **AFMC, Pune** Dr. TVSVGK Tilak **Saroj Gupta Cancer Centre & Research Institute** Dr. Somasubhra Nath	ICMR
54.	Dr. S. A. Bapat	Identification and Validation of Neoantigens in a syngenic mouse model of Ovarain cancer		ICMR
55.	Dr. Deepa Subramanyam	Understanding the role of clathrin mediated endocytosis in neural development and function		ICMR
56.	Dr. Shailza Singh	System regulatory networks of autophagy proteins in *Leishmania*: Implication towards Drug Design		ICMR
57.	Dr. Avinash Sharma	Discovery of novel antimicrobials from uncultured micro-organisms against the multidrug resistant bacteria	**DSMZ- Germany** Prof. Jörg Overmann **NCL, Pune** Dr. Asish K. Bhattacharya	Wellcome Trust-DBT India Alliance
58.	Dr. Jyoti Singh	Understanding the role of RNAi - mediated antiviral host defense against DNA Viruses.		Wellcome Trust-DBT India Alliance
59.	Dr. Ajay Pillai	IRMI Research Management Grant		Wellcome Trust-DBT India Alliance

60.	Dr. Dhiraj Prakash Dhotre	Understanding the network of active metabolic pathways functioning in indigenous microbial community: essential for maintaining major biogeochemical cycles and their survival/nutrient acquisition in oligotrophic glacier ecosystem.	**ESSO-NCPOR, Goa** Dr. Runa Anthony	Ministry of Earth Sciences
61.	Dr. Amitabha Majumdar	A novel function for a conserved bio-amine in long-term memory and RNA granule remodeling-No. 6503-E	**The University Cote d Azur (UCA), France** Dr. Florence Besse	IFCPAR
62.	Dr. Amit Yadav	Determination of the vector of sandal spike disease (SSD) of Indian Sandalwood (Santalum Album L.) and Development of integrated vector management strategies.	**Institute of Wood Science and Technology (IWST), Bangalore.** Dr. R. Sundararaj	Ministry of Ayush
63.	Dr. GC. Mishra	Regulation & differentiation of T helper 17 & T regulatory cells in collagen induced arthritis by modulating antigen presenting dendritic cells.		NASI
64.	Dr. Manas Santra	Clinical role of a pair of novel mutations in BCR-ABL 1 towards therapy switch in imatinib resistant chronic myeloid leukemia		Lady Tata Memorial Trust
65.	Dr. Dhiraj Dhotre	Study on distribution, function and geonomic reconstruction of deep-subsurface abundant and rare microbial communities in different depth of the rock (Basalt-granite zone) at Koyan-Waran region.	Dr. Dhiraj Paul	Ministry of Earth Sciences

Parties with whom MoA / MoU were signed for research collaborations

1) The Centre National de la Recherche Scientifique (CNRS), France
2) The Maharashtra University of Health Sciences, Nashik, India.
3) Pune Knowledge Cluster Foundation (PKCF), Pune, India.
4) Bhaktivedanta Hospital & Research Institute (BVH), Thane, India

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AWARDS & HONOURS

Awards / Honours – NCCS Faculty

Sharmila Bapat

- Shri Ramniklal J. Kinarivala Cancer Research Award; 18 February 2023.

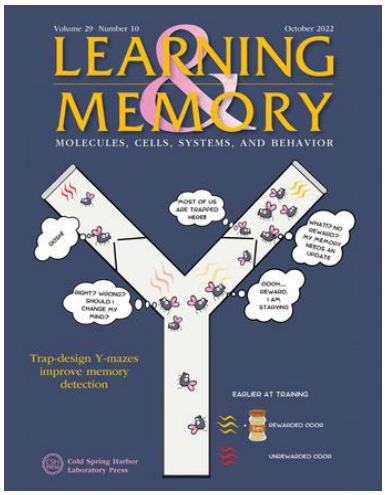

- Invited Chairperson of the Cancer Disease Biology Program (TEC) of DBT.
  She chaired the 1st Meeting of the Technical Expert Committee on Cancer Disease Biology to consider new proposals received by the Department of Biotechnology under the Competitive Grant Scheme, and to review ongoing and completed projects; 27, 28, 29 July 2022.

Akanksha Chaturvedi

- Sree Ramakrishna Paramahamsa Research Grant for Translational Biomedical Research 2022, awarded by the Sree Padmavathi Venkateswara Foundation (SreePVF), for the proposal entitled ‘Generation of novel high-affinity human monoclonal antibody cocktail against rabies virus for efficacious post-exposure prophylaxis’. She received this award in February 2023, and the project will be activated in April 2023.

Gaurav Das

- Dr. Gaurav Das & his team's research on testing olfactory associative memory in fruit flies was featured on the cover of the October issue of Learning & Memory.
  Link: http://learnmem.cshlp.org/content/29/10.cover-expansion



Jomon Joseph

- Elected Member, Guha Research Conference, India
- Member, Molecular Immunology Forum, India
- Life Member, Indian Society for Cell Biology
- Life Member, Society of Biological Chemists, India
- Life Member, Indian Society for Developmental Biologists

Janesh Kumar

- **Membership of following Journal editorial boards**
  1) Communications Biology (Nature) - Editorial Board
  2) BMC Molecular and Cell Biology- Associate Editor

3) Plos One- Editorial Board
4) Scientific reports -Editorial Board
5) FEBS OpenBio- Advisory Editorial Board
6) Neuropharmacology- Guest Editor
7) Member of the Technical Monitoring and Advisory Committee for periodic monitoring of the progress of the "GenomeIndia" and "Human Microbiome" initiatives

Santosh Kumar

- Selected for the Intermediate Career Fellowship in the Basic Biomedical Research (2022) category, awarded by the DBT/Wellcome Trust India Alliance (2023-2028).

Girdhari Lal

- The 2022 NASI-Scopus Young Scientist Award (Biomedical Research & Healthcare).
- The Transplantation Society (TTS) Scientific Travel Award, to present his team's work at the 29th International Congress of The Transplantation Society, Buenos Aires, Argentina (10–14 Sep. 2022). The award was presented during the President's Plenary and Awards session at the congress, which was attended by more than 3500 international clinicians and scientists.

- International Travel Award from the Society for Leukocyte Biology (SLB), USA, to present an oral paper and a poster presentation at the 55th Annual meeting of the Society for Leukocyte Biology in Hawaii, USA (26-29 October 2022).
- The scanning electron microscopy image of an NK cell and a cancer cell, taken by Dr. Girdhari Lal and Mrs. Meenakshi Jadhav of his research group won the 'SLB 2022 Image Contest' organized by the Society of Leukocyte Biology, USA, in celebration of the International Day of Immunology.

Nibedita Lenka

- 'Distinguished Woman Researcher in Stem Cells and Regeneration in Health and Medical Sciences Discipline' award presented by the Board of Trustees, Venus International Foundation, at the 8th Venus International Women Awards (VIWA 2023) presentation held at Chennai, India; 04 March 2023.
- Member, Board of Studies, D.Y. Patil International University, Akurdi, Pune.
- Editorial Board Member, Stem Cells Review and Reports, Springer-Nature.
- Mentor, Faculty Refresher Course in Biotechnology (Trends in Biotechnology and its Contemporary Relevance), UGC-HRDC, Utkal University, Bhubaneswar, Odisha.
- Eminent Speaker, 12th BIRAC-SITARE Biotechnology Innovation Ignition School (BIIS) online workshop for selected groups of undergrad students (Life Science, Biotechnology and Pharmacology) in India, organized by SRISTI, Ahmadabad.
- N. Lenka, Chairperson, Institutional Ethical Committee and Member, IC-SCR, OCT Therapies & Research Pvt. Ltd. Mumbai.

Jyoti Rao

- Second prize in the 'Celebrating 200 Years of Gregor Mendel' Sci-Art competition organized by CSIR-IGIB, New Delhi.

Srikanth Rapole

- General Secretary, Proteomics society of India (PSI)
- Life member, Indian society for mass spectrometry (ISMAS)
- Member, Human proteome organization (HUPO)
- Associate Editor, Journal of Proteins and Proteomics

- Member, Indian Society of Translational Research (ISTR)

Avinash Sharma
- Selected as a member of the Indian National Young Academy of Science (INYAS), New Delhi, in 2023.

Nishant Singhal
- Dr. Nishant Singhal and his team's publication in Stem Cell Research was featured in ESC & iPSC News, Volume 17.13.

Deepa Subramanyam
- Awarded the 2022 'NASI-SCOPUS Young Scientist Award' in the 'Women in Science' category.
- Featured in the book, 'India's Science Geniuses (And the Problems They Are Solving)', published by Archana Sharma (CERN scientist) and Spoorthy Raman (science journalist), via HarperCollins Publishers India Pvt Ltd.

Mohan Wani
- Chief Guest for 3rd Annual Meeting of KNP Vet Alumni Association at K.N.P. College of Veterinary Science, Shirwal; 11 December 2022.
- Chief Guest for Inauguration and Valedictory Ceremony of "Avishkar 2023 Competition" at S. P. Pune University; 12 January 2023.
- Chief Guest for Inauguration Session of 6th International Conference on Recent Trends in Bioengineering at School of Bioengineering Sciences and Research, MIT-ADT University, Pune; 20 January 2023.

Amit Yadav
- 'Best Innovative Idea' award at the "Antimicrobial Resistance Dx Bootcamp", organized by UKIERI (UK-India Education and Research Initiative), at IIT, Delhi; 28, 29 March 2022.

Awards / Honours – Postdoctoral Scientists, Students, Project Scientists and Technical Staff

Gaurav Das's group

- **Radhika Mohandasan** won the Consolation Prize in the 'Celebrating 200 Years of Gregor Mendel' Sci-Art competition organized by CSIR-IGIB, New Delhi.

M. V. Krishnasastry's group

- **Prachi Urade** received the Joshua Lederberg Best Poster Presentation Award at the 18th International Conference on 'Converging Microbiological Innovation for Application in Animal, Plant, Environment and Health Care', organized by the Manonmaniam Sundaranar University, Tirunelveli, India; 27-28 January 2023. She presented a poster titled, 'The role of ESPG1 in mycobacterial virulence and pathogenicity'.

Janesh Kumar's group

- **Juhi Yadav** was selected to participate with full funding in the 'São Paulo School of Advanced Science in CryoEM – 2023', to be held at the Institute of Chemistry, University of São Paulo, Brazil; July 10-21 2023. She is one among 70 students selected internationally.
- **Juhi Yadav** won the Consolation Prize in the 'Celebrating 200 Years of Gregor Mendel' Sci-Art competition organized by CSIR-IGIB, New Delhi.

Girdhari Lal's group

- **Namrita Halder** won an International Travel Award from the Society for Leukocyte Biology (SLB), USA, to present a paper at the 55th Annual Meeting of the Society for Leukocyte Biology (SLB2022); 26-29 October 2022, in Hawaii, USA.
- **Amrita Mishra** won a Travel Award from DBT-CTAP to present a poster at the Cell Symposium: The Neuro-Immune Axis (11-13 September 2022), in Lisbon, Portugal.

- **Namrita Haldar** won the Best Presentation Award for her oral presentation at the 6th Annual conference of the Society of Inflammation Research (SIRCON 2022; 24-25 September 2022), at NCCS, Pune, India.
- **Heikrujam Thoihen Meitei:** won the Best Poster Presentation at the 6th Annual conference of the Society of Inflammation Research (SIRCON 2022; 24-25 September 2022), at NCCS, Pune, India.

Srikanth Rapole's group

- **Osheen** won the third place at the INSA–SERB Essay Competition 2021, in Group-I (Graduates and Post Graduates in science), for her essay titled, "Destroyer and teacher: Corona as the ultimate teacher of 2020".

Manas Kumar Santra's group

- **Tanisha Sharma** received the Prof. V.C. Shah Award for Best Poster, at the 45th edition of the All-India Cell Biology Conference (AICBC), hosted by the Department of Zoology, Banaras Hindu University (BHU), Varanasi; 20-22 January 2023. She presented a poster titled, "Attenuation of glycosylated PD-L1 by SCF E3 ligase can modulate the immune checkpoint".
- **Tanisha Sharma** and **Sharad Tat** were winners of the 'Best Stories' in the PhD category of the Augmenting Writing Skills for Articulating Research (AWSAR 2022) award of the Department of Science and Technology (DST). Tanisha's research story entitled: 'PD-L1: A tale of Karan from Mahabharat', and Sharad's research story entitled: 'PUMA: A double-edged sword' were selected among the 100 best popular science stories (Ph. D Category), 2022.

Vasudevan Seshadri's group

- **Gaurav Aggarwal**: Best Oral presentation Award at the 11th RNA meeting, NCCS Pune (01-03 Dec. 2022).

Shailza Singh's group

- **Subhajit Das**: Best Poster Award from Molecular Omics, for his poster, 'Effect of SH3PXD2B from Breast to Lung Cancer Migration and Metastasis' (Das, S. and Singh, S.), presented at the International Conference on Proteins & Proteomics (PSI-ICPP 2022) held at CSIR-IICB, Kolkata, India; 03-05 November 2022. The certificate was awarded on behalf of the Royal Society of Chemistry.
- **Shweta Khandibharad** received the IUIS-FOCIS Travel Grant from International Union of Immunological Societies and Federation of Clinical Immunology Societies to participate in the Advanced Course in Basic & Clinical Immunology, to be held from 26 February through 01 March at La Jolla, USA. Only four recipients were selected, and she is the only Indian to have received this award.

Deepa Subramanyam's group

- **Jyoti Das** received the ASCB Travel Award

Vidisha Tripathi's group

- **Tejashree Dhamale** was awarded the "Praj Best M.Tech Thesis Gold Medal" for her M.Tech (Chemical and Biotechnology) dissertation in 2020, which was given in May 2022, due to the pandemic-induced hiatus. She conducted her M.Tech research project under the guidance of Dr. Vidisha Tripathi at NCCS, as a student of the Department of Technology, Savitribai Phule Pune University.

Mohan Wani's group

- Garima Pandey received the ASBMR 2022 Young Investigator Emerging Country Travel Grant to attend the American Society for Bone and Mineral Research Annual Meeting (9 - 12 September 2022, Austin, USA).

- Ms. Juilee Karhade received “Best Oral Presentation Award” at Annual Meeting of “Society of Inflammation Research India (SIRCON 2022)” organized by National Centre for Cell Science, Pune; 24-25 September 2022.

Other Awards

- NCCS was awarded the 3rd prize for exemplary performance during Swachhata Pakhwada-2022 by the Department of Biotechnology, Govt. of India.

- NCCS received the third prize for ‘Best Official Language Implementation’, awarded by the Town Official Language Implementation Committee, Pune.

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Research Fellows Awarded with Ph.D. Degrees

(01.04.2022 – 31.03.2023)

Sr. No.	Research Scholar	Title of the Thesis	Date of Award of Ph.D. (dd.mm.yyyy)	Research Guide
1	Ms. Priyanka Padghan	Role of CCR6 in isotype class switch recombination in B cells during homeostasis and inflammation	11.04.2022	Dr. Girdhari Lal
2	Ms. Megharani Mahajan	Role of redoximiRs in breast tumour angiogenesis and metastasis: Nrf2 as a target protein	25.04.2022	Dr. Sandhya Sitaswad
3	Ms. Pranita Borkar	Characterization of translation regulatory activity of PIP4K2A	25.05.2022	Dr. Vasudevan Seshadri
4	Mr. Nimma Ramakrishna	A study on role of osteopontin in metabolic reprogramming leading to breast cancer progression	29.06.2022	Dr. Gopal Kundu
5	Mr. Sahab Ram	Isolation and characterization of gluten degrading bacteria from the human gastrointestinal tract	18.07.2022	Dr. Yogesh Shouche
6	Mr. T. V. S. Kumar	Role of breast cancer stem cells in regulation of tumor progression and angiogenesis in response to hypoxia	22.07.2022	Dr. Gopal Kundu
7	Mr. Pankaj Kumar Madheshiya	Elucidating the role of Nup62 in mammalian nuclear pore complex (NPC) assembly	27.07.2022	Dr. Radha Chauhan
8	Ms. Arathi Nair	CD40-activatted cellular trafficking of Ras GTPase isoforms	28.07.2022	Dr. Bhaskar Saha
9	Ms. Madhuri More	Understanding molecular attributes and dormancy in ovarian cancer	17.08.2022	Dr. Sharmila Bapat
10	Ms. Kruthika Iyer	Studies on the role of HSP70 isoforms during HIV-1 infection in T-cells	06.09.2022	Dr. Debashis Mitra
11	Ms. Divya Kumari	Understanding the role of extracellular vesicles in glioblastoma pathogenesis	06.09.2022	Dr. Sharmila Bapat
12	Mr. Pavan Kumar M. S	Investigating the role of RNA binding proteins in pluripotency and differentiation	15.09.2022	Dr. Sharmila Bapat
13	Mr. Heikrujam Thoihen Meitei	Chemokine receptor CCR6 signaling in CD4 T cell differentiation and function.”	17.10.2022	Dr. Girdhari Lal
14	Ms. Prajakta Nimsarkar	Synthetic bioengineering of miRNAs regulatory networks in *Leishmania* for therapeutic intervention	30.11.2022	Dr. Shailza Singh
15	Mr. Mayengbam S. Singh	Insight into the relation between obesity and colorectal cancer	29.12.2022	Dr. Manoj K. Bhat
16	Ms. Shrankhla Bawaria	Structural and functional investigations of human central transport channel of nuclear pore complex.	24.01.2023	Dr. Radha Chauhan

17	Mr. Nitin Bayal	Pathogenomic studies on skin microbiota of leprosy patients from India	01.02.2023	Dr. Shekhar Mande
18	Ms. Osheen	Identification and functional characterization of FBXO31 interacting proteins that participate in DNA damage response	20.02.2023	Dr. Srikanth Rapole
19	Ms. Sakalya Chavan	Insight into the role of Ran GTPase in inter-cellular communication through exosome	23.02.2023	Dr. Jomon Joseph
20	Ms. Sonali Jathar	Investigating the role of mammalian LncRNAs in regulating cellular quiescence	27.02.2023	Dr. Vidisha Tripathi
21	Ms. Misha K. R	Regulation of ER-mitochondrial functions by Nup358	02.03.2023	Dr. Jomon Joseph
22	Mrs. Malati Umrani	Understanding cellular interactions in organization and function of islets of langerhans	14.03.2023	Dr. Anand Hardikar
23	Ms. Juhi Srivastava	Investigating the role of mammalian long noncoding RNAs in cell cycle regulation	24.03.2023	Dr. Vidisha Tripathi

POSTDOCTORAL FELLOWS & OTHER EARLY-CAREER SCIENTISTS SUPPORTED

Sr. No.	**Name**	**Designation**	**Tenure at NCCS** (dd.mm.yyyy)	**Working in the research lab of**
1	Dr. Priyanka Dutta	DST Inspire Faculty Fellow	01.05.2018 - 30.04.2023	Dr. Radha Chauhan
2	Dr. Deepika Puri	DST Inspire Faculty Fellow	30.07.2018 - 29.07.2023	Dr. Deepa Subramanyam
3	Dr. Khushman Taunk	CSIR-RA	22.08.2019 - 31.08.2022	Dr. Srikanth Rapole
4	Dr. Upasana Narula	ICMR-RA	15.02.2021 -14.02.2023	Dr. Nibedita Lenka
5	Dr. Archana Rajendran	SERB-N-PDF	15.03.2021 - 14.02.2023	Dr. Nibedita Lenka
6	Dr. Jupitara Kalita	M K Bhan Young Researcher Fellow	08.10.2021 - 07.10.2024	Dr. Janesh Kumar
7	Dr. Dharmendra Pal Singh	ICMR-RA	01.12.2021 - 30.11.2025	Dr. Girdhari Lal
8	Dr. Bhuvaneshwaran SP	DBT - RA	22.03.2022 - 21.03.2025	Dr. Nibedita Lenka
9	Dr. Nikhil Ghate	M K Bhan Young Researcher Fellow	01.04.2022 - 31.03.2025	Dr. Manans Santra
10	Dr. Neelam Bodhale	ICMR-RA	15.11.2022 - 14.11.2023	Dr. Bhaskar Saha
11	Dr. Jyoti Singh	Wellcome Trust DBT India Alliance Early Career Fellow	01.01.2018 - 31.12.2023	Dr. Shekhar Mande

CAPACITY BUILDING and OUTREACH

Teaching and Training

Talks/lectures delivered & hands-on activities/training conducted by NCCS scientists

Scientist's name	Subject / Course or Talk title or Symposium / Conference	Class (standard) + Discipline / Dept.	School / College / Institution / Organization	Dates (dd/mm/yyyy)
Sharmila Bapat	Science Carnival Delivered a lecture and was a judge of science projects	Std. 5 – 10 students	Delhi Public School, Pune	18/11/2022
Sharmila Bapat	Research Seminar Series 'Enhancing Molecular Diversity in a Cell Through Chimeric Transcripts': Talk delivered at this series	Masters, PhD, Faculty	School of Arts and Sciences, Ahmedabad University, Ahmedabad	09-10/11/2022
Gaurav Das	Fruit flies feeding	Pre-primary	Indira National School (Pre-Primary), Pune	27/02/2023
Manas Kumar Santra	Cell cycle and cyclins: Maintain them to cherish or leave them to perish	Department of Zoology	Midnapur College, West Bengal	08/06/2022
Manas Kumar Santra	Principle of western blot technique & its importance in biological application	Department of Zoology	NEHU, Shillong	02/11/ 2022
Manas Kumar Santra	Designing potential inhibitor of AKT kinase through targeting non-conventional site	Department of Chemistry	VIT-Vellore	14/12/2022
Deepa Subramanyam	'Stem Cells' – Outreach talk	Class XII	Delhi Public School, Pune	30/08/2022
Deepa Subramanyam	'Move it around: intracellular trafficking in development and disease'	BS/MS, PhD	UM-DAE, Centre for Excellence in Basic Sciences, Mumbai	12/10/2022

Classes taught by NCCS scientists for the Ph.D. course work (2022)

(*conducted by NCCS for Ph.D. students from NCCS and various organizations in Pune, who have registered with the Department of Biotechnology, Savitribai Phule Pune University, Pune, as well as NCCS students registered with the Regional Centre for Biotechnology, Faridabad*)

Name of Scientist	Subject / Topic
Sharmila Bapat	**Co-ordinator of the Cancer Biology Coursework (Elective)** Cancer Stem Cells and Phenotypic Plasticity Cancer Metastases – A Hallmark of Cancer
Akanksha Chaturvedi	Immunology
Radha Chauhan	**Structural Biology, course coordinator** **Biostatistics, course coordinator** Quantitative methods, Instructor
Gaurav Das	Science Communication
Dhiraj Dhotre	Science Communication NGS techniques
Jomon Joseph	Advances in Cell Biology
Janesh Kumar	Quantitative Methods Membrane Proteins
Santosh Kumar	Cell signaling pathways Molecular Genetics and Genetic Engineering Role of animal models in biomedical research
Girdhari Lal	Tumor Immunology Transplantation Immunology
Amitabha Majumdar	Stem cells and neurobiology
Srikanth Rapole	Proteomics basics and applications Mass spectrometry Instrumentation MALDI-MS, ESI-MS, GC-MS MS based proteomics and PTMs characterization Quantitative Proteomics DIGE, iTRAQ, SILAC, Label Free etc. Cancer Biomarkers
Manas Kumar Santra	Molecular Biology Cancer Biology Quantitative methods (protein-protein interaction)
Vasudevan Seshadri	Science Communication Q-PCR, (Quantitative Methods) Protein Translation and its regulation, Molecular Biology
Shailza Singh	Computer Applications
Nishant Singhal	Stem Cells
Sandhya Sitasawad	Cancer Biology (Tumor Angiogenesis) Research Ethics (Biosafety)
Ajay Pillai	Research Ethics, Grants Writing
Deepa Subramanyam	Stem Cells, Development and Neurobiology
Vidisha Tripathi	Molecular Biology Cancer Biology
Amit Yadav	Science Communication

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Other Workshops / Training Conducted and Mentorship Provided

(in addition to the information included in the reports of the cell repository & central support units, and training provided to the IAS Summer Research Fellows and other Summer Trainees, 6 moths' / 1-year Project Trainees, and students of the Ph.D. course work)

- Workshop on Cultivation, Preservation and Characterization of Anaerobic Bacteria': Organized by NCCS-National Centre for Microbial Resource (NCMR-NCCS); 20-24 June 2022. The 16 participants included thirteen Ph. D. students and three faculty members from institutions across India.



