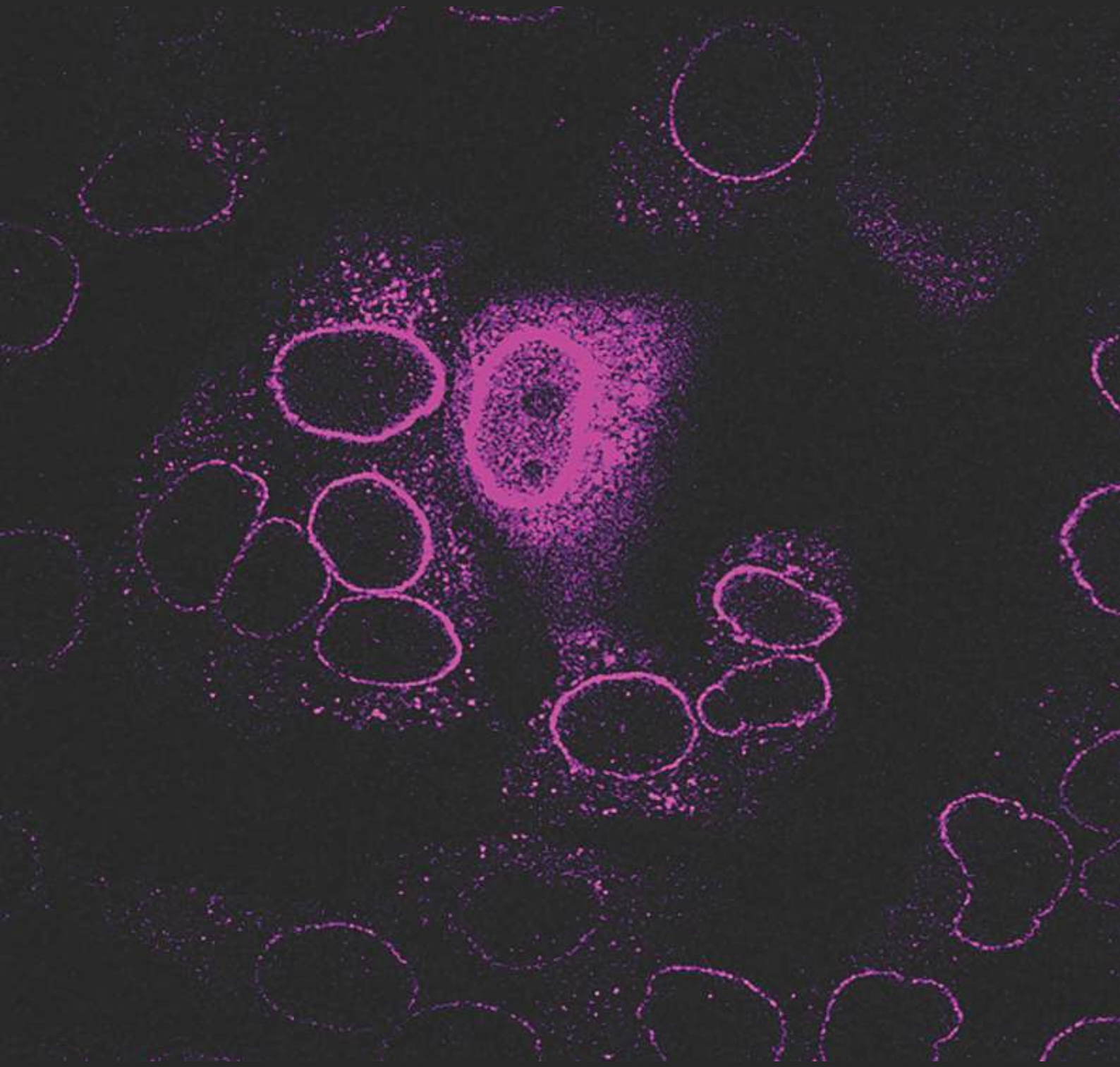
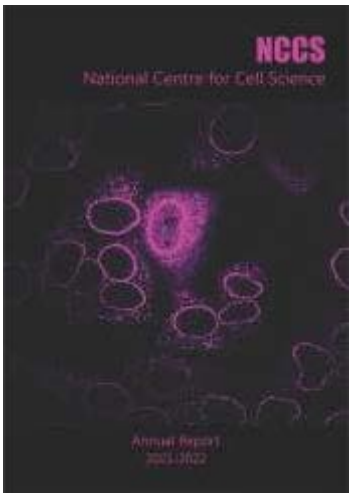
NCCS

National Centre for Cell Science



Annual Report

2021-2022



Cover page image:

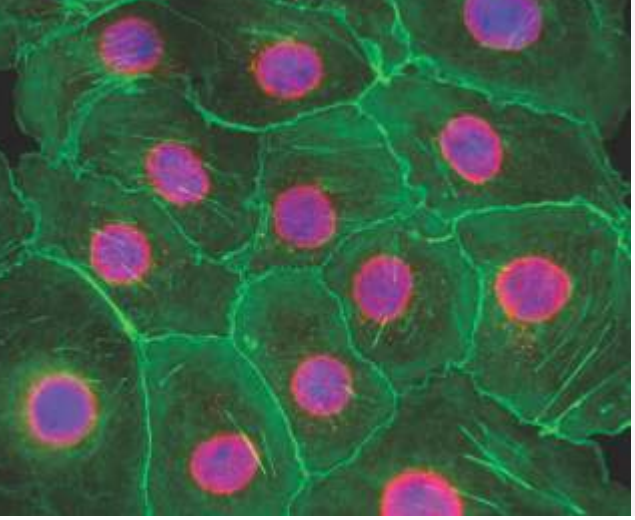
Inter-cellular transport of Ran GTPase

The image is a fluorescence confocal micrograph showing HeLa cells transfected with RanQ69L (violet) - a mutant version of Ran GTPase locked in it's GTP-bound form. The high-expressing cell (near the centre) is the transfected cell. The presence of RanQ69L in the other cells was shown to be due to it's inter-cellular transport through extracellular vesicles.

(Image courtesy: Dr. Jomon Joseph's group and the NCCS Bio-Imaging Facility team)

National Centre for Cell Science

Annual Report 2021 - 2022



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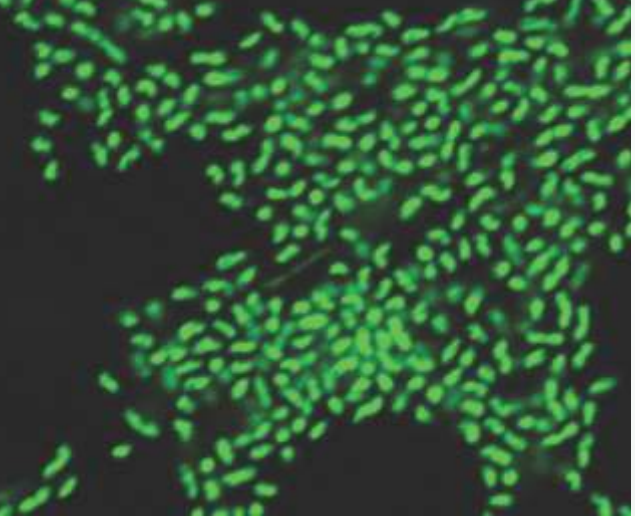


Vision, Mission and Mandate of NCCS

VISION

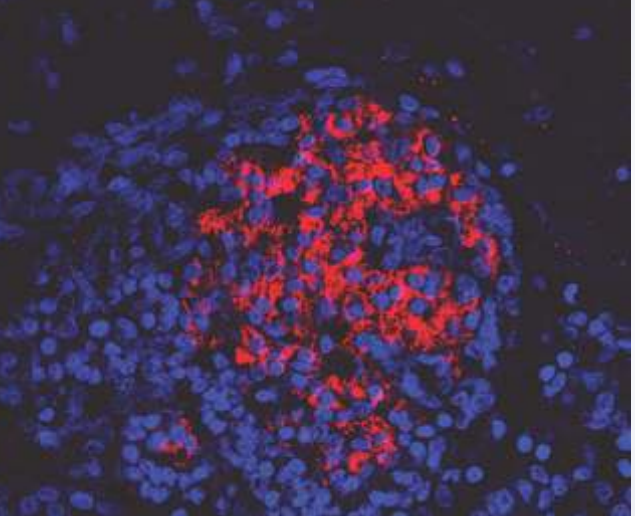
To carry out cutting-edge research in cell biology and contribute to national development through capacity-building and value-added services that facilitate cell biology research across India.

MISSION

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

MANDATE

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.



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), 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 has been 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. (biotechnology) coursework for students registered with the S. P. Pune University. The NCCS scientists also deliver lectures and provide hands-on training for students at various educational organizations. For example, 'Edu-Bridge', was initiated by NCCS as an extramural teaching programme wherein the scientists teach fundamental concepts of science through lectures & hands-on activities to students and faculty of the Jankidevi Bajaj College of Science (JBCS), Wardha. Students and faculty members from educational institutions across India also visit NCCS, which provides them the opportunity to learn about cutting-edge approaches and tools used in biology, which they may not have exposure to at their own institutions. 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.

From the Director's Desk

I am pleased to welcome you to the Annual Report of the National Centre for Cell Science (NCCS), Pune, for the year 2021-22.

Towards the end of the previous year, we were honoured when the Government of India entrusted us with the role of serving as a Central Drugs Laboratory to test COVID-19 vaccines, to meet the national demand for COVID-19 vaccines. A state-of-the-art facility was constructed on a war footing, with generous support from the PM CARES Trust Fund during 2021-22. Carrying forward our other initiatives from last year, NCCS also continued to contribute to national COVID surveillance through viral genome sequencing from clinical samples, as participants in the nationwide consortium called the Indian SARS-CoV-2 Genomics Consortium (INSACOG). Additionally, our faculty engaged in research related to different aspects of COVID-19, in collaboration with clinicians and other domain experts. In a nutshell, these investigations included studying the changes in the nasopharyngeal microbiome associated with this disease, generation of neutralizing human monoclonal antibodies against the virus, studying the antibody response upon vaccination with three doses of Covishield, and using machine learning to identify molecules with therapeutic potential.

Never has the need for science outreach come more to the forefront than during the COVID-19 pandemic. Public engagement has played an invaluable role in spreading awareness, dispelling myths and allaying fears. Our faculty reached out to a wide general audience via webinars, discussions, and articles in magazines and newspapers in Hindi, Marathi and English. Moreover, recognizing the need to understand the impact of COVID-19 on STEM researchers in India, our faculty member, Dr. Deepa Subramanyam, conducted a survey in association with Monk Prayogshala, with support from the DBT/Wellcome Trust India Alliance. This survey and its outcome were featured by Nature India in March 2022.

More about all our COVID-related initiatives is detailed in the annual report that follows.

We gradually resumed normalcy in our research, training and other activities with persistent efforts through subsequent waves of the pandemic. We successfully published more than hundred papers, had three patents granted in Europe and India, and filed eight patent applications in the US, Europe, South Korea and India, during the year under report. I am happy that we were also able to continue with our academic programmes, through which eighteen students were enrolled in the Ph.D. coursework, and fourteen summer and project trainees were imparted training. Twenty-two of our research scholars received their Ph.D. degrees as well, and an equal number of students joined us as Ph.D. students. At the end of the year under review, there were 111 registered Ph.D. students, working determinedly towards their goal, irrespective of the external circumstances.

In addition to testing our resilience, 2021-22 was also one of the saddest years that took away from us the visionary scientist to whom NCCS owes its existence. We lost our Founder Director, Dr. Ulhas Wagh, on 11th of March, 2022. NCCS took flight under his dynamic leadership more than three decades ago, and we were blessed with his gracious guidance and support ever since. He was a thorough gentleman who believed in leading with a gentle, but firm hand, and a kind heart. His wisdom has been a beacon of inspiration and hope for us over all these years. On 23rd March 2022, we also lost Prof. Sohan Modak, another inspiring scientist who played a big role in the genesis of NCCS. He made significant contributions to drafting the proposal for the National Tissue Culture Facility (NTCF) along with Dr. Wagh. NTCF subsequently led to the establishment of what is now NCCS. Our deepest condolences to their families and may the departed souls rest in peace. They will be missed by many.

This is the last annual report that I have the honour of presenting on behalf of NCCS. Subsequent to my superannuation on 31st January 2022, Dr. Arvind Sahu, Scientist G, was entrusted with the responsibility of serving as the Director In-charge. I am fully confident that the future leadership will successfully carry forward the legacy of NCCS that was born out of Dr. Wagh's vision and hard work, and which has grown and flourished under the dynamic leadership of many Directors and with the diligent efforts of the entire NCCS team.

I invite you to learn more about all our activities over the year 2021-22, which are covered in the annual report that follows.

Manoj Kumar Bhat
Director, NCCS

Obituary

Dr. Ulhas V. Wagh

A visionary scientist who was driven by the strong conviction that science should benefit the common man

Dr. Ulhas V. Wagh, Founder Director of the National Centre for Cell Science (NCCS), established India's first and unique national animal cell repository to cater to the needs of cell biologists in India. He was instrumental in introducing the concept of human tissue/organ bank way back in the mid-1980s. He developed the technology for long-term organ culture of the human cornea, skin and heart valve. It was his vision to facilitate cell biology research across the country by providing cell cultures at affordable costs, as well as the training required for handling cell cultures.

Dr. Wagh took a step towards realizing his vision when he initiated a project called the 'National Tissue Culture Facility' (NTCF) within the Department of Zoology, University of Pune in 1986. Subsequently, NTCF was registered as a Society under the name, 'National Facility for Animal Tissue and Cell Culture' (NFATCC) in 1988, which formally marked the inception of what is now called NCCS. NCCS was recognized as an autonomous institution of the Department of Biotechnology (DBT), Govt. of India, soon after.

Dr. Wagh established NFATCC with a mandate of three main functions:

i) To serve as a National Cell Repository,
ii) To conduct research in cell biology
iii) Human Resource Development.

As a consequence of Dr. Wagh's tireless and diligent efforts, NFATCC was able to begin a new chapter in August 1992, when the late Shri P. R. Kumaramangalam, the then Minister for Science & Technology, laid the foundation stone for a new laboratory building within the campus of the University of Pune. NFATCC, was later renamed as the 'National Centre for Cell Science' (NCCS) in 1996.

Himself a cytogeneticist by training, Dr. Wagh led NCCS to be the first institute to initiate stem cells-based research in India. His dynamic leadership as Director of NCCS extended over 7 years from 1988 to 1995. Prior to establishing NCCS, he was a senior scientist at NIV.

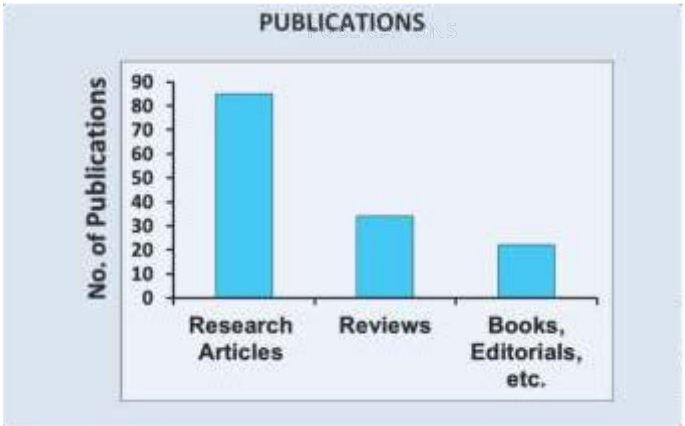
Building on Dr. Wagh's belief that science should serve the common man, the research at NCCS has been largely focused on addressing paramount human health issues like cancer, diabetes, infectious diseases and regenerative medicine. Under his leadership, some medically useful technologies like bone marrow cryopreservation, and large-scale expansion of human skin culture for the treatment of burns, vitiligo and non-healing ulcers, were transferred free of cost to Government hospitals in Pune, Mumbai & New Delhi, as a service to the nation. They were also provided with the necessary high-end equipment as well as training to help them appropriately utilize the transferred technology.

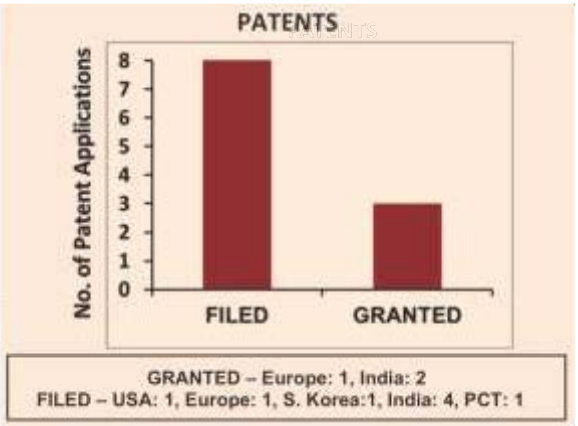
Even after his retirement from the position of Director, NCCS, Dr. Wagh was very active and continued to provide his guidance and support to help NCCS grow and flourish. Subsequent to his superannuation from NCCS, he also served as the first Director of the Interactive Research School for Health Affairs (IRSHA) at Bharati Vidyapeeth, Pune.

Dr. Wagh's will be sorely missed by all who benefited from his wisdom, kindness and guidance.

Manoj Kumar Bhat
Director, NCCS

MAJOR HIGHLIGHTS (2021-22)





REPRESENTATIVE PUBLICATIONS

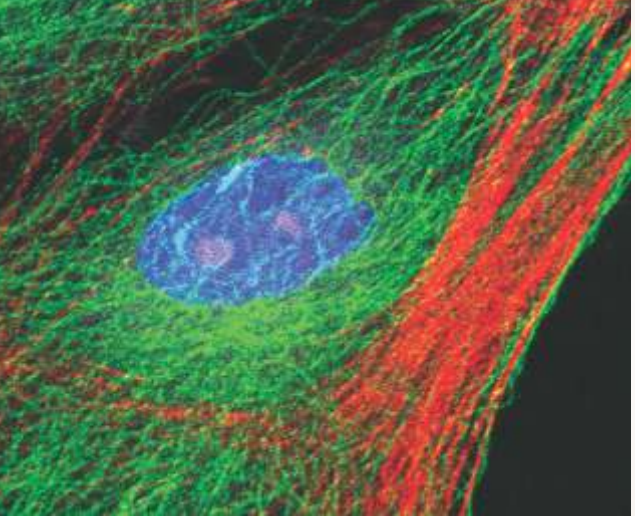
CONTRIBUTING TO THE NATIONAL EFFORTS AGAINST COVID-19

A Vaccine Testing Facility (VTF) was constructed at NCCS during 2021-22 to facilitate the Government's efforts to meet the national demand for COVID-19 vaccines.

Prof. Rajesh Gokhale, Secretary, Department of Biotechnology, and Vaidya Rajesh Kotecha, Secretary, Ministry of Ayush, visited the facility and interacted with the VTF team.

BENEFICIARIES OF THE ACADEMIC PROGRAMMES (2021-22)

Students awarded with a Ph.D. degree	22
Indian Science Academies' Summer Research Fellows & Project Trainees	14
Students enrolled in the S.P. Pune University Biotechnology PhD coursework at NCCS	18



Human Resource Development

The beneficiaries of the NCCS academic programmes during the year 2021-22 are as follows:

22 Research Fellows joined NCCS, and 18 research scholars registered for a Ph.D. with the University during this year, taking the total number of registered Ph.D. students to 111, as on 31st March, 2022.

25 students submitted their theses to the University for evaluation, and 22 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.

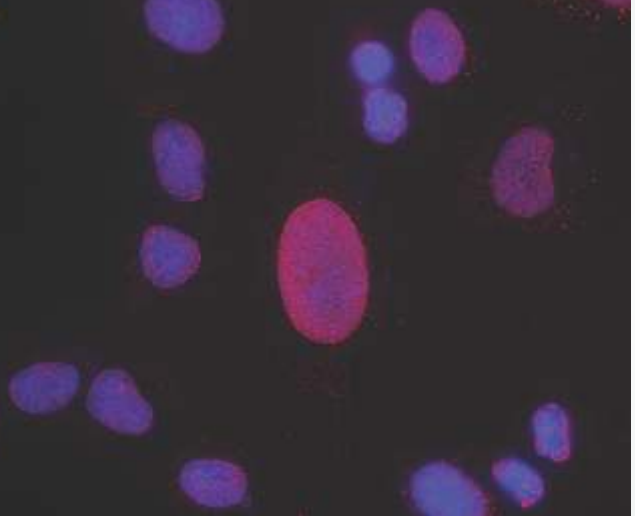
b) Summer training is conducted for 2 months during May-June. The summer trainees are selected from among the Indian Academy of Sciences Summer Research Fellows of the respective year.

The number of students who received training under these programmes during 2021-22 is as follows:

Project Trainees: 9

Summer Trainees: 5

Additionally, NCCS conducts the Ph.D. coursework on behalf of the S. P. Pune University, for students from NCCS and other research organizations who are registered with the Department of Biotechnology for a Ph.D. 18 students received training at NCCS during the 2021 coursework.



Cell Repository

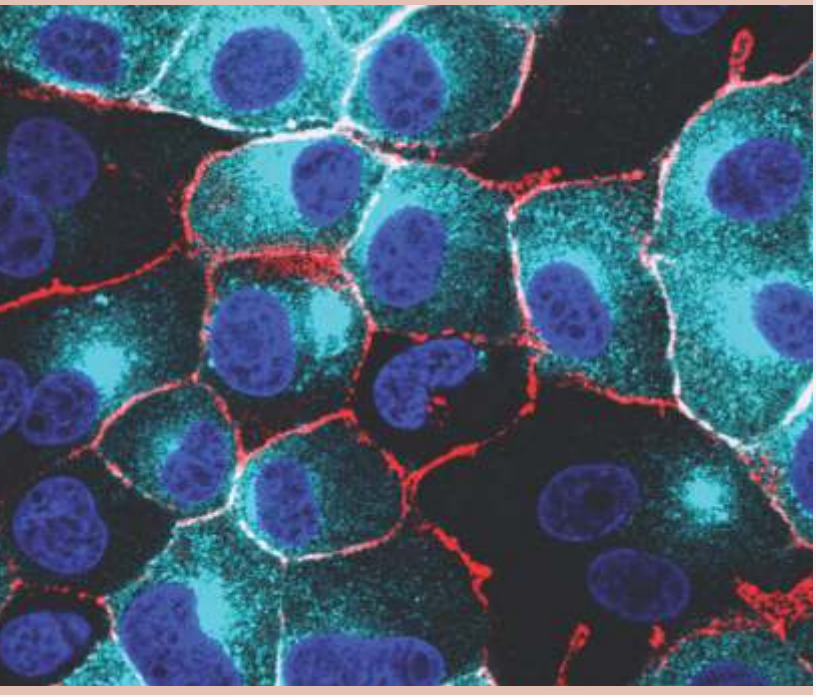
The Team

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

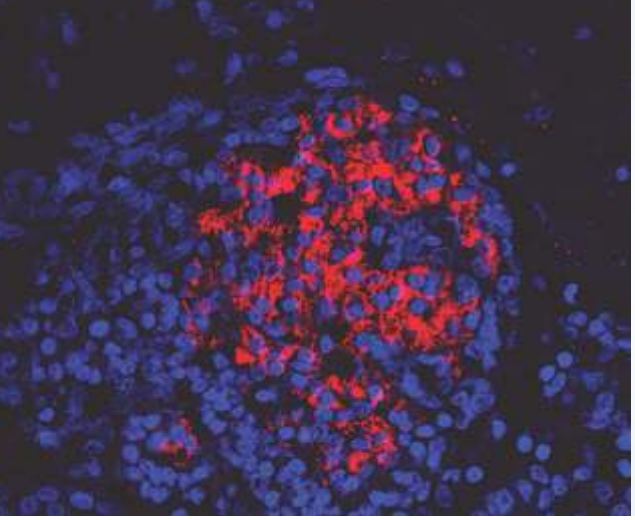
NCCS has been functioning as a National Cell Repository for cell lines in India, wherein we conduct the expansion, cryopreservation and distribution of cell lines to researchers in academia and government as well as private research institutions and industry in the country. In the year 2021-22, four thousand and twenty-six cell cultures have been provided to 2131 users in the country across five hundred thirty organizations. We have supplied cell cultures on a priority to researchers for facilitating COVID-related research. In addition, we have also provided one hundred and twenty cell cultures (including NCI cell lines) to scientists in NCCS. Moreover, we give various types of cell culture media to in-house scientists and have supplied 365 litres in the reporting year.

Efforts have been undertaken to encourage scientists from NCCS and other organizations to deposit their indigenously developed or modified cell lines in Cell Repository. We have facilitated in providing cell line developed by NCCS and licensed to Applied Biological Materials (ABM), Inc., Canada. Additionally, 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. Hands-on training in cell culture techniques was also provided to faculty members from 1-4 March 2022.

The repository team also participated in outreach programs such as the India International Science Festival (IISF 2021) from December 10-13, 2021 at Panaji, Vigyan Sarvatra Pujyate from February 22-28, 2022 at New Delhi, DST STUTI Popular Science Event for School Students on February 23, 2022 and Open day for D.Y. Patil students from March 28-29, 2022. Through all these events, visitors were familiarized with the importance and usage of cell lines in research, and the services provided by the cell repository.



Research Reports



Index of Research Reports

Dr. Sharmila Bapat

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Identification of cryptic neoepitopes generated by chimeric transcripts in ovarian cancer

Objectives of the study

- Determination of the coding potential of chimeric transcripts identified in ovarian cancer RNA-sequencing datasets.
- Prediction of possible antigenecity of the novel proteins and /or peptides generated by these Cts.

Summary

Background

Genomic sequencing followed by evaluation of immunogenicity is a recognized neoantigen prediction approach towards personalized cancer therapy, especially in tumors with a high mutation burden. An underlying assumption is that while most intragenic mutations would not alter gene expression and translation capabilities, they generate a tumor-specific protein modified, which could harbour a neoepitope capable of evoking host immunity. Chimeric transcripts on the other hand, being considered a fall-out of aberrant transcriptional and/or splicing machinery in a cell, often may not be translated and have not been evaluated as a source of neoantigens. We had earlier mined chimeric transcripts (CTs; defined as RNA sequences which contains the nucleotide sequences derived from two distinct parental genes) within the TCGA ovarian cancer RNA-seq data through development of a customized cloud based analytical pipeline. Further, we identified that several of these CTs have protein coding capabilities that suggests the generation of tumor-associated novel proteins. In this study, we hypothesized that chimeric transcripts identified in the TCGA ovarian cancer RNA sequencing datasets may be translated to generate novel chimeric, tumor-specific peptides, and a few of these presented as neoepitopes to CD8+ cells.

Lab members

Madhuri More, SRF
Pavan Kumar Mysuru Shivalingappa, SRF
Divya Kumari Singh, SRF
Ankita More, SRF
Amruta Jadhav, JRF
Aravindan Narayanan, JRF
Bhagyashree Karmarkar, JRF
Shreya Junnarkar, Project JRF
Vaishnavi Dixit, Project Assistant
Avinash Mali, Technical Officer A

Academic Collaborator - International

Prof. David Fenyo, NYULangone, NY, USA

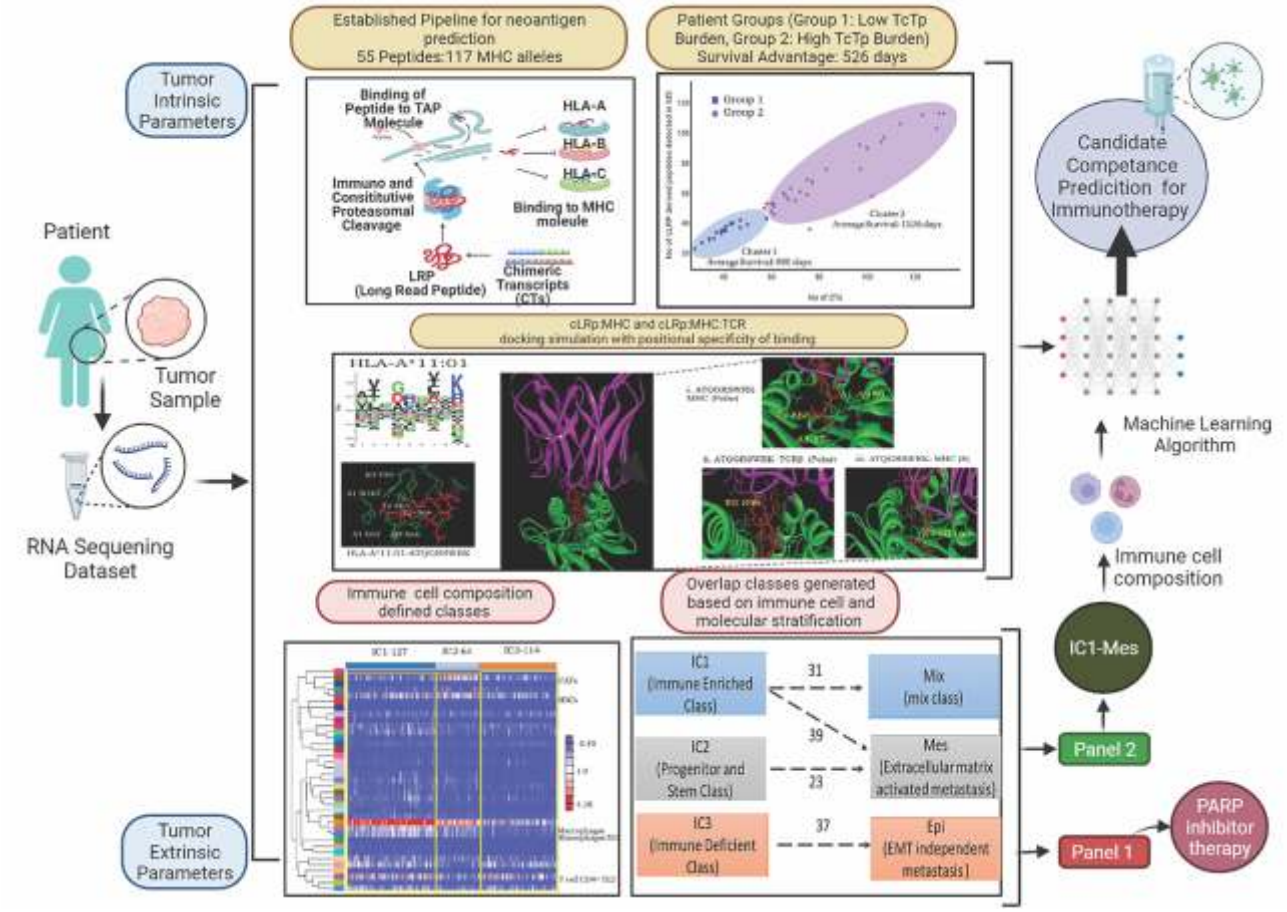

Fig. legend: Neoantigen prediction in ovarian cancer resulting in the identification of several putative neoantigens and validated through molecular docking

Main findings & Significance

Our proteogenomics approach yielded several novel, tumor-specific peptides in mass spectrometry datasets of ovarian tumors. This identification of peptides derived from chimeric reads using a customized database was an essential prelude in our antigenicity prediction, and assigned protein-coding potential to around a fifth of the chimeras produced, a large majority of which were tumor-specific. While we began with the premise of screening only the chimeric peptides with residues of both partners, a realization was that chimera generation may also mediate frame-shift of either / both parental partners besides using of the anti-sense strand, to generate additional neoantigens. These peptides were further assessed for potential antigenicity via prediction of proteasome/ immunoproteasome processing, ferrying of degradation products to the endoplasmic reticulum by the transporter associated with antigen processing (TAP), recognition, binding to major histocompatibility complex class I (MHC-I) molecules for presentation and recognition by specific CD8+ T-cell receptors (TCRs) that would mark the tumor cell for destruction. The salient features of this identification include -

1. Translation of chimeric transcripts (CTs) in ovarian cancer generates tumor-specific (TS) peptides.
2. Tumor associated Chimeric Transcript-Protein (TcTP) burden may define MHC-I allele restriction by cLRPs and patient prognosis in a personalized manner.
3. Positional amino acid binding preferences in cLRP-derived epitope-MHC complexes exhibit homology with binding pocket preferences of reference peptide: MHC structures
4. Antigenic epitopes present a low Agretopicity Index over corresponding sequence reading-frame / strand isoforms.
5. cLR-p: MHC: TCR complex stabilization involves dynamic interactions similar to reference structures.
6. Similar assessment of earlier reported immunizing mutated neoantigens affirms prediction analyses.

Our assessment of the frequency of chimeric transcripts and peptides vis-a-vis a Chimeric Transcript-Protein (TcTP) burden indicated influences on overall patient survival in a personalized manner through MHC-I allele-specific restriction by some

peptides. Modelling the latter at a molecular level revealed the complex dynamics of peptide recognition and presentation, which is challenging since a few thousand human MHC-I alleles are known, and individuals can express as many as six distinct alleles, each with different epitope affinities. We hope that since our predictions were monoallelic, validation may widen the horizons of neoantigenicity to enhance the repertoire of peptide recognition. Further, the specificity in recognition assigned through our modelling of the TCR interactions shifts the focus to peptide-TCR interactions as a definitive complementation to MHC-I based predictions and thereby strengthens the neoepitope prediction pipeline. Considered broadly, our findings including studying the conformation and dynamics of peptide-MHC-TCR interactions to qualify a bona fide neoepitope from chimeric transcript-derived peptides also contribute to understanding why only some of the several predicted neoantigens are likely to elicit immunogenicity; this will be useful in developing novel, immunogenicity based personalized therapies. A further study towards derivation of full-length chimeric transcripts and mass-spectrometry based identification of their translation products to explore for neoantigenecity would widen the horizons of the present study.

Dr. Manoj Kumar Bhat

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Influence of Obesity-Associated Factor (Cholesterol) on Tumor Initiation, Progression, and Cancer Cell Proliferation

Lab members

Mr. Shyamananda Singh Mayengbam, SRF (submitted thesis in December 2021)
Ms. Ankita Deb, SRF (submitted thesis in February 2022)
Mr. Abhijeet Singh, SRF
Mrs. Bhavana Deshmukh, SRF
Ms. Himanshi, SRF
Mr. Firoz Khan Bhati, SRF
Dr. Varsha Shepal, Technical officer B

Collaborator(s) - National

Dr. Bipin G. Nair, and Dr. Sudarslal S. Nair, Amrita School of Biotechnology, Amrita Vishwa Vidyapeetham, Kollam, Kerala
Dr. Mahesh J. Kulkarni, National Chemical Laboratory, NCL, Pune
Dr. Mohan R. Wani, National Centre for Cell Science, NCCS, Pune
Dr. Gyan Chandra Mishra, National Centre for Cell Science, NCCS, Pune
Dr. Vasudevan Sheshadri, National Centre for Cell Science, NCCS, Pune

Collaborator(s) - Industry

Dr. Ankur Kumar Upadhyay, Basic Ayurveda, Ghaziabad, India

Objectives of the study

- Understanding the role of cholesterol in colon cancer initiation, tumor progression, and cell proliferation.
- To study the role of cholesterol (LDLc & HDLc) in regulating the cellular glucose and lipid metabolism of colon cancer cells.

Summary

Background

The rapid increase in the incidences of obesity has become a matter of grave concern. The burden of obesity is multifactorial and extends to various organs, leading to dyslipidaemia, insulin resistance, diabetes, arterial hypertension, and increased incidences of multiple cancers. Our lab, over the last decade has been extensively investigating the area of obesity and role of its associated factors i.e., adipokines, glucose and cholesterol in cancer. We have delineated the role of adipokines- leptin, resistin and tumor necrosis factor-α in cancer (Pandey et.al. 2012, Malvi et.al., 2015, Singh et.al. 2020), its effect on chemotherapy and the significance of targeting these adipokines towards cancer progression and chemotherapeutic outcome (Singh et.al., 2017, Malvi et.al., 2016, Malvi et. al., 2018). In the current study, we have examined the significance of an obesity-associated component i.e., cholesterol in the tumorigenesis and metabolic reprogramming of colon cancer.

With the increasing population of overweight & obesity globally, there is a surge in the percentage of individuals with dyslipidemia, i.e., increased level of total blood cholesterol, circulatory low-density lipoprotein cholesterol (LDLc), triglycerides, and a decrease in high-density lipoprotein cholesterol (HDLc).

Obesity is an established risk factor for different cancer, including the colon, with a relative risk of approx. 1.5 to 2.0 in men and 1.2 to 1.5 in women. Earlier studies from our group have also demonstrated the effect of obesity in promoting colon cancer initiation and melanoma progression through animal studies. However, the mechanism by which obesity-associated factors influence cancer risk and tumorigenesis is not clearly understood. It is likely that cholesterol could contribute significantly to increasing cancer risk, promoting cancer cell proliferation, and worsening prognosis in obesity-associated cancers.

Clinical and preclinical studies have shown a possible link between high cholesterol diet and hypercholesterolemia in different cancers, including colon cancer. Abnormalities in the blood cholesterol levels, i.e., either increase or decrease in cancer patients, is a very common phenomenon compared to healthy individuals. Numerous groups have reported a decrease in colon cancer patient's blood cholesterol levels, which is inversely correlated with a higher grade of polyps/tumors. Preclinical studies in breast and colon cancer have also reported that cholesterol regulates signaling pathways through AKT or ERK phosphorylation. It has also been shown that cholesterol can directly acts as a mitogen for intestinal stem cells (ISC) and promotes the proliferation of progenitor cells or intestinal crypt. Collectively all these studies suggest a crucial role of cholesterol in cancer cell proliferation and tumorigenesis.

In addition, an aberration in lipid metabolism leading to rapid cholesterol uptake and biosynthesis is often reported to support rapid cell proliferation in the majority of cancers. The biological function of cholesterol in normal cells is diverse, starting from the biosynthesis of vitamins & hormones to structural components of the cell membrane. In addition to these essential functions, earlier findings have reported a correlation between HDLc and glucose metabolism in normal adipocytes (3T3-L1) and skeletal muscle cells. Moreover, it is also reported that in hypercholesterolemic patients, elevated LDLc is often correlated with an increased risk of diabetes mellitus. A recent study by Broadfield LA et al., 2021, have shown that fat can alter glucose metabolism of non-transformed normal hepatocytes cells. All these studies indicate a substantial correlation of lipid/fat components (i.e., LDLc or HDLc) with the regulation of glucose metabolism in normal cells. However, in cancer cells, reprograming glucose metabolism is a prominent feature for sustained rapid cell division. Cancer cells metabolize available glucose primarily through aerobic glycolysis. Additionally, an increase in glycolysis is also considered as a marker of aggressive cancer.