- Dr. Sharmila Bapat served as an External Mentor for Dr. Shilpa Rao, Asst. Professor in the department of Neuropathology, NIMHANS, who was awarded DBT-Wellcome trust India Alliance fellowship for the project titled "Analysis of mitochondrial alterations in glioblastoma cells derived from primary culture" under the guidance of Dr.Vani Santosh, MD., FAMS, Professor, Department of Neuropathology.
- Workshop on 'Cultivation, Preservation & Characterization of Anaerobic Bacteria' organized by the NCCS Centre of Excellence, National Centre for Microbial Resource (NCCS-NCMR); 20-24 June 2022.
- Dr. Shailza Singh delivered a lecture-cum training on ‘Molecular Dynamics Simulations using GROMACS’ as an invited speaker at the "Bioinformatics, Genomics, Machine learning, and Big Data Analysis Workshop" organized by NextGenHelper. She imparted online training on the GROMACS-MD Simulation Package to about 30 participants (students, faculties and industry people); 16 July 2022.
- Dr. Deepa Subramanyam conducted hands-on lab training for BS/MS students at IISER-Pune; Feb-April 2022 and May 2022-April 2023.
- Dr. Amit Yadav provided hands-on training to two Ph.D. scholars from Asam Agriculture University, Jorhat, Assam; 11 to 21 December 2022.
- B. Ramanamurthy delivered a lecture as guest faculty at the National Online Training Programme on ‘Laboratory Animal Management and Breeding’ organized by the Department of Animal Genetics and Breeding, College of Veterinary & Animal Sciences, Parbhani, Maharashtra; 10-16 January 2023.
- ‘Workshop on Phylogenomics and Network Biology in the era of Machine Learning’: Virtual workshop organized by the bioinformatics facility team; 15 and 16 March 2023. 34 participants from various institutions in India attended this workshop.
- Virtual workshop on ‘Data Science in Drug Discovery’ organized by the bioinformatics facility; 02-06 February 2023. 27 external faculty members and students received training.
- Workshop on Integrative Health & Personal Medicine through Ayurgenomics’: Jointly organised by NCCS and the Maharashtra University of Health Sciences (MUHS), Nashik; 27 February 2023. 60 participants from various medical and ayurvedic colleges attended the meeting.
- A Hindi Workshop was held on the topic, ‘Official Communication’ 20 December 2022. The invited speaker was Shri. Kaushal Kumar, Admin Officer, CSIR-National Chemical Laboratory (NCL), Pune. 45 staff members (including admin officers, administration staff and technicians) attended the talk.
- ‘Pathogen sequence detection using metagenomics’: Virtual talk delivered by Dr. Dhiraj Dhotre at the ‘Viral Genomics and Bioinformatics Asia 2022’ workshop conducted by Wellcome Connecting Science and the COVID-19 Genomics UK (COG-UK) consortium; 22-26 August 2022. Audience: PhD students and postdoctoral fellows (30 participants).
- ‘From weeds, pulses, coconut to sandalwood: Understanding Devastating Phytoplasma Diseases’: Talk delivered by Dr. Amit Yadav at the training programme on ‘Integrated Pest and Disease Management’ organised by the Institute of Wood Science and Technology (IWST), Bangalore; 03 August 2022. Audience: Indian Forest Service (IFS) officers.
- Dr. Shailza Singh provided on-site training given to 50 MSc (part 1 & 2) students at the Central University of South Bihar (Department of Bioinformatics), Gaya; 07-09 September 2022.
- ‘Overview of NCCS Cell Repository & Cell Culture for Neuroscience Research’: Talk delivered by Dr. Punam Nagvenkar at the 6th Advanced Training Programme in Experimental Behavioral Neurosciences-2023, organized by PGIMER, Chandigarh; 21 January 2023. The audience included about 50 PG students.
- ‘Biosafety guidelines and governing institutions’: Talk delivered by Dr. Vasudevan Seshadri at the Refresher Course for Life Science, "Tools and Techniques in Emerging Viral Diseases" (23 Jan – 06 Feb), organized by the UGC-Human resource development Centre, S.P. Pune University; 27 January 2023. The audience included mainly faculty members of colleges.

- ‘Quantitative proteomics in cancer biology’: Talk delivered by Dr. Srikanth Rapole at the ‘Workshop on Proteomics and Data Analysis’ organized by THSTI, Faridabad; 09-10 February 2023. The audience included PhD students and other researchers.
- ‘Stem Cell Arena and S.T.E.M. - the Avenues for Interdisciplinary Pursuits’: Virtual invited talk delivered by Dr. Nibedita Lenka at the Refresher Course in Biotechnology (10-23 February 2023) organized by the UGC-Human Resource Development Centre (HRDC), Utkal University, Odisha; 17 February 2023. The audience of 37 participants included assistant professors and lecturers serving at various colleges and universities across the state.

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Upskilling of NCCS Members

Upskilling of Staff

- Mr. Vaibhav Argade, Officer ‘C’ (Accounts) & Mr. G. Harikumar, Officer ‘A’, attended workshops No. T-217B “Financial Management, Audit & Accrual Accounting for Autonomous Institution”, and No. T-217 “Government e-Market Place (GeM) & Central Public Procurement Portal (E-Procurement)”, held at Bangalore; 23-27 May 2022.
- Mr. Sunil Kachare, Office Assistant ‘B’ & Mr. Amol Salunkhe, Office Assistant ‘B’, attended an online training on “Public Procurement, E-Procurement, Govt e-Marketplace (GeM)”; 13 & 14 May 2022.
- Mrs. Snigdha Dhali, Technical Officer ‘A’ (Lab) & Mr. D. R. Waghmare, Technician ‘C’ (Lab), participated in FACStep training organized by Becton Dickinson India Pvt. Ltd at Mumbai; 24, 25 June 2022.
- Mr. Ganesh B. Yadav, Technician B, experimental animal facility, attended a workshop on “Monitoring of Genetic and microbiological status of small laboratory animals for production of quality animals”, at ACTREC, Mumbai; 17-19 November 2022.
- Mr. Mahamud Shaikh, Technical Officer ‘B’ (Lab) – Attended a workshop on “Mouse Genome Engineering Facility’s Cryo./ IVF” held at Mouse Genome Engineering Facility, National Centre for Biological Sciences, Bengaluru; 12 – 17 December 2022.
- Mr. Mahadeo Gorain, Technician ‘C’ (Lab)and Mr. Mahavir Rangole, Technician ‘C’ (Lab) attended a workshop on “In vivo Preclinical Imaging and Drug Discovery” held at ACTREC, Tata Memorial Centre, Mumbai; 12 – 14 December 2022.
- Mrs. Bhagyashri A. Tilekar, Office Assistant ‘B’, participated in an online training course on “Advanced Course on Good Governance and Transparency through RTI”; 15 and 16 February 2023.
- Dr. Varsha Shepal, Technical officer ‘C’ (Lab), attended the I-STEAM Tech Management Conclave for Women, at IITMC-W, Bangalore; 20-23 February 2023.
- Mrs. S.S. Namjoshi, Officer ‘A’ (Admin.) & Mr. P.T. Jagtap, Office Assistant ‘A’, participated in a workshop on “Reservation in Services for SC/ST/OBC/ EWS/ PWD & Ex-Servicemen” at Goa; 22-24 February 2023.

In-house Upskilling of Students, Scientists and Technical Staff

- High-Content Screening Training Workshop (including lectures and practical sessions) to upskill the students of NCCS; 05, 06 April 2022. The trainer was Dr. Sahab Uddin from Thermofisher Scientific, and eight PhD students of NCCS benefitted from this workshop.
- ‘Introduction to Biacore and its Applications’: Technical seminar organized by the SPR facility team to create awareness about this technology among the faculty, students and staff of NCCS; 14 March 2023.
- In-house training on Biacore T200’ (SPR): Organized by the NCCS surface plasmon resonance (SPR) facility team to familiarize the PhD scholars, project staff and technicians with the Biacore T200 biomolecular interaction analysis system; 14-16 March 2023. 14 participants, which included twelve PhD students, one Project JRF, and one technician benefited from this training.
- The bioimaging facility conducted an in-house training on the Leica SP5 II microscope for two Ph.D students; 14 February 2023.
- The bioimaging facility conducted in-house training on confocal-based bio-imaging for 17 trainees (1 scientist, 1 technician, 1 RA, 1 project trainee and 13 PhD students); The training began on 03 January 2023.

- Olympus FV3000 and Zeiss LSM 880 Training, 11 October–17 November 2022: 17 in-house participants (14 PhD students, 1 postdoctoral researcher, 1 project staff and 1 technician) were trained at the bioimaging facility of NCCS. The training culminated in an exam to assess the capability of the participants to use these high-end microscopes independently.
- Hands-on workshop on sample preparation and mass spec analysis of proteome was conducted by the NCCS Proteomics Facility for the PhD students and other researchers of NCCS; 10-13th October 2022.
- Hands-on workshop on sample preparation and mass spec analysis of proteome conducted by the NCCS Proteomics Facility; 12-15 September 2022.
- Technical seminars organized in August 2023, followed by hands-on training, served to upskill students, scientists and technical staff at NCCS about the newly acquired flow cytometry tools at NCCS and the latest technologies in this field.
- The NCCS Bio-Imaging Facility organized a High-Content Screening Training Workshop (including lectures and practical sessions) to upskill the students of NCCS; 05, 06 April 2022. The trainer was Dr. Sahab Uddin from Thermofisher Scientific, and eight PhD students of NCCS benefitted from this workshop.
- Hands-on workshop on sample preparation and mass spec analysis of proteome conducted by the NCCS Proteomics Facility for the PhD students and other researchers of NCCS: 12–15 September 2022 and 10–13 October 2022 (also included in the proteomics facility report).
- An in-house seminar series was initiated to get students, technical staff, postdoctoral researchers and scientists acquainted with the research tools and equipment available at NCCS, and to keep them abreast of the latest updates. The following technical staff members delivered talks in this series:
  - Dr. Mahadeo Gorain (Technician "C"): 'Application of IVIS Spectrum CT and Bruker Micro City for small animal studies'; 27 January 2023.
  - Dr. Vijayakumar M V (Technical Officer "C") and Dr. D Venkatesh (Technician "C"), Proteomics Lab: 'Applications of Mass Spectrometry in Proteomics and Metabolomics Research'; 10 March 2023 (also included in the proteomics facility report).

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Other Talks Delivered by Scientists and Technical Staff

FACULTY

Sharmila Bapat

- 'Cancer stem cells, Phenotypic Plasticity and Drug resistance': Invited talk at the 41st Annual Conference of the Indian Association for Cancer Research (IACR-2022).
- 'The role of basic research in women's health and oncology': Invited Panel discussant for "The Role and Challenges of Women in Science, Innovation, Cancer Research and Treatment" at the 41st Annual Conference of the Indian Association for Cancer Research (IACR-2022).
- 'Chimeric Transcripts': Invited Talk during Guha Research Council at Bhimtaal, Uttarakhand, India, 22-25th April, 2022.
- 'Phenotypic Plasticity of Tumor Cells': Invited Talk during MEDSER Workshop at IISER, Bhopal, India on 1st - 2nd July, 2022.
- 'Plasticity in Biological Systems': Invited to deliver the NIAB Institute Day Talk at the National Institute of Animal Biotechnology, Hyderabad, India on 11th August, 2022.
- 'Transcriptional Plasticity - enhancing molecular diversity in a cell through Chimeric Transcripts': Invited Talk delivered as a part of Research Seminar Series at the School of Arts and Sciences, Ahmedabad University, South Campus, Navrangpura, Ahmedabad on 9 Nov, 2022.
- 'Chimeric Transcripts in Ovarian Cancer': Invited Talk during Guha Research Council at 91st Annual Meeting of the Society of Biological Chemists (India), at Kolkatta from 8-11 Dec, 2022.
- 'Chimeric Transcripts in Ovarian Cancer': Invited Talk during Biological Sciences and Bioengineering (BSBE) winter symposium on Trends in Cancer Research and Precision Medicine, from 16-18 Dec, 2022 at IIT (Kanpur).
- 'Chimeric Transcripts – A complex level of Cellular Regulation': Invited Talk Centre at the annual symposium and Bioengineering Ideathon of the BioSystems Science and Engineering, Indian Institute of Science, Bangalore, on 20th Jan, 2023.
- 'Two Decades of Ovarian Cancer Research - knowledge generated, resources developed and hope ahead': Shri R J Kinarivala Oration Award – 18th February, 2023.

- ‘Personalized oncology - Complementation with Ayurgenomics’: Invited Talk during at Integrative Health & Personalised Medicine symposium organized by MUHS, at NCCS Pune on 27 Feb, 2023.
- ‘Knowledge Enablers in Targeting Ovarian Cancer’: Invited Talk during International Women’s Day Symposium at NIBMG, Kalyani, India on 9th March, 2023.
- ‘Two Decades of Ovarian Cancer Research – knowledge generated and resources developed’: Invited Plenary Talk at the National Conference on “Gender Equality in S & T for a Sustainable Future” organized by NASI, Nagpur chapter to commemorate the International Women Day with “Bharat ka Amrut Mahostav”, and centenary year of RTMNU, Nagpur, on 14th-15th March, 2023.

Akanksha Chaturvedi

- Invited Talk: ‘Dynamics and diversity in B cell responses”, SIRCON 2022, Pune, India, September 2022.
- Plenary talk: ‘Study of immune response to COVID-19 vaccination among COVID-19 infected and naive individuals’, AFMC, Pune, India, October, 2022.
- Invited talk: ‘Human monoclonal antibodies for therapeutics’, CBM 2023, Bhopal, India, March 2023.
- Invited talk: ‘Path to monoclonal antibodies for NIPAH virus diagnostics’, Bhopal, India, March 2023.

Radha Chauhan

- ‘Deciphering interacting interfaces of multi protein complexes using in-silico tool, CoRNeA’: Invited talk delivered at the Bioinformatics centre, SP Pune University, August 24, 2022.
- 'The Ramachandran plot': Invited talk delivered at the SP Pune University Biotechnology department, September 16, 2022.
- ‘3D classification in cryo-EM’: Invited talk delivered at the EMBO sponsored CEM3DIP practical course at IISER Pune.
- ‘Insights into the role of Nup62 and Nup93 in assembling cytoplasmic ring and central transport channel of the nuclear pore complex’: Invited talk delivered at the American Society of cell biology (ASCB) Cell-Biology annual meeting, Washington DC, December 1-4th 2022.

Gaurav Das

- ‘The food fly: neural circuits of learned and innate feeding behaviours in *Drosophila*’: Invited Webinar; Research Talk Series, KMC, Manipal; India, April 2022.
- ‘Neurotransmitters involved in toxin-induced emesis are conserved between mammals and flies’: Selected platform talk. The 19th European *Drosophila* Neurobiology Conference, St-Malo, France, September 2022.
- ‘Neurotransmitters involved in toxin-induced emesis are conserved between mammals and flies’: Selected platform talk. “The 3rd No Garland Neuroscience Conference”, IISER Pune, India February 2023.

Dhiraj Dhotre

- ‘Understanding the microbiome’: Talk delivered as invited faculty at the 12th edition of the Young Clinicians Program, organized by the Indian Society of Gastroenterology at Chennai; 24 April 2022.
- ‘Understanding Human microbiome’: Talk delivered at the Young Clinicians Program (YCP) organized by the Indian Society of Gastroenterology at Hyderabad; 04-06 November 2022. The audience included about 200 Clinicians (DM/DNB).

Jomon Joseph

- Invited Talk: King Abdullah University of Science and Technology (KAUST); 20 October 2022.
- Invited Talk: The biennial M2T2 (Microtubules, Motors, Transport, and Trafficking) meeting; 27-29 January 2023.
- Invited Talk: Mitochondria and Metabolism meeting, IISER, Pune; 13-15 February 2023.

- 'Nup358 localizes to ER-mitochondria contact sites and regulates cytoplasmic calcium-induced autophagy': Invited talk delivered at the Autophagy India Network (AIN) Meeting (17-19 Feb.), organized by CSIR-IMTECH, Chandigarh; 18 February 2023.
- Invited Talk: Mumbai-Pune Bio-Network Schedule, The Fountainhead Alibagh; 11-12 March 2023.
- Invited Talk: NISER, Bhubaneswar; 19 March 2023.
- Invited Talk: Institute of Life Sciences; 20 March 2023.
- Invited Talk: National Seminar on Recent Trends in Biology, Department of Zoology, S. P Pune University, Pune; 24 March 2023.

Janesh Kumar

- 'De-orphaning the Orphan Glutamate Delta Receptors: Structural and Functional Insights': Invited talk delivered at the event, 'Vision Oriented Thought Exchange (VORTEX) on Present Status and Future Prospects on Preparedness of Utilization of SERB National Cryo-Electron Microscopy Facilities', organized by the School of Biological Sciences, IIT Mumbai; 05 May 2022. The audience included faculty and scientists (50), and PhD students (25).
- 'Unlocking the Mysteries of Brain Function: The Fascinating World of Kainate Receptors': Invited talk delivered at Computer-Aided Drug Design and Structural Bioinformatics (CADDSB-2023), at Indian Institute of Technology-BHU, Varanasi, held on March 13-17, 2023.
- 'Single Particle CryoEM: A Revolutionary Tool for Structural Biology': Invited talk delivered at Computer-Aided Drug Design and Structural Bioinformatics (CADDSB-2023) at Indian Institute of Technology-BHU, Varanasi, held on March 13-17, 2023.
- 'Emerging insights into Functions and Modulation of Kainate receptors': Invited talk delivered at Asian Chemical Biology Initiative (ACBI) Meeting at Indian Institute of Science Education and Research, Pune, held on September 14, 2022.
- 'Emerging insights into Functions and Modulation of Kainate receptors': Invited talk delivered at New Avenues in GPCR-Drug Discovery, Webinar organized by British Journal of Pharmacology, held on July 27, 2022 (virtual mode).
- 'The Power of Cryo-Electron Microscopy: Driving the Revolution in Structural Biology': Invited talk delivered at Biofootprints, A.I.I.M.S., New Delhi organized public lecture, held on May 12, 2022 (virtual mode).

Santosh Kumar

- 'Identification and characterization of downstream effector protein(s) for Gαo': Invited talk delivered at the 3rd Indian *C. elegans* meeting 2022, Thiruvananthapuram, Kerala (27-30 Sep. 2022) organized by DBT-NBRC, Gurugram and Sree Chitra Tirunal Institute for Medical Science and Technology, Trivandrum, Kerala; 28 September 2022. The audience included scientists and Ph.D. Students (~100-110). Dr. Santosh Kumar's project student also presented a poster at this meeting.

Girdhari Lal

- 'The nervousness of the gut in health and disease': Talk delivered at the Regional Centre for Biotechnology, Faridabad, Gurgaon; 17 June 2022.
- 'T-cell targeted therapy in the inflammation and autoimmunity': Talk delivered at the 7th Lecture series on Inflammation, organized by the Society of Inflammation Research, Bangalore; 23 July 2022. The audience included MSc, MBBS, MD, PhD students, scientists and clinicians.
- 'Regulatory function of gamma-delta T cells in transplantation tolerance': Online invited talk delivered at the 48th Annual Meeting of Indian Immunology Society, organized by the Banaras Hindu University (BHU), Varanasi; 8-9 July 2022. The audience included BSc, MSc, MBBS, MD, PhD students, scientists and clinicians.
- 'Tumor Microenvironment, Inflammation and Cancer': Talk delivered at the Symposium on Inflammation organized by the Translational Health Science and Technology Institute, Faridabad, Gurgaon; 14 July 2022. The audience included BSc, MSc, MBBS, MD, PhD students, scientists and Clinicians.
- 'The nervousness of the gut in health and disease': Talk delivered at the Monthly Lecture Series organized by the Regional Centre for Biotechnology, Faridabad, Gurugaon; 17 June 2022. The audience included BSc, MSc, PhD students, and scientists.

- ‘Neuroimmune communication in health and diseases’: Invited talk delivered at the 14th TCS Annual Conference (14-15 Oct.) organized by the Hyderabad Central University, Hyderabad; 15 October 2022. The audience included MSc students, Ph.D. students, scientists, and clinicians.
- ‘T-cell targeted therapy in the inflammation and autoimmunity’: Online talk delivered at the 7th Lecture Series on Inflammation organized by Society of Inflammation Research, Bangalore; 23 October 2022.
- ‘Neuroimmune communication in controlling gut inflammation and autoimmunity’: Invited talk delivered at 49th Annual conference of the Indian Immunology Society (23-26 Nov.), at PGIMER, Chandigarh; 25 November 2022. The audience included MSc and Ph.D. students, scientists and professors.
- ‘Gut-brain connection in the inflammation and autoimmune diseases’: Online invited talk delivered at the International Conference on Recent Advances in research and Innovations in Life Sciences (17-19 Nov.) held at Mata Gujri Mahila Mahavidyalaya, Jabalpur; 19 November 2022. The audience included MSc, PhD and MD students, clinicians and scientists.
- ‘Development and Education of immune cells in Health and diseases’: Invited talk delivered at the Indian Immunology Society CME and Workshop on Immunological Perspectives in Transplantation and Cancer, organized by the Department of Biochemistry, Andhra University, Visakhapatnam, Andhra Pradesh, India; 16 December 2022. The audience included MSc, MBBS, and Ph.D. students, scientists, and faculty.
- ‘Importance of neuroimmune communication in cancer Immunotherapy’: Invited talk delivered at the 4th Annual Congress of Immuno-Oncology Society of India (IOSICON 2023; 20-22 Jan.), organized by the Mahatma Gandhi University of Medical Sciences and Technology, Sitapura, Jaipur; 20 January 2023. The audience included medical oncologists, clinicians, scientists, professors, MSc students, MD students, MBBS students and Ph.D. scholars.
- ‘The importance of regulatory networks in maintaining homeostasis in humans’: Invited talk delivered at the group discussion on ayurvedic medicine and advancement in science, organized by the National Institute of Ayurveda, Jaipur; 21 January 2023. The audience included ayurvedic physicians, professors, scientists, MD students and MBBS students.
- Lal G (2023) Antigen presentation and its importance in autoimmunity, alloimmunity and immunity. 3rd Immunology workshop CMC Vellore 2023 on Advanced Immunology concepts and Techniques, held at Jacob Chandy Hall, CMC Vellore on 31 March 2023. (Invited Talk).
- Lal G (2023) Development of T cells – Importance in autoimmunity and tolerance. 3rd Immunology workshop CMC Vellore 2023 on Advanced Immunology concepts and Techniques, held at Jacob Chandy Hall, CMC Vellore on 31 March 2023. (Invited Talk).

Nibedita Lenka

- ‘Advances in Stem Cell Research & Therapeutic Development’: Virtual talk delivered at BIRAC SITARE-BIIS Programme (BIIS-12) organized by the Society for Research and Initiatives for Sustainable Technologies and Institutions (SRISTI), Ahmedabad, Gujarat; 28 June 2022. The audience included a selected number of undergraduates from various disciplines of Life Science, Biotechnology and Pharmacology.
- ‘USP and differential cell-fate modulation from embryonic stem cells’: Invited talk delivered in virtual mode at the 2nd Subhash Mukhopadhyay e-Symposium on Stem Cells and Epigenetic reprogramming - 30th West Bengal State Science and Technology Congress (13-15 Jan. 2023), organized by Adamas University, Kolkata, along with the Department of Science & Technology and Biotechnology, Government of West Bengal, India; 15 January 2023. The audience included national and international participants.
- ‘Investigation of differential cell-fate modulation during early development using embryonic stem cells as a model system’: Guest Lecture delivered at the Sri Ramachandra Institute of Higher Education and Research (SRIHER), Sri Ramachandra Medical College (SRMC), Chennai; 03 March 2023. The audience included Faculty, B.Tech., M. Tech., and Ph.D. students.

Amitabha Majumdar

- ‘Towards understanding molecular mechanisms of memory’: Talk delivered at the 11th RNA meeting at NCCS, Pune; 02 December 2022.
- ‘Studying the role of protein synthesis pathway and RNA binding proteins in a Huntington’s disease model in *Drosophila*’: Talk delivered at the SNCI-CON 2022 meeting in Nagpur; 11 November 2022.

Punam Nagvenkar

- ‘NCCS Cell Repository - An Overview’: Talk delivered at the TSCOST-DBT Skill Vigyan Initiative, Workshop on Animal Cell Line Technology, organized by JNTUH, Hyderabad; 19 October 2022. The audience included approximately 50 mid-career scientists and faculty members.

Ajay Pillai

- He spoke at two sessions on ‘Research Agreements’ at the DST-sponsored residential training on "Scientific Project Management" organized by IISER, Pune; 22 and 23 February 2023. The audience of 40 participants included research administrators from various institutions across India.
- ‘Making a Successful Career in Science’: Invited virtual talk delivered for the Indian Pharmaceutical Association Kerala Chapter; 28 February 2023. The audience included over 200 participants.
- Dr. Ajay Pillai gave a talk at Fergusson College, Pune. He discussed the following topics: (i) The importance of a research proposal and basic requirements; (ii) Examples of research proposals; (iii) Research proposal writing & ethics of scientific grant writing; 04 March 2023. 63 students (BSc, Life Sciences) attended the discussions.

Srikanth Rapole

- ‘Identification and functional characterization of potential targets and biomarkers for Multiple Myeloma using global proteomic analysis and molecular approaches’: Invited talk delivered at the Conference on Molecular and Translational Research for Precision Oncology organized by Sri Shankara Cancer Hospital and Research Centre (SSCHRC), Bengaluru; 14-15October 2022.
- ‘Identification and functional characterization of potential targets and biomarkers for Multiple Myeloma using global proteomic analysis and molecular approaches’: Invited talk delivered at the 14th Annual Meeting of the Proteomics Society, India and International Conference on Proteins & Proteomics (PSI-ICPP 2022), organized by CSIR-IICB Kolkata; 03-05 November 2022. The audience included scientists, PhD students and postdoctoral researchers.
- 'Proteomics in Myeloma': Invited talk delivered at the 5th Annual Conference of The Indian Myeloma Academic Groupe (IMAGe), organized by St. John's Medical College and Hospital, Bengaluru; 13-15 January 2023. The audience included 200 clinicians and researchers.
- 'Identification and functional characterization of potential targets and biomarkers for multiple myeloma using global proteomic analysis and molecular approaches': Invited talk delivered at the 45th All India Cell Biology Conference & International Symposium on Biology of Development and Disease, organized by the Banaras Hindu University, Varanasi; 20-22 January 2023. The audience included 400 students and researchers.
- ‘Quantitative proteomics in Cancer Biology’: Invited talk at the Workshop on Proteomics and Data Analysis organized by the Translational Health Science and Technology Institute (THSTI), Faridabad; 9-10 February 2023.
- ‘Application of Mass Spectrometry-based quantitative proteomics approaches towards identification of potential targets and biomarkers for multiple myeloma’: Invited talk delivered at the 34th ISMAS Symposium on Mass Spectrometry organized by the National Geophysical Research Institute, Hyderabad; 15-18 February 2023. The audience included PhD students and scientists.