Based on the available literature, we hypothesized that cholesterol might directly or indirectly regulate colon cancer cell proliferation, tumor initiation, and progression through different mechanisms. One major factor could be the alteration in cellular metabolism.

Main findings & Significance

In our study, we explored the role of an obesity-associated factor i.e., cholesterol, in the tumorigenesis of the colon and the significance of cholesterol in the metabolic reprogramming of cancer cells. By utilizing *in vitro and in vivo models*, we have delineated the role of cholesterol in supporting colon cancer initiation and progression. This study also deciphers a mechanism by which LDLc or HDLc facilitates rapid cell proliferation by altering glucose and lipid metabolism. We reported that extracellular LDLc or HDLc increases the ATP-generating capacity of colon cancer cells through upregulation of the aerobic glycolytic process, with a concomitant decrease in OXPHOS (mitochondrial respiration) mediated ATP production. Overall, this study opens avenues for investigating the interrelationship between high blood cholesterol levels with the etiology of various cancers and its implication in therapy.

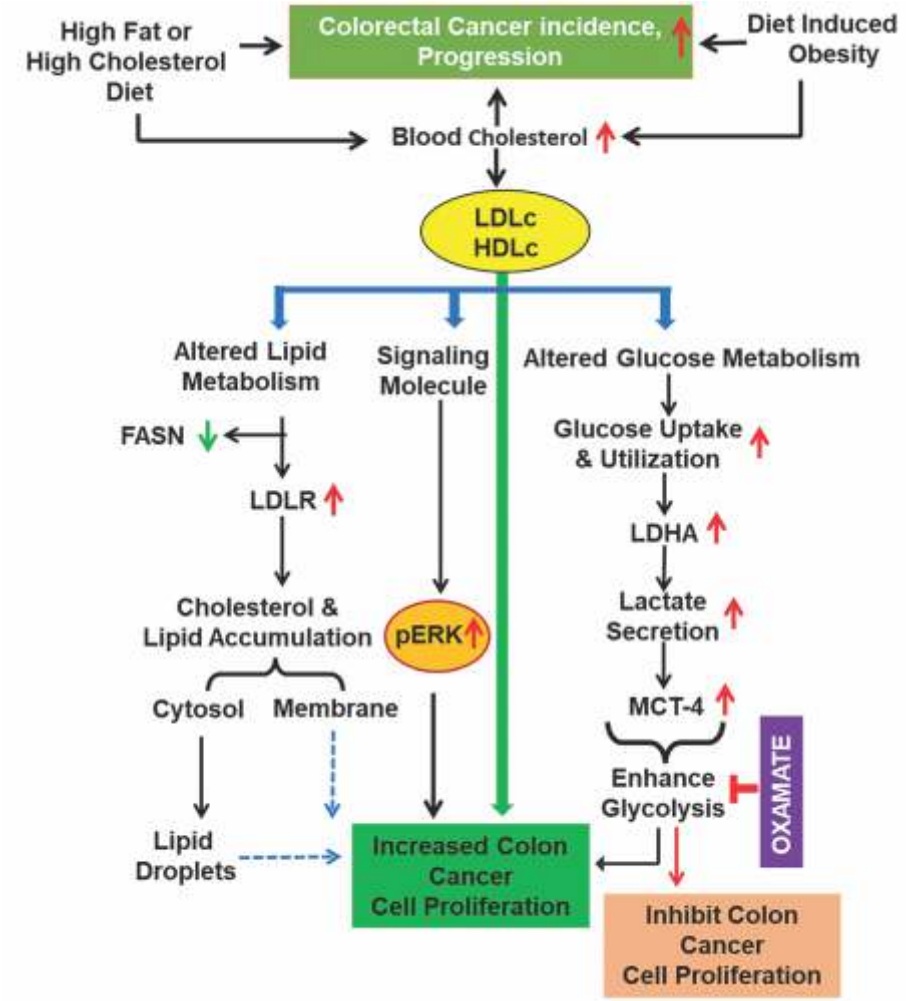

Fig. legend: Our study shows that hypercholesterolemia due to a high cholesterol diet or obesity can influence and promote colon cancer occurrence & tumor progression. Colon cancer cells can directly utilize the available cholesterol, i.e., LDLc and HDLc, to support cancer cell proliferation. With the increase in the availability of extracellular cholesterol, colon cancer cells upregulate their cellular lipid and glucose metabolism. The presence of cholesterol helps colon cancer cells become more aggressive to sustain rapid cell proliferation by shifting the energy source from oxidative phosphorylation/ mitochondrial respiration towards a more glycolytic phenotype (aerobic glycolysis) for rapid ATP production. Understanding this unique property of cancer cells in tuning the cellular metabolism upon cholesterol availability may be relevant in targeting various cancers associated with obesity and hypercholesterolemia.

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Dynamics and Diversity in B Cell Responses Upon Infection and Vaccination

Objectives of the study

- Understanding the diversity and dynamics in B cell response upon infection and vaccination.
- Generation of human monoclonal antibodies against the SARS-CoV2.

Summary

Background including the need for & importance of the research

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.

Main findings & Significance

Over the last two year our focus has shifted to the SARS-CoV2 as the pandemic has been the huge health and economic burdon across the globe. My laboratory is trying to identify the specific BCR clones that are crucial in fighting

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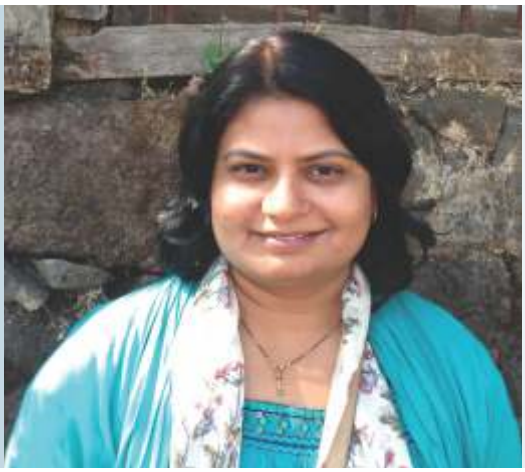
SARS-CoV2 infection. During our efforts to understand the antibody response in COVID-19 patients, we have generated human monoclonal antibodies against Spike protein many of which are able to neutralize the SARS-CoV2 both Wuhan and Delta strain. A few such clones have been transferred to Bharat Biotech for further development. We have also generated and characterized clones against Nucleocapsid, another highly immunogenic protein of SARS-CoV2. 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.

Additionally, in collaboration with AFMC we have looked at the durability of SARS-CoV2 specific antibody responses upon Covishield vaccination in COVID-19 naive and experienced individuals. We find that the SARS-CoV2 specific antibodies wane between 4 to 6 months of second dose of Covishield in both COVID-19 naive and experienced individuals. 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. This study is useful in tracking the durability and the nature of the antibody responses against variants of concerns in vaccine recipients.



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Structural and Functional Studies on Components of the Nuclear Pore Complex

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.

Summary

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.

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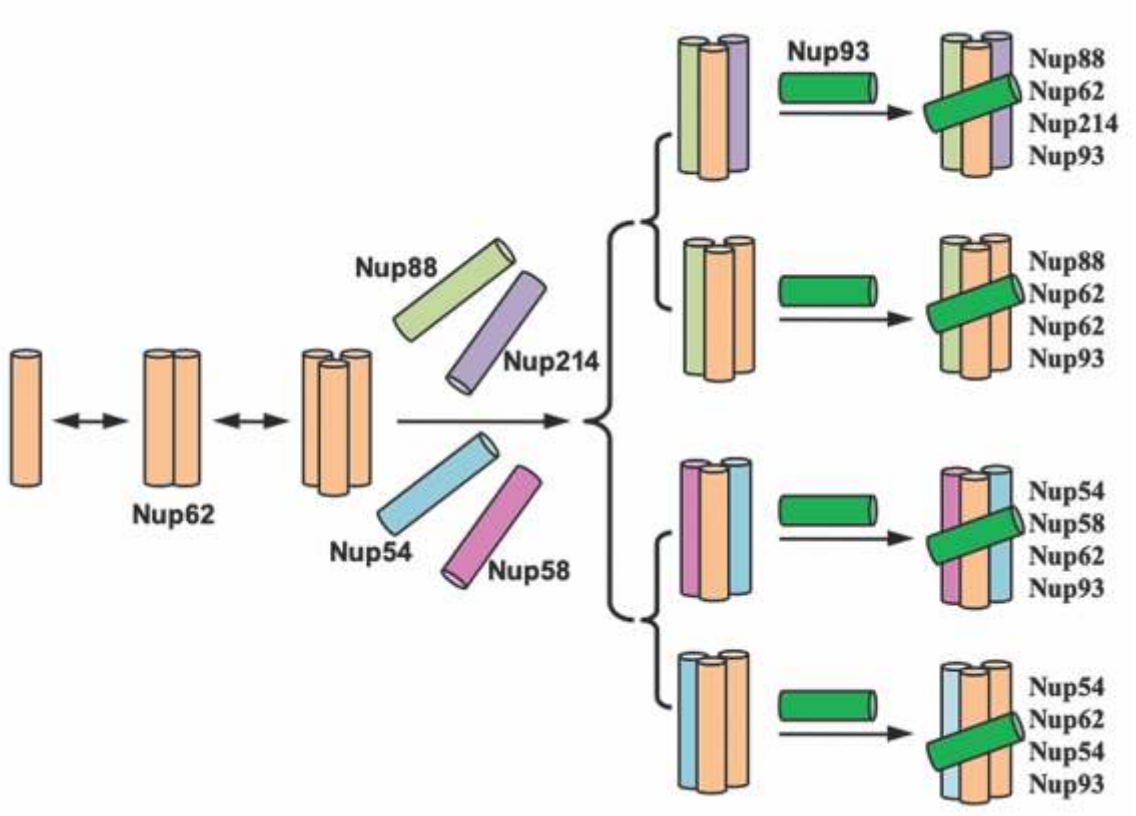

Fig. legend: Role of Nup62 and Nup93 as hub proteins in the mammalian NPC.
The cartoon representation of coiled-coil domain of Nup62 as (orange), Nup88 (green), Nup214 (purple), Nup54 (cyan) and Nup58 (pink) cylinders. The plasticity exhibited by the Nup62 coiled-coil domain allows it to interact with other Nups and form various heterotrimers such as Nup88•Nup62, Nup88•Nup62•Nup214, Nup62•Nup54 and Nup62•Nup54•Nup58. Such heterotrimers are further recognized by the N-terminal helix of Nup93 (blue) to form distinct quaternary complexes

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 (Figure 1).

Significance: Altogether, our study establishes that the Nup62 is a hub protein and its coiled-coil domain is central to form compositionally distinct yet structurally similar heterotrimers, and the Nup93 anchors these diverse heterotrimers by recognizing them non-selectively, which may play a role in regulating the nucleocytoplasmic transport.

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Neurobiology of Nutrient-Specific Memories and Feeding Behaviour in Drosophila

Objectives of the study

- To study food memories and how they influence food choices.
- To investigate how high-fat or high-sugar diets affect the brain and influence feeding behaviour.
- Neural circuits underlying emesis in flies.

Summary

Memories of past feeding experiences are critical in making food choices. Such memories can guide choice towards a particular food source that redresses current nutrient deficiencies. Our ability to study these memory phenomenons depend on our ability to quantify learned behaviours. Fruit flies are powerful genetic model organisms for studying brain function. Remarkably, they share most of the genes and molecular pathways that are required for proper brain development and function. Flies also exhibit robust behaviours that can be measured in behavioural assays. Hence flies have been used in learning and memory research for almost 50 years. We have developed an improved setup to assay food and odour relevant memories in flies. This assay allows us to measure memory at time -points where it was not possible with earlier assays. Hence it opens up the possibility to study novel memory phenomenons.

High-fat or high-sugar diets now tend to occupy a significant part of our dietary space and this has profound implications for our health and well being. Studies suggest that such diets may bias the brain to shift our food preference to more of the same. To test such phenomenon, robust feeding measurement is needed. In flies, most assay to quantify feeding are either indirect or with liquid food. We have developed an assay to directly measure solid food consumption

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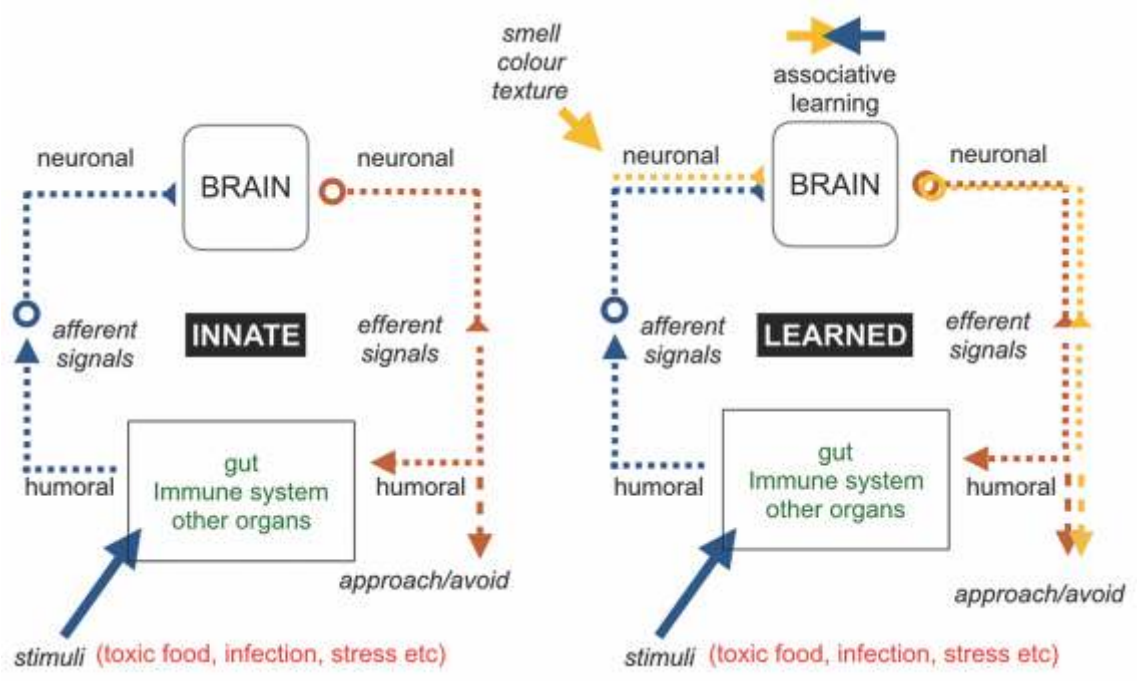

Fig. legend: We study brain-body communication using behaviour paradigms

in flies over extended period of time. We are now using this to assess how various signaling molecules in the brain is affected by different diets.

Emesis or vomiting occurs as a common response to ingesting toxin, illness, motion sickness, pregnancy amongst other triggers. Chemotherapy induced emesis is a major adverse event for cancer patients. We observed that flies show emesis upon ingestion of toxins. Since rodents do not show emesis and most emesis research is conducted on small mammals and primates, we are the first to establish flies as a genetic model system for understanding the neural and genetic basis of emesis. We have shown that common neurotransmitter signaling pathways underlie emesis in both flies and mammals.

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Human Microbiome Initiative of Select Endogamous populations of India

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 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.

Summary

Background

Indian population is a unique conglomeration of genetically and ethnically diverse groups having varied dietary habits and residing in vast biogeographic locations. There are growing evidences to support occurrence of distinct microbiota based on biogeographic location of the populations. Considering the geographic, ethnic and dietary diversity of Indian population, it is a perfect model to study association of 'Genetics, biogeography and diet with Microbiome'. Human Microbiome Initiative of Select Endogamous populations of India aims to characterize gut microbiota of 3400 subjects from 17 selected endogamous populations. Gut Microbiota will be correlated with diet, geographical, age, lifestyle and ayurvedic prakriti.

Main findings & Significance

In total, 2640 first time-point and 719 second time-point stool samples have been collected and Ayurvedic prakriti assessment of 910 subjects has been completed. Currently, 292 samples are in overlap with GenomeIndia.

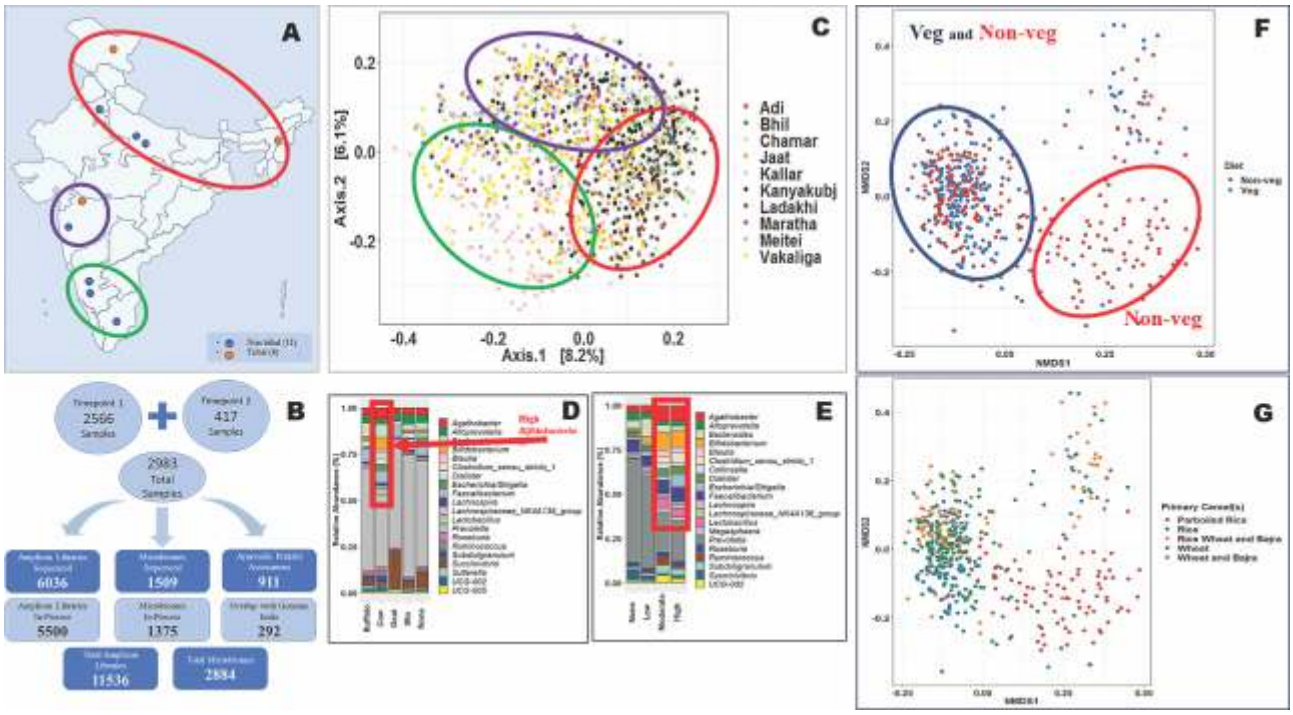

Fig. legend: A: India map showing location of the sampled communities across the country. Tribal and non communities are highlighted with different colors. From each community 200 samples were collected. B: Total number of samples collected at two timepoints are shown. Numbers showing overlap with Genome India project for genome sequencing and Ayurvedic prakriti assessment are shown. The total number of microbiome sequenced and those which are under process are also shown. C: Bray Curtis metrics based NMDS plot for Gut Bacterial Beta Diversity of 10 communities. D: Influence of Milk on Gut Microbiome Composition at genus level. High amount of Bifibacteria are observed in communities consuming cow milk. E: Influence of Fermented foods on Gut Microbiome Composition at genus level. F: Bray-NMDS plot for vegetarian and non-vegetarian diet Influence on Gut Microbiome Composition. G: Influence of Primary Cereals on Gut Microbiome Composition. Wheat and Parboiled rice eating individuals show distinct microbiome composition. Mixed intake of secondary cereals correlates with higher diversity.

Based on the preliminary microbiome data analysis, it seems that diet has greater influence on microbiome as compared to geography and other confounding facors. Ethiniciy has been observed to have a major influence on diet and in turn on microbiome. Bacterial, fungal and micro eukaryotic microbiome has shown to be influenced by dairy products, primary cereals, feremented foods and overall dietary variation.

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RanGTPase links nucleo-cytoplasmic transport to the recruitment of cargoes into small extracellular vesicles

Objectives of the study

- To determine the mechanism of intercellular transport of RanGTPase.
- To determine the role of RanGTPase in intercellular communication.

Summary

Small extracellular vesicle (sEV) mediated intercellular communication regulates multiple aspects of growth and development in multicellular organisms. However, the mechanism underlying cargo recruitment into sEVs is currently unclear. We show that the key nucleo-cytoplasmic transport (NCT) protein - RanGTPase, in its GTP bound form (RanGTP), is enriched in sEVs secreted by mammalian cells. This recruitment of RanGTP into sEVs depends on the export receptor CRM1. The recruitment of GAPDH, a candidate cargo protein, into sEVs is regulated by the RanGTP-CRM1axis in a nuclear export signal (NES)-dependent manner. Perturbation of NCT through overexpression or depletion of nuclear transport components affected the recruitment of Ran, CRM1 and GAPDH into sEVs. Our studies thus suggest a link between NCT, particularly the Ran-CRM1 axis, and recruitment of NES containing cargo into the sEVs. Collectively, these findings implicate RanGTPase as a link between NCT and sEV mediated inter-cellular communication.

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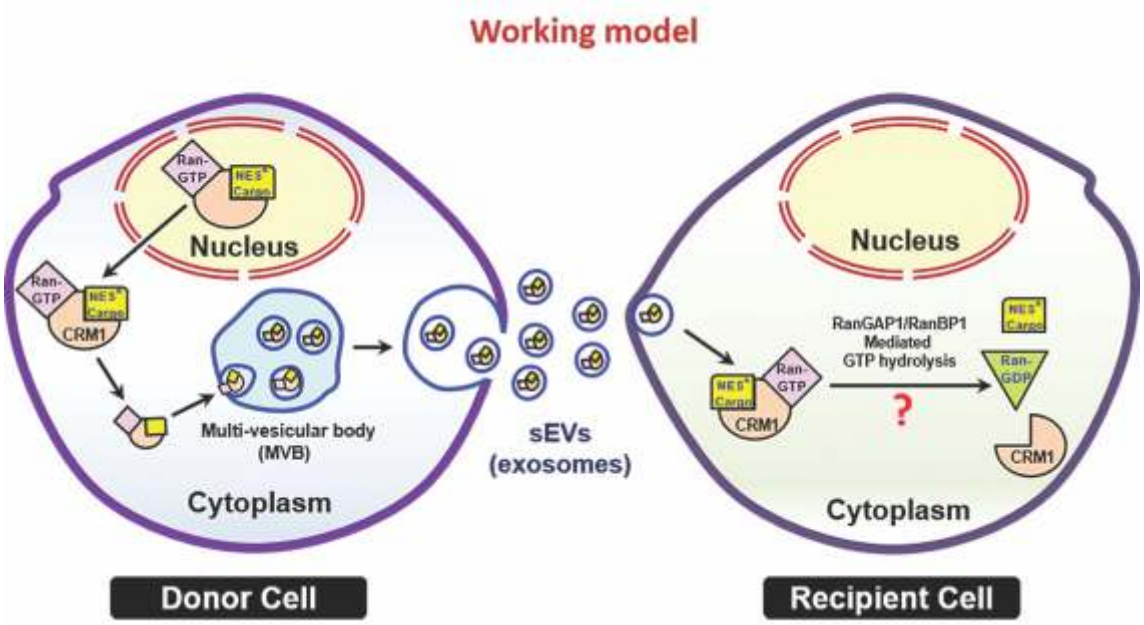

Fig. legend: Working model for Ran-CRM1 mediated recruitment of cargoes into sEVs.

Some of the RanGTP-CRM1-NES*Cargo export complexes may escape disassembly in the cytoplasm, and get recruited into the intra-luminal vesicles of the multi-vesicular bodies (MVBs) generated by inward budding. The MVBs eventually fuse with the plasma membrane to release the intra-luminal vesicles, called exosomes, a class of sEVs. This implies a role for the NCT machinery in the sorting of a subset of cargoes into sEVs released by the donor cells. In the recipient cells, this complex may be disassembled, thus releasing the cargo due to cytoplasmic RanGAP1-mediated hydrolysis of GTP on Ran.

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Exploration for a Reliable Extra Pulmonary Human Tuberculosis Infection Model: Generation of a Bone TB Model.

Objectives of the study

- Establishemnt of infection by *Mycobacterium marinum* in mice tails as model for bone erosion and degenration

Summary

* Extra-pulmonary tuberculosis (EPTB) constitutes 15-20% of the entire TB cases worldwide, and immune-suppressive conditions like HIV-AIDS further aggravate the disease often without symptoms and lack of proper diagnostic method delays the treatment. A thorough understanding of the EPTB infection and the pathogenesis is necessary and requires a reliable in-vivo animal model that mimics pathology similar to human infection. - in only a few sentences.

Findings

* The *M. marinum* mice infection model presented here offers visible and quantifiable pathological features. Moreover, sections of the infected tails exhibited infiltration of the immune cells, a prominent feature frequently observed. Interestingly, the micro-CT imaging of the infected mice's tails displayed bone erosion to the extent of the coccygeal vertebral loss. Furthermore, infection of the mice with drug-resistant forms of *M. marinum* generated against Isoniazid (IRP) and Ethambutol (EmbRP) exhibited pathological features akin to wild-type *M. marinum* infection. At the same time, for EmbRP, the severity is significantly reduced, suggesting the nature of the selected population and its ability to retain or fix the virulent determinant(s) during bacterial growth. These findings advocate the use of the developed model to understand the EPTB precisely bone and spine TB, and it can be further utilized to develop novel therapeutics and diagnostics.

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M. marinum infection to mice offers visible and quantifiable pathological features in the form of tail lesions as early as 4-7 days post infection and culminate around 15-18 days post infection. Furthermore, the micro-CT and histopathological images confers the loss of bony aperture and infiltration of the immune cells to form granulomatous structure; importantly, the histological sections revealed the loss of periosteum and infiltration of the immune cells to the bone marrow space.

In summary, the *M. marinum* infection of mice tails is highly informative regarding the bone erosion and probably the factors that lead or accelerate the onset of disease symptoms. The manifested symptoms are akin to skin lesion or the osteomyelitis of the individuals infected with *M. marinum* that can be employed to understand the progression of *M. marinum* infection to humans.

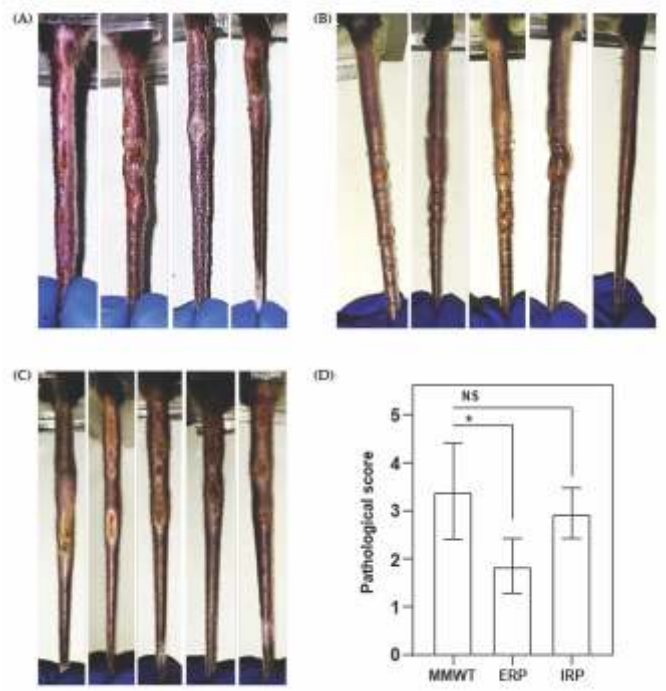

Fig. 1. Kumar M. et al, 2022

Fig. 1: Mice infection with anti-mycobacterial drug resistant *M. marinum* population, via tail-vein injection with 1x107 bacterial cells (A): *M. marinum* WT, (B): *M. marinum* EMB resistant population (EmbRP), (C): M. marinum INH resistant population (IRP), and (D): quantitation of the severity of lesions of the infected tails based on the length and nature of the lesion as shown in Table 1. Values represent mean ± SD of 5 mice for each group M. marinum WT, EmbRP and IRP. One-way anova (*P<0.05).

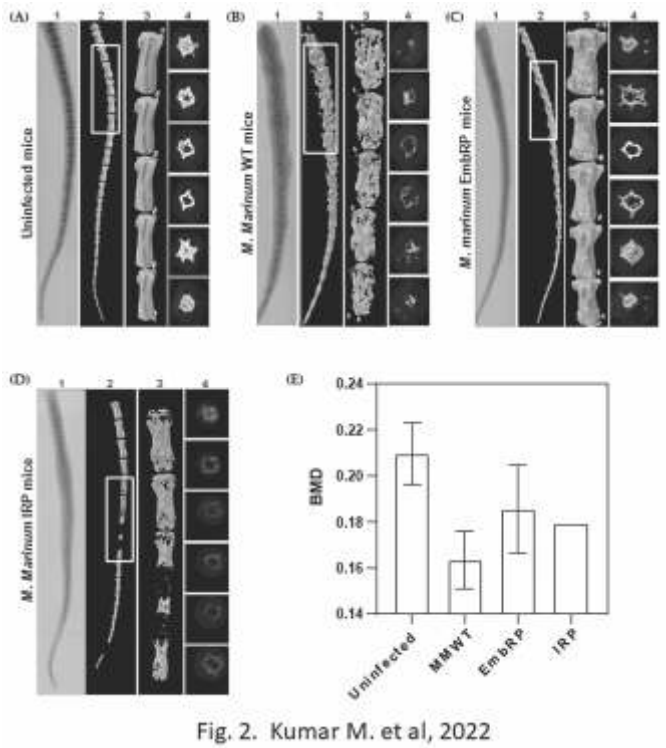

Fig. 2. Kumar M. et al, 2022

Fig, 2: Micro-CT visualization of the mice tails of the mice infected anti-mycobacterial drug resistant *M. marinum* population (A): Uninfected mice, (B): Infected with M. marinum WT, (C): *M. marinum* EMB resistant population (EmbRP), and (D): *M. marinum* INH resistant population (IRP). The mice tails were subjected to digital X-ray (panel labeled with 1) and Micro-CT (panel labeled with 2, 3 and 4 represents the whole mice tail, highlighted region of tail and representational images of the cross sections of the tail vertebrae respectively). (E): Quantification of the bone erosion in terms of bone mineral density (BMD) for different M. marinum population. Values represent mean ± SD of 2 mice for uninfected and *M. marinum* WT infected mice. While 3 mice for EmbRP and 1 mouse for IRP (P value is not significant).

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N-terminal Alternative Splicing of GluK1 Kainate Receptors Imparts Novel Properties and Affects Receptor Modulation by Auxiliary Neto Proteins

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Objectives of the study

- Cloning, expression, purification and structure determination of GluK1-1a splice variant.
- Electrophysiological investigations to understand the role of splice residues in modulation of receptor properties.
- Insights into modulation of GluK1-1a receptors by auxiliary Neto proteins.

Summary

Background

Kainate receptors belong to the family of ionotropic glutamate receptors and play vital roles in the development and modulation of synaptic transmission and plasticity in the central nervous system. Several splicing events are known to generate kainate receptor isoforms having unique functional properties and distinct spatio-temporal expression patterns. GluK1-1 splice variants are abundant in the adult brain and have exon 9, resulting in the insertion of 15 amino acids in the amino-terminal domain (ATD). However, the structural and functional implications of this N-terminal alternative splicing of GluK1 receptors are not known.

Main findings & significance

Here, we determined the first structures of GluK1-1 ATD and full-length GluK1-1a receptors in the desensitized state at 5.2 Å resolution. The extracellular domain of the GluK1-1a model revealed the position of the splice at the ATD-LBD interface, a hub for protein-protein and protein-glycan interactions. The structure also demonstrated that the mechanism of desensitization is

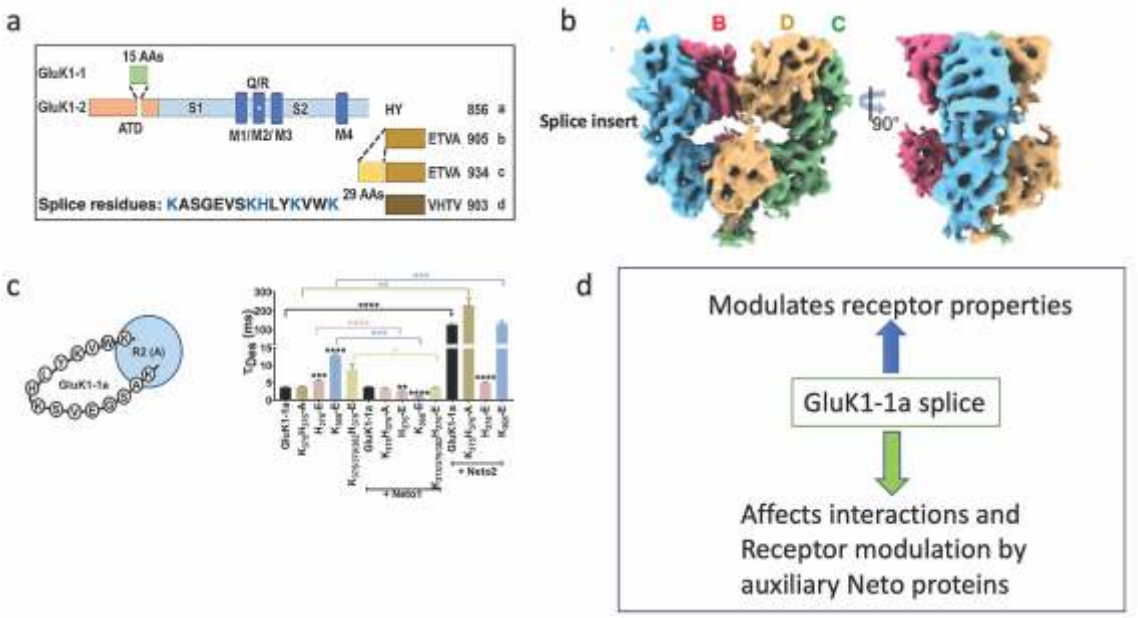

Fig. legend: N-terminal splice insertion in GluK1 receptors affects its functional properties. (a) Shows the schematic GluK1 splice variants. Splice residue insertion in the amino terminal domain is also indicated. (b) Front and side views of GluK1-1a cryoEM map is shown. Different subunits in receptor tetramer are uniquely colored. (c) Schematic of 15-amino acid splice insert in the lower lobe of ATD is shown. Also, comparision of receptor desensitization kinetics for wild type and splice residue mutants coexpressed with either Neto1 or Neto 2 is shown. (d) Schematic of functional properties affected by the splice and affect of Neto proteins is depicted.

conserved across all the members of kainate receptor family. Our functional assays demonstrated that the presence of splice residues affects the functional properties of the GluK1 receptor in terms of desensitization, recovery from desensitization, and channel rectification in the presence of the physiological ligand, glutamate.

Using biophysical and biochemical assays, we observed that the splice also affected the Neto modulation of GluK1 receptors, the effect being more pronounced for Neto2 in terms of glutamate-evoked desensitization and rectification. In accordance with previous reports, we observed that Neto1 is responsible for faster recovery in GluK1 receptors while Neto2 retards the recovery from desensitization for both splice variants. This indicates that Neto isoforms might interact with both the GluK1 splice variants (GluK1-1a and GluK1-2a) in a mutually exclusive manner, or the position of the splice might allosterically regulate the modulatory behavior of Neto2 more than that of Neto1.

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.

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

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.

Summary

In this study, we propose 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 a large number of systematic and developmental diseases such

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as diabetes, cancer, Alzheimer's, Parkinson's disease and other neurodegenerative congenital disorders.

Work Progress

- We discovered that only a single one of the 13 genes encoding V-ATPases a-subunits (GeneID: TTHERM_01332070) was co-regulated with known mucocyst-associated genes, and therefore represents a strong candidate for a mucocyst-specific V-ATPase isoform.
- The V-ATPase knockout cells had no defects in growth rate. This is consistent with a role in mucocyst formation, since mucocysts themselves are not required for Tetrahymena growth under laboratory conditions.

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Understanding Cellular Immunology to Prolong the Survival of Allogeneic Organ Transplants

Objectives of the study

- To understand the role of gamma-delta T cells in transplantation immunology.
- To investigate the cross-talk of gamma-delta T cells in the survival of transplanted grafts.