Arvind Sahu

- ‘Contextualizing research in consonance with national priorities: my perspective’: Invited talk delivered at ‘Symresearch 2022’ - National Conference on Research in Health and Biomedical Sciences, organized by the Faculty of Health Sciences, Symbiosis International Deemed University, Pune; 04 November 2022. The audience included ~300 MSc and PhD students and Symbiosis Faculty members.
- ‘Designing complement regulator: lessons from viruses’: Invited talk delivered at ACBICON 2022, 48th National Conference of the Association of Clinical Biochemists of India, New Delhi, India; 24 November 2022. The audience included about 50 PhD students and faculty.
- ‘Viral regulation of complement: Viral teachings on complement regulation’: Invited talk delivered at the India-EMBO lecture course on ‘Complement in Kidney Diseases’, NCCS, Pune; 31 January 2023.

Manas Kumar Santra

- 'Design of small molecules to inhibit AKT signaling through targeting non-conventional site: Implication in cancer therapeutics: Talk delivered at a SERB-sponsored International Symposium on 'Exploring Molecules, Materials and Bio-materials for Sustainable Society' (8-10 Sep. 2022), organized at MIdinapore College, West Bengal; 09 September 2022.
- 'Development of synthetic compound to inhibit AKT signaling through targeting non-conventional site: Implication in cancer therapeutics': Talk delivered at NIPER-PHARMACON2022 organized by NIPER Mohali; 10 November 2022. The audience include BSc, MSc and Ph.D. students, scientists, and faculty.
- 'Unwinding the LOVE-HATE relationship between FBXO31 and γH2AX in DNA damage response and repair pathway': Talk delivered at the 91st Annual Meeting of the Society of Biological Chemists (India), organized by SBC(I) Kolkata Chapter, Bose Institute, CSIR-IICB, NIBMG, and Sister Nivedita University, at the Biswa Bangla Convention Centre, Kolkata, India; 09 December 2022. He audience included about 500 post graduate and Ph. D. students, and scientists.
- 'Designing potential inhibitor of AKT kinase through targeting non-conventional site: Implication in cancer therapeutics': Talk delivered at the Faculty Development Programme (FDP), organized by the Department of Chemistry, VIT-Vellore, India; 14 December, 2022. The audience included ~100 Ph.D. students and faculty members.

Avinash Sharma

- 'Probiotic potentials of traditional fermented foods; a microbiome perspective': Talk delivered at the National Seminar on Food Science and Technology, organized by the University of North Bengal; 25 April 2022. The audience of 70 included faculty members, postdoctoral researchers, and PhD and Master's students.
- 'Mass gatherings and AMR': Invited Talk delivered at the Indo-German Bilateral Workshop on Agricultural Management Practice Effects on Soil- and Plant-associated Bacterial Communities and their Resistome; Potsdam, Germany, 20-22 June 2022.
- 'Prevalence of Opportunistic Pathogens in SARS-CoV-2 Infected Individuals: A microbiome perspective': Invited talk (virtual) delivered at the 3rd Science and Mathematics International Conference (SMIC) on Emerging Post-Pandemic Trends of Research and Education in Mathematics and Science, organized by the State University of Jakarta, Indonesia; 07 September 2022. The audience included 215 faculty, Master's, Bachelor's and PhD students.
- 'Tiny microorganisms from Antarctica; from few colonies to million sequences': Invited talk delivered at the 'International Conference on Mountain Ecosystems: Biodiversity and Adaptations Under Climate Change Scenario', held at Graphic Era Deemed to be University, Dehradun, organized by the GEU, Dehradun and ICIMOD, Nepal; 22-24 March 2023. The audience included 150 PhD and masters students, and senior, intermediate and junior researchers from across the globe.

Shailza Singh

- 'ImmunoRegulatory Networks in Inflammation Model for Therapeutics - Case Study in Leishmaniasis': ICMR-sponsored talk delivered at the Central University of South Bihar (Department of Bioinformatics), Gaya; 06 September 2022. Th audience included 60 students and 10 faculty members.
- 'Reciprocity of cytokines modulates through AI in Infection model": Invited talk delivered at SRM College of Pharmacy, 15 February 2023.
- 'Bioinformatics for Microbiologists': Invited talk delivered at Abasaheb Garware College, Pune, to inaugurate the 'Microfest 2023' of the Department of Microbiology; 21 March 2023. The audience of approximately 150 included UG and PG students, as well as faculty of Microbiology.

Deepa Subramanyam

- 'Moving through hard times: A story of trafficking and neurodegeneration': Invited talk, delivered at 'Microtubules, Motors, Transport and Trafficking', IISER Bhopal; 27-29 January 2023.
- 'Deciphering patterns of trafficking in neurodegeneration': Invited talk delivered at the NCBS Annual Talks, 2023: Patterns in Biology, Bangalore; 23-25 January 2023.
- 'Move it around: intracellular trafficking in development and disease': Invited talk delivered at UM-DAE, Centre for Excellence in Basic Sciences, Mumbai; 12 October 2022.

- ‘Move it around: intracellular trafficking in development and disease’: Invited talk delivered at Champalimaud, Centre for the Unknown, Lisbon, Portugal; 02 August 2022.

Mohan Wani

- “Mesenchymal stem cell therapy in Rheumatoid Arthritis”: Invited talk at PGIMER, Chandigarh; 9 May 2022.
- “Importance of the quality animals in biomedical research”: Inauguration Lecture in Workshop for Laboratory Animal Professional at ACTREC, Mumbai; 17 November 2022.
- “Stem cell therapy in autoimmune diseases”: Invited talk in 8th International Bioprocessing India Conference at CSIR-NCL, Pune; 18 December 2022.
- “Large animal models in biomedical research”: Invited talk at National Brain Research Institute, Manesar, Haryana; 9 February 2023.

Amit Yadav

- ‘The AMR repository at NCCS and its role in AMR surveillance’: Talk delivered at the Consultative meeting of Biofilms and Antimicrobial Resistance Consortium (BARCOD), organized by the Christian Medical College, Vellore; 24 & 25 May 2022. The audience of about a hundred included scientists, faculty of at CMC Vellore, and research and medical students.
- ‘From weeds, pulses, coconut to sandalwood: Understanding Devastating Phytoplasma Diseases’: Invited lecture delivered at the training on "Integrated pest and disease management in nurseries, plantation and forest", organised for Indian Forest Service (IFS) officers by the Indian Council of Forestry Research and Education (ICFRE) - Institute of Wood Science and Technology (IWST), Bangalore, India. 03 August 2022.

PROJECT SCIENTISTS

Amaraja Joshi (NCCS-NCMR Project Scientist)

- ‘Alkaliphilic bacteria from Lonar lake: A potential source of antibiotics’: Virtual talk delivered at the ‘International Conference on Advances in Bioactive Molecules’, organized by the Department of Microbiology, School of Life Sciences, S R T M University, Nanded; 07 April 2022. The audience included MSc students.
- ‘Microbial Identification by API, BIOLOG and VITEK’: Talk delivered at SAGE Talks organized by SAGE University, Bhopal; 17 September 2022. The audience included M. Sc. II students (40) and faculty (6).

Om Prakash Sharma (NCCS-NCMR Project Scientist)

- ‘Municipal Landfill Leachate: Public and Environmental Health Perspective’: Talk delivered at the Energy Water and Food Nexus International Conference organized by the Florida Agricultural and Mechanical University (FAMU), USA; 12 April 2022.

Tushar Lodha (NCCS-NCMR Project Scientist)

- ‘Importance of clinical research’: Talk delivered for Indian Institute of Professional Centre, Satara; 18 September 2023. The audience included M.Sc. and Ph.D. students.

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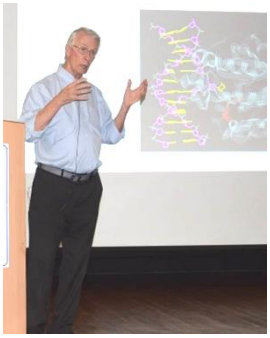
OTHER OUTREACH

Public Talks by Nobel Laureates

'The Path to the Nobel Prize' **02 November 2022**

Public talk by **Sir Richard Roberts**
(1993 Nobel Laureate in Physiology or Medicine)
Organized by NCCS in association with the S. P. Pune University.
Over 450 people attended the talk in person at NCCS, plus several more viewed the live streaming online. The recording is also available at: https://www.youtube.com/watch?v=B7M18ASuxgg



'Axioms from a Life in Science' **17 January 2023**

Public talk by **Prof. Harold Varmus**
(1989 Nobel Laureate in Physiology or Medicine)
Organized in dual mode with live streaming on YouTube.

This talk was hosted under the aegis of Prof. Varmus' visit to India as Raman Chair (2020) of the Indian Academy of Sciences, Bengaluru, hosted by Dr. Sharmila Bapat at NCCS.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National Science Day at NCCS **28 February, 2023**

Open Day

Selected laboratories of NCCS were thrown open to the public, to give them an opportunity about the research, academic and other activities of NCCS, as well as the cutting-edge research tools used in cell biology. Demonstrations and displays were also exhibited by the central facilities, Dr. Gaurav Das's group' and the NCCS-NCMR group. An overwhelming response was received, with around a thousand people of diverse age groups and backgrounds having visited NCCS as school and college groups, as well as individuals and families.

The following visitors also visited the campus of the NCCS project, National Centre for Microbial Resource (NCCS-NCMR):

- 14 M.Sc, 32 B.Sc. and 4 faculty members from Dr. Ghali College, Kolhapur.

- 13 B.Sc Microbiology students plus faculty members from Abhasaheb Garware College, Pune.
- 37 M.Sc Microbiology students and two faculty members from Dr. D.Y. Patil ACS College, Pune.








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India International Science Festival (IISF 2022) **21–24 January 2023**




NCCS joined the nation in celebrating the scientific achievements of India as part of the 'Azadi Ka Amrit Mahotsav' by showcasing its research and other activities, and achievements at the IISF 2022 Mega Science & Technology Expo at Bhopal. Visitors were made aware of the research opportunities available in cell biology and at NCCS. Microscopes as well as cell and microbial cultures were also exhibited, and interactive games and activities were also organized for the benefit of the visitors.
Thousands of visitors from different backgrounds, age groups and demographics visited the NCCS stall. These included mainly school, college and Ph.D. students and educators from various organizations, as well as the general public. Dr. Jyoti Rao, (Scientist D), Dr. Amaraja Joshi (Project Scientist, NCCS-NCMR), Mr. Mahavir Rangole (Technician C, Lab), and Mr. Amit Salunkhe (Technical Officer A, Lab) participated in the event as representatives from NCCS.

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Other Public Talks

- '**The Power of Cryo-Electron Microscopy: Driving the Revolution in Structural Biology'**: Virtual public talk delivered by Dr Janesh Kumar for Biofootprints, a not-for-profit society engaged in science promotion and popularization; 12 May 2022. The audience included faculty and scientists (10), PhD students (25), & MSc/Mtech students (20).
- '**Journey to the coldest continent on the earth**': Invited public talk delivered by Dr. Avinash Sharma as a popular science talk jointly organized by the Association of Microbiologists of India (AMI) Pune Unit and the Department of Microbiology, MES' Abasaheb Garware College, Pune; 02 February 2023. The audience of 250 included faculty, and Masters, Bachelors and PhD students.
- **'जिज्ञासा' - Taking science to the masses in the national language**
  NCCS initiated the seminar series in Hindi in March 2022. The June session in this series was a presentation in Hindi on 'Increase your immunity with Ayurveda' by Vaidya (Dr.) Leena Borude, Ayurvedacharya and Panchakarma Specialist; 15 June 2022. This talk was also aligned with the commemoration of the International Day of Yoga since Dr. Borude also spoke about yoga.



Other Open Days at NCCS

The following open days were organized (in addition to the ones mentioned above). :

- Three MSc students from the Department of Microbiology, Ramnarain Ruia College, Mumbai, visited the NCCS-National Centre for Microbial Resource (NCMR-NCCS); 04 April, 2022.
- A virtual open day was organized for 31 students and three faculty members of BTech Agricultural Biotechnology from the Tamil Nadu Agricultural University; 18 April 2022.
- 34 students from the 3rd year BSc Microbiology course and three faculty members from Bharti Vidyapeeth's Dr. Patangrao Kadam Mahavidyalaya, Sangali, visited the NCCS-National Centre for Microbial Resource (NCMR-NCCS); 13 April, 2022.
- 23 M.Sc. Biodiversity students and faculty (21+2) from the Abhasaheb Garware College, Pune, visited the NCCS Centre of Excellence, National Centre for Microbial Resource (NCCS-NCMR) on 18 May, 2022.
- 17 B.Sc. Biotechnology students and faculty (14+3) from the Yashwantrao Chavan College of Science, Karad, visited the NCCS Centre of Excellence, National Centre for Microbial Resource (NCCS-NCMR) on 19 May, 2022.
- 16 recently-recruited scientists from the National Institute of Virology (ICMR-NIV) visited NCCS as part of their orientation programme; 24 May 2022.
- 15 faculty members from Genomebio Technologies Pvt. Ltd., Pune visited the NCCS Centre of Excellence, National Centre for Microbial Resource (NCCS-NCMR) on 11 May 2022. The visit included a demonstration of Vitek and Genome sequencing.
- 26 students and faculty (23_3) of the M.Sc. Microbiology course at the D.B.F. Dayanand College of Arts and Science, Solapur (Maharashtra) visited the NCCS Centre of Excellence, National Centre for Microbial Resource (NCMR-NCCS); 02 June 2022.
- 160 visitors including standard IX students and teachers (152+8) from City Pride School, Pune, visited NCCS-National Centre for Microbial Resource (NCMR-NCCS); 20, 21, 22, 25 July 2022.
- 31 visitors including B.Sc. Zoology students and faculty members (28+3) from Prof. Ramkrishna More College, Akurdi, Pune, visited NCCS-National Centre for Microbial Resource (NCCS-NCMR); 29 June, 2022.
- Students from class 6th to 9th of the Saraswati Vishwa Vidyalaya National School, Nigdi, Pune (48 students + 3 teachers) visited NCCS on 22 August 2022. Dr. Deepa Subramanyam gave a popular science talk on stem cells, and the students also visited the cell repository and bioimaging facility, and played a DNA game.
- Six students and faculty (5+1) of XIIth standard from Ryan International School, Pune, visited the National Centre for Microbial Resource of NCCS (NCCS-NCMR); 16 September 2022.
- Eighteen students and faculty (15+3) of the M.Sc. Industrial Microbiology course from Bharti Vidyapeeth, Pune, visited the NCCS National Centre for Microbial Resource (NCCS-NCMR); 07 October, 2022.
- About 50 students of the 1st year, B. Voc. Medical Lab Technology (MLT) course and a faculty member from the Poona College of Art, Science & Commerce, Pune, visited NCCS; 10 October 2022.
- 47 students of the Poona College of Arts, Science and Commerce (AKIs Poona College) visited on 10 October 2022.
- 16 graduate students and a faculty member (15+1) of the Symbiosis School for Liberal Arts (SSLA), Symbiosis International University, Pune, visited the NCCS National Centre for Microbial Resource (NCCS-NCMR); 18 October 2022.
- 37 B.Sc. Microbiology students and faculty (34+3) from St. Xavier's College, Panaji, Goa, visited the NCCS CoE, National Centre for Microbial Resource (NCCS-NCMR); 02 November 2022.
- Two faculty members from Nivea Industries, Navi Mumbai, visited the NCCS CoE, National Centre for Microbial Resource (NCCS-NCMR); 18 November 2022.

- 69 BTech (Biotechnology) students and faculty members of the Shri Shivaji College of Agril. Biotechnology, Amravati, visited NCCS; 06 December 2022.
- 79 BSc and MSc students and faculty from the Department of Biotechnology, Ramniranjan Jhunjhunwala College, Mumbai, visited NCCS; 14 December 2022.
- A few students from the Symbiosis School for Liberal Arts (SSLA), Pune, interviewed two scientists from NCCS (Dr. Gaurav Das and Dr. Deepa Subramanyam) and toured their labs as part of their college project where they had to familiarize themselves with the research and day in the life of a scientist; December 2022.
- 32 students and faculty (30+2) of the B.Sc. Microbiology course from B.N. Bandodkar College, Thane, visited the National Centre for Microbial Resource campus of NCCS (NCMR-NCCS); 03 January 2023.
- 55 students and faculty (51+4) of the B.Sc. Biotechnology course from Jai Hind College, Mumbai, visited the National Centre for Microbial Resource campus of NCCS (NCMR-NCCS); 10 January 2023.
- 52 students and faculty (48+4) of the M.Sc. Microbiology course from S.M. Joshi College, Pune, visited the National Centre for Microbial Resource campus of NCCS (NCMR-NCCS); 19 January 2023.
- 45 students and faculty of the B. Sc. Biotechnology course from Rajarshi Shahu Mahavidyalaya (Autonomous), Latur, visited the National Centre for Microbial Resource campus of NCCS (NCMR-NCCS); 20 January 2023.
- 44 B.Sc.-II Microbiology and Industrial Microbiology students and faculty members (42+2) from Rajaram College, Kolhapur, visited the National Centre for Microbial Resource of NCCS (NCCS-NCMR); 24 February 2023.
- 22 M.Sc Microbiology students plus faculty members (20+2) from Abhasaheb Garware College, Pune, visited the NCCS project, National Centre for Microbial Resource (NCCS-NCMR); 03 March 2023.
- 42 B.Sc Microbiology students plus faculty members from Abhasaheb Garware College, Pune, visited the NCCS project, National Centre for Microbial Resource (NCCS-NCMR); 21 March 2023.
- 38 M.Sc Microbiology students plus faculty members from Smt. Kasturbai Walchand College of Arts and Science, Sangli, visited NCCS; 29 March 2023.
- 42 B.Sc Microbiology students plus faculty members from Abhasaheb Garware College, Pune, visited the NCCS project, National Centre for Microbial Resource (NCCS-NCMR); 29 March 2023.
- 44 B.Sc Microbiology students plus faculty members from Fergusson College, Pune, visited the NCCS project, National Centre for Microbial Resource (NCCS-NCMR); 29 March 2023.

COVID-19-Related Outreach

- **Bilingual Public Talk on 'Resurgence of COVID-19'**
  Talks and Q&A in Marathi and English by Dr. Shekhar Mande (Honorary Distinguished Scientist, NCCS) and Dr. Arvind Sahu (Scientist G, NCCS); 15 January 2023. Organized in association with the Pune Knowledge Cluster, in hybrid mode: the discussions were held in the NCCS auditorium, and were also live streamed on Zoom and YouTube.

- **Outcomes of the survey done to assess how COVID-19 affected STEM scientists and stakeholders across India.**
  This survey was done last year by Dr. Deepa Subramanyam of NCCS in association with Monk Prayogshala, funded by Wellcome Trust/DBT India Alliance. An article presenting the key takeaways from this survey was published by them on the India Bioscience website in April 2022, as given below -
  Part 1 (written by Dr. Deepa Subramanyam, Scientist, NCCS, Pune, and Nikita Mehta & Arathy Puthillam, Department of Psychology, Monk Prayogshala, Mumbai):
  https://indiabioscience.org/news/2022/assessing-the-impact-of-covid-19-on-the-indian-stem-community-part-1
  Part 2 (written by Dr. Deepa Subramanyam, Scientist, NCCS, Pune, and Vedika Inamdar & Shivani Chunekar, Department of Sociology, Monk Prayogshala, Mumbai):
  https://indiabioscience.org/news/2022/assessing-the-impact-of-covid-19-on-the-indian-stem-community-part-2

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YouTube Videos

To help spread awareness about the research done at NCCS and popularize science, NCCS scientists and students shared their research in the 'Biotech Talks' series hosted by the YouTube channel, 'The Curious Biotechnologist'. These are listed below:

- Dr. Radha Chauhan spoke about structural biology and her research (08 April 2022).
  Link: https://www.youtube.com/watch?v=_LjsydBvWuM
- Dr. Deepa Subramanyam spoke about stem cells and her research (26 April 2022).
  Link: https://www.youtube.com/watch?v=IZ7wSvgMjSU
- Cancer Biology at NCCS – Dr. Sharmila Bapat, Dr. Sandhya Sitasawad, Dr. Manas Kumar Santra and Dr. Srikanth Rapole spoke about their research.
  Link: https://www.youtube.com/watch?v=HFD-TvAkr7A
- Janesh Kumar spoke about his work on glutamate receptors and other structural biology studies.
  Link: https://www.youtube.com/watch?v=B664g2v0SUU

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Other Extramural Outreach by NCCS scientists and technical staff

- Dr. Avinash Sharma interacted with the students & staff of the University of North Bengal & Kurseong College; April 2022.
- 'Facts & facets of stem cells, the unit of development': Public talk delivered by Dr. Nibedita Lenka for the popularization of science at the outreach event organized by Bigyan Chetana Manch, Odisha (affiliated to the Breakthrough Science Society); 18 April 2022. The audience included attendees from all walks of life.
- 'Career opportunities in polar research': Talk delivered by Dr. Avinash Sharma at the National Seminar on Career Opportunities in Life Sciences with special reference to food, pharma and agricultural microbiology, organized by the University of North Bengal; 26 April 2022. The audience of 60 included faculty members, and PhD and undergraduate students.
- 'Cell cycle and cyclins: Maintain them to cherish or leave them to perish': Talk delivered by Dr. Manas Kumar Santra at Midnapur College, West Bengal; 08 June 2022. The audience included >100 B.Sc. and M. Sc. students.
- 'Opportunities in Life Sciences': Talk delivered by Dr. Amaraja Joshi (Project Scientist, NCCS-NCMR) at the research training program for M.Sc. Microbiology students organized by Rayat

Institute of Research and Development, Satara; 25 August 2022. The audience included: M. Sc. II (Life Sciences) students (45) and faculty (5).

- 'Principle of western blot technique & its importance in biological application' & 'Tools in determining protein – protein interaction and its biological application': Talks delivered by Dr. Manas Kumar Santra at Synergistic Training program Utilizing the Scientific and Technological Infrastructure (DST-STUTI), organized by the Department of Zoology, NEHU, Shillong; 02 November 2022. The audience included BSc, MSc, and Ph. D. students, and faculty.
- Prachi Chopade (Technician C): Participated in Krishithon - International Agriculture Trade Fair & Conference at Nashik (24 - 28 November 2022), and represented the Department of Biotechnology, along with Dr. Rajneesh Gaur, Scientist, DBT. The estimated footfall for this event was approximately 1.5-1.6 lakh people from various backgrounds. She helped create awareness about the different research and other activities of DBT, with special emphasis on plant and animal biotechnology, and directed numerous enquiries related to start-up towards the Biotechnology Industry Research Assistance Council (BIRAC).


- Mr. Suresh Basutkar (Technical Officer 'C') and Mr. Anil Lotke (Technical Officer 'B') participated in and represented DBT and NCCS at the Shining Maharashtra 2022 exhibition at Akluj, Maharashtra; 22-24 December 2022.
- Visit to Indira National School, Pune, by Dr. Gaurav Das and his group members (Radhika Mohandasan and Asmita Dogra). They interacted with students and teachers from the nursery to senior KG class, organized scientific activities, and observed the students' scientific demonstrations; 27 February 2023.

- 'In Search of Microorganisms from Antarctica, the Coldest Landmass on the Planet': Inaugural talk delivered by Dr. Avinash Sharma at the national science day celebrations of Shivaji University, Kohlapur; 24 February 2023. The audience of 80 included faculty, and PhD & Master's students.
- Popular science talk delivered by Dr. Nibedita Lenka: 'Facts and Facets of Stem Cells, the Unit of Development', Popularization of Science for all walks of life, organized by Bigyan Chetana Manch (affiliated to Breakthrough Science Society), 18 April 2022.
- 'Advances in Stem Cell Research & Therapeutic Development': Talk delivered by Dr. Nibedita Lenka as Eminent Speaker at the 12th BIRAC-SITARE Biotechnology Innovation Ignition School (BIIS) online workshop for selected groups of undergrad students (Life Science, Biotechnology and Pharmacology) in India, organized by SRISTI, Ahmadabad, 28 June 2022.
- 'Stem Cell Arena and S.T.E.M., the Avenues for Interdisciplinary Pursuits': Talk delivered by Dr. Nibedita Lenka at the Faculty Refresher Course in Biotechnology (Trends in Biotechnology and its Contemporary Relevance), UGC-HRDC, Utkal University, Bhubaneswar, Odisha, 17 February 2023.
- 'Towards understanding molecular mechanisms of memory': Talk delivered by Dr. Amitabha Majumdar at the Biophysics, Molecular Biology and Genetics Department, University of Calcutta; 30 December 2022.
- 'Towards understanding molecular mechanisms of memory': Talk delivered by Dr. Amitabha Majumdar at IISER Pune; 16 December 2022.

- ‘Towards understanding molecular mechanisms of memory, Bose Institute, Kolkata; 26 October 2022.
- ‘Looking into the microroganisms from the coldest continent on earth’: Inaugural talk delivered by Dr. Avinash Sharma at the National Science Day celebrations; Kohlapur, 24 February 2023.
- ‘Journey to the coldest continent on the earth’: Talk delivered by Dr. Avinash Sharma at Abasaheb Garware College of Arts and Science, Pune; 02 February 2023. The audience included BSC, MSC and PhD students and faculty.
- Dr. Nishant Singhal delivered a talk at Sanjeevani School for specially-abled children, Pune, India; 26 January 2023.
- Dr. Nishant Singhal spoke about stem cell-based disease modeling and about his work published on Down syndrome impaired neurogenesis, at an interview conducted by a journalist from the health magazine ‘Happiest Health’.
  Links to the articles:
  https://www.happiesthealth.com/articles/neurology/how-disease-in-a-dish-model-could-help-treat-brain-disorders
  https://www.happiesthealth.com/articles/neurology/stem-cells-understanding-down-syndrome-better.
- Dr. Deepa Subramanyam delivered popular science talks on ‘Stem Cells’ at:
  (i) Saraswati Vishwa Vidyalaya National School, Nigdi, Pune; 22 August 2022.
  (ii) Delhi Public School, Pune; 30 August 2022. 100 students from class XI and XII attended the talk.