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Summary

Background

Gamma-delta (γδ) T cells are important cells having an innate and adaptive function and constitute about 0.5-6% of total peripheral blood lymphocytes, 4-10% of $CD3^+$ blood cells, and ~10-50% of tissue-resident T cells. The majority of γδ T cells can recognize self- as well as non-self-antigens such as phosphoantigens, small peptides, MHC-class I chain-related protein A (MICA), MICB, and heat-shock proteins of mycobacteria. γδ T cells can distinguish nonself or transformed cells using activating and inhibitory receptors on their surface, and this is independent of self-MHC restricted priming of the immune response. γδ T cells are also shown to regulate lymphocyte proliferation, B cell differentiation, and Ig production. Depending on the tissue microenvironment, γδ T cells produce several inflammatory molecules known as cytokines such as IFN- γ, TNF-α, IL-17 as well as anti-inflammatory cytokines TGF-β, IL-4, and IL-10. In allogenic kidney transplantation, due to ischemia-reperfusion (IR) injury, γδ T cells showed very early infiltration followed by recruitment of αβ T cells. In transplantation, the role of γδ T cells is mostly described in the IR injuries and rejection of allograft, but its role in the costimulatory blocked-induced transplantation tolerance is not known. In the present work, using skin transplantation models in mice, we identified a specific subset of γδ T cells and

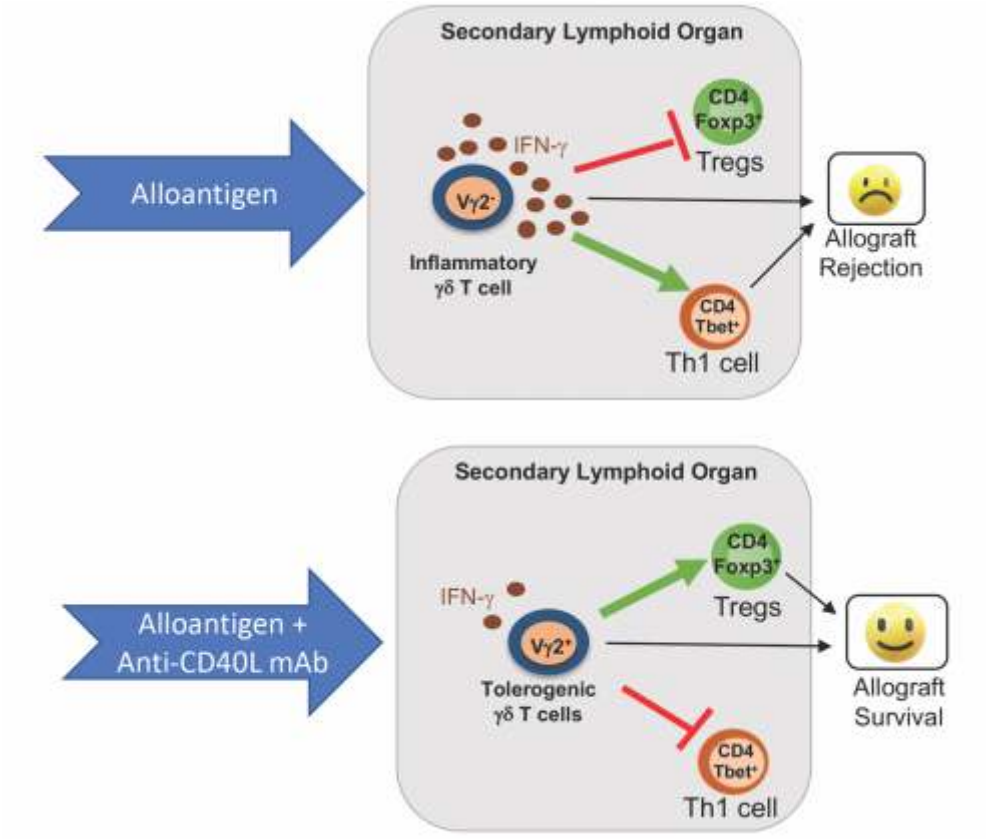

Fig. legend: In the absence of any costimulatory blockade, exposure to alloantigen or foreign graft promotes inflammatory cytokine IFN-γ secretion in differentiation of pathogenic Th1 cells and reduces regulatory CD4 T cells. This leads to acute rejection of allograft. In presence of co-stimulatory blockade (anti-CD40L antibody), Vγ2$^+$ T cells produce less IFN-γ and promote the differentiation of regulatory CD4 T cells and reduce the differentiation of pathogenic Th1 cells. This leads to prolonged survival of foreign graft in the recipient.

tested their cellular and molecular interactions with other cells and their contribution to prolonging the survival of allografts.

Main findings & Significance

We used a mouse model of skin transplantation where skin from one strain of mice (BALB/c) was transplanted onto the back of another strain of mice (C57BL/6). Recipient mice also received donor-specific transfusion (blood cells from donor mice) and anti-CD40L antibody to prevent foreign graft rejection. This treatment is defined as the co-stimulatory blockade and promotes the survival of allografts. The recipient mice depleted the gamma-delta T cells using intravenous injection of anti- γδ TCR antibody, mice fail to prolong the survival of transplanted skin. This suggests that the presence of γδ T cells in the body is important for the co-stimulatory blockade-induced prolonged survival of skin allograft. These are several subsets of γδ T cells in the body. When we depleted only one of the subsets of γδ T cells known as Vγ2$^+$ γδ T cells, co-stimulatory blockade induced prolonged survival of skin graft failed to suggest that Vγ2$^+$ γδ T cells play important role in transplantation. Co-stimulatory blockade treatment promoted Cd39$^+$Vγ2$^+$ γδ T cells and suppressed IFN-γ-producing Vγ2$^+$ γδ T cells in the spleen and allografts. Vγ2$^+$ γδ T cells isolated from tolerized mice suppress the Th1 cell differentiation. Furthermore, in a preclinical model when only Vγ2$^+$ γδ T cell regulatory cells were intravenously injected into the recipient mice, it prolonged the survival of allografts in an untreated recipient and mice deficient in γδ T cells (TCRδ$^{-/-}$ mice). Together, our data show that the Vδ2$^+$ subset promotes costimulatory blockade-induced survival of skin allografts, and tolerogenic Vγ2$^+$ T cells can be used as an adoptive cellular therapy to promote the survival of allografts. The molecular mechanism of Vγ2$^+$ T cells induced survival of allograft is depicted in Figure 1.

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Title of the project: Fabrication and Characterization of Bioactive and Biocompatible Scaffolds for Various Tissue-Engineering Applications Using Stem Cells

Objectives of the study

- Fabrication and characterization of Bioactive and Biocompatible composite scaffolds and assessing their efficacy in bone tissue engineering using mesenchymal stem cells (MSCs) as the preferred cell type.

Summary

The dearth of transplantable organs evokes interest in identifying strategies to meet the demand to supply ratio. The recent surge in the Tissue Engineering arena with interdisciplinary pursuits has kindled some hope in this regard. This has also put emphasis on exploring various biomaterials as the scaffold environment or bioink for bioprinting that are fabricated utilizing various techniques such as electrospinning, freeze-drying, spectral lithography, 3D printing etc. Depending on the tissue of interest, whether hard or soft, the scaffold materials may vary. While ceramic is preferred for bone tissue engineering applications, polymeric materials are opted for soft tissues. Currently, the composite materials have drawn major attention because of their structural and mechanical characteristics akin to the extracellular matrix and the endogenous tissues. We are investigating the efficacy of various ceramic-polymer composite scaffolds in bone tissue engineering applications, where the mesenchymal stem cells (MSCs) have been preferred as the ideal cellular source.

We have shown earlier the efficacy of calcium phosphate (CP) and collagen-based (CP-Col) ceramic-polymer composite scaffolds in supporting osteogenic differentiation from MSCs. Strikingly, the biphasic one rendered the best response while remaining intermediate in its calcium ions release potential. This further led us to investigate the influence of conditioned medium and

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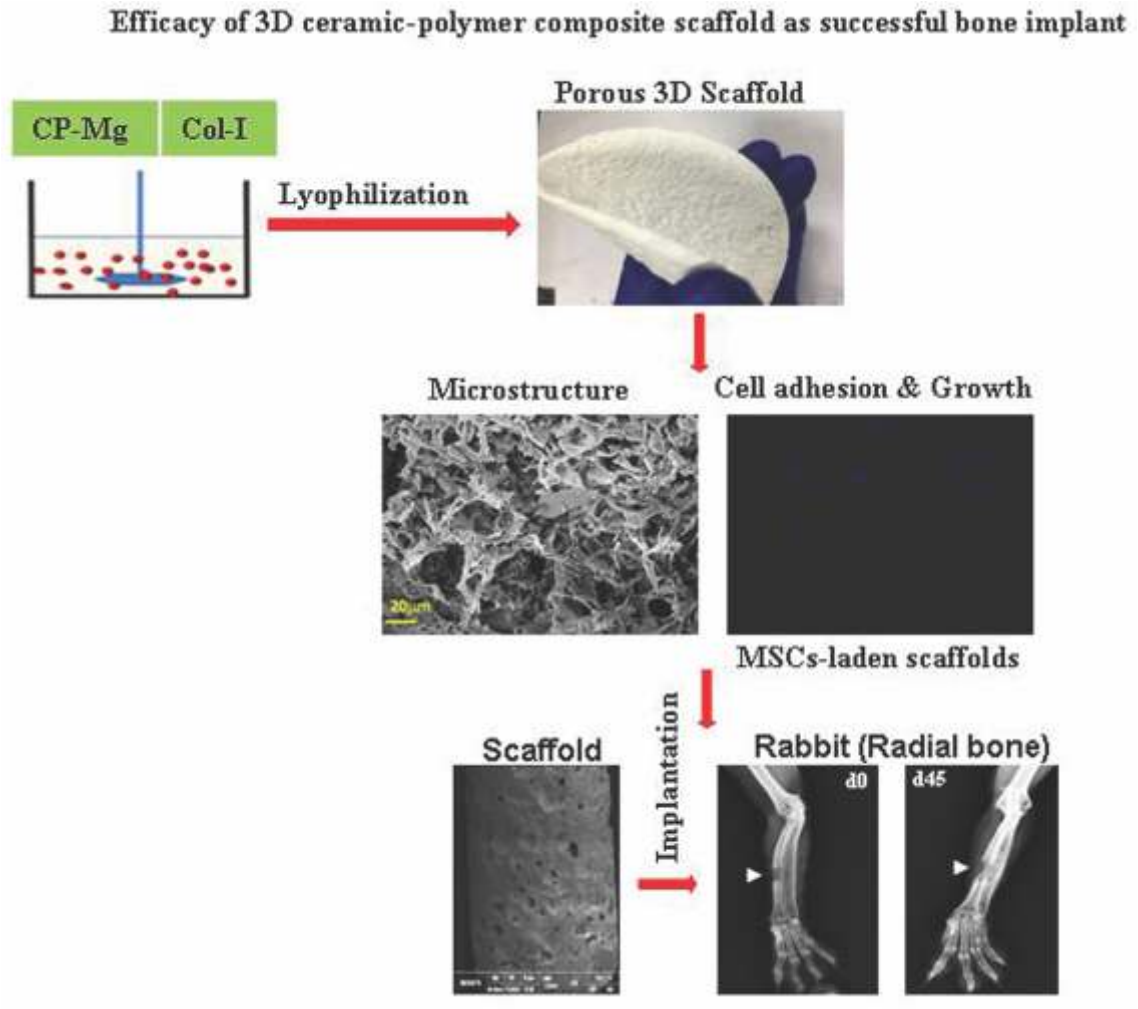

Fig. legend: Efficacy of 3D ceramic-polymer composite scaffold as successful bone implant

interestingly, we could see the conditioned medium successfully promoting osteogenesis in MSCs sans addition of osteoinduction medium. Hence, we also explored their in vivo efficacy by ectopic implantation of the fabricated CP-Col scaffolds both with and without MSCs seeded on it using SCID mice. After three weeks of implantation, we could demonstrate migration of host cells on to the implanted scaffold. In parallel, we have also tried substituting calcium ions with that of Magnesium (CP-Mg-Col), since the latter is involved in bone remodeling and maintaining bone homeostasis through its association with parathyroid hormones. Following successful fabrication and characterization, the same was tested in vitro for its bioactivity and biocompatibility. In collaboration with IVRI, Izatnagar, we are also studying the potential of CP-Mg-Col scaffold in bone regeneration using bone incision model in rabbit. Our current findings have suggested the efficacy of the fabricated scaffolds as ideal bone substitutes in large-sized bone defects.

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Towards Understanding the Mechanism of Long-term 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.

Summary

Background including the need for & importance of the research

Memory is the experience dependent ability of the brain to preserve and recover information from the past. A translation regulator in Aplysia, Cytoplasmic Polyadenylation Element Binding protein (CPEB) was identified as a key regulator of the maintenance phase of long-term facilitation and stabilization of learning- induced new synaptic growth. The connection between CPEB and memory was further supported in Drosophila, where its homolog, Orb2 was found to be necessary for persistence of long-term memory and has amongst its mRNA targets, genes regulating protein turnover, synapse formation, and neuronal growth. Further evidence suggests oligomerization of Orb2A is crucial for formation of Orb2 oligomers and maintenance of memory. In our lab we are attempting to understand what regulates the oligomerization of Orb2A, and if this regulator has any role on long term memory.

Main findings & Significance

Taking cue from the Yeast prion literature, where the protein folding machinery/ chaperones were found to be key regulators of prions, we hypothesized, chaperones may play some role in regulation of Orb2A oligomerization. In

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Yeast, the Hsp70, Hsp40 and Hsp104 chaperones have been found to regulate the oligomerization and propagation of prions. Using an immunoprecipitation-based screen and a yeast-based prion conversion assay, we identified a novel chaperone protein, to be a regulator of Orb2A's oligomerization. We are currently characterizing this chaperone in more details. Our preliminary data suggest that this chaperone protein regulates Orb2 oligomerization in rhe barin and long-term memory.

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Identification of Potential Targets for Triple Negative Breast Cancer Using Quantitative Proteomics and Molecular Approaches

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Objectives of the study

- Identification of potential markers/targets for triple negative breast cancer using proteomic and molecular approaches.

Summary

Background

Being a heterogeneous disease, breast cancer has distinct morphological features and thus different tumor subtypes as well. In recent years, there is an incremental pattern observed in the incidence rates of breast cancer in India. The treatment strategies of breast cancer depend majorly on the molecular receptor status of the tumor. The major clinically relevant subtypes of breast cancer include Luminal A (LA), Luminal B (LB), Her2-Enriched (HE), and Triple-negative (TN). The clinically classified present subtypes of breast cancer LA, LB and HE have hormonal receptors, which enhances the diagnosis precision and chances of efficient treatment interventions. However, this is not true for a subtype of breast cancer i.e.. triple-negative breast cancer (TNBC), which lacks all the three major molecular receptors viz. estrogen receptor (ER), progesterone receptor (PR) and human epidermal growth factor receptor 2 (HER2/ neu) thereby, causing its treatment much more complicated and challenging. Triple-negative breast cancer (TNBC) is an aggressive subtype of BC which accounts for approximately 15–20% of BC patients. In India, the TNBC subtype has high prevalence (around 30% of all BC cases) and an incidence shift is observed towards the lower-aged patients (30-40 years) at the time of diagnosis. Late diagnosis of this particular subtype can lead to high mortality as it is an aggressive form of BC.

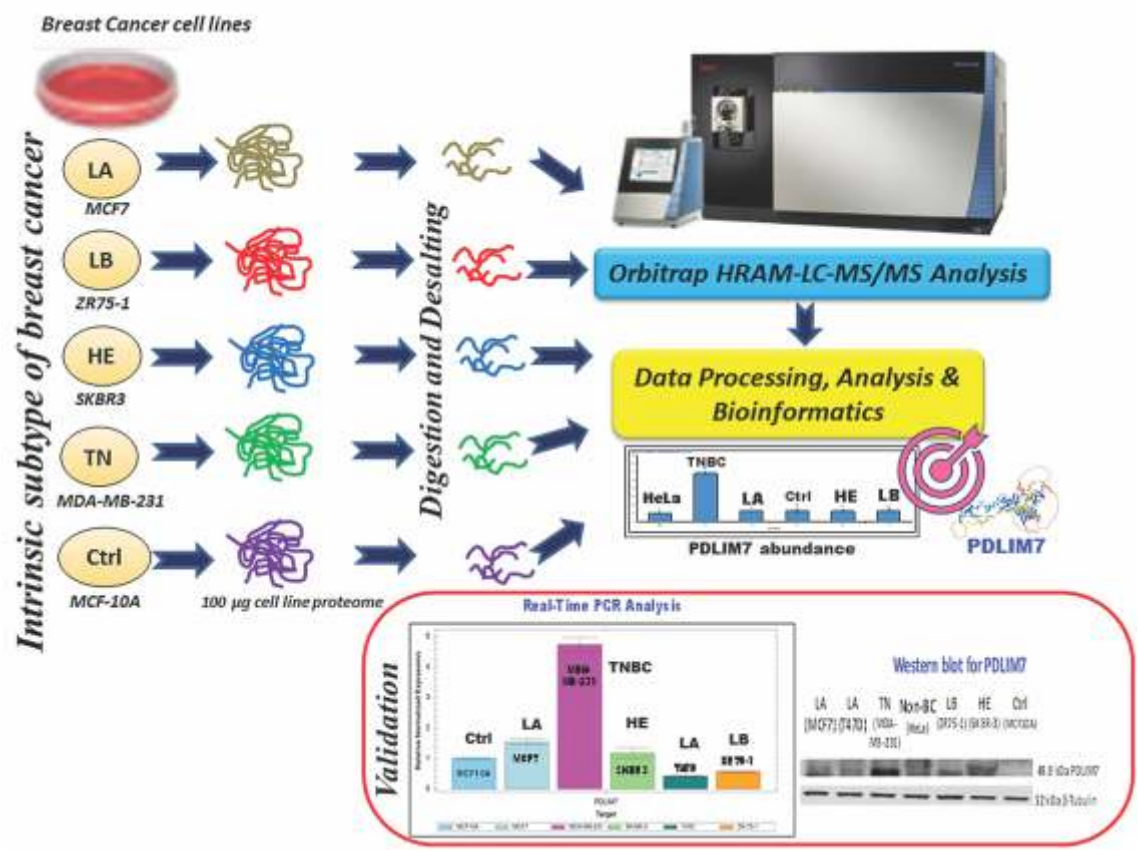

Fig. legend: An experimental design and overall results obtained for label free quantitative proteomic analysis of intrinsic subtypes of breast cancer cell lines and control cell line. PDZ and LIM domain protein 7 (PDLIM7) was found to be up-regulated in TNBC compared with other BC cells lines as well as control cell line. Real-time PCR and western blotting-based validation also confirmed the similar expression indicating PDLIM7 as a potential theranostic target for TNBC.

Even though, the molecular classification and prognostic assessment of breast tumors based on gene expression profiling are well accomplished, several proteomics discoveries that propose putative breast cancer biomarkers have not yet led to any new diagnostic, prognostic or predictive test in the wide clinical setting. Proteomics serves as one of the most powerful techniques, which is capable of the discovery of novel biomarkers for various diseases including cancer. Proteomics provides an information of protein-based markers, including alterations in the protein levels and post-translational modifications of proteins found in tissues and other bodily fluids. Proteins act as the backbone of cellular processes, the deep understanding of molecular pathways, will help in the detection and treatment of cancer. The advancements and developments in mass spectrometry (MS) allows for the fast and reliable detection, identification and relative quantitation of proteins. These powerful MS-based technologies can identify majority of the differential expressed proteins that are very low abundant, during cancer progression which can be used as potential biosignature for cancer towards its early diagnosis and monitoring disease treatment. Quantitative proteomic profiling of body fluids, tissues, or other biological samples to identify differentially expressed proteins represents a very promising approach for improving the outcome of this disease. Quantitative measurement of proteins involved in triple negative breast cancer using high-throughput mass spectrometry-based techniques will be more appropriate to discover novel biosignatures.

Main findings & Significance

In the present study, we have worked towards the identification of potential target proteins specific to the TNBC using the cell line model of BC disease. Label free quantitative proteomics approach was undertaken that evaluated the identification of differentially abundant proteins across the MCF7 (representing LA subtype), ZR75-1 (representing LB subtype), SKBR3 (representing HE subtype) and MDA-MB-231 (representing TNBC subtype) cell line samples compared to control breast epithelial cell line MCF10A. We also included a non-breast cancer cell line HeLa to further strengthen our search for TNBC specific novel potential protein targets. Using a study design that involved two biological and four technical replicates, we

identified an interesting potential target protein that was found to be significantly upregulated in TNBC sample as compared to cell lines representing other subtypes of BC and non-malignant breast cell line MCF10A as well as non-breast cancer cell line HeLa (Fig. 1). This protein was identified as PDZ and LIM domain protein 7 (PDLIM7) which was found to be 3.33 folds upregulated as compared to control.

Literature survey suggested that this protein was not well studied in terms of cancer and especially in the context of breast cancer, thereby exciting us further to look into elucidating the role of PDLIM7 in TNBC pathogenesis. The validation experiments carried out using RT-PCR and immunoblotting experiments confirmed the same pattern of abundance for PDLIM7 compare to other BC subtypes (highest in TNBC). Currently, we are optimizing the method to use mass spectrometry-based MRM approach to quantify the unique peptide for PDLIM7 as a fast and quantitative alternative to immunoblotting approach. Towards elucidation of the role of PDLIM7 in TNBC pathogenesis, we first developed a reporter cell line in MDA-MB-231 cells that expressed luciferase (Luc2) activity and were red fluorescent (TurboRFP). Further, we used this reporter cell line to generate PDLIM7 knockdown (using shRNA) and PDLIM7 knockout (using CRISPR-Cas9) MDA-MB-231 cells so that the effect of PDLIM7 can be directly observed in in-vivo mouse model where the luciferase activity can be traced in the tumor of the mice through in-vivo live imaging system. At present, we intend to identify the molecular regulators involved in upregulation of PDLIM7 protein in TNBC and unravel the molecular mechanism responsible for PDLIM7-mediated TNBC progression. In conclusion, quantitative proteomics led us to identification of an interesting target viz. PDLIM7 which can be established as a potential theranostic target for TNBC.

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Role of T Cells and Non-T Cells in Leishmaniasis and Other Infectious Diseases

Objectives of the study

- To understand the mechanism of immunity against infectious diseases and tumors.

Summary

Background

Leishmania, a protozoan parasite, causes the disease leishmaniasis for which very restricted options for chemotherapy are available; anti-antileishmanial prophylaxis remains unaccomplished despite 7 decades of extensive research. The T cell responses and macrophage functions in leishmaniasis show strong similarities with that observed in tuberculosis and cancer. Therefore, in many instances, the other disease models are also consulted to understand the role of T cells and non-T cells in leishmaniasis.

Main findings & Significance

Leishmania is a protozoan parasite that resides and replicates within macrophages where Toll-Like Receptors-driven inflammasomes [Challagundla N et al. 2022. Immunol Res. May 24] play a significant role in anti-leishmanial immunity. In a bi-directional interaction, inflammasomes and cytokines regulate each other's functions reflecting reciprocity between counteractive principles, as observed in case of IL-10-IFN-γ reciprocity [Sarma U et al. 2021. Cytokine 148:155665]. Similarly, *Leishmania* infection outcome depends on PD-1, a checkpoint inhibitor [Jafarzadeh A et al. 2022. Cytokine 153:155839] and both IFN-γ responsiveness [Gurjar D et al. 2022 Cytokine 157:155956] and costimulatory molecules are targeted for anti-leishmanial immunotherapy

[Mazire PH et al. 2022 Int Immunopharmacol. 110:108969]. These and many other functions of macrophages are regulated by miRNAs in *Leishmania* infection [Jafarzadeh A et al. 2022 PLoS Pathogens. 18(8):e1010696], as observed in case of *Mycobacterium* infection [Chauhan P et al. 2020. Clin Transl Immunol. 9:e1179].

Realizing the emergence of resistance against front-line anti-malarial drug Artemisinin [Das S et al. 2018. New Engl J Med. 379: 1962-1964; Das S et al. 2019. Clin Infect Dis. 69: 1144-1152], a new combination of new potential anti-malarials has been formulated [Mukherjee S et al. 2022 Front Immunol. 2022. 12:819469]. For Covid-19, using bioinformatics, a new target and potential molecules have been predicted [Parvatikar P et al. 2022 Research Journal of Pharmacy and Technology. 2022. 15(2):555-8] and CD40-ligand has been shown as a target in Mouse hepatitis virus, a coronavirus, infection [Saadi F et al. 2021 PLoS Pathogens. 2021. 17(12):e1010059].

In case of anti-tumor therapy, the potential of Berberine [Shah D et al. 2021 Phytomedicine. 99:153904] and TLR-driven IL-27 production [Patidar A et al. 2022 Cytokine. 2022. 154:155871] as anti-tumor therapies have been tested. IL-6 in tumor heterogeneity, with particular reference to ovarian cancer and the role of human endogenous retroviruses in tumor heterogeneity have been pointed out. A Special Issue on Tumor heterogeneity for the journal Cytokine is being edited. As an offshoot, role of plumbagin in osteoblastogenesis has been discussed [Yadav AM et al. 2021 Biol Chem. 2021. 403:211-229].

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Role of Complement in Macrophage Polarization

Objectives of the study

- To study the expression of complement receptors on M1 and M2 polarized macrophages.
- To delineate the role of complement anaphylatoxins C3a and C5a on macrophage polarization.

Summary

Background

The complement system is critically involved in inflammation. It can affect multiple steps of inflammation, including vascular permeability, extravasation of leukocytes, chemotaxis and cellular activation. Macrophages, on the other hand, migrate and accumulate at the inflammation site. They can initiate, maintain as well as resolve inflammation. Also, they have a remarkable ability to sense and respond to biochemical cues present in the microenvironment. Since both complement and macrophages inhabit the inflammatory sites and macrophages express complement receptors, it is conceivable that a cross-talk likely exists between these two entities. Intriguingly, like T cells, macrophages exhibit the property of polarization: Th1 cytokines polarize them to M1 or classically activated macrophages, and Th2 cytokines polarize them to M2 or alternatively activated macrophages. Besides, the complement anaphylatoxins C3a and C5a are known to mediate Th1 polarization. We, therefore, probed whether complement receptor expression varies among M1 and M2 macrophages and whether immunomodulatory complement peptides C3a and C5a skew macrophage polarization.

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Main findings & Significance

Macrophages are known to express various complement receptors, including those that are involved in phagocytosis, such as complement receptor 1/2 (CR1/2), CR3 and CR4 and those engaged in immunomodulation such as C3aR and C5aR.

In this study, we first asked: Does a shift in macrophage phenotype affect the expression pattern of phagocytic complement receptors? And does this influence the opsonin-dependent phagocytic ability of polarized macrophages? Because bone marrow-derived macrophages (BMDMs) are considered an ideal model for studying macrophage polarization and function, we employed them for our study. We polarized murine BMDMs to M1 and M2 phenotypes and studied the surface expression of CR1/2, CR3 and CR4. We observed that both macrophage phenotypes expressed CR3 (CD11b) to a similar degree. On the contrary, CR1/2 was exclusively expressed by M1 macrophages, and M2 macrophages exhibited higher expression of CR4. Thus, M1 cells are CR1/2+CR4+, and M2 are CR1/2-CR4+. Hence, we propose that this differential expression of complement receptors on polarized macrophages can be used as macrophage polarization markers in combination with other consensus markers to better locate a macrophage along its phenotypic spectrum.

Next, we performed a phagocytosis assay to determine whether differential expression of complement receptors on polarized macrophages translates into phagocytosis of opsonin-specific particles. C3b is a ligand for CR1/2, and iC3b is a ligand for CR3 and CR4; thus, we opsonized erythrocytes (E) with C3b or iC3b and subjected them to phagocytosis by macrophages. M1 cells exhibited higher phagocytosis of E-C3b compared to M2 cells, which correlated with the increased expression of CR1/2 on these cells. These data suggest that CR1/2 is the likely receptor involved in enhanced E-C3b phagocytosis. Both M1 and M2 macrophages exhibited a similar degree of internalization of E-iC3b. Blocking these receptors using antibodies revealed that blockade of CR3, but not CR4, inhibited the phagocytosis of E-iC3b. Thus, CR3 is the primary iC3b phagocytic receptor in murine BMDMs, whereas CR4 is not involved in the erythrophagocytic function.

Upon activation, the complement system generates two potent immunomodulatory peptides, C3a and C5a. The former exerts its effect by binding to C3aR, while the latter exerts its effect by binding to C5aR1 and C5aR2. Examination of the expression of these receptors on polarized macrophages showed that both M1 and M2 cells express C3aR and C5aR1 at similar levels; however, the expression of C5aR2 is low on M2 cells. Thus, the

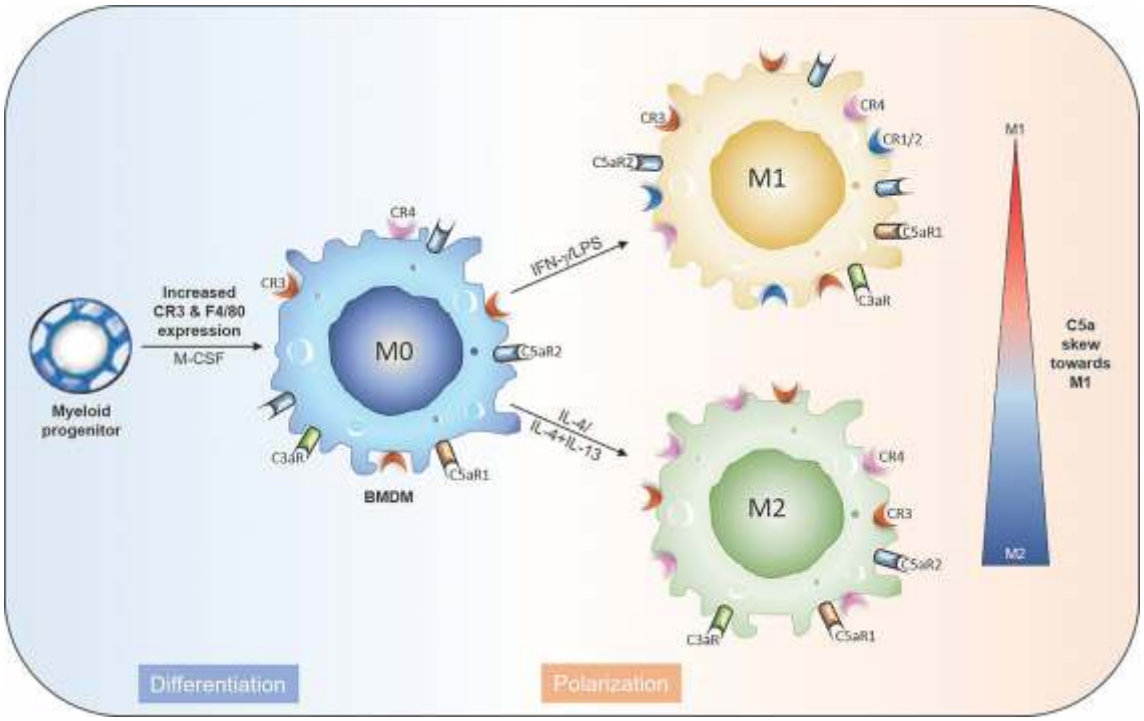

Figure: Model for complement receptor expression on polarized macrophages and influence of C3a and C5a on M1 and M2 polarity

questions we asked: do C3a and C5a signalling influence macrophage polarization and is it contingent on the macrophage microenvironment? And which functional phenotype do macrophages acquire upon C3a or C5a signalling? To answer these questions, we polarized BMDMs to M1 and M2 phenotypes in the presence and absence of C3a or C5a and measured various M1 and M2 markers at transcript and protein levels. Overall, the results showed that C3a did not alter the expression of either M1 or M2 markers in the M1 as well as M2 polarizing microenvironments. On the contrary, C5a increased the expression of M1 markers, in both M1 and M2 polarizing environments. The effect of C5a on M2 was more intriguing as it indicated that C5a could overcome the anti-inflammatory environment and push macrophages towards an inflammatory phenotype.

Considering macrophage phenotypes can exist across a continuum, looking at specific markers' expressions is insufficient to comment on the exact nature of macrophages. Thus, we used the quantitative proteomics approach to understand the global effect of C5a, specifically on the M2 phenotype. Quantitative proteome analysis of BMDMs (M0), M2 and C5a stimulated M2 confirmed the inflammatory skewing of M2 macrophages post C5a treatment. IPA analysis indicated the topmost activated pathway was IFNG in C5a stimulated M2 cells. Thus, the pro-inflammatory skewing of macrophages in the presence of C5a may be an IFN-γ-induced phenomenon.

In summary, our data show that CR1/2 is a novel M1 marker and, therefore, can be employed for profiling M1 versus M2 macrophages. The data also establishes that C5a is capable of skewing the macrophage phenotype towards an inflammatory M1-like phenotype irrespective of the M1 or M2 stimuli present in the milieu of macrophages.

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

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Objectives of the study

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

Summary

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.

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 FBXO31 as potent tumor suppressor in multiple cancers. It prevents cell proliferation of cancer cells by directing the proteasomal degradation of many oncogenic proteins like cyclin D1, MDM2 etc. However, how FBXO31 is inactivated in cancer was not well

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understood. Using ovarian cancer model, for the first time, we reveal that expression levels of tumor suppressor FBXO31 is inhibited at the transcriptional level by oncogene (promote cancer cell proliferation) c-Myc. c-Myc is a potent oncogene and is highly expressed in many cancers including ovarian cancer. c-Myc functions a a transcription factor and promotes the tumor growth progression and metastasis through controlling gene expression. In our study, we found that c-Myc prevents the expression levels of FBXO31 to promote ovarian cancer tumor growth. In contrast, FBXO31 directs the proteasomal degradation of c-Myc to prevent the transformation of normal cells into cancer cells as well as proliferation of cancer cells by c-Myc. Thus, restoration of tumor suppressive function of FBXO31 in cancer cells may be beneficial to prevent tumor growth. We have published these observations in Internation journal of Cancer. (Int. J. Cancer 2022, 150:1512-1524).

Last year we reported that F-box protein FBXW8 prevents unscheduled accumulation of F-box protein β-TrCP1 to control precise cell cycle progression through SCF complex. Generally, SCF is a complex of F-box protein, scaffolding protein Cullin1, adapter protein SKP1 and RING-finger protein RBX1. Further, our study reveals that FBXW8 forms a unique SCF complex wherein Cullin1 and Cullin7 are simaltenously associated with FBXW8 to from SCF-FBXW8 complex. Our study reveals that Cullin1 is associated with FBXW8 through SKP1 wehereas Cullin7 directly associates with FBXW8. However, association of Cullin1 with FBXW8 is dependent on the presence of Cullin7 and vice versa. Indeed, we observed that both the Cullins synergistically increase each other association with FBXW8. This is the first SCF complex that requires two Cullin proteins simaltenously to direct the ubiquitination of the substrates. These observations are published in the International Journal of Biological Macromolecules (Islam et al Int J Biol Macromol. 2021, 190:233-243).

Cancer cells are known to be death resistant. They deregulate cell death pathways through many mechanisms. One of the general mechanisms is inactivation of cell death inducing proteins by oncoproteins. Oncoproteins inactivate the cell death inducing proteins by many ways like transcriptional, post-transcriptional and post-translational process to prevent cell death. In cancer, potent death inducing proteins like BAX and PUMA are known to be inactivated because of inactivation of tumor suppressor p53. Tumor suppressor p53 functions as a

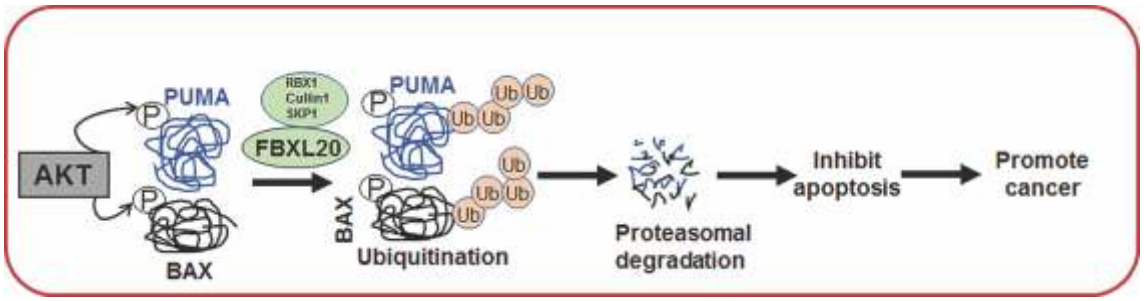

Fig. legend: Model depicts that FBXL20 accelarates breast cancer by inhibiting apoptotic cell death through degradation of PUMA and BAX.

transcriptional factor, which increases the expression level of death inducing proteins like BAX and PUMA at the transcriptional level. However, it was observed that cancer cells are death resistant even in the presence of functional p53, indicating that cancer cells have evolved alternative mechanism to resist their cell death. Our study revealed that cancer cells utilize the cellular machinery to prevent chemotherapeutic drugs induced cell death. Through a highthroughput screening, we have identified the critical regulators those attenuate the expression levels of PUMA and BAX. We show that F-box protein FBXL20 directs the proteasomal degradation of PUMA and BAX in a oncogenic protein kinase AKT1-dependent manner to promote cancer cell proliferation and tumor growth. Interestingly, inactivation of AKT1 results in activation of tumor suppressor protein kinase GSK3α/β, which facilitates the proteasomal degradation of FBXL20 by another F-box protein, FBXO31. Thus, a switch between two signaling kinases AKT1 (oncogenic kinase) and GSK3α/β (tumor suppressive kinase) modulates the functional activity of these proapoptotic regulators, thereby determining cell survival or death. RNAi-mediated ablation of FBXL20 results in increased levels of PUMA as well as BAX, which further enhances the sensitivity of cancer cells to chemotherapeutic drugs. We showed that high level expression of FBXL20 in cancer cells reduces therapeutic drug-induced apoptosis and promotes chemoresistance. This is the first study to show that BAX and PUMA could be regulated at the post-translational level by a ubiquitin ligase SCF-FBXL20 to resist the cancer cell death. In addition, we show, for the first time, the molecular mechanism of tumor suppressive activity of GSK3α/β. Overall, this study highlights the importance of targeting FBXL20 in cancers in conjunction with chemotherapy and may represent a promising anticancer strategy to overcome chemoresistance. These observations are published in the international journal "Journal of Biological Chemistry" (Manne et al J. Biol. Chem. 2021, 297:101253).

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Role of RNA-Protein Interactions in Gene Regulation

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.

Summary

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.

Main findings & Significance

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

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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. 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. Our preliminary results show that PIP4K knock down results in increased expression of GluRIIA, suggesting that Mon1 regulates the levels of PIP4K2A which in turn can regulate the expression of GluRIIA (Fig 1). Although the reporter assay performed in S. cerevisiae, suggests that PIP4K could be a translation activator, however in drosophila PIP4K expression is negatively correlated with the expression of target RNA suggesting that other factors could play a crucial role in determining the functional consequence of PIP4K association with RNA. 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.

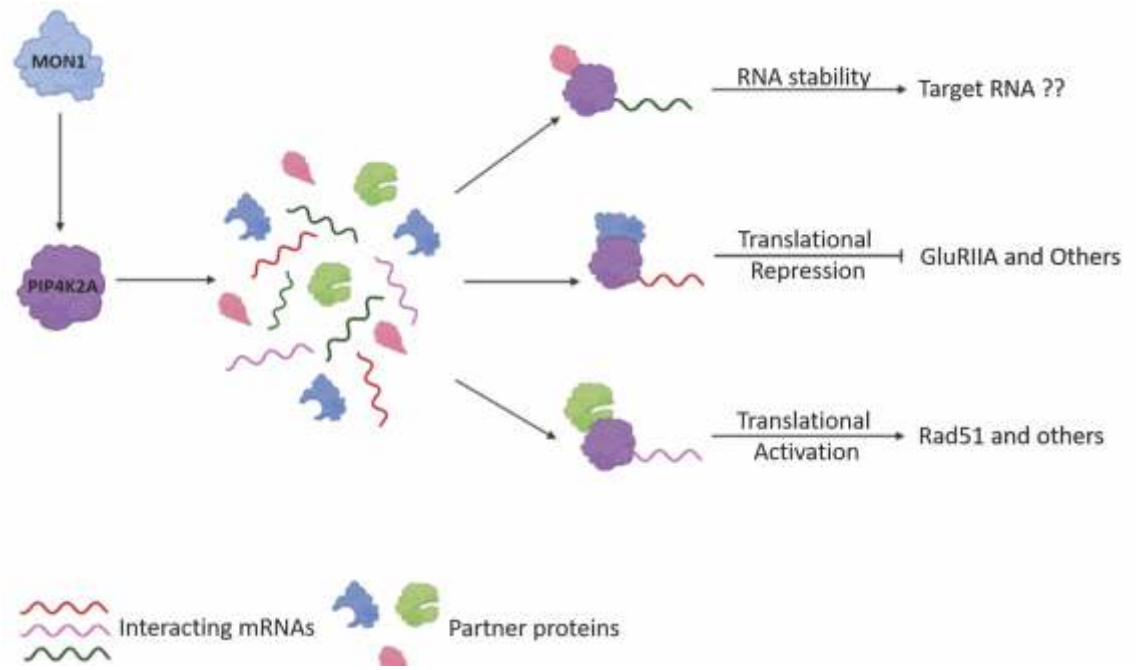

Figure 1: DPIP4K in regulation of gene expression.