Extramural Outreach in Association with the National Academy of Sciences, India (Pune Chapter)

Dr. Milind Patole (former NCCS faculty member), and the NCCS technical staff, including Dr. Ashwini Atre, Dr. Bhimashankar Utage, Dr. Jayashri Jagtap, Dr. Satish Pote, and Dr. Varsha Shepal, delivered talks in Marathi and demonstrated cells under the microscope for underprivileged students and educators at various locations in Maharashtra, including small towns and villages. The places visited included Shivaji Mahavidyalaya, Renapur; Swami Vivekananda Vidyalaya, Asade, Mulshi; Jay Malhar High School, Jambut, Shirur; Krantiveer Vasudev Balwant Phadke Smruti Vidyalay, Rawadi, Bhor; Vasundhara Vidnyan Kendra, Nerurpar, Kudal; Vidyapeeth High School, Pune; and Indrayani Institute of Pharmaceutical Educations and Research, Talegaon Dabhade. These activities were undertaken under the aegis of the NASI Pune Chapter outreach initiative.





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CONFERENCES & OTHER EVENTS

Conferences / Workshops / Meetings / Other Events Participated in

Participation by the NCCS Faculty

- **Sharmila Bapat**
  - Attended the Guha Research Conference (GRC)-2022 held at Nainital, Uttarakhand; 22-26 April 2022.

- **Gaurav Das**
  - Attended the 19th European Drosophila Neurobiology conference (Neurofly 2022) at Saint Malo, France (05-13 September 2022).

- **Dhiraj Dhotre**
  - Participated as a panelist in a Panel Discussion on 'Microbiome: Science and Entrepreneurship opportunities', as part of the 'Microbiome: Science and Entrepreneurship Opportunities' event jointly organized by CSIR-National Chemical Laboratory, Association of Microbiologist of India, Pune Chapter and Vidnyan Bharati Paschim Maharashtra Prant; 29 July 2022. Audience: Graduate and Post graduate Students from Microbiology / Biotechnology and related subjects along with the general public having an interest in this subject (~ 200 participants).

- **Jomon Joseph**
  - Attended the Guha Research Conference (GRC)-2022 held at Nainital, Uttarakhand; 22-26 April 2022.

- **Girdhari Lal**
  - Attended the 2022 Gordon Research Conference on "Immunometabolism in Health and Disease" held at Bryant University, Smithfield, Rhode Island, USA; 19 – 24 June 2022.
  - Attended the 29th International Congress of the Transplantation Society (TTS 2022) at Buenos Aires, Argentina (09-16 September 2022).

- **Nibedita Lenka**
  - 7th Annual Cell and Gene Therapy Symposium, 1-3 September 2022, CMC, Vellore.

- **Ajay Pillai**
  - Dr. Ajay Pillai participated in a round table on "Technology Transfer & Venturing" organized by the Venture Center, Pune; 18, 19 November 2022.

- **Jyoti Rao**
  - Dr. Jyoti Rao attended the Springer Nature – GlobalSCAPE workshop on Science Communication conducted by Subhra Priyadarshini, Chief Editor, Nature India, at IUCAA, Pune; 25 November 2022.

- **Arvind Sahu**
  - Attended the Guha Research Conference (GRC)-2022 held at Nainital, Uttarakhand; 22-26 April 2022.

- **Manas Kumar Santra**
  - Attended the Guha Research Conference (GRC)-2022 held at Nainital, Uttarakhand; 22-26 April 2022.

- **Avinash Sharma**
  - Attended the Indo-German Science and Technology Centre- supported workshop on 'Agricultural management practice effects on soil and plant-associated bacterial communities and their resistome', organised by Julius Kuhn Institute and ICAR-IARI in Leibniz Institute for Agricultural Engineering and Bioeconomy (ATB), Potsdam; 20-22 June 2022.

- **Nishant Singhal**
  - Session Chairman at the 2nd Subhash Mukhopadhyay Symposium, Kolkata, India; 13 to 15 January 2023.

- **Deepa Subramanyam**
  - 'Regulation of clathrin-mediated endocytosis in Huntington's disease': Poster presented at the EMBO meeting on 'Birth and Fission of Cellular Compartments', Bilbao, Spain; 25-29 July 2022.

- **Mohan Wani**
  - Attended the Guha Research Conference (GRC)-2022 held at Nainital, Uttarakhand; 22-26 April 2022.
  - 15th Young Investigator Meeting 2023 held at IIT, Gandhinagar; 13-17 February, 2023.

Participation by the Early-career & Project Scientists, Students, & Technical Staff

Dr. Sharmila Bapat's group

- **Aravindan Narayanan**: Attended international conference on proteins & proteomics, PSI-ICPP 2022 at CSIR-IICB, Kolkata and presented a poster titled Identification of molecular players maintaining stemness in ovarian cancer.
- **Ankita More**: Attended 11th RNA group meeting (Dec 1-3, 2022) at National Centre for Cell Science, Pune and presented a poster titled Characterization of chimeric transcripts and splice variant in ovarian cancer.
- **Amruta Jadhav**: Attended 11th RNA group meeting (Dec 1-3, 2022) at National Centre for Cell Science, Pune and presented a poster titled Structural and functional characterization of a novel chimeric transcript RMND5A-ANAPC1
- **Ritika Gupta:** Attended- SIRCON 2022 (Society of inflammation research) -10th September 2022 at National Centre for Cell Science, Pune.
- **Amruta Jadhav, Ritika Gupta, Sushmita Sahoo and Aravindan Narayanan**: Attended The EMBO-India delegate lecture series at IISER, Pune 1st March 2023.

Dr. Akanksha Chaturvedi's group

- **Vibhuti Mahajan, Pooja Arya, Hariom Goswami, Anuradha Bulbule, Spriha Ghosh, Anurag Mishra, Debasis Nayak, Akanksha Chaturvedi**: 'Utilizing plasmablasts of the infected individuals to isolate human monoclonal antibodies specific to the immunogenic proteins of SARS-CoV2', SIRCON 2022, 24-25th August 2022, Pune, India.
- **Pooja Arya, Vibhuti Mahajan, Girish Malagi, Anuradha Bulbule, Anurag Mishra, Hariom Goswami, Deepali Agarwal, Mohan Wani, Debasis Nayak, Saurabh Bobdey, Akanksha Chaturvedi**: 'Longitudinal antibody response upon ChadOx1-nCov vaccination in naive and experienced individuals'. SIRCON 2022, 24-25th August 2022, Pune, India.
- **Pooja Arya, Vibhuti Mahajan, Girish Malagi, Anuradha Bulbule, Anurag Mishra, Hariom Goswami, Deepali Agarwal, Mohan Wani, Debasis Nayak, Saurabh Bobdey, Akanksha Chaturvedi**: 'Imprinted antibody responses following repeated exposure of original SARS-CoV2 infection of vaccination', EMBO Lecture course, Complement and Kidney diseases, 31 January to 3rd February, Pune, India.
- **Vibhuti Mahajan, Pooja Arya, Hariom Goswami, Anuradha Bulbule, Spriha Ghosh, Anurag Mishra, Debasis Nayak, Akanksha Chaturvedi**: 'Utilizing plasmablasts of the infected individuals to understand the B cell receptor repertoire upon SARS-CoV2 infection', EMBO Lecture course, Complement and Kidney diseases, 31 January to 3rd February, Pune, India.

Dr. Radha Chauhan's group

- **Aswathy LB:**
  - Poster presentation 'The role of Nup188 in nuclear pore complex assembly' National Workshop on Electron Tomography of Biological Specimen" at Electron Microscope Facility, AIIMS New Delhi, from May 9th to 13th 2022.
  - Nucleoporin 188: Answer from a question mark CEM3DIPSI society Annual Symposium, IISER Pune, 17th December 2023.

- **Jyotsna Singh:** Poster presentation 'Understanding the role of Nup93 in NPC assembly' EMBO CEM3DIP 4th-16th December 2022.
- **Priyanka Dutta:** Poster presentation 'Structural and functional studies on human Kaptin' EMBO CEM3DIP 4th-16th December 2022.
- **Prachi Chopade** (Lab Technician 'C') attended the International Asian Chemical Biology Initiative (ACBI) meeting 2022 at Indian Institute of Science Education and Research (IISER), Pune; 14 September 2022.

Dr. Gaurav Das's group

- **Radhika Mohandasan:** Attended "The 19th European Drosophila Neurobiology Conference", St-Malo, France, September 2022. She presented a poster titled, "Enhanced olfactory memory detection in trap-design Y-mazes allows the study of imperceptible memory traces in *Drosophila*.'
- **Manikrao Thakare:** Attended "The 19th European Drosophila Neurobiology Conference", St-Malo, France, September 2022. He presented a poster titled, "Direct Intake Estimation and Longitudinal Tracking of Solid-food Consumption (DIETS) in *Drosophila*'.
- **Rashmi Karunakaran:**
  - Attended "The 3rd No Garland Neuroscience Conference", IISER Pune, India February 2023. She presented a poster titled, "Neural mechanisms of malaise induced learning in *Drosophila*'.
  - Attended "The 1st Indian Neurobehavior Conference", Manipal, India, December 2022. She presented a talk titled, "Neural mechanisms of malaise induced learning in *Drosophila*".

Dr. Jomon Joseph's group

- **Nihil More:** 'Regulation of P-bodies by autophagy'. 45th All India Cell Biology Conference, BHU, Varanasi, Jan 20-23, 2023.

Dr. Janesh Kumar's group

- **Suparna Bhar:**
  - EMBO Cryo electron microscopy and 3D image processing (CEM3DIP), IISER Pune, 04-16 Dec 2022.
  - Asian Chemical Biology Initiative (ACBI) Meeting, IISER Pune, 14 Sep. 2022.
- **Jupitara Kalita:** EMBO Cryo electron microscopy and 3D image processing (CEM3DIP), IISER Pune, 04-16 Dec 2022.
- **Juhi Yadav:** Asian Chemical Biology Initiative (ACBI) Meeting, IISER Pune, 14 Sep. 2022.
- **Prachi Boraste:** Asian Chemical Biology Initiative (ACBI) Meeting, IISER Pune, 14 Sep. 2022.

Dr. Santosh Kumar' group

- **Niraj N. Tadasare** (JRF student): Presented a poster at *C. elegans* meeting in Thiruvananthapuram (27-30 September, 2023).
- **Sakshi Gangurde** (Project student):
  - Attended online Asia-Pacific Worm Meeting (18-20 July 2022).
  - Presented a poster at No Garland Neuroscience (NGNC. meeting in IISER, Pune (2-5 February, 2023).

Dr. Girdhari Lal's group

- **Amrita Mishra:**
  - 'Tachykinin receptor 1 (TACR1) signaling promotes Foxp3+ regulatory CD4 T cell differentiation and controls gut inflammation' (Mishra A, Halder N, Kumar D, Lal G.). Cell Symposium: The Neuro-Immune Axis, Lisbon, Portugal; 11-13 September 2022 (Poster presentation). Travel Award from DBT-CTAP.
  - 'Tachykinin receptor 1 (TACR1) is a potential target to treat gut inflammation' (Mishra A, Halder N, Kumar D, Lal G.), 6th Annual conference of the Society of Inflammation Research (SIRCON 2022), NCCS, Pune; 24-25 September 2022. (Oral presentation).
  - 'Tachykinins: potential target to treat gut inflammation' (Mishra A, Halder N, Kumar D, and Lal G), India|EMBO Lecture course on 'Complement in Kidney Diseases', NCCS, Pune; 31 January to 03 February 2023. (Poster presentation).

- **Heikrujam Thoihen Meitei:**
  - 'CCR6 intrinsic signaling fine-tunes Th17 cell metabolism and drives its pathogenicity during gut inflammation' (Meitei HT, Kulkarni N, Rapole S, Lal G.), 6th Annual conference of the Society of Inflammation Research (SIRCON 2022), NCCS, Pune; 24-25 September 2022. (Oral Talk and Best Poster Presentation).
  - 'CCR6 intrinsic signaling fine-tunes Th17 cell metabolism during gut inflammation' (Meitei HT, Kulkarni N, Rapole S, Lal G.), 48th Annual Meeting of Indian Immunology Society, to be held at Banaras Hindu University (BHU), Varanasi; 08-09 July 2022. (Poster presentation).
- **Namrita Haldar:**
  - 'Role of acetylcholine in CD4+ T cell response in gut inflammation and autoimmunity' (Halder N, Ghosh S, Kumar D, Lal G.). 6th Annual conference of the Society of Inflammation Research (SIRCON 2022) was held at NCCS, Pune; 24-25 September 2022.
    (Oral presentation that won the Best Presentation Award).
  - 'Muscarinic acetylcholine receptor 3 controls the CD4 T cell differentiation and function during colitis' (Halder N, Ghosh S, Kumar D, Lal G), India|EMBO Lecture course on 'Complement in Kidney Diseases', NCCS, Pune; 31 January to 03 February 2023. (Poster presentation).
- **Pradipta Pal:**
  - 'Complement C3 deficiency increases the anti-tumor immunity of NK cells and controls tumor growth' (Pal P, Paul S, Meitei HT, Wahi P, Sahu A, and Lal G.), 37th Annual Meeting of Society for Immunotherapy of Cancer, Boston, USA; 10-12 November 2022. (Poster presentation).
  - 'Deficiency of complement C3 enhances the anti-tumor effector function of CD8 T cells and reduces tumor growth' (Pal P, Paul S, Meitei HT, Wahi P, Sahu A, Lal G), India|EMBO Lecture course on 'Complement in Kidney Diseases', NCCS, Pune; 31 January to 03 February 2023. (Poster presentation).
  - 'Absence of complement 3 leads to increased effector function of NK cells in reducing tumor growth' (Pal P, Paul S, Meitei HT, Wahi P, Sahu A, and Lal G), 6th Annual conference of the Society of Inflammation Research (SIRCON 2022), NCCS, Pune; 24-25 September 2022. (Poster presentation).
- **Reshmi Suresh:**
  - 'Tachykinin signaling promotes anti-tumor immune response and controls colon cancer growth' (Suresh R, Karmakar S, Mishra A, Lal G), India|EMBO Lecture course on 'Complement in Kidney Diseases', NCCS, Pune; 31 January to 03 February 2023. (Poster presentation).
  - 'Substance P affects the effector CD8 and CD4 T cell subsets and controls the growth of colon cancer' (Suresh R, Karmakar S, Mishra A, and Lal G), 6th Annual conference of the Society of Inflammation Research (SIRCON 2022), NCCS, Pune; 24-25 September 2022. (Poster presentation).
- **Souparni Ghosh:** 'Choline acetyltransferase in CD4+ T cells controls gut inflammation and colitis' (Ghosh S, Halder N, Dhali S, Kumar D, Lal G), India|EMBO Lecture course on 'Complement in Kidney Diseases', NCCS, Pune; 31 January to 03 February 2023. (Poster presentation).
- **Surojit Karmakar:**
  - 'Neurotransmitter Substance P alters the anti-tumor immune response and controls the growth of colon cancer' (Karmakar S, Suresh R, Mishra A, Lal G.). 4th Annual Congress of Immuno Oncology Society of India (IOSICON 2023), Jaipur; 20-22 January 2023. (Oral presentation).
  - 'Antagonizing serotonin receptor 5-HTR2B promotes antigen-specific anti-tumor immunity to solid tumors' (Karmakar S, Lal G.), 4th Annual Congress of Immuno Oncology Society of India (IOSICON 2023), Jaipur; 20-22 January 2023. (Oral Presentation).
  - 'Serotonin receptor 5-HTR2B signaling alters the antigen-specific cytotoxic T cell response and controls the growth of colon cancer' (Karmakar S, Lal G.), 6th Annual conference of the Society of Inflammation Research (SIRCON 2022), NCCS, Pune; 24-25 September 2022. (Oral presentation).
  - 'Serotonin receptor 5-HTR2B signaling antagonism promotes antigen-specific effector immune response and inhibits the growth of colon cancer' (Karmakar S, Lal G), India|EMBO Lecture course on 'Complement in Kidney Diseases', NCCS, Pune; 31 January to 03 February 2023. (Poster presentation).

Dr. Nibedita Lenka's group

- **H. G. Patil, S. Murugesan, S. Anandhan, A. Rajendran,** N. Lenka. 'Strontium Doped Hydroxyapatite Nanorods for Bone Tissue Engineering Applications'. National Conference on New Developments in Polymeric Materials, Thiruvananthapuram, Kerala, Mar. 2-3, 2023.
- **A. Rajendran, U. Kapoor-Narula,** N. Lenka, **D. K. Pattanayak**. 'A comparative study on the effect of Ca-Ag / Mg-Ag / Sr-Ag co-existing titania layer over Ti metal on its bioactivity, antibacterial activity; adhesion, proliferation and osteogenic differentiation potential of gMSCs'. BIO-Remedi 2022: International Conference on Biomaterials, Regenerative Medicine and Devices, IIT, Guwahati, Dec 15-18, 2022 (Selected for Oral presentation delivered by the Student).
- **F. Munavar,** N. Lenka. 'Deciphering the regulatory role(s) of Deubiquitinating enzymes (DUBs) in cell fate specification using Embryonic Stem Cells model'. 7th Annual symposium on Cell and Gene Therapy, Centre for Stem Cell Research, CMC, Vellore, Sept. 1-3, 2022 (Poster presentation by student: Virtual).

Dr. Srikanth Rapole's Group

- **Saikiran Jajula** presented a poster entitled "Identification of potential therapeutic targets associated with Breast Cancer resistant to Doxorubicin and Ionization Radiation" at 14th Annual Meeting of the Proteomics Society of India and International Conference on Proteins & Proteomics (PSI-ICPP 2022)" organized by the CSIR-Indian Institute of Chemical Biology (IICB) November 3-5, 2022 at Kolkata.
- **Praneeta Bhavsar** presented a poster entitled "Identification and functional characterization of therapeutic targets associated with Breast cancer resistance" at 14th Annual Meeting of the Proteomics Society of India and International Conference on Proteins & Proteomics (PSI-ICPP 2022)" organized by the CSIR-Indian Institute of Chemical Biology (IICB) November 3-5, 2022 at Kolkata.
- **Sadanand Bhanuse:**
  - Presented a poster entitled "Understanding the role of MZB1 in multiple myeloma genesis and malignancy using proteomic and molecular approaches" at 14th Annual Meeting of the Proteomics Society of India and International Conference on Proteins & Proteomics (PSI-ICPP 2022)" organized by the CSIR-Indian Institute of Chemical Biology (IICB) November 3-5, 2022 at Kolkata.
  - Presented a poster entitled "Understanding the role of MZB1 in multiple myeloma genesis and malignancy using proteomic and molecular approaches" at Indian Myeloma Congress 2023 organized by the St John's Medical College and Hospital January 13-15, 2023 at Bengaluru.
- **Khushman Taunk** presented a poster entitled "Deciphering the Role of VDAC3 in Multiple Myeloma Malignancy using Proteomic and Molecular Approaches" at Indian Myeloma Congress 2023 organized by the St John's Medical College and Hospital January 13-15, 2023 at Bengaluru.

Dr. Manas Kumar Santra's group

- **Tanisha Sharma** presented a poster titled, 'Attenuation of glycosylated PD-L1 by SCF E3 ligase can modulate the immune checkpoint', at the 45th edition of the All-India Cell Biology Conference (AICBC), hosted by the Department of Zoology, Banaras Hindu University (BHU), Varanasi; 20-22 January 2023. (Prof. V.C. Shah Award for Best Poster).

Dr. Vasudevan Seshadri's group

- **Shyam More, Gaurav Agarwal and Sourav Halder** participated in the 11th RNA group meeting of India at NCCS, Pune; 01-03 December 2022.

Dr. Shailza Singh's group

- **Shweta Khandibharad:**
  - Conference: Advance course in basic and clinical immunology [International Union of Immunological Societies (IUIS) and Federation of Clinical Immunology (FOCIS)], La Jolla, California, USA; 26 February - 01 March 2023.

- Presented a poster, 'Computational aided peptides as potential targeted therapy in leishmaniasis', at the International Conference on Drug Discovery, BITs Pilani, Goa, India; 10 – 11 November 2022.

- **Pooja Gulhane:** Presented a poster, 'miR-520c-3p: key regulon in PI3K-AKT pathway and sphingolipid signaling axis in non-small cell lung cancer therapeutics', at the International Conference on Drug Discovery, BITs Pilani, Goa, India; 10 – 11 November 2022.
- **Nikhil Samarth:** Presented a poster, **'**Narrative of NRF2-KEAP1 derived autophagy and benzimidazole derivative in NSCLC: System aided drug discovery', at the International Conference on Drug Discovery, BITs Pilani, Goa, India; 10 – 11 November 2022.
- **Prajakta Ingale:** Presented a poster, 'The triad of leishmanial infection: Immune metabolism, autophagy and lipid metabolism', at the International Conference on Drug Discovery, BITs Pilani, Goa, India; 10 – 11 November 2022.
- **Subhajit Das**: Presented a poster, 'Effect of SH3PXD2B from Breast to Lung Cancer Migration and Metastasis', in Molecular Omics at the International Conference on Proteins & Proteomics (PSI-ICPP 2022) held at CSIR- Indian Institute of Chemical Biology (CSIR-IICB), Kolkata, India; 03-05 November 2022. (Bagged the Best Poster Award)

Dr. Nishant Singhal's group

- **Vishi Sharma:**
  - Presented 'Generation of AAVS1-EGFP reporter cell lines from an isogenic pair of trisomy 21 and euploid human iPSCs', at No-Garland Neuroscience, Pune, India; 02 – 05 February 2023.
  - Presented 'Generation of an isogenic pair of Down syndrome EGFP reporter cell lines with consistent expression in human iPSCs and differentiated derivatives' at SYMRESEARCH 2022: National Conference on Research in Health and Biomedical Sciences, Pune, India; 03 – 05 November 2022.

- **Sunita Nehra:**
  - No Garland Neuroscience,
    Generation of integration-free Down syndrome and isogenic euploid human induced pluripotent stem cells as a platform for disease modeling, 02/02/2023 to 05/02/2023, Pune, India.
  - SYMRESEARCH 2022, National Conference on research in health and biomedical sciences,
  - Generation of integration-free Down syndrome and isogenic euploid human induced pluripotent stem cells, 03/11/2022 to 05/11/2022, Pune, India.

Dr. Deepa Subramanyam's group

- **Jyoti Das:** Presented 'Clathrin light chain regulates neural development and function in *Drosophila melanogaster*' (Jyoti Das and Deepa Subramanyam) at the American Society for Cell Biology, Washington DC, USA; 03-07 December 2022.

Dr. Mohan Wani's Group

- Ms. Juilee Karhade attended Annual Meeting of "The American Society for Bone and Mineral Research (ASBMR)"; Austin, Texas, USA; 9-12 September 2022.
- Ms. Juilee Karhade attended Annual Meeting of "Society of Inflammation Research India (SIRCON 2022)"; National Centre for Cell Science, Pune; 24-25 September 2022.
- Ms. Garima Pandey presented a poster "Studies on mechanistic insight of chondroprotective role of IL-3" in Annual Meeting of "The American Society for Bone and Mineral Research (ASBMR)"; Austin, Texas, USA; 9-12 September 2022.
- Ms. Garima Pandey presented a poster "Chondroprotective role of IL-3 under inflammatory microenvironment" in Annual Meeting of "Society of Inflammation Research India (SIRCON 2022)"; National Centre for Cell Science, Pune; 24-25 September 2022.
- Ms. Adrita Guha presented a poster "The role of complement component 3 (C3) in bone remodeling" in EMBO Lecture Course on "Complement in Kidney Diseases"; National Centre for Cell Science, Pune; 31 January to 3 February 2023.
- Ms. Arpita Prasad attended Annual Meeting of "Society of Inflammation Research India (SIRCON 2022)"; National Centre for Cell Science, Pune; 24-25 September 2022.

- Ms. Krishna Ashokkumar attended Annual Meeting of "Society of Inflammation Research India (SIRCON 2022)"; National Centre for Cell Science, Pune; September 24- 25, 2022.
- Ms. Krishna Ashokkumar participated in Workshop on FACS on BD New Canto II; National Centre for Cell Science, Pune; 15 February 2023.

- **Other Scientists**

- **Dr. Tuhsar Lodha** (Project Scientist, NCCS-NCMR) attended the 62nd Annual Conference on 'Microbes and Society: Current Trends and Future Prospects' (MSCTFP-2022), organized jointly by the University of Mysore, Central Food Technological Research Institute (CSIR-CFTRI), DRDO Defense Food Research Laboratory (DFRL) & Karnataka Science and Technology Academy, under the aegis of the Association of Microbiologists of India (AMI); 21-23 September 2022.

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Conferences & Other Events Organized

'A Half-Century of Cancer Research' **16 January 2023**

Technical Talk by Nobel Laureate, Prof. Harold Varmus (1989 Nobel Laureate in Physiology or Medicine).

Dr. Sharmila Bapat hosted Prof. Harold Varmus under the aegis of Raman Chair (2020) of the Indian Academy of Sciences, Bangalore, for talks and interactions with the faculty and students at NCCS; 15–17 January 2023.



Tree plantation done by Prof. Harold Varmus on the NCCS campus



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NCCS Foundation Day **26 August 2022**

Prof. V. Nagaraja (IISc, Bengaluru), delivered the **Foundation Day Oration:**
'**Topology perturbation and epigenetic modification influence chromosome dynamics, gene expression and intracellular survival of mycobacteria**'

	Felicitation of the contractual staff for their contribution towards winning the 3rd prize for exemplary performance during Swachhata Pakhwada-2022 awarded to NCCS by DBT

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Dr. Ulhas Wagh Memorial Oration **20 May 2022**

The first lecture was delivered by Dr. Shekhar Mande, former Director of NCCS, and former DG, CSIR and Secretary, DSIR on '**How atomic details have enhanced our view of the Biological World**'

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6th Annual Conference of the Society of Inflammation Research (SIRCON 2022)
Theme: "Bridging the gap between lab and clinic".
Jointly conducted by NCCS and the Society of Inflammation Research at NCCS Pune.
24 - 25 September 2022

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11th RNA Group Meeting of India **01–03 December 2022**

Organized at NCCS jointly by Dr. Vasudevan Seshadri and Dr. Jomon Joseph of NCCS and Dr. Anjan Banerjee of IISER, Pune








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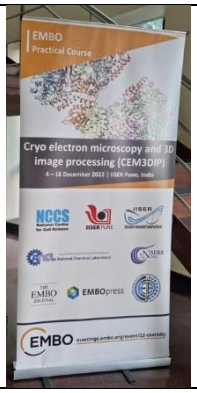
EMBO Practical Course: Cryo electron microscopy and 3D image processing (CEM3DIP)
Organized by NCCS jointly with IISER-Pune, CSIR-NCL and IISER Thiruvananthapuram
04–16 December 2022

	66 participants were selected at the global level for participation in this practical course, which was co-organized by Dr. Radha Chauhan and Dr. Janesh Kumar, Scientists at NCCS.

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India|EMBO Lecture Course on 'Complement in Kidney Diseases'
31 January– 03 February 2023
Organized by NCCS in association with researchers from Imperial College London, UK, and All India Institute of Medical Sciences, India

Organizing Committee: Dr. Arvind Sahu (NCCS), Prof. Arvind Bagga (AIIMS, New Delhi), Prof. Matthew Pickering (Imperial College London) and Prof. Marina Botto (Imperial College London). Co-organizers: Drs Vasudevan Seshadri (NCCS), Jomon Joseph (NCCS) and Ajay Pillai (NCCS).

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EMBO Global Lecture Series **20 February 2023**

'**Mechanisms of intracellular communication**'
Talk delivered by Dr. Anne Spang (Professor, Biozentrum, University of Basel)


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Integrative Health & Personal Medicine through Ayurgenomics **27 February 2023**
Workshop jointly organised by NCCS and the
Maharashtra University of Health Sciences (MUHS), Nashik.

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Scientific Conference in Hindi **29 April 2022**

Disseminating scientific knowledge in the national language:

A scientific conference in Hindi was organized by the National Centre for Cell Science jointly with the National Chemical Laboratory (CSIR-NCL) and the Agharkar Research Institute (ARI) in Pune. The theme of the conference was:
'**The role played by science and technology institutes during the pandemic**'.

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Other Talks Delivered by Invitees

Cell Biology Lecture Series (CBLS)
(Celebrating Azadi ka Amrit Mahotsav by showcasing the work of contemporary Indian scientists)

Date	Invitee	Talk Title
04 April 2022	Dr. Richa Rikhy (IISER, Pune)	The mighty mitochondrion shapes the destiny of stem cells
02 May 2022	Dr. Vidita Vaidya (TIFR, Mumbai)	Serotonergic Psychedelics - A revival
06 June 2022	Dr. Shobhona Sharma (INSA Honorary Scientist, ICT, Mumbai).	Elasticity provided to sporozoites by the circumsporozoite protein, the predominant malaria vaccine candidate
04 July 2022	Dr. Siddhesh Kamat (Dept. Of Biology, IISER-Pune)	A Chemical Biology Approach Towards Understanding a Human Neurological Disorder
08 August 2022	Dr. Oishee Chakrabarti (Biophysics & Structural Genomics Division, Saha Institute of Nuclear Physics, Kolkata)	Organellar dynamics regulate cellular surveillance
07 November 2022	Dr. Minhaj Sirajuddin (inStem, Bengaluru).	Structure, function and pathologies of contractile assemblies across scale dimensions
30 November 2022	Dr. Mohit Kumar Jolly (IISc, Bengaluru);	Dynamical landscape of epithelial-mesenchymal plasticity: an integrated computational - experimental approach

Other Guest Seminars

Date	Guest	Seminar Title
17 May 2022	Dr. Debasish Paul from the Laboratory of Cancer Biology and Genetics, Center for Cancer Research, National Cancer Institute, USA (an NCCS alumnus)	Studying the role of ubiquitin ligases in cell fate decision: journey from basic to translation
27 July 2022	Dr. Bahnisikha Barman (Research Instructor, Vanderbilt University School of Medicine, USA)	Endoplasmic reticulum membrane contact sites: The critical biogenesis platforms for RNA-RBP-containing extracellular vesicles

03 August 2022.	Dr. Bhagawat Subramanian (Lineberger Comprehensive Cancer Center, University of North Carolina, USA)	Regulation and functions of force generating structures: From sub-cellular to tissue-level homeostasis
17 October 2022	Dr. Dr. Shraddha Karve (Research Faculty Fellow, Ashoka University, Sonipat, India)	Evolutionary novelties
19 October 2022	Dr. Renu Maan (Guest Researcher, Delft Technical University, The Netherlands)	In vitro Reconstitutions to Mimic Cellular Functions: Towards building a Synthetic Cell
21 March 2023	Dr. Purnima Sharma (Managing Director, Biotech Consortium India Limited, New Delhi) and Dr. Shiv Kant Shukla (DGM, BCIL & Head, TTO at BCIL)	Essentials of Technology Licensing
16 March 2023	Ms. Suranjana Das, Program & Alumni Manager, USIEF Fulbright Commission in India, Mumbai	Information Session on Fulbright-Nehru & Other Fulbright Opportunities

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Speak your Science (SyS) Seminar Series

This seminar series commemorated 'Azadi ka Amrit Mahotsav' by showcasing contemporary science by Indian researchers.
50 seminars were delivered in this series through the year by PhD students and faculty members of NCCS, as well as by invited speakers including scientists from other research organizations in India and the Indian diaspora.

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Postdoctoral Fellows' Presentations 09 June 2022

Scientific presentations were made by Research Associates, INSPIRE Faculty, Wellcome Trust-DBT/India Alliance Early Career Fellows, MK Bhan Fellows, Project Scientists, etc.

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Technical Seminars

- 'Turn-key multimodal multi-photon microscope' - by a representative from Prospective Instruments, Austria'; organized to introduce this microscope to the scientists, students and other researchers at NCCS.
- **Talk series organized by the NCCS FACS Facility:**
  - 'Introduction to Spectral Flow Cytometry'; 23 August 2022.
  - 'Usage of OMIQ flow cytometry software and its application' (webinar); 24 August 2022.
  - 'Data troubleshooting on Spectral Flow Cytometry'; 25 August 2022.
- 'Light sheet Microscopy for high resolution 3-D Imaging': A technical seminar by Dr. Bernd Muller Zullow (Miltenyi Biotec Germany) was organized to help the scientists, students and technicians of NCCS keep themselves abreast of cutting-edge bioimaging systems; 15 December 2022.

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Extramural Events

- Dr. Gaurva Das was the co-organizer of the 1st 'Indian Neurobehavior Conference' organized at the Kasturba Medical College, MAHE, Manipal, India; 19-21 December 2022. https://sites.google.com/view/inc2022/home
- Dr. Radha Chauhan co-chaired a mini-symposium series in the ASCB cell biology meeting at Washington DC; 01–04 December 2022.

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Other Happenings

Promoting Yoga

a) International Day of Yoga **21 June 2022**

Events organized to commemorate the 8th International Day of Yoga in the 75th year of India's independence:

a) Events organized on the International Day of Yoga (21 June 2022):
Yoga demonstration + A talk on "Importance of Yoga in our Life"
by Mrs. Kanchan Bhosale (Vice President, Indian Yoga Teacher's Association, Pune District)




b) An essay competition was held on the topics:
(i) Interaction of science and yoga (ii) Long-term benefits of yoga & (iii) How does yoga help to reduce stress in day-to-day life?
The essay competition winners listed below were awarded with prizes on the International Day of Yoga:
1st Prize: Mr. Akshay Lonare, 2nd Prize: Ms. Kirti Patil, and 3rd Prize: Mr. Mayur Maru

c) Daily yoga sessions held in the evening under the guidance of Mr. Sunil Kachhare, for the staff and students of NCCS.

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Commemoration of Constitution Day / Samvidhan Diwas

- A talk by Prof. Prakash Pawar, Vice Principal, Fergusson College, Pune, was organized on 18 November 2022. He gave a talk in HINDI about the Constitution of India, it's meaning, and various related acts.


- A copy of the Preamble to the Constitution was circulated among the NCCS members to be read by them, and for reaffirmation of their commitment to uphold its ideology; 26 November 2022.

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Vigilance Awareness Week **31 Oct–06 Nov 2022**

NCCS observed the Vigilance Awareness Week on the theme, 'Corruption-free India for a Developed Nation':

- An 'Integrity Pledge' was taken by members of NCCS on 31 October 2022.
- 'Corruption free India for a developed Nation' / 'भ्रष्टाचार मुक्त भारत - विकसित भारत': This bilingual talk was delivered by Mr. I. B. Pendhari, Addl. Supdt. of Police, CBI, on 03 November, 2022.



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Activities under Swachh Bharat Initiative

Swacchata Pakhwada

NCCS observed the 'Cleanliness Fortnight' during 01-15 May 2022

Special Campaign 2.0

NCCS participated in this campaign by undertaking extensive cleaning across the NCCS campus, including deep cleaning, jet spray cleaning, mechanized cleaning and scrap disposal at various locations through October 2022.

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Fit India Freedom Run 3.0

NCCS staff and students participated in the Fit India Freedom Run 3.0 organized at NCCS on 14 October 2022. Running and walking relay races were organized on this occasion.



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NCCS members attended virtually the live telecast of the launch of Mission LiFE by the Hon'ble Prime Minister of India, Shri Narendra Modiji, on 20 October 2022.

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'16 Days Campaign against Gender-Based Violence' **29 November, 2022**

A sensitization seminar was held on this occasion. A talk on 'Sexual Harassment of Women at the Workplace and Related Acts' was delivered by Ms. Lata Sonawane (State Secretary & National Executive Member , National Federation of Indian Women) for the staff and students of NCCS.

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International Women's Day **08 March 2023**

In support of promoting gender equity on the occasion of the International Women's Day, two competitions were held as given below:
1] Fine Art Contest on the topic, 'My thoughts on the International Women's Day'.
2] Impromptu writing and speech contest on the theme, 'I get by with a little help from my friends' (in Hindi, Marathi & English).
All members of NCCS, including men and women students, staff and trainees participated in both competitions enthusiastically.




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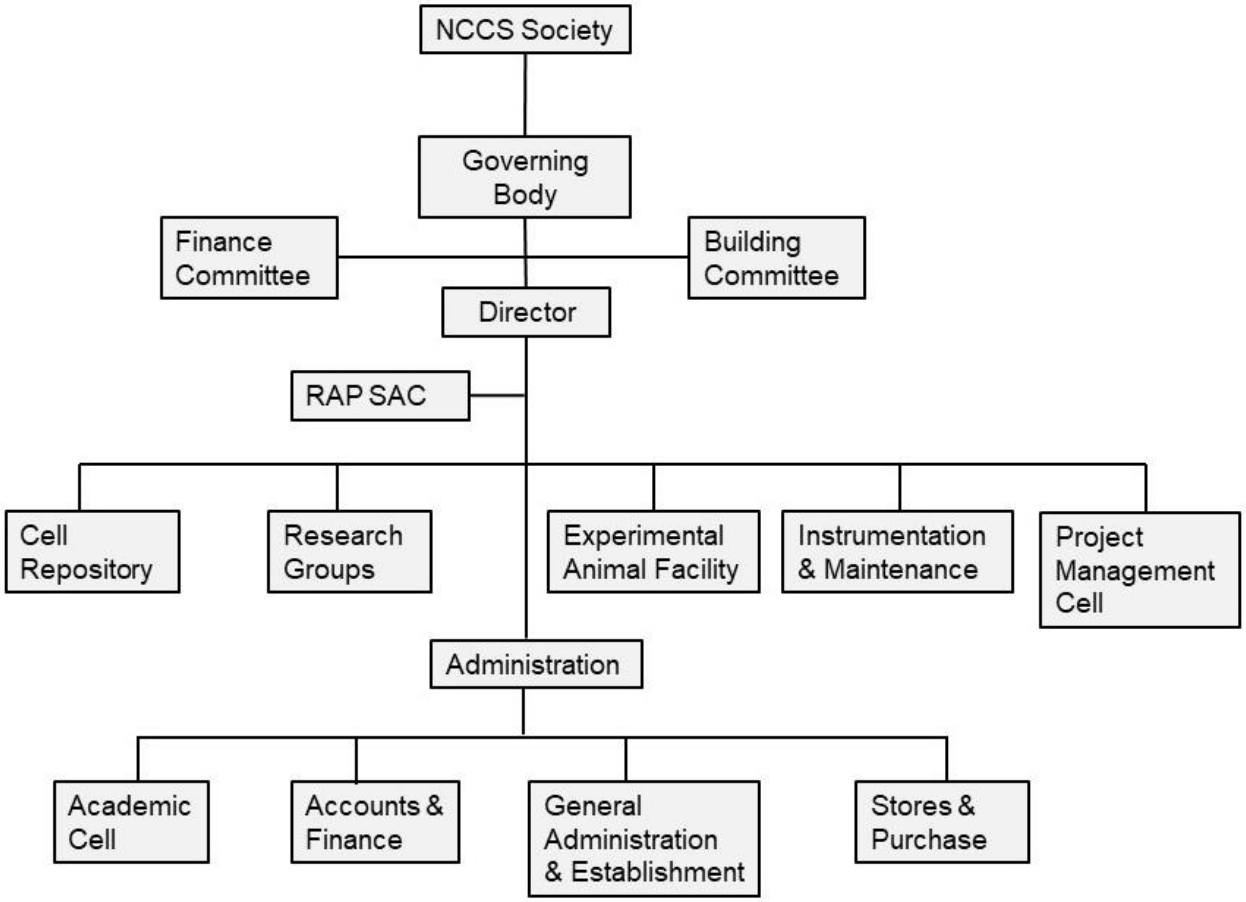
NCCS Organizations

NCCS ORGANIZATION



NCCS Society Members

1	**Dr. Jitendra Singh** President NCCS Society and Hon'ble Minister of State (Independent Charge) Ministry of Science and Technology & Earth Sciences, Council of Scientific & Industrial Research, Anusandhan Bhawan, 2, Rafi Marg, New Delhi – 110 001	President	**7**	**Prof. Padmanabhan Balram** Former Director Indian Institute of Science (IISc), CV Raman Rd, Bengaluru – 560012	Nominated Member
2	**Shri. Chandrakant Patil** Minister of Higher & Technical Education Government of Maharashtra, Mantralaya, Mumbai,400-032	Ex-Officio Member	**8**	**Dr. Amulya Kumar Panda** Former Director, National Institute of Immunology, Aruna Asaf Ali Marg, Jawaharlal Nehru University, Delhi - 110067	Nominated Member
3	**Dr. Rajesh Gokhale** Secretary, Department of Biotechnology, Ministry of Science & Technology Block No. 2, 7th - 8th Floor, CGO Complex Lodhi Road, New Delhi -110003	Ex-Officio Member	**9**	**Prof. Govindarajan Padmanabhan** NASI-Platinum Jubilee Chair/ Honorary Professor Indian Institute of Science (IISc), CV Raman Rd, Bengaluru – 560012	Nominated Member
4	**Shri. Vikas Chandra Rastogi, IAS** Principal Secretary Higher & Technical Education Department 4th Floor, Mantralaya Annex Madam Cama Road, Nariman Point, Mumbai – 400032	Ex-Officio Member	**10**	**Dr. Rajiv Bahl** Secretary to Government of India, Department of Health Research and Director General, Indian Council of Medical Research Ansari Nagar New Delhi - 110029	Ex-Officio Member
5	**Dr. Himanshu Pathak** Secretary (DARE) & Director General (ICAR) Indian Council for Agricultural Research, Krishi Bhavan, New Delhi 110 001	Ex-Officio Member	**11**	**Dr. Mathukumalli Vidyasagar** SERB National Science Chair & Distinguished Professor, Indian Institute of Technology (IIT) Kandi, Sangareddy, Telangana - 502285	Nominated Member
6	**Shri. Vishvajit Sahay** Additional Secretary & Financial Adviser, Department of Biotechnology, Ministry of Science & Technology Block No. 2, 7th - 8th Floor, CGO Complex Lodhi Road New Delhi - 110003	Ex-Officio Member	**12**	**Dr. Rajiv I. Modi** Chairman and Managing Director Cadila Pharmaceuticals Ltd. Sarkhej-Dholka Road, Bhat Ahmedabad – 382210	Nominated Member

13	**Shri. Chaitanya Murti** Joint Secretary Department of Biotechnology, Ministry of Science & Technology Block – 2, 7th Floor, CGO Complex, Lodhi Road, New Delhi – 110003	Ex-Officio Member	**15**	**Dr. Mohan R. Wani** Director National Centre for Cell Science, NCCS Complex, Ganeshkhind, Pune – 411007	Ex-Officio Member Secretary
14	**Prof. Chandrabhas Narayana** Director Rajiv Gandhi Centre for Biotechnology (RGCB), Melarannoor Road, Behind Central Jail Poojapura, Thycaud Thiruvananthapuram - 695014	Nominated Member			

NCCS Governing Body Members

1	**Dr. Rajesh S. Gokhale** Secretary Department of Biotechnology, Ministry of Science & Technology, Block No. 2, 7th - 8th Floor CGO Complex, Lodhi Road New Delhi - 110 003	Chairperson	**5**	**Dr. Shahaj Uddin Ahmed** Scientist 'E' Department of Biotechnology, Ministry of Science & Technology, Block No. 2, 7th Floor, CGO Complex, Lodi Road, New Delhi – 110003	Ex-Officio Member
2	**Mr. Vishvajit Sahay** Additional Secretary and Financial Adviser, Department of Biotechnology, Block No. 2, 7th - 8th Floor CGO Complex, Lodhi Road, New Delhi - 110 003	Ex-Officio Member	**6**	**Dr. Rajendra Prasad Roy** Staff Scientist - VII Biochemistry & Structural Biology, National Institute of Immunology (NII) Aruna Asaf Ali Marg New Delhi – 110067	Nominated Member
3	**Dr. Suchita Ninawe** Scientist 'G' Department of Biotechnology, Ministry of Science & Technology, Block No. 2, 7th Floor, CGO Complex, Lodi Road, New Delhi – 110 003	Ex-Officio Member	**7**	**Dr. Nandini K. Kumar** Former Deputy Director General Sr. Grade (ICMR), Vice President, Forum for Ethics Review Committees in India, TC 16/1051-10, CEEMEX Centre, CS Road, Jagathy Trivandrum - 695014	Nominated Member
4	**Shri. Chaitanya Murti** Joint Secretary Department of Biotechnology Ministry of Science & Technology, Block – 2, 7th Floor, CGO Complex, Lodhi Road, New Delhi – 110003	Ex-Officio Member	**8**	**Dr. Rajan Sankaranarayanan** Group leader, Structural Biology Laboratory CSIR- Centre for Cellular & Molecular Biology (CCMB) Uppal Rd, IICT Colony, Habsiguda Hyderabad - 500007	Nominated Member

9	**Prof. (Dr.) Nitin R. Karmalkar** Vice Chancellor Savitribai Phule Pune University, Ganeshkhind, Pune - 411007 (at the 64th Governing Body meeting)	Nominated Member	**12**	**Prof. Karbhari Kale** Vice Chancellor Savitribai Phule Pune University Ganeshkhind, Pune - 411007 (at the 65th Governing Body meeting)	Nominated Member
10	**Dr. Arvind Sahu** Scientist 'G' National Centre for Cell Science, NCCS Complex, Ganeshkhind, Pune - 411007 (as Director-In-Charge, NCCS, at the 64th Governing Body meeting) (as Member at the 65th Governing Body meeting)	Ex-Officio Member	**13**	**Dr. Mohan R. Wani** Director, National Centre for Cell Science, NCCS Complex, Ganeshkhind, Pune - 411 007 (as Member at the 64th Governing Body meeting) (as Director, NCCS, at the 65th Governing Body meeting)	Ex-Officio Member
11	**Mrs. Sandra Fernandes** Officer 'B' (Administration) National Centre for Cell Science, NCCS Complex, Ganeshkhind, Pune-411007 (at the 64th Governing Body meeting)	Ex-Officio Member Secretary	**14**	**Mr. G. Harikumar** Officer 'C' (Administration) National Centre for Cell Science, NCCS Complex, Ganeshkhind, Pune-411007 (at the 65th Governing Body meeting)	Ex-Officio Member Secretary

NCCS Finance Committee Members

1.	**Mr. Vishvajit Sahay** Additional Secretary and Financial Adviser Department of Biotechnology, Block No. 2, 7th - 8th Floor, CGO Complex, Lodhi Road, New Delhi - 110 003 Phone- 011-24366774 Email – fa.dbt@nic.in	Chairperson
2.	**Dr. Suchita Ninawe** Scientist 'G' & Scientific Coordinator Department of Biotechnology Ministry of Science & Technology Block No. 2, 7th Floor, CGO Complex Lodhi Road, New Delhi – 110003 Phone – 011-24363722 Email – sninawe.dbt@nic.in	Ex-Officio Member
3.	**Dr. K. Thangaraj** Director Centre for DNA Fingerprinting and Diagnostics (CDFD) Inner Ring, Uppal Hyderabad – 500039 Phone – 040-24749321 Email – director@cdfd.org.in	Nominated Member

4.	**Shri. Deepak Shetty,** IRS (Retired) Former Secretary to the Govt. of India Former Director General of Shipping G-1302, Jadegardens MIG CHS. Opp. MIG Club, Gandhi Nagar Bandra (E), Mumbai – 400051 Email: dshetty0211@hotmail.com Home – 022-26653090	Nominated Member
5.	**Mrs. Manjula Rangarajan,** IRAS (Retired) Former Ex-Officio Secretary to the Government of India and Former Member – Finance Railway Board, Ministry of Railways 50, First Avenue, Indira Nagar Opp. Indian Bank, Adyar Chennai – 600020 Email: manjularangarajan@gmail.com	Nominated Member
6.	**Dr. Arvind Sahu** Director-In-Charge NCCS, Pune - 411 007 (at the 65th Finance Committee meeting)	Ex-Officio Member
7.	**Dr. Mohan R. Wani** Director National Centre for Cell Science, NCCS Complex, Ganeshkhind, Pune - 411 007 (at the 66th Finance Committee meeting)	Ex-Officio Member
8.	**Mrs. Sandra Fernandes** Officer 'B' (Administration) National Centre for Cell Science, NCCS Complex, Ganeshkhind, Pune - 411007	Ex-Officio Member
9.	**Mr. Vaibhav A. Argade** National Centre for Cell Science, NCCS Complex, Ganeshkhind, Pune - 411007	Ex-Officio Member Secretary

NCCS Building Committee Members

1.	Dr. Dinkar Salunke Director, International Centre for Genetic Engineering and Biotechnology ICGEB Campus Aruna Asaf Ali Marg New Delhi 110 067	Chairman	7.	Executive Engineer, Central Public Works Department (CPWD) PCD1, Pune 411037	Member
2.	Dr. Debashis Mitra Professor of Eminence, National Centre for Cell Science, Pune 411007	Member	8.	Director, National Centre for Cell Science, Pune 411007	Member
3.	Shri. Pushkar M. Kanvinde Principal, BKPS College of Architecture, 2043, Sadashiv Peth, Tilak Road, Pune 411030	Member	9.	In-Charge Maintenance National Centre for Cell Science, Pune 41007	Convener
4.	Dr. Sukhanand Sopan Bhosale Prof. & Head, Department of Civil Engineering, College of Engineering (COEP), Pune 411005	Member	10	Dr. Y S Shouche National Centre for Cell Science, Pune-411007	Special Invitee
5.	Dr. Anil Agarwal Sr. Professor, National Institute of Construction Management and Research (NICMAR), Pune 411045	Member	11	In-Charge Admin National Centre for Cell Science, Pune-411007	Special Invitee
6.	Shri. Nitin D. Ohol Head, Engineering Section, Inter-University Centre for Astronomy and Astrophysics (IUCAA), Pune 411007	Member	12	In-Charge Accounts National Centre for Cell Science, Pune-411007	Special Invitee

DBT-Approved
NCCS Research Area Panels - Scientific Advisory Committee (RAP-SAC) Members

Prof. M. Radhakrishna Pillai Former Director, Rajiv Gandhi Centre for Biotechnology, Thycaud, Poojappura, Thiruvananthapuram-695014 Kerala	Chairman	**Prof. (Dr.) Nitin R. Karmalkar** Vice Chancellor Savitribai Phule Pune University Ganeshkhind, Pune - 411007	Member
Dr. Rajan Sankaranarayan Group leader Structural Biology Laboratory, Center for Cellular and Molecular Biology (CCMB), Uppal Road, Hyderabad 500 007, Telangana	Member	**Prof. Swati Saha** Department of Microbiology University of Delhi South Campus Benito Juarez Road New Delhi-110021	Member
Dr. Rajendra Prasad Roy Staff Scientist - VII Biochemistry & Structural Biology National Institute of Immunology (NII) Aruna Asaf Ali Marg New Delhi – 110067	Member	**Dr. Shree Kumar Apte** Distinguished Professor UM-DAE Centre for Excellence in Basic Sciences Nalanda, Opp. Nano Sciences Building University of Mumbai, Vidynagari Mumbai – 400098	Member
Dr. Nandini K. Kumar Former Deputy Director General (ICMR) TC 16/1051-10, CEEMEX Centre CS Road, Jagathy, Thiruvananthapuram – 695014, Kerala	Member	**Dr. Vijay K. Kuchroo** Samuel L Wasserstrom Professor of Neurology, Harvard Medical School Member, Broad Institute Director, Ever Grande Centre for Immunologic Diseases Harvard Medical School and Brigham and Women's Hospital, 60 Fenwood Road Boston, MA 02115, USA	Member
Dr. Suchita Ninawe Scientist 'G' & Scientific Coordinator Department of Biotechnology Ministry of Science & Technology Block No. 2, 7th Floor CGO Complex, Lodi Road New Delhi – 110003	Ex-officio Member	**Dr. Mohan R Wani** Director NCCS, Pune – 411007 Maharashtra	Ex-officio Member Secretary

ADMINISTRATION

The NCCS Administration consists of the following sections: General Administration & Establishment, Civil Maintenance, Accounts & Finance, and Stores & Purchase. The centre also has an Instrumentation & Maintenance unit. All these sections provide support services to the main scientific activities of the centre.