Mon1 gene of drosophila regulates the expression levels of DPIP4K. DPIP4K in turn can interact with specific transcripts in association with other factors leading to Translation repression (GluRIIa), Translation activation (Rad 51) or altered RNA stability.

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Mass gatherings and its imapct on microbial communities; a microbiome perspective

Objectives of the study

- Spatiotemporal meta-analysis of bacterial communities of Godavari River, India, using targeted metagenomics.
- qPCR-based quantification to understand the comparative analysis of mass bathing and lockdown samples.

Summary

Background including the need for & importance of the research

The unprecedented COVID-19 pandemic has had major impact on human health worldwide. Whilst national and international COVID-19 lockdown and travel restriction measures have had widespread negative impact on economies and mental health, they may have beneficial effect on the environment, reducing air and water pollution. Mass gathering religious bathing (MBE) events such as the Kumbh Mela are known to cause perturbations of the ecosystem affecting resilient bacterial populations within water of rivers in India. Lockdowns and travel restrictions provide a unique opportunity to evaluate the impact of minimum anthropogenic activity on the river water ecosystem and changes in bacterial populations including antibiotic resistant strains.

Main findings & Significance

We performed a spatiotemporal meta-analysis of bacterial communities of Godavari river, India. Targeted metagenomics revealed 0.87-fold increase in the bacterial diversity during the restricted activity of lockdown. A significant increase in the resilient phyla viz. Proteobacteria (70.6%), Bacteroidetes

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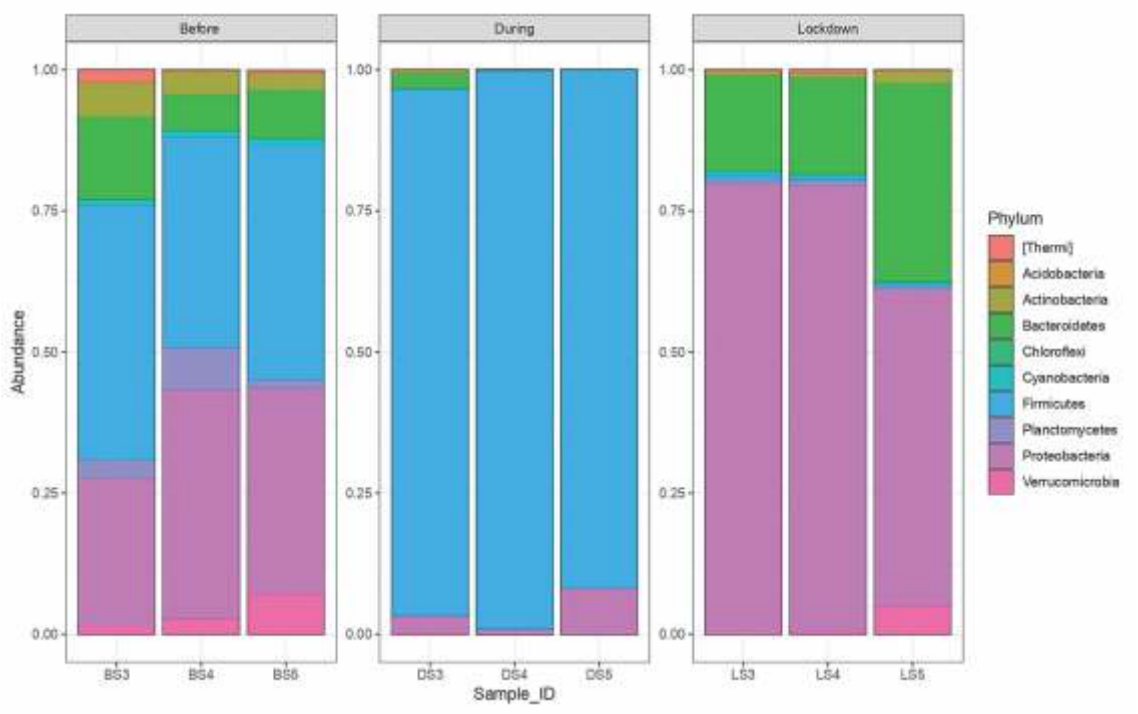

Fig. legend: Distribution of most abundant bacterial phyla across the temporal variation of mass bathing event and lockdown period.

(22.5%), Verrucomicrobia (1.8%), Actinobacteria (1.2%) and Cyanobacteria (1.1%) was observed. There was minimal incorporation of allochthonous bacterial communities of human origin. Functional profiling using imputed metagenomics showed reduction in infection and drug resistance genes by -0.71-fold and -0.64-fold, respectively. These observations may collectively indicate the positive implications of COVID-19 lockdown measures which restrict MBE, allowing restoration of the river ecosystem and minimize the associated public health risk.

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Molecular Simulation to Biochemical Network Perturbation in Infectious Disease

Summary

Major Research Outcomes and Significance

Leishmaniasis, caused by the intracellular protozoan parasite *Leishmania*, is found in 98 of the world's 200 countries worldwide, currently the second most neglected disease. Because the *Leishmania* parasite primarily affects immune system effector cells, like macrophages, treating it is a considerable challenge. The parasite resides inside the mammalian host in the fatal enzymatic environment of macrophage cells, where they must deal with the oxidative stress caused by the macrophages to survive. Surprisingly, the parasite's survival is aided by a particular redox metabolism that it has evolved. The parasite's defensive mechanism is centered on trypanothione, a unique thiol reductant (N1, N8-bis-glutathionylspermidine; T[SH]2) maintained by NADPH-dependent trypanothione reductase (TryR). The study focused on TryR protein as a model subject for preventing the parasite from surviving within the cell. Phylogenetic and molecular clock analysis confirmed that TryR is evolutionarily conserved in *Leishmania* only and not in humans. The relevance of TryR and T[SH]2 protein for parasite survival inside the macrophages was demonstrated using kinetic models. Various hypothetical scenarios were constructed and evaluated to demonstrate the impact of TryR inhibitors. Protein folding and unfolding studies of TryR interacting with Urea and GdmCl were seen in CD spectroscopy and long-range MD simulations to assess the stability of TryR protein as a possible therapeutic target. Diverse screening procedures, such as the Lipinski's rule of five, molecular docking, MD simulations, and others, were used to screen compounds/derivatives of Thiabendazole and Benzimidazole from various databases. Based on the screening and filtering criteria, two compounds were chosen to serve as TryR inhibitors for experimental validation.

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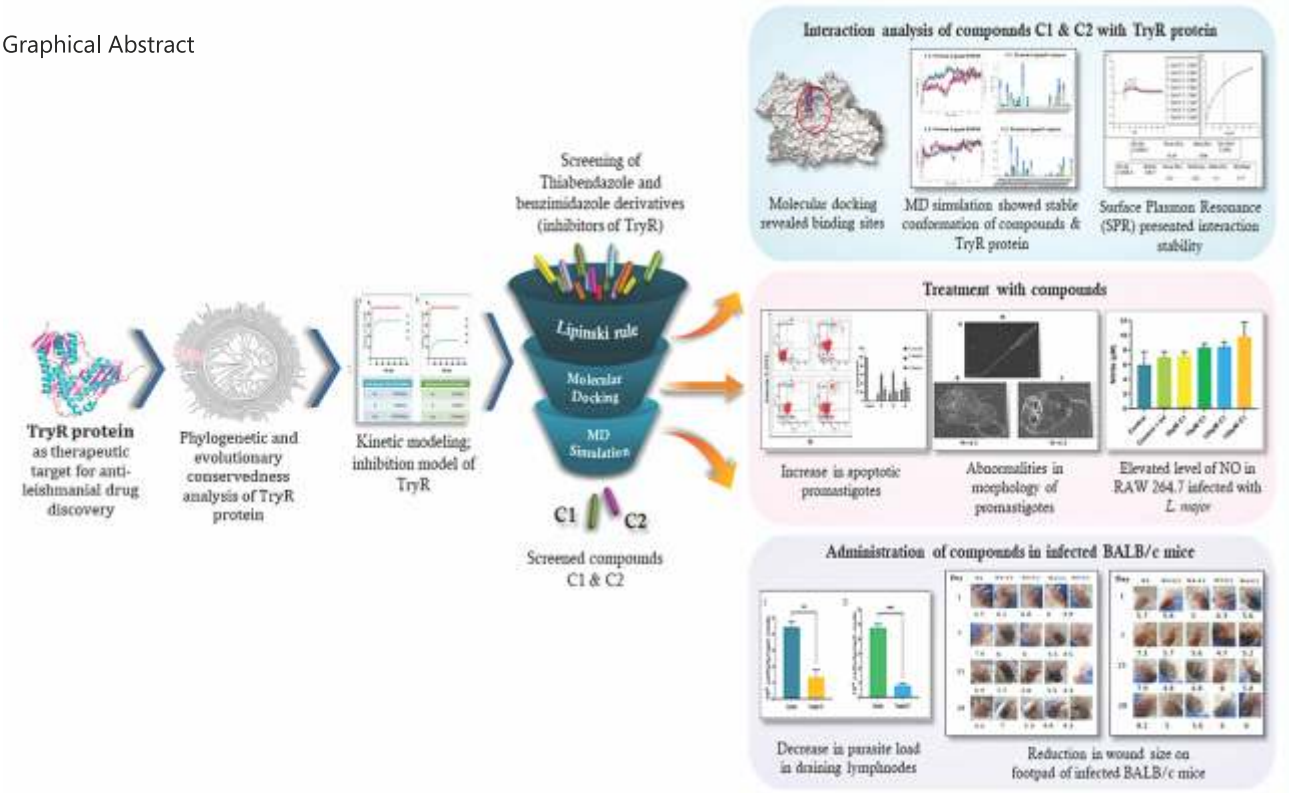
When screened compounds C1 & C2 were docked with TryR, C1 had a substantial interaction, whereas C2 did not. A subsequent SPR (Surface Plasmon Resonance) investigation revealed similar findings. Using the MTT test, the IC50 of C1 & C2 was determined to be 44.17µM and 46.61µM, respectively. TryR protein enzyme activity in the presence of C1 & C2 demonstrated a reduction in TryR activity as C1 & C2 concentrations increased. FACS analysis revealed that C1 and C2 had a cytotoxic impact on parasites, with increased apoptotic cells of 59.10% and 63.90% for C1 and C2, respectively. Compounds C1 & C2 elicit morphological alterations in *L. major* promastigotes, such as cell size reduction and flagellar size reduction, as well as cell membrane blebbing, indicating anti-leishmanial action, according to the SEM analysis. On the RAW264.7 cell line, cytotoxicity of compound C1 exhibited no significant difference in viability compared to the control. After treating RAW264.7 cells with C1, elevation in NO production indicated macrophages polarization to the M1 phenotype with subsequent killing of the parasite.

Taswell's technique, which employed a limited dilution test to evaluate parasite burden in draining lymph nodes, was used to determine the effectiveness of C1 and C2 in BALB/c mice in vivo. The parasite burden was decreased by 70% and 83.78%, respectively, after treatment with C1 and C2. Thus, the study of systems biology of thiol-redox system in infection model facilitated screening of compound C1 which may show potential as anti-leishmanial drug.

Graphical Abstract



Dr. Nishant Singhal

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Generation of Integration-Free hiPSCs Clones, NSi001-A, NSi002-B, and NSi003-C from Peripheral Blood Mononuclear Cells of an Individual with Down Syndrome having Robertsonian translocation

Objectives of the study

- Generation of integration-free human iPSCs from an individual with Down syndrome having Robertsonian translocation.

Summary

Down syndrome is the primary genetic cause of intellectual disability. In addition, individuals with Down syndrome also suffer from Alzheimer's disease, congenital heart defect, leukaemia, and several other health problems. Down syndrome is caused by the presence of an extra copy of chromosome 21. Aneuploidy caused by the presence of an extra copy of chromosome 21 leads to an increased dosage of genes. In addition, free-floating extra chromosomes may cause additional health issues. To develop therapies for Down syndrome-related health problems, it is essential to understand the role of chromosome 21 genes and the function of a free-floating chromosome. However, until now, it was not possible due to the absence of a suitable research model.

About 3% of cases of Down syndrome occur due to Robertsonian translocation. In Robertsonian translocation, an additional full or partial copy of chromosome 21 attaches to another chromosome. Robertsonian translocation provides an opportunity to segregate the role of chromosome 21 genes and free-floating chromosomes. In this case, chromosome 21 genes are still present in increased dosage, but extra chromosome 21 is not free-floating.

We employed induced pluripotent cells (iPSCs) technology to take advantage of Robertsonian translocation. In iPSCs technology, blood cells from any individual can be converted into stem cell-like cells. These cells can be later

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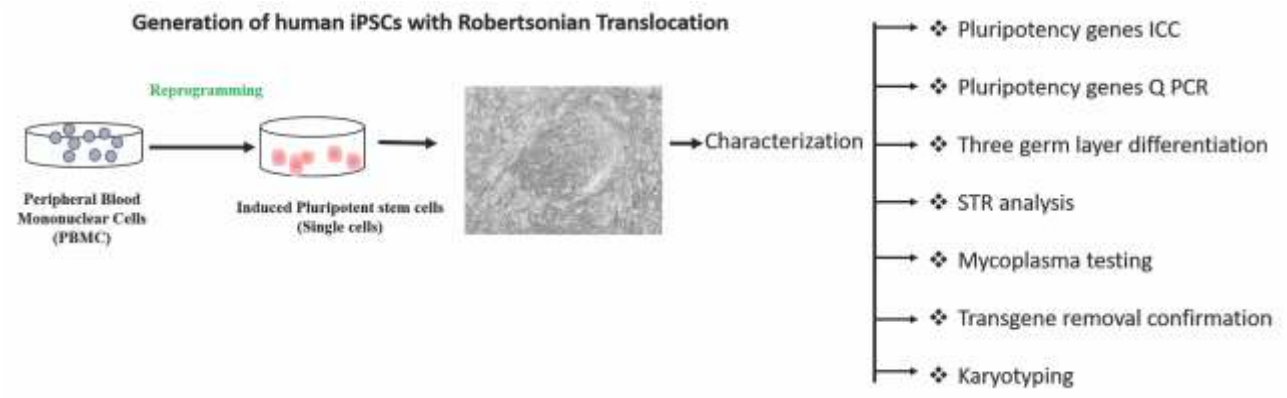
converted into more than 200 body cell types, including brain and heart cells.

This study isolated blood from a 17-month-old child with Robertsonian translocation with karyotype showing Robertsonian translocation t(14; 21) on chromosomal analysis. This individual with Robertsonian translocation was reported to have Down syndrome characteristics like hypotonia, epicanthal folds, and protruding tongue. Peripheral blood mononuclear cells (PBMCs) isolated from this child's whole blood were reprogrammed to generate patient-specific induced pluripotent stem cells. The established hiPSCs clones (NSi001-A, NSi001-B, and NSi001-C) had karyotype similar to the child sample with Robertsonian translocation [46, XX rob (14;21)] and stem cell-like characteristics. These lines would be helpful to study and develop a therapy for Down syndrome-associated disorders.

Graphical Abstract



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Role of NADPH Oxidase 4, (Nox4) in Breast Cancer Progression.

Objectives of the study

- To study the role of NOX4 in breast cancer cell migration and its underlying mechanism in normal breast epithelial cells and cancer cells.
- The subcellular localization of NOX4 and its interacting partners.
- Identification and characterization of NOX4 splice variants (protein isoform) in breast cancer cell lines and their role invasive behaviour of breast cancer cell lines.

Summary

Background

NADPH oxidase 4 (NOX4) is a major source of reactive oxygen species (ROS) production. It is a hydrogen peroxide-producing NADPH oxidase which is overexpressed in breast tumors and has been increasingly reported to be involved in tumorigenesis and/or tumor progression, including cellular senescence, resistance to apoptosis, and tumorigenic transformation and metastasis but limited data are available regarding the role of NOX4 in breast cancer (BC).

Main findings & Significance

In the previous work we showed that NOX4 mRNA expression, levels of H2O2 and cell migration was more in aggressive MDA-MB-231 cell line than the less invasive MCF7, but the NOX4 protein levels were inversely correlated with aggressiveness and ROS levels. We further showed that NOX4 knockdown (NOX4KD) increases the migration and invasion of less invasive MCF7 and it's over expression decreases migratory and invasive potential of MDA-MB231 cells (NOX4OE). To understand its molecular function, we studied its sub cellular

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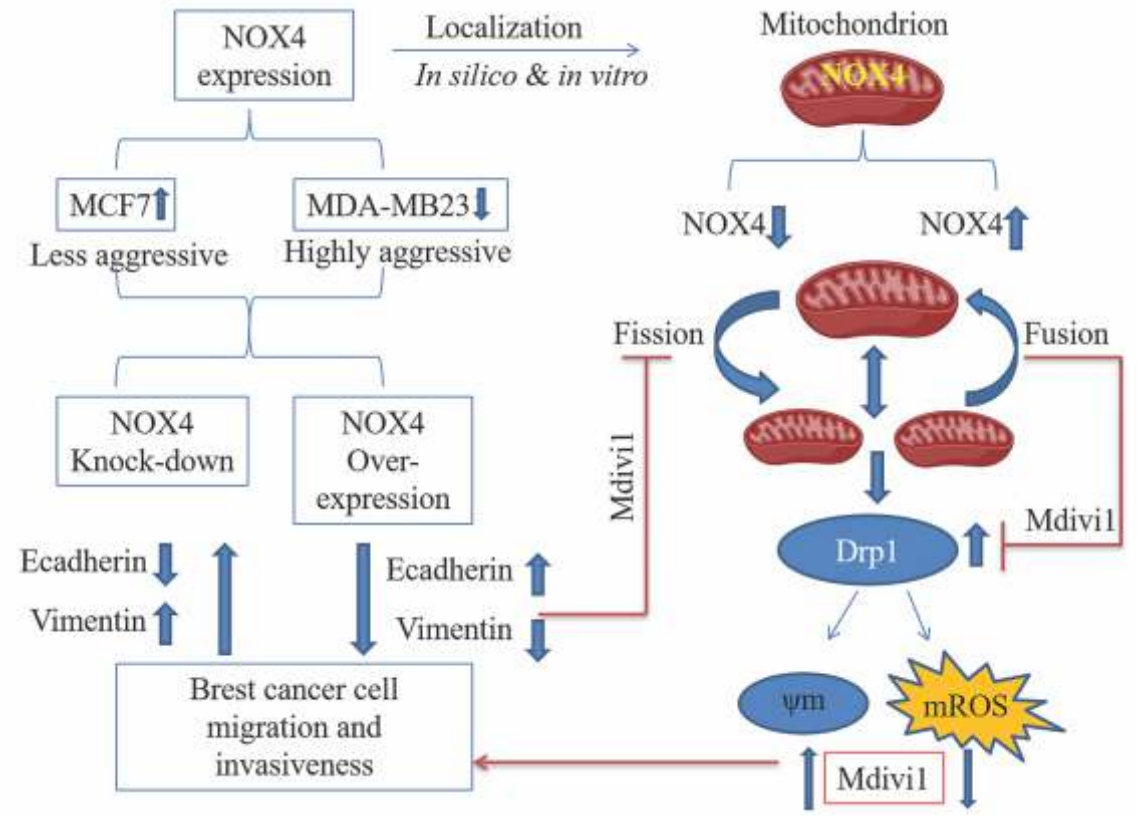
localization and it was found to be localized majorly into the nucleus, mitochondria and cytoplasm in MCF7 and only in nucleus and cytoplasm in MDA-MB231 cells.