The NCCS staff strength (as on 31st March, 2023)

Scientists	:	32
Administrative Staff	:	36
Technical Staff	:	67
Total	**:**	**135**

Reservation Policy

NCCS follows the Government of India orders on reservation matters. For direct recruitments, respective rosters are followed, with reservation as follows: 15% for SC, 7.5% for ST and 27% for OBC, on an All India Basis other than Open Competition. Liaison officers have been nominated to ensure compliance with the reservation orders issued in favour of SC/ST/OBC. NCCS also follows the Government of India reservation policy for physically handicapped candidates.

Right to Information Act 2005

As per the requirement of the RTI Act 2005, NCCS has nominated Mr. G. Harikumar, Office 'C' (Administration) as CPIO and Dr. Jomon Joseph, Scientist 'G' has been nominated as the First Appellate Authority.

Security

NCCS has engaged a private Security Agency for providing security services on a contractual basis. All important places in the complex have been manned by security personnel throughout 24 hours in a day. As on date, there is no security-related problem at the Centre.

Committees

The Centre has formed the following committees as required under various statutes and guidelines for smooth functioning of the institute:
1. Grievance Committee.
2. Internal complaints committee (for the prevention of sexual harassment at the workplace)
3. Institutional Animal Ethics Committee (IAEC)
4. Institutional Biosafety Committee (IBSC)

Disciplinary Matters

The Centre follows CCS (CCA) rules 1965 and NCCS bye-laws for monitoring disciplinary matters at the Centre.

Vigilance-related Matters

The National Centre for Cell Science (NCCS), Pune has been regularly sending the monthly, quarterly and yearly reports of all the vigilance related matters including probity report, information about foreign tours of the staff, and responses to departmental inquiries and complaints (if any), to the CVO of the Department of Biotechnology, New Delhi. The 2022 Vigilance Awareness Week was observed from 31st October to 6th November, 2022 with the theme "भ्रष्टाचार मुक्त भारत - विकसित भारत" ("Corruption free India for a developed Nation"). During the Vigilance Week, an Integrity Pledge was taken by around 125 staff and students on 31st October 2022, an Essay Competition was arranged on "Corruption free

India for a developed Nation" on 2nd November, 2022 and a lecture on the above theme was delivered by Mr. I. B. Pendhari, Addl. Supdt. of Police, CBI, on 3rd November 2022 at NCCS.

NCCS, Pune, complied with the Vigilance Awareness Week-2022: A 3-month campaign on "Preventive Vigilance measures cum housekeeping activities" was organized from 16th August, 2022 to 15th November, 2022.

A compliant/suggestion box is available in the reception area of NCCS, and the same is opened and checked regularly in the presence of the CVO and Officer C (Admin.).

Implementation of the Official Language

The Director, NCCS, strongly supports the use of the Official Language in routine official work, in accordance with the orders of the Government of India, and other activities as well, to promote the use of Hindi. The Official Language Implementation Committee constituted by NCCS meets routinely to brainstorm and recommend different ways to encourage the use of Hindi in official and scientific activities.

Hindi Fortnight

The Hindi fortnight was held from 14 through 29 September, 2022. Various competitions were organized in Hindi. As always, an overwhelming response was received from the staff and students for the 'Essay writing', 'Vocabulary', 'General Knowledge' 'Poetry Recitation', and 'Elocution' competitions. Dr (Mrs). Swati Chaddha, Hindi Officer at CSIR-NCL, Mrs. Archana Nair, Sr. Hindi Officer at AFMC, Pune, Dr. Radha Chauhan and Dr. Shailza Singh, Scientists at NCCS, Mrs. Nalini Chavan, Officer 'A' (PMC) at NCCS, and Mrs. Prachi Dani, Technical Officer (Accounts) at NCCS, were deputed as examiners for these competitions. To encourage students and staff with diverse linguistic abilities to participate in these competitions, the tradition of giving separate prizes to "*Hindi bhashi*" & "*A-Hindi bhashi*" particpants was followed this year as well. The Hindi Day function was held on 27th September, 2022. Dr. Himanshu Shekahr, Scientist & Corporate Director, DRDO, Pune, graced the function as the Chief Guest. Dr. Mohan Wani, Director, NCCS, gave an overview of the day-to-day activities conducted in Hindi at the institute. Dr. Girdhari Lal, Scientist at NCCS, read out Cabinet Secretary, Shri. Rajiv Gouba's message on the occasion of Hindi Diwas. In his keynote address, Dr. Shekhar emphasized the importance of using the Hindi Language in scientific institutes, and its value in sharing scientific and technical content with the masses. The tenth issue of the annual Hindi magazine, 'Meemansa' was released at the hands of the Chief Guest, the Director, NCCS, and Dr. G. C. Mishra, Former Director, NCCS, who was a special invitee on this occasion. The winners of the various competitions held during the Hindi Fortnight were awarded with certificates & plants at the hands of the chief guest. The Hindi Day event was compered by Ms. Parul Pandita, Project student at NCCS.

Dr. Himanshu Shekhar

Dr. Girdhari Lal

Launch of the 10th issue of '*Meemansa*'

Dignitaries with the organizing team

Prize Winners

Other Activities

(a) Workshop:

A workshop was held in Hindi on 20 December, 2022 on the topic, 'प्रशासनिक संप्रेषण (Official Communication)' by Shri. Kaushal Kumar, Administrative Officer, CSIR-NCL, Pune.

Shri. Kaushal Kumar

Participants

(b) Scientific Conference in Hindi:

The 3rd Scientific Conference in Hindi was organised on 29th April, 2022 in association with CSIR-National Chemical Laboratory (CSIR-NCL) and Agharkar Research Institute. It was hosted by CSIR-NCL, Pune. The topic of the conference was 'महामारी के दौर में विज्ञान और प्रौद्योगिकी संस्थानों की भूमिका (The role of Science & Technology Institutes during the pandemic)'. Seventeen participants made presentations in Hindi on various aspects related to COVID-19 and the initiatives undertaken by their respective institutes during the pandemic. An abstract book containing 47 abstracts was released during the conference at the hands of the Directors of the three organising institutes, and the chief guest, Dr. Himanshu Shekahr, Scientist & Corporate Director, DRDO, Pune. Approximately 125 participants from various scientific and government institutes participated in this one-day conference.

National Centre For Cell Science

An Autonomous Institute of
Department of Biotechnology, Govt of India

NCCS Complex, Savitribai Phule Pune University Campus, Ganeshkhind,
Pune 411007.

AUDITED STATEMENTS OF ACCOUNT

FOR

F.Y. 2022-2023

AUDITORS

M/S BHIDE & SHAH
CHARTERED ACCOUNTANTS

5th Floor, 1025 Sadashiv Peth, Opp. Shivaji Mandir,
Pune - 411030.
Tel : 020-24472314/24474737

bhideandshah@hotmail.com

BHIDE & SHAH
Chartered Accountants

5th Floor. 1025, Sadashiv Peth,
Opp. Shivaji Mandir, Pune – 411030
Phone Nos. : 24472314 / 24474737 / 24486357
E-mail : bhideandshah@hotmail.com

INDEPENDENT AUDITOR'S REPORT

To
THE DIRECTOR
NCCS Complex, P.B. No.40,
Ganesh Khind P.O.,
Pune-411007

Opinion

We have audited the financial statements of National Centre For Cell Science (the entity), which comprise the Balance Sheet as at 31st March 2023, and the Income And Expenditure Account for the year then ended, and notes to the financial statements, including a summary of significant accounting policies.
In our opinion, the accompanying financial statements of the entity are prepared, in all material respects, in accordance with The Maharashtra Public Trust Act 1950, read with ,the common format of accounts for all Autonomous Institute as per letter No. BT/MED/NCCS/ADMN/2002 dtd.June 10,2002 of Department of Biotechnology, New Delhi and comptroller & Auditor General of India letter No. OA-VII(MISC/CORRES/2002-03/1165)dtd.16 October 2002.

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

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

Management is responsible for the preparation of the financial statements in accordance with The Maharashtra Public Trust Act 1950 , read with ,the common format of accounts for all Autonomous Institute as per letter No. BT/MED/NCCS/ADMN/2002 dtd. June 10,2002 of Department of Biotechnology, New Delhi and comptroller & Auditor General of India letter No. OA-VII(MISC/CORRES/2002-03/1165)dtd.16 October 2002 and for such internal control as management determines is necessary to enable the preparation of financial statements that are free from material misstatement, whether due to fraud or error.
In preparing the financial statements, management is responsible for assessing the entity's ability to continue as a going concern, disclosing, as applicable, matters related to going concern and using the going concern basis of accounting unless management either intends to liquidate the entity or to cease operations, or has no realistic alternative but to do so. Those charged with governance are responsible for overseeing the entity's financial reporting process.

Auditor's Responsibilities for the Audit of the Financial Statements
Our objectives are to obtain reasonable assurance about whether the financial statements as a whole are free from material misstatement, whether due to fraud or error, and to issue an auditor's report that includes our opinion. Reasonable assurance is a high level of assurance, but is not a guarantee that an audit conducted in accordance with SAs will always detect a material misstatement when it exists. Misstatements can arise from fraud or error and are considered material if, individually or in the aggregate, they could reasonably be expected to influence the economic decisions of users taken on the basis of these financial statements.

BHIDE & SHAH ★ PUNE-30. ★ CHARTERED ACCOUNTANTS

FOR BHIDE & SHAH
CHARTERED ACCOUNTANTS
FIRM REG. NO. 119383W

(SAMIR V.BHIDE)
PARTNER
M.NO.46274
UDIN: 23046274BGWQPC6512

Date: 25.07.2023
Place: Pune

NATIONAL CENTRE FOR CELL SCIENCE, PUNE - 411 007.

BALANCE SHEET AS AT 31.03.2023

Amount (Rs.)

CORPUS/CAPITAL FUND AND LIABILITIES	Schedule	2022-2023	2021-2022
CORPUS/CAPITAL FUND	1	97,93,96,833.68	86,66,00,788.44
GENERAL RESERVE	2	-	-
EARMARKED/ENDOWMENT FUNDS	3	66,55,34,272.11	38,44,77,655.47
CURRENT-LIABILITIES & PROVISIONS	4	8,00,60,789.31	9,20,36,689.31
Total		**1,72,49,91,895.10**	**1,34,31,15,133.22**
ASSETS			
FIXED ASSETS	5	82,06,21,623.00	77,26,33,368.00
CURRENT ASSETS, LOANS, ADVANCES	6	90,43,70,272.10	57,04,81,765.22
MISCELLANEOUS EXPENDITURES			
(to the extent not written off or adjusted)			
Total		**1,72,49,91,895.10**	**1,34,31,15,133.22**
SIGNIFICANT ACCOUNTING POLICIES	14		
CONTINGENT LIABILITIES AND NOTES ON ACCOUNTS	15		

The schedules referred to above form an integral part of the Balance Sheet.
The above Balance Sheet to the best of our knowledge & belief contains a True Account of the Funds & Liabilities of the Property and Assets of the National Centre for Cell Science.

As per our report of even date.

Date: 25.07.2023
Place: Pune

FOR BHIDE & SHAH
CHARTERED ACCOUNTANTS
FIRM REG. NO. 119383W

OFFICER 'C' ACCOUNTS
NCCS
वैभव अ. अरगडे
Vaibhav A. Argade
अधिकारी 'ग' (लेखा)
Officer 'C' (Accounts)
रा.को.वि.के./NCCS Pune-411007

राष्ट्रीय कोशिका विज्ञान केंद्र पुना

DIRECTOR
NCCS
डॉ. मोहन आर. वाणी
निदेशक, एनसीसीएस, पुणे
Dr. Mohan R. Wani
Director, NCCS, Pune

BHIDE & SHAH CHARTERED ACCOUNTANTS PUNE-30.

(SAMIR V.BHIDE)
PARTNER
M.NO.46274

NATIONAL CENTRE FOR CELL SCIENCE, PUNE - 411 007.

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31.03.2023

Amount (Rs.)

INCOME	Schedule	2022-2023	2021-2022
INCOME FROM SALES/SERVICE	7	1,05,14,696.00	95,72,085.00
GRANTS/SUBSIDIES	8	46,95,41,167.00	39,11,75,327.00
FEES/SUBSCRIPTIONS	9	6,360.00	3,392.00
INTEREST EARNED	10	35,145.00	52,292.00
OTHER INCOME	11	80,49,444.40	41,96,905.00
TOAL (A)		**48,81,46,812.40**	**40,50,00,001.00**
EXPENDITURE			
ESTABLISHMENT EXPENSES	12	24,78,77,817.00	24,72,15,232.00
OTHER ADMINISTRATIVE EXPENSES	13	22,59,15,815.16	16,96,78,025.44
DEPRECIATION	5	11,05,84,305.00	10,69,77,769.00
TOTAL (B)		**58,43,77,937.16**	**52,38,71,026.44**
BALANCE BEING SURPLUS/(DEFICIT) CARRIED TO			
CORPUS/CAPITAL FUND		**(9,62,31,124.76)**	**(11,88,71,025.44)**
SIGNIFICANT ACCOUNTING POLICIES	14		
CONTINGENT LIABILITIES AND NOTES ON ACCOUNTS	15		

The schedules referred to above form an integral part of the Income & Expenditure Account.

We hereby certify the above statement to be true and correct to the best of our knowledge and belief.

As per our report of even date.

Date: 25.07.2023

Place: Pune

FOR BHIDE & SHAH
CHARTERED ACCOUNTANTS
FIRM REG. NO. 119383W

OFFICER 'C' ACCOUNTS
NCCS
वैभव अ. अरगडे
Vaibhav A. Argade
अधिकारी 'ग' (लेखा)
Officer 'C' (Accounts)
रा.को.वि.के./NCCS Pune-411007

राष्ट्रीय कोशिका विज्ञान केंद्र पुना

DIRECTOR
NCCS
डॉ. मोहन आर. वाणी
निदेशक, एनसीसीएस, पुणे
Dr. Mohan R. Wani
Director, NCCS, Pune

BHIDE & SHAH CHARTERED ACCOUNTANTS PUNE-30.

(SAMIR V.BHIDE)
PARTNER
M.NO.46274

NATIONAL CENTRE FOR CELL SCIENCE, PUNE - 411 007.
RECEIPTS & PAYMENTS ACCOUNTS FOR THE YEAR ENDED 31ST MARCH 2023.

Receipts	Amount	Amount	Payments	Amount	Amount
OPENING BALANCE		**55,08,36,254.81**	**ESTABLISHMENT EXPENSES**		**24,78,77,817.00**
Bank of India - CSR 8574	37,84,843.54		Salaries	22,54,79,377.00	
NCCS Employee Welfare Current A/c 0538	6,24,138.22		Contribution to Provident Fund	1,20,90,834.00	
Bank of India - 4911	11,58,16,248.37		Contribution to NPS	1,03,07,606.00	
NCCS RBP METING 9071 (LOCAL)	48,206.80				
RBP INDIA MEETING 9072 (FOREIGN)	20,62,624.34		**OTHER ADMINISTRATIVE EXPENSES**		**22,55,40,511.16**
STATE BANK OF INDIA	1,18,76,953.46		Consumables	8,08,49,946.29	
Bank Of India 4912	32,38,62,075.58		Contingencies	3,11,91,389.40	
BANK OF INDIA (FOR SERB) -8403	3,36,71,528.12		Work On Contract	4,51,52,338.00	
Bank of India (Vaccine Facility)8783	5,90,39,636.38		Electricity and Power	3,77,09,310.01	
Cash-in-hand	50,000.00		Rent Rates and Taxes	1,43,43,800.00	
			PMC Water Charges	24,00,143.00	
GRANTS/SUBSIDIES		**46,95,41,167.00**	User Charges @5% trf to Staff Welfare A/c	5,43,993.00	
Grant In Aid General	22,50,00,000.00		TA-DA	25,45,053.00	
Grant In Aid Salary	24,45,41,167.00		Bank Charges	3,51,045.64	
			Fellowship-JGEEBILS	46,10,133.00	
CORPUS/CAPITAL FUND		**20,90,27,170.00**	Professional Expenses for R & D	58,43,359.82	
Corpus / Capital Fund	20,90,27,170.00				
Earmarked Fund		**48,24,78,690.80**	**Earmarked Fund**		**20,14,22,074.16**
Sales Accounts		**1,03,29,322.54**	**Purchase of Fixed Assets**		**15,85,72,560.00**
Income from Sales / Services			Buildings	7,50,135.00	
			Furniture	69,793.00	
Tender Fees		**6,360.00**	Library	6,99,233.00	
			Equipment	15,70,53,399.00	
Interest Earned		**35,145.00**			
Interest earned on Staff Computer Advance	25,369.00		**Payment against Advances**		**24,08,600.00**
Interest earned on Staff HBA	9,776.00		Leave Travel Concession	20,79,165.00	
			Contingency Staff Advance	59,435.00	
Receipt from Vendor of Current Assets		**26,06,102.00**	Bhatnagar Award	2,70,000.00	
Staff Computer Advance	40,018.00				
Receipt against Bhatnagar Award	3,75,000.00		**Deposit against work at Baner Campus**		**6,75,00,000.00**
Received against Contingency Staff Advance	1,14,139.00		Deposit to CPWD	6,75,00,000.00	
MSED Deposit (Kothrud)	2,82,200.00				
Settlement of Advance LTC	17,94,745.00		**Payment against Current Liabilities**		**50,65,94,560.65**
			Earnest Money Deposit	24,17,521.00	
Receipt against Current Liabilities		**49,42,47,250.65**	Security Deposit	24,27,275.00	
Earnest Money Deposit	28,44,811.00		Security Deposit /Caution Money	7,51,000.00	
Security Deposit	2,35,009.00		Payment of GST	53,89,361.00	
Security Deposit /Caution Money	12,40,000.00		Tax Deducted at Source	4,35,35,245.00	
Receipt of GST	51,11,264.00		Sundry Creditors	41,47,23,077.32	
Tax Deducted at Source	4,72,62,197.00		Payment of Interest Earned to DBT	34,70,568.00	
Sundry Creditors	41,47,48,991.32		Sundry Debtors	2,01,32,519.33	
Advance from Customers	2,04,89,627.33		Performance Bank Guarantee	80,100.00	
Performance Bank Guarantee	76,780.00		Salary Profession Tax	7,05,450.00	
Receipt of Salary Profession Tax	7,30,650.00		Saalry-Employee Welfare	6,78,235.00	
Salary-Employee Welfare	12,23,981.00		Payment against Provision for Gratuity & Leave Encashmen	1,07,06,571.00	
Provision for Auditors Fee	2,12,400.00		Auditors Fee	2,12,400.00	
Extra Mural Project	15,000.00		Extra Mural Project	7,67,701.00	
Transport Allowance Recovery	56,540.00		Transport Allowance Recovery	5,97,537.00	
Other Income		**80,49,444.40**	**Closing Balance**		**81,72,40,784.23**
Ph.D Fees	14,40,460.00		Bank of India - CSR 8574	38,95,372.54	
Application Fee	2,11,679.00		NCCS Employee Welfare Current A/c 0538	11,70,714.55	
Hostel Charges	8,72,369.00		Bank of India - 4911	10,49,27,852.37	
Miscellaneous Income	224.00		State Bank of India	1,04,51,096.37	
License Fee	2,34,594.00		Bank Of India 4912	18,51,66,630.62	
Receipts from Guest House	2,33,980.00		Bank of India (for SERB)-8403	1,36,33,279.97	
Interest earned on Covid Testing Recepits A/C No.8574	1,10,529.00		Bank of India (Vaccine Facility)8783	4,87,83,101.78	
Sale of Scrap	7,53,604.00		EMBO Conference Foreign A/c BOI 0033	31,057.49	
Auditorium Charges	8,000.00		EMBO Conference Local A/c BOI 0034	1,20,908.70	
Income from Road Show	1,80,000.00		ICICI-ZBSA-042401003830	6,74,31,047.92	
Income from Day Care	1,16,294.00		ICICI-ZBSA-042401003879	38,15,79,721.92	
Interest earned	34,65,005.00		Cash-in-hand	50,000.00	
Interest on MSEB deposit	3,33,539.00				
TCS on Interest on MSEB deposit	185.40				
Income from BCCT Workshop	88,982.00				
Total		**2,22,71,56,907.20**	**Total**		**2,22,71,56,907.20**

SIGNIFICANT ACCOUNTING POLICIES SCH "14"

CONTINGENT LIABILITIES AND NOTES ON ACCOUNTS SCH "15"

The schedules referred to above form an integral part of the Receipts & Payments Account.
This is the Receipts & Payments Account referred to in our report of even date.

EXAMINED AND FOUND CORRECT AS PER BOOKS OF ACCOUNT PRODUCED AND INFORMATION GIVEN, SUBJECT TO OUR SEPARATE REPORT OF EVEN DATE

OFFICER 'C' ACCOUNTS
वैभव अ. अरगडे
Vaibhav A. Argade
अधिकारी 'ग' (लेखा)
Officer 'C' (Accounts)
रा.को.वि.के./NCCS Pune-411007

DIRECTOR
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डॉ. मोहन आर. वाणी
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Dr. Mohan R. Wani
Director, NCCS, Pune

FOR BHIDE & SHAH
CHARTERED ACCOUNTANTS
FIRM REG. NO. 119383W

(SAMIR V.BHIDE)
PARTNER
M.NO.46274

NATIONAL CENTRE FOR CELL SCIENCE, PUNE - 411 007.

SCHEDULES FORMING PART OF BALANCE SHEET AS ON 31.03.2023

SCHEDULE 1 - CORPUS/CAPITAL FUND

(Amount-Rs.)

Particulars	2022-23	2021-22
SCHEDULE 1- CORPUS/CAPITAL FUND:		
Balance at the beginning of the year	86,66,00,788.44	98,54,58,821.88
Less:(Deduct) : Balance of net income /(expenditure)/Refund through Bharatkosh [Note: A (6) (v) Accounting Significant Policies]	1,70,37,000.00	-
Deduct : Capital grants written off	-	-
Less: Deduction from TSA Account [Note: A (6) (v) Accounting Significant Policies]	-	8,99,87,008.00
	84,95,63,788.44	89,54,71,813.88
Add : Contribution towards Capital Fund	22,60,64,170.00	9,00,00,000.00
Add : General Reserve	-	-
	1,07,56,27,958.44	98,54,71,813.88
Add/(Deduct) : Bal. Of net income/(expenditure) transferred from the Income and Expenditure A/c.	(9,62,31,124.76)	(11,88,71,025.44)
BALANCE AS AT THE YEAR - END	**97,93,96,833.68**	**86,66,00,788.44**

राष्ट्रीय कोशिका विज्ञान केंद्र
पुणे

BHIDE & SHAH
PUNE-30.
CHARTERED ACCOUNTANTS

NATIONAL CENTRE FOR CELL SCIENCE, PUNE - 411 007.

SCHEDULES FORMING PART OF BALANCE SHEET AS ON 31.03.2023

SCHEDULE 2 -GENERAL RESERVE

Amount (Rs.)

Particulars	2022-23	2021-22
General Reserve	-	-
Grand Total	-	-

राष्ट्रीय कोशिका विज्ञान केंद्र पुणा

BHIDE & SHAH CHARTERED ACCOUNTANTS PUNE-30.

NATIONAL CENTRE FOR CELL SCIENCE, PUNE - 411 007.

SCHEDULES FORMING PART OF BALANCE SHEET AS ON 31.03.2023

SCHEDULE-3 EARMARKED/ENDOWMENT FUND

(Amount-Rs.)

No.	Name of the Project & P.I.	Opening	Additions	Interest &	Total	Expenditure			Closing
		Balance	Grant. Recd.	Other Receipts		Capital	Revenue	Total	Balance
1	DBT-0150 (Biotechnology Research & Development Scheme)	14,03,56,869.82	4,90,35,237.00	68,05,295.00	19,61,97,401.82	1,13,20,280.00	10,85,56,401.98	11,98,76,681.98	7,63,20,719.84
2	DBT-0155 (Industrial & Entrepreneurship Development)	1,95,61,928.96	36,18,83,200.00	3,44,099.00	38,17,89,227.96	-	(1,34,592.96)	(1,34,592.96)	38,19,23,820.92
3	AB/MW/BIOCARE/07/9813-AMRUTA BARHANPURKAR	(2,88,776.00)	-	-	(2,88,776.00)	-	-	-	(2,88,776.00)
4	AC/BIRAC/COVID-0032-DR. AKANKSHA CHATURVEDI	38,391.00	-	1,187.00	39,578.00	-	-	-	39,578.00
5	AC/SERB/CRG/004981-DR. AKANKSHA CHATURVEDI	5,70,462.00	-	27,711.00	5,98,173.00	-	3,13,183.22	3,13,183.22	2,84,989.78
6	AC/SERB/IPA/000148-DR. AKANKSHA CHATURVEDI	27,58,360.00	-	1,22,143.00	28,80,503.00	-	23,70,076.00	23,70,076.00	5,10,427.00
7	AM/DBT-WELLCOME-DR. MAJUMDAR	(37,056.14)	-	-	(37,056.14)	-	-	-	(37,056.14)
8	AM/IFCPAR-DR. MAJUMDAR	-	20,08,854.00	33,647.00	20,42,501.00	-	1,70,000.00	1,70,000.00	18,72,501.00
9	AM/SERB/003130-DR. MAJUMDAR	21,88,463.00	-	1,11,009.00	22,99,472.00	-	13,18,673.00	13,18,673.00	9,80,799.00
10	AP/DBT-WELLCOME-DR. PILLAI	2,82,417.00	2,72,342.00	6,046.00	5,60,805.00	-	5,04,488.00	5,04,488.00	56,317.00
11	AS/CSIR-NMITLI-DR. A K SAHU	20,14,595.36	-	-	20,14,595.36	-	20,14,595.36	20,14,595.36	-
12	AS/DST/VI-D&P/551-DR. SHIRAS	6,63,292.28	-	-	6,63,292.28	-	6,63,292.28	6,63,292.28	-
13	AS/ICMR/90-DR. SHIRAS	(32,924.00)	-	-	(32,924.00)	-	-	-	(32,924.00)
14	AS/SERB/000126-DR. AVINASH SHARMA	0	13,44,050.00	23,317.00	13,67,367.00	-	1,84,550.00	1,84,550.00	11,82,817.00
15	AS/SERB/JCB/000020-DR. A K SAHU	3,15,994.00	19,00,000.00	48,150.00	22,64,144.00	-	6,81,427.00	6,81,427.00	15,82,717.00
16	AS/UNILEVER-DR. SHIRAS	6,71,914.00	-	-	6,71,914.00	-	-	-	6,71,914.00
17	AS/WELLCOME-DR. AVINASH SHARMA	18,86,840.37	-	39,170.00	19,26,010.37	-	11,84,016.00	11,84,016.00	7,41,994.37
18	ASHWINI DHAMANGE/GM/NASI/620/3	4,89,207.00	-	-	4,89,207.00	-	4,89,207.00	4,89,207.00	-
19	AY/KR-03/NMPB-IV-DR. AMIT YADAV	8,72,000.00	-	8,459.00	8,80,459.00	-	8,72,000.00	8,72,000.00	8,459.00
20	BAHIR/WOS-LS-602-DR. BAHIR	1,50,733.00	-	-	1,50,733.00	-	1,50,733.00	1,50,733.00	-
21	BIVALKAR/WOS-A/LS/2016-DR. BIVALKAR	(1,60,453.00)	-	-	(1,60,453.00)	-	-	-	(1,60,453.00)
22	BS/SERB/JCB-DR. SAHA	7,77,424.34	-	25,120.00	8,02,544.34	-	6,40,036.34	6,40,036.34	1,62,508.00
23	CICS-ISRF FELLOWSHIP-MR. SUJIT SHAH	9,283.00	-	-	9,283.00	-	9,283.00	9,283.00	-
24	CSIR	(1,96,67,040.05)	1,25,126.00	-	(1,95,41,914.05)	-	1,40,950.00	1,40,950.00	(1,96,82,864.05)
25	CSIR-RA FELLOWSHIP	(13,25,946.00)	-	-	(13,25,946.00)	-	-	-	(13,25,946.00)
26	DBT-BINC FELLOWSHIP	2,61,678.00	2,82,855.00	1,617.00	5,46,150.00	-	4,85,782.00	4,85,782.00	60,368.00
27	DBT FELLOWSHIP	28,49,374.93	1,07,60,638.00	1,39,910.00	1,37,49,922.93	-	1,10,25,043.00	1,10,25,043.00	27,24,879.93
28	DBT-JRF PROGRAMME	1,40,895.00	-	4,291.00	1,45,186.00	-	21,242.00	21,242.00	1,23,944.00
29	DBT - PDF PROGRAMME	2,10,298.00	-	6,488.00	2,16,786.00	-	-	-	2,16,786.00
30	GL/BT/03/IYBA-DR. LAL	(5,62,237.00)	-	-	(5,62,237.00)	-	-	-	(5,62,237.00)
31	NL/BT/MUTAGENESIS(INDO-AUS)-DR.LENKA	(13,208.00)	-	-	(13,208.00)	-	-	-	(13,208.00)

राष्ट्रीय कोशिका विज्ञान केंद्र पुना

B. K. SHAH & CO. CHARTERED ACCOUNTANTS PUNE 30.

SCHEDULE-3 EARMARKED/ENDOWMENT FUND

(Amount-Rs.)

No.	Name of the Project & P.I.	Opening	Additions	Interest &	Total	Expenditure			Closing
		Balance	Grant. Recd.	Other Receipts		Capital	Revenue	Total	Balance
32	SM/BT/IN/NEW INDIGO/05/SB/TB-OMICS-DR.MANDE	(32,671.30)	-	-	(32,671.30)	-	-	-	(32,671.30)
33	SM/BT/NEW INDIGO/18-DR. MANDE	(6,59,959.00)	-	-	(6,59,959.00)	-	-	-	(6,59,959.00)
34	SM/BT/PR-3260/BRB/2012-17	6,27,972.00	-	43,212.00	6,71,184.00	-	-	-	6,71,184.00
35	SM/BT/PR-7265-DIRECTOR,NCCS	2,70,905.00	-	-	2,70,905.00	-	2,70,905.00	2,70,905.00	-
36	DBT TWAS FELLOWSHIP	39,298.00	-	1,209.00	40,507.00	-	-	-	40,507.00
37	DM/BIRAC-DR. MITRA	-	-	-	-	-	-	-	-
38	DM/SERB/003331-DR. MITRA	2,51,771.00	-	-	2,51,771.00	-	1,31,163.00	1,31,163.00	1,20,608.00
39	DM/JCB/18-19-DR. MITRA	2,40,140.27	16,50,000.00	26,558.00	19,16,698.27	-	15,23,683.27	15,23,683.27	3,93,015.00
40	DM/THSTI-DR. MITRA	(18,445.00)	-	-	(18,445.00)	-	-	-	(18,445.00)
41	DP/PACER-POP/BS-01-DR. DHIRAJ PAUL	3,67,164.83	5,99,500.00	11,092.00	9,77,756.83	-	8,44,458.00	8,44,458.00	1,33,298.83
42	DS/BATTELE INDIA-DR. DEEPA	(22,472.00)	-	-	(22,472.00)	-	-	-	(22,472.00)
43	DS/ICMR-2020-3076/SCR-DR. DEEPA	3,26,581.23	11,48,608.00	31,672.00	15,06,861.23	-	7,99,517.28	7,99,517.28	7,07,343.95
44	DS/SERB/CRG/002728-DR. DEEPA	17,81,968.00	-	80,413.00	18,62,381.00	-	11,89,715.00	11,89,715.00	6,72,666.00
45	DST INSPIRE FELLOWSHIP	2,59,781.00	-	26,881.00	2,86,662.00	-	35,405.00	35,405.00	2,51,257.00
46	DS/WELLCOMETRUST-DR. DEEPA	(4,91,460.00)	-	-	(4,91,460.00)	-	-	-	(4,91,460.00)
47	EMBO CONFERENCE IN KIDNEY DISEASES	-	33,74,587.36	61,655.86	34,36,243.22	-	32,84,277.03	32,84,277.03	1,51,966.19
48	EMBO RNA	21,09,689.14	45,318.00	-	21,55,007.14	-	21,55,007.14	21,55,007.14	-
49	GD/CRG/2019-005587 - DR. GAURAV DAS	4,81,946.43	-	20,864.00	5,02,810.43	-	2,86,406.00	2,86,406.00	2,16,404.43
50	GD/SB/S2/RJN-048/2017-DR. GAURAV DAS	2,37,166.00	3,50,000.00	7,790.00	5,94,956.00	1,94,286.00	3,34,219.00	5,28,505.00	66,451.00
51	GK/5TH INTERNATIONAL CONF. TRANSLATION RES.-DR. KUNDU	2,83,533.44	-	-	2,83,533.44	-	-	-	2,83,533.44
52	GK/CSIR-DR. KUNDU	(47,957.00)	-	-	(47,957.00)	-	-	-	(47,957.00)
53	GK/DST/IMRCD/INNO-INDIGO-DR. KUNDU	2,10,246.00	-	6,498.00	2,16,744.00	-	-	-	2,16,744.00
54	GK/SERB/002298-DR. KUNDU	2,47,698.38	-	7,711.00	2,55,409.38	-	-	-	2,55,409.38
55	GK/SR/SO/HS-70-DR. KUNDU	(3,32,350.00)	-	-	(3,32,350.00)	-	-	-	(3,32,350.00)
56	GL/DST/SJF/LSA-01-DR. LAL	55,167.69	30,00,000.00	71,691.00	31,26,858.69	-	31,70,726.28	31,70,726.28	(43,867.59)
57	GL/KEMHRC-DR. LAL	7,18,257.20	-	-	7,18,257.20	-	1,15,804.00	1,15,804.00	6,02,453.20
58	GL/KEMHRC-II-DR. LAL	62,14,954.28	-	-	62,14,954.28	-	14,16,965.86	14,16,965.86	47,97,988.42
59	GM/NASI PLATINUM JUBILEE CHAIR-DR. MISHRA	7,00,404.16	25,96,048.00	36,224.00	33,32,676.16	-	29,25,988.00	29,25,988.00	4,06,688.16
60	ICMR	(15,34,580.35)	22,22,102.00	78,424.00	7,65,945.65	-	20,46,654.00	20,46,654.00	(12,80,708.35)
61	INSPIRE FACULTY AWARD-DEEPIKA PURI	12,00,056.01	-	-	12,00,056.01	-	12,00,056.01	12,00,056.01	-
62	INSPIRE FACULTY AWARD-DR. DEBASRI MUKHARJEE	(42,253.00)	-	-	(42,253.00)	-	-	-	(42,253.00)
63	INSPIRE FACULTY AWARD-DR. JYOTI SINGH	(3,497.00)	-	-	(3,497.00)	-	-	-	(3,497.00)
64	INSPIRE FACULTY AWARD-PRIYANKA DUTTA	7,61,717.09	20,57,454.00	31,938.00	28,51,109.09	-	25,54,561.00	25,54,561.00	2,96,548.09

राष्ट्रीय कोशिका विज्ञान केंद्र पुना

BHIDE & SHAH CHARTERED ACCOUNTANTS PUNE-30

SCHEDULE-3 EARMARKED/ENDOWMENT FUND

(Amount-Rs.)

No.	Name of the Project & P.I.	Opening	Additions	Interest &	Total	Expenditure			Closing
		Balance	Grant. Recd.	Other Receipts		Capital	Revenue	Total	Balance
65	INTRAMURAL PROJECT-IM-001	(24,368.36)	-	-	(24,368.36)	-	-	-	(24,368.36)
66	INTRAMURAL PROJECT-IM-002	(4,48,468.68)	-	-	(4,48,468.68)	-	-	-	(4,48,468.68)
67	IUSSTF FELLOWSHIP	13,599.00	-	-	13,599.00	-	13,599.00	13,599.00	-
68	JJ/SERB/001092	(85,886.00)	-	-	(85,886.00)	-	-	-	(85,886.00)
69	JJ/SERB/000352-DR. JOSEPH	24,14,610.00	-	51,366.00	24,65,976.00	-	22,35,189.00	22,35,189.00	2,30,787.00
70	JK/DST/FRG/DAAD/P-18-DR. JANESH	2,48,940.00	-	2,947.00	2,51,887.00	-	-	-	2,51,887.00
71	JK/SERB/003971-DR. JANESH KUMAR	14,56,167.00	3,50,000.00	53,268.00	18,59,435.00	-	14,09,163.00	14,09,163.00	4,50,272.00
72	JK/SERB/CVD/000298-DR. JANESH KUMAR	2,68,891.00	-	11,456.00	2,80,347.00	-	88,360.00	88,360.00	1,91,987.00
73	JS/WELLCOME - DR. JYOTI SINGH	4,18,759.42	29,37,745.00	6,972.00	33,63,476.42	-	3,83,946.00	3,83,946.00	29,79,530.42
74	JUILEE/NASI PLATINUM JUBILEE CHAIR	-	4,36,800.00	5,383.00	4,42,183.00	-	3,57,445.00	3,57,445.00	84,738.00
75	LL/DAE/37B/BRNS-DR. LIMAYE	(1,08,965.00)	-	-	(1,08,965.00)	-	-	-	(1,08,965.00)
76	LL/JAI RESEARCH FOUNDATION-DR. LIMAYE	(25,46,806.00)	-	-	(25,46,806.00)	-	-	-	(25,46,806.00)
77	MB/BIRAC/BT/CRS0400/PACE-DR. BHAT	88.67	82,911.00	-	82,999.67	-	82,999.67	82,999.67	-
78	MB/ITC/CONSULTANCY - DR. BHAT	8,15,312.08	-	-	8,15,312.08	-	8,15,312.08	8,15,312.08	-
79	MS/ICMR-DR. MANAS SANTRA	-	35,76,613.00	-	35,76,613.00	-	-	-	35,76,613.00
80	MS/CSIR/37/(1655)/15/EMR-II-DR. MANAS SANTRA	41,121.00	-	1,271.00	42,392.00	-	-	-	42,392.00
81	MS/LADY TATA FELLOWSHIP-DR. MANAS SANTRA	3,50,000.00	-	7,485.00	3,57,485.00	49,997.00	2,55,188.00	3,05,185.00	52,300.00
82	MS/SERB/CRG/005433-DR. MANAS SANTRA	12,08,747.68	12,50,000.00	72,772.00	25,31,519.68	-	16,55,063.00	16,55,063.00	8,76,456.68
83	MS/UNILEVER-DR. SANTRA	20,00,399.50	-	-	20,00,399.50	-	20,00,399.50	20,00,399.50	-
84	MW/BHU-DR. WANI	21,680.00	-	670.00	22,350.00	-	-	-	22,350.00
85	MW/SERB/004441-DR. WANI	2,06,481.37	-	11,156.00	2,17,637.37	-	-	-	2,17,637.37
86	MW/SPPU/AYUSH-DR. WANI	23,768.74	-	-	23,768.74	-	23,768.74	23,768.74	-
87	NAM S&T FELLOWSHIP	8,136.00	-	-	8,136.00	-	8,136.00	8,136.00	-
88	NAS/141/7/2014-15-DR. RANI LEKHA	(2,34,000.00)	-	-	(2,34,000.00)	-	-	-	(2,34,000.00)
89	NE/SB/FT/CS-067/2014-DR. N D ERANDE	(75,165.00)	-	-	(75,165.00)	-	-	-	(75,165.00)
90	OP/EMR/2016/006589-DR. OM PRAKASH	81,490.00	-	2,479.00	83,969.00	-	55,670.00	55,670.00	28,299.00
91	PA/DST-INSPIRE FACULTY-DR. PRASAD ABNAVE	-	4,24,225.00	1,255.00	4,25,480.00	-	3,96,354.00	3,96,354.00	29,126.00
92	PD/SERB/CRG/001727-DR, PRIYANKA DUTTA	1,80,247.00	1,50,000.00	6,640.00	3,36,887.00	-	3,13,961.00	3,13,961.00	22,926.00
93	PN/BT/NBM0166/04/19/BIRAC-DR. NAGVENKAR	12,72,89,793.36	-	39,26,244.00	13,12,16,037.36	-	16,11,799.00	16,11,799.00	12,96,04,238.36
94	PN/CVTF-DR. NAGVENKAR	5,77,92,946.43	-	16,61,965.00	5,94,54,911.43	13,31,670.00	94,33,598.35	1,07,65,268.35	4,86,89,643.08
95	PR/NMHS-DR. PRAVEEN RAHI	1,88,338.97	8,28,053.00	16,120.00	10,32,511.97	-	3,75,910.00	3,75,910.00	6,56,601.97
96	Project Overheads	2,46,84,393.49	66,31,060.58	-	3,13,15,454.07	-	85,319.64	85,319.64	3,12,30,134.43
97	PS/DBT RA-DR. PARSHURAM SONAWANE	1,68,633.39	-	5,211.00	1,73,844.39	-	-	-	1,73,844.39

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BHIDE & SHAH CHARTERED ACCOUNTANTS PUNE-30.

SCHEDULE-3 EARMARKED/ENDOWMENT FUND

(Amount-Rs.)

No.	Name of the Project & P.I.	Opening	Additions	Interest &	Total	Expenditure			Closing
		Balance	Grant. Recd.	Other Receipts		Capital	Revenue	Total	Balance
98	PS/ICMR/53/6/BM-DR. PADMA SHASTRY	(6,60,992.00)	-	-	(6,60,992.00)	-	-	-	(6,60,992.00)
99	PV/JJ/DBT-RA-PALLAVI VARSHNEY	(2,731.00)	-	-	(2,731.00)	-	-	-	(2,731.00)
100	RC/SB/SO/BB-0030/13-16-DR.RADHA CHAUHAN	(2,46,623.00)	-	-	(2,46,623.00)	-	-	-	(2,46,623.00)
101	RC/SERB/000272-DR. RADHA CHAUHAN	(8,820.00)	-	-	(8,820.00)	-	-	-	(8,820.00)
102	RNA MEET 2022-DR. SESHADRI	0	6,13,667.00	-	6,13,667.00	-	6,13,667.00	6,13,667.00	-
103	SANDHYA/DAE/35/14/31-BRNS-DR. SANDHYA	57,501.65	-	1,776.00	59,277.65	-	-	-	59,277.65
104	SANDHYA/SR/SO/BB-0119-DR.SANDHYA	(33,598.00)	-	-	(33,598.00)	-	-	-	(33,598.00)
105	SB/CRG/2019/001157 - DR. BAPAT	5,77,178.07	12,00,000.00	63,580.00	18,40,758.07	-	12,44,471.74	12,44,471.74	5,96,286.33
106	SB/GODAVARI BIOREFINERIES-DR. BAPAT	18,600.00	-	-	18,600.00	-	18,600.00	18,600.00	-
107	SB/INDO AUSTRALIA SYMPOSIUM-DR. BAPAT	(16,664.00)	-	-	(16,664.00)	-	-	-	(16,664.00)
108	SC/AMRITA THERAPEUTICS-DR. SAMIT	(1,08,000.00)	-	-	(1,08,000.00)	-	-	-	(1,08,000.00)
109	SC/CSIR/37(1572)-DR.SAMIT	(2,27,473.00)	-	-	(2,27,473.00)	-	-	-	(2,27,473.00)
110	SERB PDF	11,93,014.00	10,68,400.00	61,680.00	23,23,094.00	-	12,21,883.00	12,21,883.00	11,01,211.00
111	SK/SERB/000732-DR. SANTOSH KUMAR	17,71,835.58	5,00,000.00	80,342.00	23,52,177.58	9,98,263.00	9,23,360.28	19,21,623.28	4,30,554.30
112	SM/DST/INDO-RUSSIA/23.04.14-22.04.16-Dr. Mande	(1,07,683.00)	-	-	(1,07,683.00)	-	-	-	(1,07,683.00)
113	SM/DST/INT/RFBR/P-89-DR. MANDE	(2,38,142.00)	-	-	(2,38,142.00)	-	-	-	(2,38,142.00)
114	SM/DST/SPAIN/P-26/23.7.12-22.7.15-DR. MANDE	(4,30,348.00)	-	-	(4,30,348.00)	-	-	-	(4,30,348.00)
115	SR/DST/IMRCD/INNO-INDIGO-DR. SRIKANTH	(2,25,736.00)	-	-	(2,25,736.00)	-	-	-	(2,25,736.00)
116	SS/58/39/2020/PHS/(BMS)/ICMR-DR. SHAILAZA SINGH	23,22,440.00	-	51,153.00	23,73,593.00	8,99,926.00	11,48,543.00	20,48,469.00	3,25,124.00
117	SS/NATL. CONF. ON EMERGING TRENDS-REGN. FEES	1,27,203.00	-	-	1,27,203.00	-	-	-	1,27,203.00
118	SS/NATIONAL CONF. ON EMERGING TRENDS IN D.M.S.-NASI	(694.00)	-	-	(694.00)	-	-	-	(694.00)
119	SS/BT/LS-400-DR. SINGH	(1,303.00)	-	-	(1,303.00)	-	-	-	(1,303.00)
120	STRUCTURAL BASED DRUG DESIGNING (SBDD)	(1,57,063.00)	-	-	(1,57,063.00)	-	-	-	(1,57,063.00)
121	TL/SERB/SRG/2019/001818-DR. TUSHAR LODHA	1,10,250.36	-	-	1,10,250.36	-	1,10,250.36	1,10,250.36	-
122	TRAVEL GRANT - CD318	45,887.00	-	-	45,887.00	-	-	-	45,887.00
123	UGC	(74,56,561.50)	-	-	(74,56,561.50)	-	(1,52,639.00)	(1,52,639.00)	(73,03,922.50)
124	VK/DAE/PR-37B/BRNS-DR.KALE	(2,47,647.00)	-	-	(2,47,647.00)	-	-	-	(2,47,647.00)
125	VS/SERB/2014/001093-DR. SESHADRI	21,195.00	-	-	21,195.00	-	21,195.00	21,195.00	-
126	VT/SERB/004159-DR. TRIPATHI	5,06,333.07	15,00,000.00	64,263.00	20,70,596.07	-	14,72,500.00	14,72,500.00	5,98,096.07
127	VT/SERB/000242-DR. TRIPATHI	(22,336.00)	22,336.00	-	-	-	-	-	-
128	WORKSHOP ON DATA SCIENCE-DR. SHAILAZA SINGH	-	58,884.00	-	58,884.00	-	-	-	58,884.00
129	WORKSHOP ON P N & B-DR. SHAILAZA SINGH	-	33,062.00	-	33,062.00	-	-	-	33,062.00
130	YS/BHORUKA CHARITABLE TRUST-DR. SHOUCHE	51,619.00	-	-	51,619.00	-	-	-	51,619.00

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BHIDE & SHAH CHARTERED ACCOUNTANTS PUNE-30.

SCHEDULE-3 EARMARKED/ENDOWMENT FUND

(Amount-Rs.)

No.	Name of the Project & P.I.	Opening	Additions	Interest &	Total	Expenditure			Closing
		Balance	Grant. Recd.	Other Receipts		Capital	Revenue	Total	Balance
131	YS/BIRAC-DR. SHOUCHE	(40,595.00)	4,49,769.00	-	4,09,174.00	-	-	-	4,09,174.00
132	YS/ES/PO/SEISMO/1(361)/2019	2,71,232.00	2,00,000.00	6,932.00	4,78,164.00	-	4,34,364.00	4,34,364.00	43,800.00
133	YS/ICMR/236-DR. SHOUCHE	5,75,314.00	7,16,008.00	19,483.00	13,10,805.00	-	9,92,656.00	9,92,656.00	3,18,149.00
134	YS/MS/RGSTC/FILE 2007-DR.SHOUCHE	(50,400.00)	-	-	(50,400.00)	-	-	-	(50,400.00)
135	YS/TATA STEEL/PHASE-I-DR. SHOUCHE	(1,19,450.00)	-	-	(1,19,450.00)	-	-	-	(1,19,450.00)
136	YS/TATA STEEL/PHASE-II-DR. SHOUCHE	7,49,251.62	-	-	7,49,251.62	-	-	-	7,49,251.62
137	YS/UNILEVER-DR. SHOUCHE	64,782.00	-	-	64,782.00	-	64,782.00	64,782.00	-
138	ZK/WELLCOME-DR. ZAHID KAMAL	-1,30,084.97	1,30,085.00	-	0.03	-	0.03	0.03	-
139	ITS/2018/2706-DR. AVINASH SHARMA	1,83,624.00	-	-	1,83,624.00	-	1,83,624.00	1,83,624.00	-
140	ITS/2018/003276-DR. PRAVEEN RAHI	71,002.00	-	-	71,002.00	-	71,002.00	71,002.00	-
141	MASSTRICH UNIV. PROJECT	(3,50,730.00)	-	-	(3,50,730.00)	-	-	-	(3,50,730.00)
142	Receivable	-	-	-	-	-	12,654.00	12,654.00	(12,654.00)
143	SPONSORSHIP FEE-SIGNALS FROM GUT SYMPOSIUM -ARUN K	1,40,000.00	-	-	1,40,000.00	-	140000	1,40,000.00	-
144	SVETNER INNOVATIONS P LTD. - DR. SHOUCHE	23,600.00	-	-	23,600.00	-	23600	23,600.00	-
145	TA/DA-CTEP CLAIM-MR. ROHAN KULKARNI,EX SRF. CSIR	(45,887.00)	-	-	(45,887.00)	-	-	-	(45,887.00)
	Total	**38,34,94,739.31**	**46,78,15,537.94**	**1,44,85,360.86**	**86,57,95,638.11**	**1,47,94,422.00**	**18,60,91,591.48**	**20,08,86,013.48**	**66,49,09,624.63**
No.	Name of the Project & P.I.	Opening	Addition	Interest	Total	Deletion		Total	Closing
		Balance	Unidentified		identified and trf to project				Balance
			during the year						
1	SUSPENSE A/C	9,82,916.16	1,77,792.00	-	11,60,708.16	-	5,36,060.68	5,36,060.68	6,24,647.48
					-			-	
	Grand Total	**38,44,77,655.47**	**46,79,93,329.94**	**1,44,85,360.86**	**86,69,56,346.27**	**1,47,94,422.00**	**18,66,27,652.16**	**20,14,22,074.16**	**66,55,34,272.11**

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BHIDE & SHAH CHARTERED ACCOUNTANTS PUNE-30.

NATIONAL CENTRE FOR CELL SCIENCE, PUNE - 411 007.

SCHEDULES FORMING PART OF BALANCE SHEET AS ON 31.03.2023

SCHEDULE 4 - CURRENT-LIABILITIES

Amount (Rs.)

Particulars	2022-23	2021-22
Canteen Deposit	10,000.00	10,000.00
Earnest Money Deposit	16,47,510.00	12,20,220.00
Gardening Contract Deposit	30,000.00	30,000.00
Laundry Deposit	500.00	500.00
Security Deposit	23,43,371.00	45,35,637.00
Security Deposit/ Caution Money	42,50,000.00	37,61,000.00
Tele. Deposit	3,164.00	3,164.00
* M/s Shalaka Infra-Tech(I) Pvt. Ltd.	15,55,516.00	15,55,516.00
GST Payable	4,14,259.00	6,92,356.00
Tax Deducted at Source payable	49,35,812.00	12,08,860.00
Sundry Creditor	2,93,255.00	2,67,341.00
Interest Earned Payble to DBT	-	34,70,568.00
Advance from Customers	29,31,527.31	25,74,419.31
Salary Profession Tax Payable	79,600.00	54,400.00
Performance Gurantee Deposit (PBG)	8,36,398.00	8,39,718.00
Centre Reserve Funds	10,000.00	10,000.00
Conti.-Welfare Fund (Project)	7,95,575.00	7,95,575.00
Salary- Employee Welfare Deduction	11,70,371.00	6,24,625.00
Provision for Gratuity & Leave Encashment	5,53,44,376.00	6,60,50,947.00
Provision for Charity Commissioner	31,40,615.00	27,69,205.00
Provision of Auditors Fee	2,12,400.00	2,12,400.00
Payable from Extra Mural projects	-	7,52,701.00
**Transport Allowance Recovery	56,540.00	5,97,537.00
Grand Total	**8,00,60,789.31**	**9,20,36,689.31**

Note

*Amount kept on hold due to non-completion of work within contract period by the said Vendor.

** Transport Allowance Recovered of Rs. 56,540.00 from Dr. Krishnasastry as per C & AG Audit objection and kept under current liabilities, as the proposal of reconsideration is sent to Department of Biotechnology, New Delhi.

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BHIDE & SHAH CHARTERED ACCOUNTANTS PUNE-30

NATIONAL CENTRE FOR CELL SCIENCE, PUNE - 411 007.

SCHEDULES FORMING PART OF BALANCE SHEET AS ON 31.03.2023

SCHEDULE 5 - FIXED ASSETS

(Amount-Rs.)

DESCRIPTION	Rate	GROSS BLOCK					DEPRECIATION / AMORTIZATION				NET BLOCK	
		As at begining of the year	Additions during the year		Deduction during the year	Cost valuation at the year-end	As at the beginning of the year	Additions during the year	Deduction during the year	Total up to the Year-end	As at the Current year-end	As at the Previous year-end
A. FIXED ASSETS:												
1. Lease Hold Land Baner												
a> Lease Hold Land - Baner		1,54,41,563.00	-		-	1,54,41,563.00	25,73,594.00	5,14,719.00	-	30,88,313.00	1,23,53,250.00	1,28,67,969.00
b> Lease Hold Land - Baner - Compound Wall		17,48,412.00	-		-	17,48,412.00	1,24,886.00	62,443.00	-	1,87,329.00	15,61,083.00	16,23,526.00
2. BUILDINGS:	**4.87%**											
a> Jopasana		60,26,554.30	-		-	60,26,554.30	38,62,629.00	1,05,383.00	-	39,68,012.00	20,58,542.00	21,63,925.00
b> Jidnyasa		69,14,265.25	-		-	69,14,265.25	43,94,468.00	1,22,714.00	-	45,17,182.00	23,97,083.00	25,19,797.00
c> University Campus		53,00,22,506.46	1,14,14,087.00		-	54,14,36,593.46	19,50,24,893.00	1,66,06,776.00	-	21,16,31,669.00	32,98,04,924.00	33,49,97,613.00
3.Furniture & Fixtures	**25.89%**	7,42,61,217.73	69,793.00		-	7,43,31,010.73	6,44,17,781.00	25,57,504.00	-	6,69,75,285.00	73,55,726.00	98,43,437.00
4.Library Books	**18.10%**	10,33,79,857.25	6,99,233.00		-	10,40,79,090.25	8,80,61,996.00	28,87,705.00	-	9,09,49,701.00	1,31,29,389.00	1,53,17,861.00
5.Equipment												
a> Institute	**18.10%**	1,68,63,93,182.26	15,86,00,049.00		-	1,84,49,93,231.26	1,30,53,04,546.00	8,77,27,061.00	-	1,39,30,31,607.00	45,19,61,624.00	38,10,88,636.00
b> Fetal Liver project *		2,00,000.00	-		-	2,00,000.00	1,99,999.00	-	-	1,99,999.00	1.00	1.00
6.Vehicles *		13,11,895.00	-		-	13,11,895.00	13,11,894.00	-	-	13,11,894.00	1.00	1.00
Total A		**2,42,56,99,453.25**	**17,07,83,162.00**		**-**	**2,59,64,82,615.25**	**1,66,52,76,686.00**	**11,05,84,305.00**	**-**	**1,77,58,60,991.00**	**82,06,21,623.00**	**76,04,22,766.00**
Capital WIP												
A) Advance CPWD ***		1,06,63,952.00	-		1,06,63,952.00	-	-	-	-	-	-	1,06,63,952.00
B) Advance (Advance Equipment-Cryoscientific)		15,46,650.00	-	**	15,46,650.00	-	-	-	-	-	-	15,46,650.00
Total B		**1,22,10,602.00**	**-**		**1,22,10,602.00**	-	-	-	-	-	-	**1,22,10,602.00**
Total (A+B)		**2,43,79,10,055.25**	**17,07,83,162.00**		**1,22,10,602.00**	**2,59,64,82,615.25**	**1,66,52,76,686.00**	**11,05,84,305.00**	**-**	**1,77,58,60,991.00**	**82,06,21,623.00**	**77,26,33,368.00**

Note: The aforesaid expenditure is incurred out of Govt. Grants, disposal of which is subject to conditions attached to these Grants.

* As the useful lifes of Vehicle and Fetal Liver are expired, both are recorded at nominal value of Rs.1.00.

** Advance for Equipment-Cryoscientific - Settled during the F.Y.2022-2023 hense, actual expenditure is capitalised under Equipment Head.

*** Advance for CPWD is Settled during the F.Y.2022-2023 hense, actual expenditure is capitalised under Buildings Head.

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BHIDE & SHAH CHARTERED ACCOUNTANTS PUNE-30.

NATIONAL CENTRE FOR CELL SCIENCE, PUNE - 411 007.

SCHEDULES FORMING PART OF BALANCE SHEET AS ON 31.03.2023

SCHEDULE 6 - CURRENT ASSET LOAN AND ADVANCES

Amount (Rs.)

Particulars		2022-23	2021-22
CURRENT ASSET			
Cash-in-hand		50,000.00	50,000.00
SAVING ACCOUNTS			
Bank of India - 4911		10,49,27,852.37	11,58,16,248.37
Bank of India - 4912		18,51,66,630.62	32,38,62,075.58
State Bank Of India		1,04,51,096.37	1,18,76,953.46
Bank of India-SERB 8403		1,36,33,279.97	3,36,71,528.12
Bank of India - 8574		38,95,372.54	37,84,843.54
Bank of India - 8783		4,87,83,101.78	5,90,39,636.38
Bank of India - NCCS Employee Welfare A/c 0538		11,70,714.55	6,24,138.22
Bank of India -EMBO Local-9071		-	48,206.80
Bank of India- EMBO Foreign-9072		-	20,62,624.34
Bank of India-EMBO Foreign-0033		31,057.49	-
Bank of India-EMBO Local-0034		1,20,908.70	-
ICICI ZBSA- 3879		38,15,79,721.92	-
ICICI ZBSA- 3830		6,74,31,047.92	-
TOTAL (A)		**81,72,40,784.23**	**55,08,36,254.81**
LOAN AND ADVANCES			
Advance-LTC		3,08,418.00	23,998.00
Advance - Contingency		-	54,704.00
Staff Computer Advance		54,792.00	94,810.00
Deposit for Compressor for AC Plant-Phase II		38,29,000.00	38,29,000.00
Deposit for AC Plant-Phase II		57,68,307.00	57,68,307.00
Deposit to DAE-University Campus-Phase I		2,07,948.00	2,07,948.00
Equipment-Security Deposit		38,663.60	38,663.60
Gas Deposit		49,650.00	49,650.00
MSED Deposit		73,12,600.00	73,12,600.00
MSED Deposit (Kothrud)		-	2,82,200.00
Telephone Deposit		1,21,701.00	1,21,701.00
Prepaid Expenditure Postage		-	3,894.00
TDS Receivable FY 2017-18		6,20,934.00	6,20,934.00
TDS Receivable FY 2018-19		8,08,568.00	8,08,568.00
TDS & TCS Receivable FY 2020-21		1,41,569.64	1,41,569.64
TDS & TCS Receivable FY 2021-22		94,963.17	94,963.17
TDS & TCS Receivable FY 2022-23		1,85,373.46	-
Receivable		75,000.00	1,80,000.00
GST TDS Receivable		12,000.00	12,000.00
Advance - CPWD		6,75,00,000.00	-
TOTAL (B)		**8,71,29,487.87**	**1,96,45,510.44**
GRAND TOTAL		**90,43,70,272.10**	**57,04,81,765.25**

NATIONAL CENTRE FOR CELL SCIENCE, PUNE - 411 007.

SCHEDULES FORMING PART OF INCOME AND EXPENDITURE ACCOUNTS FOR THE YEAR ENDED 31.03.2023

SCHEDULE 7 - INCOME FROM SALES/SERVICE

Amount (Rs.)

Particulars	2022-23	2021-22
Cell Line Handling	99,63,276.00	92,53,861.00
LC-MS/MS Proteome Analysis (Digested Samples)	1,75,000.00	75,000.00
FACS Analysis Charges	54,000.00	87,000.00
Bio Imaging Facility	1,10,000.00	25,000.00
Cell Line Authentication	42,000.00	42,000.00
Proteomene Analysis of Chronomus Samples	-	89,224.00
Plasmon Resonance Interactive Analysis Facility	1,52,920.00	-
Income from Micro-CT	17,500.00	-
Grand Total	**1,05,14,696.00**	**95,72,085.00**

राष्ट्रीय कोशिका विज्ञान केंद्र पुना

BHIDE & SHAH CHARTERED ACCOUNTANTS PUNE-30.

NATIONAL CENTRE FOR CELL SCIENCE, PUNE - 411 007.

SCHEDULES FORMING PART OF INCOME AND EXPENDITURE ACCOUNTS FOR THE YEAR ENDED 31.03.2023

SCHEDULE 8 - GRANTS/SUBSIDIES

Amount (Rs.)

Particulars	2022-23	2021-22
GRANTS/SUBSIDIES	48,00,00,000.00	39,25,00,000.00
Less: Deduction from TSA Account [Note: A (6) (vi) Accounting Significant Policies]	71,59,833.00	13,24,673.00
Less: Refunded through Bharatkosh [Note: A (6) (v) Accounting Significant Policies]	32,99,000.00	-
Grand Total	**46,95,41,167.00**	**39,11,75,327.00**

राष्ट्रीय कोशिका विज्ञान केंद्र पुना

BHIDE & SHAH CHARTERED ACCOUNTANTS PUNE-30.

NATIONAL CENTRE FOR CELL SCIENCE, PUNE - 411 007.

SCHEDULES FORMING PART OF INCOME AND EXPENDITURE ACCOUNTS FOR THE YEAR ENDED 31.03.2023

SCHEDULE 9 - FEES/SUBSCRIPTIONS

Amount (Rs.)

Particulars	2022-23	2021-22
Tender Fees	6,360.00	3,392.00
Grand Total	**6,360.00**	**3,392.00**

राष्ट्रीय कोशिका विज्ञान केंद्र पुना

BHIDE & SHAH CHARTERED ACCOUNTANTS PUNE-30.

NATIONAL CENTRE FOR CELL SCIENCE, PUNE - 411 007.

SCHEDULES FORMING PART OF INCOME AND EXPENDITURE ACCOUNTS FOR THE YEAR ENDED 31.03.2023

SCHEDULE 10 - INTEREST EARNED

Amount (Rs.)

Particulars	2022-23	2021-22
Interest On Staff Computer Adv.	25,369.00	23,000.00
Interest On Staff HBA	9,776.00	23,472.00
Interest On Staff Vehicle	-	5,820.00
Grand Total	**35,145.00**	**52,292.00**

राष्ट्रीय कोशिका विज्ञान केंद्र पुना

BHIDE & SHAH CHARTERED ACCOUNTANTS PUNE-30.

NATIONAL CENTRE FOR CELL SCIENCE, PUNE - 411 007.

SCHEDULES FORMING PART OF INCOME AND EXPENDITURE ACCOUNTS FOR THE YEAR ENDED 31.03.2023

SCHEDULE 11 - OTHER INCOME

Amount (Rs.)

Particulars	2022-23	2021-22
Ph.D Fees	14,40,460.00	12,28,800.00
Application Fee	2,11,679.00	18,300.00
Hostel Charges	8,72,369.00	3,70,326.00
Conti (Miscellaneous Income)	224.00	7,760.00
License Fee	2,34,594.00	2,49,451.00
Usage of Premises for ATM	-	82,036.00
Receipts from Guest House	2,33,980.00	1,15,674.00
Interest on Income Tax Refund for F.Y.2019-20	-	50,828.00
Interest earned on Covid Testing Recepits A/C No.8574	1,10,529.00	1,07,995.00
Sale of Scrap	7,53,604.00	19,41,735.00
Auditorium Charges	8,000.00	24,000.00
Income from Road Show	1,80,000.00	-
Income from Day Care	1,16,294.00	-
Interest earned	34,65,005.00	-
Interest on MSEB deposit	3,33,724.40	-
Income from BCCT Workshop	88,982.00	-
Grand Total	**80,49,444.40**	**41,96,905.00**

राष्ट्रीय कोशिका विज्ञान केंद्र पुना

BHIDE & SHAH CHARTERED ACCOUNTANTS PUNE-30.

NATIONAL CENTRE FOR CELL SCIENCE, PUNE - 411 007.

SCHEDULES FORMING PART OF INCOME AND EXPENDITURE ACCOUNTS FOR THE YEAR ENDED 31.03.2023

SCHEDULE 12 - ESTABLISHMENT EXPENSES

Amount (Rs.)

Particulars	2022-23	2021-22
Salaries	22,54,79,377.00	22,61,29,805.00
Contribution to Provident Fund	1,20,90,834.00	1,28,83,224.00
Contribution to NPS	1,03,07,606.00	82,02,203.00
Grand Total	**24,78,77,817.00**	**24,72,15,232.00**

राष्ट्रीय कोशिका विज्ञान केंद्र पुना

BHIDE & SHAH CHARTERED ACCOUNTANTS PUNE-30.

NATIONAL CENTRE FOR CELL SCIENCE, PUNE - 411 007.

SCHEDULES FORMING PART OF INCOME AND EXPENDITURE ACCOUNTS FOR THE YEAR ENDED 31.03.2023

SCHEDULE 13 - OTHER ADMINISTRATIVE EXPENSES

Amount (Rs.)

Particulars	2022-23	2021-22
Consumables	8,08,49,946.29	4,62,02,915.04
Contingencies (as per attached details)	3,1[illegible],95,283.40	2,03,30,479.31
Work On Contract	4,5[illegible],52,338.00	4,05,23,222.00
Electricity and Power	3,77,09,310.01	3,66,60,055.00
Rent Rates and Taxes	1,47,15,210.00	1,16,13,581.00
PMC Water Charges	24,00,143.00	29,56,978.00
User Charges @5% trf to Staff Welfare A/c	5,43,993.00	4,86,088.00
TA-DA	25,45,053.00	4,57,026.00
Bank Charges	3,51,045.64	52,290.15
Fellowship-JGEEBILS	46,10,133.00	50,94,300.00
Professional Expenses for R & D	58,43,359.82	53,01,090.94
Grand Total	**22,59,15,815.16**	**16,96,78,025.44**

राष्ट्रीय कोशिका विज्ञान केंद्र पुना

BHIDE & SHAH CHARTERED ACCOUNTANTS PUNE-30.

SCH. "14" : SIGNIFICANT ACCOUNTING POLICIES AND NOTES ON ACCOUNTS FOR THE YEAR 2022-2023

The Accounts are generally prepared as per the common format of accounts for all Autonomus Institute as per letter No. BT/MED/NCCS/ADMN/2002 dtd.June 10,2002 of Department of Biotechnology, New De hi and comptroller & Auditor General of India letter No. OA-VII(MISC/CORRES/2002-03/1165)dtd.16 October 2002.

A. SIGNIFICANT ACCOUNTING POLICIES

1) ACCOUNTING CONVENTION :

The financial statements are prepared on the basis of historical cost convention, unless otherwise stated and on the accrual method of accounting.

2) INVENTORY VALUATION :

Inventory is valued at cost or realizable value whichever is less. At the year end value of inventary is NIL.

3) REVENUE RECOGNITION

All Revenue items are accounted for on accrual basis except Guest House/ Hostel fees/ Ph. D. Fees & bank account interest, accounted for on Receipt basis.

4) FIXED ASSETS :

Fixed assets are stated at cost of acquisition inclusive of inward freight, duties and taxes and incidental and direct expenses related to acquisition.

5) DEPRECIATION /AMORTIZATION:

i)'The effective rate of Depreciation on the basis of Useful Life of Assets prescribed against each category of asset as mentioned in Part-C, Schedule-II of Companies Act 2013. The rate of depreciation under WDV method is arrived at on the basis of formula given in the "Guidance Note on Accounting for Depreciation in Companies in the context of Schedule II to Companies Act 2013" by ICAI.
The above Rates are considered for calculation with effective from F.Y.2015-16.

Sr.No.	Group of Asset	Part 'C' 'Schedule II- Ref.No.	Rate of Depreciation
1	Building	I (a)	4.87%
2	Furniture	V (a)	25.89%
3	Library Books	IV (a) (i)	18.10%
4	Equipment	IV (a) (i)	18.10%
5	Vehicle	VI (b)	39.30%

ii) Assets costing Rs. 5000/- or less each are fully provided.
iii) Lease hold Premises are amortized over the period of lease. The annual amortization expense for a leasehold land is the cost of the leasehold land divided by the lease term, assuming straight-line amortization.

6) GOVERNMENT GRANTS/SUBSIDIES :

i) Where the Government Grants are in the nature of capital contribution, i.e., they are given with reference to the total or part investment or by way of contribution towards its total or part capital outlay, are recognized as "Contribution towards Capital Fund" under head "Corpus/Capital Fund".
ii) Grant received towards recurring expenditure are treated as income under income & expenditure account.
iii) Grants received from sponsoring agencies for sepcific Projects are recognized as "Earmarked Funds"
iv) Government grants/ subsidy's are accounted on realization basis.
v) Unspent balance for the F.Y. 2021-22 towards Capital fund of Rs. 1,70,37,000.00 and Grant-in-aid Salary of Rs. 32,99,000.00 are refunded through Bharatkosh in FY 2022-23 to Department of Biotechnology, Government of India.

vi) Deduction from Grant-in aid Salary and Corpus Capital Fund represent unspent grant in the nature of Salary and Capital is written back through Treasury Single Account to the Government of India.

7) FOREIGN CURRENCY TRANSACTION:

Transactions denominated in foreign currency are accounted at the exchange rate prevailing at the date of the transaction.

राष्ट्रीय कोशिका विज्ञान केंद्र पुना

BHIDE & SHAH CHARTERED ACCOUNTANTS PUNE-30.

8) RETIREMENT BENEFITS :

Provision for Liability towards gratuity payable on death / retirement of employees is not made due to implementation of "Treasury Single Account" because, under this system parking of funds by way of provision for Retirement Benefits is not permitted. The present fund balance represents accumulated fund upto FY 2020-21. Those will be utilized for retirement benefits settlement up to 2025-2026.

9) CURRENT ASSETS, LOANS & ADVANCES:

It is explained to us that, the value of all current assets, advances and deposits, outstancing income and other realisable assets, if any, are not less than their realisable value in the ordinary course.

10) EARMARKED/ENDOWMENT FUNDS :

i) As explained to us, Grants/Funds received from Sponsoring agencies for specific Projects are recognised as " Earmarked Funds". These Grants/Funds are credited to respective Project Funds as per the norms associated with these Projects.

ii) The amounts represent at the year end of Rs. 70,47,33,596.08 are Unspent / and Rs. (3,91,99,323.97) (Overspent) grants and receivables in respect to Projects are subject to confirmation from the granting authorities, reconciliation and consequential adjustments, if any.

iii) The Suspense account having balance amount of Rs. 6,24,647.48 represents the funds that are received directly from these Sponsoring Agencies without any prior maping towards the projects, the same will be accounted for to the concern project after getting the payment advice from the sponsoring agency.

iv) Since F.Y. 2002-2003 the agreegate accumulated cost upto F.Y. 2022-2023 of Rs.67,79,86,924.68 for aquiring fixed assets of resptective Projects.

Date: 25.07.2023
Place: Pune

FOR BHIDE & SHAH
CHARTERED ACCOUNTANTS

FIRM REG. NO. 119383W

BHIDE & SHAH * CHARTERED ACCOUNTANTS * PUNE-30.

राष्ट्रीय कोशिका विज्ञान केंद्र पुना

OFFICER 'C' ACCOUNTS
NCCS
वैभव अ. अरगडे
Vaibhav A. Argade
अधिकारी 'ग' (लेखा)
Officer 'C' (Accounts)
रा.को.वि.के./NCCS Pune-411007

DIRECTOR
NCCS
डॉ. मोहन आर. वाणी
निदेशक, एनसीसीएस. पुणे
Dr. Mohan R. Wani
Director, NCCS, Pune

(SAMIR V.BHIDE)
PARTNER
M.NO.46274

SCH. "15" : CONTINGENT LIABILITIES AND NOTES ON ACCOUNTS FOR THE YEAR 2022-2023

1) Taxation:- Inview of there being no taxable income under Income Tax Act 1961, No provision for Income Tax has been considered necessary.

Assessment Year	Status of assessment (Pending / completed/ appeal filed)	Demand outstanding (in Rs. if any)	Remark
2015-16	Income Tax Dept. has preferred appeal with ITAT against the order of CIT (A)	--	Form 36
2016-17	Assessment Complete u/s 143(3). We have filed an appeal with CIT (A) Form 35 dt. 14.01.2019	10,43,59,421.00	Appeal pending at CIT appeal level.
2017-18	Assessment Complete u/s 143(3). Against which we have filed Appeal with CIT (A). Order of the same has been passed by CIT(A) dt 03/02/2021 which has quashed entire demand raised vide order u/s 143(3). Penalty Order under section 272A(1)(d) of the Income Tax Act, 1961 has been passed by Exemption Circle Pune dt 09/12/2019 for Noncompliance to notice u/s 142(1) dated 05-03-2019	Nil*	Appeal pending at CIT appeal level, appeal will be withdrawn during the course of hearing of the appeal, since all the issues raised in the appeal have so far been resolved by way of rectification order u/s 154.
2018-19	Rectification rights with AST, Mar 18, 2020. Refund kept on hold, Intimation u/s 245 is issued proposing adjustment of refund towards outstanding demand Oct 1, 2019 Refund adjusted	--	Intimation u/s 245
2019-20	Defective Return -Processed with no demand/refund, Mar 20, 2021 is under process, only the intimation u/s 143(I) is received from Income Tax Department.	--	Intimation u/s 143(1)
2021-22	Notice u/s 143(1)(a) dated 01.07.2022 has been received proposing adjustment for non-allowance of exemption of Rs. 1,87,60,13,706/- u/s 10(21) of the IT Act, 1961	--	Intimation u/s 143(1)(a) We have filed application for rectification with Jurisdictional Assessing Officer

* CPC had raised demand of Rs. 1,42,86,178/- which is made NIL vide order dated 03.02.2021

In the above matters we are following up with Income Tax Department through our Consultant.

2) It is explained by the management that it has maintained fixed assets register and has also conducted physical verification of fixed assets, there are no discrepancies were found in the Register and Verification Report for the F.Y. 2022-2023. We verified the fixed assets register as well as fixed assets on random basis.

3) As informed to us, the land on which the NCCS complex is situated is owned by the State Government of Maharashtra. Agreement for the ground rent/ lease rent payable, if any, for the use of land is not entered into and no provision in respect of the same has been made.

4) Interest Earned on Grants Received from DBT :

i) Interest earned on Grants received towards Earmarked funds has also been credited to their respective project fund account.

Date: 25.07.2023
Place: Pune

राष्ट्रीय कोशिका विज्ञान केंद्र पुना

FOR BHIDE & SHAH
CHARTERED ACCOUNTANTS
FIRM REG. NO. 119383W

BHIDE & SHAH CHARTERED ACCOUNTANTS PUNE-30.

OFFICER 'C' ACCOUNTS
NCCS
वैभव अ. अरगडे
Vaibhav A. Argade
अधिकारी 'ग' (लेखा)
Officer 'C' (Accounts)
रा.को.वि.के./NCCS Pune-411007

DIRECTOR
NCCS
डॉ. मोहन आर. वाणी
निदेशक, एनसीसीएस, पुणे
Dr. Mohan R. Wani
Director, NCCS, Pune

(SAMIR V.BHIDE)
PARTNER
M.NO.46274

NATIONAL CENTRE FOR CELL SCIENCE, PUNE - 411 007.

SCHEDULES FORMING PART OF INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31.03.2023

CONTINGENCIES BIFURCATION

Amount (Rs.)

Particulars	2022-23
Conti-Local Conveyance	20,85,748.00
Conti-Advertisement and Publicity	7,81,345.00
Conti-Vehicle Petrol Expenses	1,20,581.00
Conti-Academic Recognition Fee	6,00,000.00
Conti-Auditors Remunerations	2,12,400.00
Conti-Fees Registration& Membership Charges	1,60,149.00
Conti-Honorarium	10,92,179.00
Conti-Hospitality Expenses	11,41,387.00
Conti-Laundry Expenses	1,45,240.00
Conti-Meeting Expenses	2,12,321.00
Conti-Membership Fees and Subscriptions	5,25,835.00
Conti-Miscellaneous Purchase	28,34,300.00
Conti-Miscellaneous Expenses	4,06,205.40
Conti-Postage and Telephone	30,52,876.00
Conti-Printing and Stationery	5,75,815.00
Conti-Professional & Legal Charges	33,37,913.00
Conti-Repairs and Maintenance	56,40,682.00
Conti-Repairs and Maintenance- Contract	68,22,406.00
Conti-Seminar / Symposia	11,05,141.00
Conti-Vehicle Insurance	26,075.00
Conti-Training / Workshop / Seminars	2,62,596.00
Conti-Day Care expenses	8,771.00
Conti-EMBO Expenses	45,318.00
Grand Total	**3,11,95,283.40**

राष्ट्रीय कोशिका विज्ञान केंद्र पुना

BHIDE & SHAH CHARTERED ACCOUNTANTS PUNE-30.