Loss of NOX4 in the mitochondria of MDA-MB-231 cells could be responsible for the aggressiveness of this cell line. As mitochondrial dynamics regulate the cell migration in breast cancer cells, and NOX4 has been linked to mitochondrial dynamics, we further studied the role of NOX4 in mitochondrial dynamics in these cell lines. Since mitochondrial fusion is reported to be more in MCF7 cells and mitochondrial fission is more in MDA-MB-231 cells, we checked the markers of fission and fusion in the NOX4KD MCF-7 cells. A significant up-regulation of the mitochondrial fission marker (Drp1) and a significant down-regulation of the mitochondrial fusion markers (Mfn1 and Mfn2) was observed in these cells. On the other hand, NOX4 over expression in MDA-MB-231 cells significantly down-regulated the expression of Drp1 and up-regulated the expression of Mfn1 and Mfn2. Further, induction of mitochondrial fission in NOX4KD cells did not show any effect on cell viability and apoptotic changes in spite of Drp1 activation. Compared to the control cells, the mitochondrial morphology of NOX4KD MCF7 cells was observed to be less elongated and more fragmented while that in the NOX4 over expressed MDA-MB231 cells showed elongated mitochondria as well as increased mitochondrial branch length. Mdivi1, the specific inhibitor of Drp1 showed increased mitochondrial branch length in NOX4KD cells indicative of fusion while it showed similar effect after NOX4 over expression and Mdivi1 treatment in MDA-MB-231 cells. Compared with the control cells, NOX4KD MCF7 cells showed reduction of the mitochondrial membrane potential (MMP) which was recovered after Mdivi1 treatment. Moreover, Mdivi1 treatment increased MMP in NOX4 overexpressed MDA-MB231 cells. There was an increase in the mitochondrial as well as total cellular ROS in NOX4KD MCF7 cells which was reduced after Mdivi1 treatment. An opposite result was observed in NOX4 overexpressed MDA-MB231 cells. Finally, it was observed that, inhibition of mitochondrial fission with Mdivi1 treatment significantly reduced the migration of NOX4KD MCF7 cells while migratory potential of NOX4 overexpressed MDA-MB231 cells was reduced significantly after Mdivi1 treatment. Collectively, our data showed that NOX4 regulates breast cancer cell migration by regulating the mitochondrial dynamics may be through Drp1 dependent pathway.



Schematic representation of the role of NOX4 in mitochondrial dynamics in breast cancer aggressiveness.

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

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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.

Summary

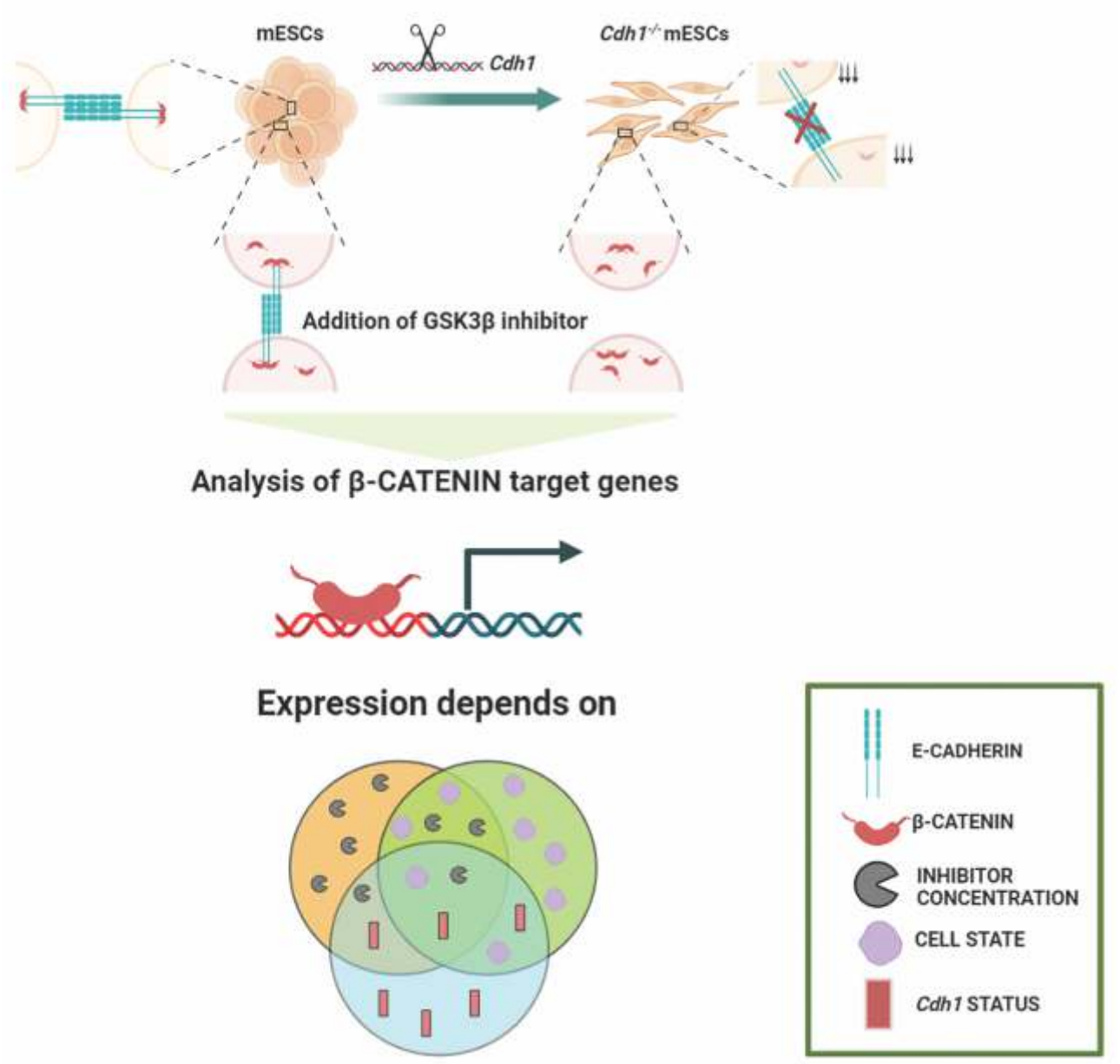
Background

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.

Main findings & Significance

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.



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.

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

Objectives of the study

- To characterize the complete lncRNA signature associated with cellular quiescence and proliferation.
- To delineate regulatory mechanisms through which lncRNAs orchestrate these processes.

Summary

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 nuclei1. 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 proteins1. 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 loading2. 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[1,2]. A highly regulated family of kinases (CDKs) associates with periodically and transiently expressed proteins, Cyclins,

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to create active cyclin-CDK complexes and drive the progression of the cell from one stage to other[1]. The activity of these complexes is fine-tuned by their regulatory phosphorylation and dephosphorylation at specific phases of the cell cycle[1]. 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[1,2]. The deregulations in the cell cycle machinery or the abrupt functioning of the cell cycle regulatory genes are the critical determinants of cancer progression[3,4]. 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[5]. Long noncoding RNAs are regulatory RNAs of various sizes ranging from 20 nucleotides to >100kb and comprise more than 50% of the eukaryotic transcriptome[6]. In order to delineate genome-wide lncRNA expression, recently Iyer et al curated approx. 7000 RNA-seq libraries from tumors, normal tissues and cell lines to comprehensively interrogate the human transcriptome and identified approx. 58000 lncRNA genes, associated with 27 tissue and cancer types[7]. This expansive landscape of tissue- and cancer-associated lncRNAs has provided a powerful starting point to begin investigating their biological relevance. 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[8,9]. Cancer is a complex disease involving various changes in gene expression that cause carcinogenesis, including cell proliferation mediated metastasis, invasion and angiogenesis[3]. An important obstacle that cells must bypass during carcinogenesis is the highly regulated cell cycle program. 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. A recent study reported extensive signatures of lncRNAs within cell cycle gene promoters and found that these lncRNAs can control cell cycle or apoptosis during DDR[10]. The lncRNA MALAT1 is differentially regulated during cell cycle progression with higher levels during G1/S and M phases of the cell cycle. It regulates transition of cells from G1 to S phase and G2 to M phase[11]. It has also been demonstrated to regulate the transcription and alternative splicing of the transcription factor bMyb, which regulates the expression of a large number of genes critical for S and G2/M phase progression[11]. Additionally, many lncRNAs have been shown to regulate critical cell cycle regulators like p53, cyclins and CDKs[5]. ***These 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.

The compelling questions pertaining to this proposal are: *How many lncRNAs are differentially expressed during cell cycle progression? How does the spatiotemporal expression of lncRNAs regulate the cell cycle program? What are the key regulatory proteins that these lncRNAs interact with? How do these lncRNAs modulate the function of various cell cycle regulatory proteins? Are there specific lncRNA-protein networks that mediate the cell cycle program? What are the key signaling networks that get affected by the deregulation of lncRNAs?*

In order to answer these questions, we would perform a systematic analysis by first identifying cell cycle stage specifically expressed lncRNAs. Once a set of lncRNAs is identified, we would perform a loss of function analysis to determine their effect on cell cycle progression. Further, we would investigate how their expression is regulated in a cell cycle stage dependent manner. Later, we would determine what proteins interact with these lncRNAs and how their function is affected by perturbation of the associated lncRNAs.

Main findings & Significance

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.

Our approach is an experimental pipeline that consists of biochemical isolation of protein interactors with confirmation from MS experiments, interacting domain analyses using molecular modeling and bioinformatics with validation through mutational screens and functional assays to definitively test the hypothesis. The strategy of Aim 2 is to identify protein interactors of specific lncRNAs through a mass spectrophotometry screen followed by a cell cycle stage specific interaction assay, determination of binding domains and generation of an interaction network delineating the cell cycle regulatory program. This detailed analysis will provide information about key proteins associated with specific lncRNAs and test the functional relevance of their dynamic regulation mediated through lncRNAs during cell cycle progression. Understanding the functional relevance of lncRNA-protein interactions during cell cycle progression would unravel previously unknown mechanism of gene regulation during this program. Finally, the strategy is to identify the molecular pathways that get affected upon depletion of lncRNAs, understand the effect on interacting partners and their function, investigate the dynamics of interaction of lncRNAs & proteins across cell cycle stages and determine mechanism of action of lncRNAs.

An interesting RNA that we focussed in our study is *LNC472* RNA [ENSG00000233237], which is an approx. 9kb transcript and is specifically upregulated during S phase of the cell cycle. Based on its function during cell cycle, we have named this RNA as DRASTIC (**D**NA **R**epair **A**ssociated **S** Phase **T**ranscript **I**n **C**ell). Analysis of ENCODE chip seq data obtained from UCSC browser showed that H3K27 acetylation(H3K27ac) and H3K4 trimethylation (H3K4me3), a signal linked with active transcription, is enriched at the TSS (Transcription Start Site) of DRASTIC, indicating that *DRASTIC* is actively transcribed lncRNA.

To investigate the cell cycle regulatory function of *DRASTIC*, WI-38 cells were treated with sequence specific LNA Gapmers targeting *DRASTIC* and scrambled oligonucleotide as control. *DRASTIC* depleted cells were assessed for the effect on cell cycle progression, cellular proliferation, and apoptosis. Cell cycle transition analysis performed through PI and BrdU/ PI flow cytometry revealed that *DRASTIC* depleted cells showed notably increased S phase and sub G1 population (cell death), implying defect in cell cycle progression through S phase. Furthermore, BrdU incorporation followed by immunostaining in normal and *DRASTIC* depleted cells indicated increased number of cells in early S phase as compared to that in the mid and late S phase. This leads to the conclusion that *DRASTIC* depletion primarily affects DNA replication in the early S phase. As the *DRASTIC* depletion results in defective S phase progression, we speculated that this defect might trigger cell death. To validate the observed increase in sub G1 population, we performed Annexin-PI flow cytometry. The FACS data displayed significant increase in early apoptotic population, with concomitant reduction in live cell population upon *DRASTIC* depletion as compared to the control cells, suggesting that *DRASTIC* is required for cell viability. We next performed proliferation assays (MTT and colony formation assay) in control and *DRASTIC* depleted cells and evaluated the effect on cellular proliferation. These experiments revealed that DRASTIC depletion leads to defect in cellular proliferation. These results specify that *DRASTIC* plays significant role in cellular proliferation and acts as pro-survival lncRNA.

To gain further insight underlying the increase in S phase population upon *DRASTIC* depletion, we addressed if *DRASTIC* is involved in uninterrupted cell cycle progression or involved in recognizing DNA damage repair or the phenotype is result of fewer permitted replication origins in mid and late S phase. To validate the notion that *DRASTIC* is required for proper S phase progression, the control and *DRASTIC* depleted cells were treated with Hydroxyurea (HU) for 16hrs followed by HU release and analysis of cell cycle progression from G1/S to G2/M. We observed that in control conditions, HU released cells resume proper DNA replication and most cells progressed to the G2/M phase. However, the *DRASTIC* depleted cells showed slower cell cycle progression, with substantial increase in number of cells in S phase. Additionally, we validated different cyclins and CDKs which are required for G1/S progression, and we observed that upon DRASTIC depletion, cells had reduced levels of cyclins D, E and CDK4/6. Thus, we speculated that slower S phase progression after *DRASTIC* depletion could be owing to stalled replication fork or failure to DNA damage repair.

To investigate the mechanism underlying S phase arrest in *DRASTIC* depleted cells, we performed chromatin fractionation and checked the chromatin loading status of pre-Replication

component. We noticed reduced chromatin loading of the PCNA, RPA32, RPA70 and MCMs (MCM3, MCM4, MCM6, MCM7) upon *DRASTIC* depletion, indicating that the early S phase arrest spotted after *DRASTIC* depletion could be attribute in the part to abnormalities in pre-RC loading. This corroborating with our findings that fewer origins are licensed, resulting in an accumulation in the S phase. We hypothesized that slower S phase progression upon *DRASTIC* depletion could be related to an inability to repair DNA damage or problem with stalled replication fork restart. To carefully scrutinise the behaviour of replication forks in *DRASTIC* depleted cells, DNA fibre assay was performed. The replicating DNA strands of *DRASTIC* proficient and *DRASTIC* deficient cells were first labelled with the thymidine analogue 5-chloro-2′- deoxyuridine (CldU) for 20 minutes. CldU was subsequently removed, and cells were given HU for 2hrs to stall DNA replication fork. HU was washed off and cells were then labelled with second thymidine analogue,5-iodo-2′-deoxyuridine (IdU) for 30minutes. Like this way, the newly synthesized DNA will be labelled with IdU. The DNA fibre assay showed that *DRASTIC* depleted cells showed reduced number of only IdU incorporated strand post HU treatment, inferring reduced number of new origins firing as compared to the control cells. At the same time, *DRASTIC* depleted cells showed higher number of stalled forks. Furthermore, *DRASTIC* deficient cells showed comparative slow fork speed to the control, suggesting that *DRASTIC* is required for proper fork progression. This showed that the local reflexes to repair stalled replication forks were spoiled when *DRASTIC* was absent. These data indicate that slower S phase progression observed in *DRASTIC* depleted cells are due to insufficient new replication origin firing and slow fork speed.

The S-phase of the cell cycle is an inherently challenging and coordinated period for cells, any error during the initial steps of DNA replication might result in DNA damage, which can lead to G1/S or S phase arrest. *DRASTIC* deficient cells showed significant increase in S phase population compared to control cells, is a consequence of enhanced DNA damage. *DRASTIC* depletion under unperturbed condition displayed increased level of DNA double strand breaks (DSBs), as shown by elevated level of γH2AX. The severity of DSBs were further confirmed by γH2AX and 53BP1 colocalization in *DRASTIC* knockdown and control cells. Colocalization of γH2AX and 53BP1 is potent marker for DSBs. Accumulated replication stress leads to DNA damage. We are interested in identifying *DRASTIC* role that have not been researched before in the DNA damage response (DDR). Here we investigated the role of *DRASTIC* in the DNA damage response. Moreover, depletion of *DRASTIC* resulted in elevated basal level of p53 and upregulated the p53 downstream targets p21 and p27.

ATM signalling plays dominant role in replication stress induced DSBs response. Activated ATM triggers cell cycle checkpoint and DNA damage repair through CDC25A, PLK1 and other factors. We investigated the activation of ATM signalling cascades in the *DRASTIC* knockdown cells. The expression of CDC25A and PLK1 were not affected in *DRASTIC* deficient cells. However, ATM pathway failed to be maintained when *DRASTIC* was lost, even though its initial stimulation was grossly normal. Moreover, knocking down *DRASTIC* did not affect ATR phosphorylation and ATR dependent CHK1 phosphorylation. Taken together, these data suggested that elevated basal level of damage markers play a role in the hypersensitivity to DNA damage upon *DRASTIC* loss.

To characterize the transcriptional difference that arise during *DRASTIC* knockdown, we performed RNA seq in *DRASTIC* proficient and deficient samples. Global gene expression analysis revealed that 1205 were differentially expressed genes (DEGs), 523 genes were upregulated, and 682 genes were downregulated at least 2fold by *DRASTIC* depletion. Gene ontology (GO) analysis exposed DEGs upregulated in *DRASTIC* depletion were majorly involved in apoptotic signalling pathway and cellular response to DNA damage stimulus. DEGs downregulated in *DRASTIC* knockdown cells were enriched in DNA replication and cell division.

Additionally, to investigate the mechanism involved, we performed proteomics analysis from control and *DRASTIC* depleted cells. A cut-off of 2-fold change and p value < 0.05 was used to classify differentially expressed proteins. In our proteomics data 407 proteins were differentially expressed out of which 343 proteins were upregulated and 64 proteins were downregulated. Gene ontology analysis revealed that DNA repair related proteins were downregulated, and cell cycle regulation related proteins were majorly upregulated. Notably, GO analysis of the 407 proteins find enrichment for various pathways including DNA repair, cell proliferation, DNA replication and DNA damage. Taken together, these data support that *DRASTIC* is predominantly required for uninterrupted DNA replication and DNA repair and its absence leads impairment of proper DNA repair and cell death.

We examined the impact of *DRASTIC* knockdown on DNA repair activity in γ radiation-induced DNA damage. Differences in the level of γH2AX at different time points after γ radiation indicated that *DRASTIC* knockdown cells had higher levels of γH2AX for a prolonged time compared to the control condition. The levels of γH2AX in the control cells at 24hrs after radiation was compared to that at 1hr, whereas γH2AX levels remained high in the *DRASTIC* knockdown cells after 24hrs of radiation. Moreover, we counted the γH2AX foci present in the *DRASTIC* deficient and proficient cells in the response to the γ radiation. Our result suggested that γH2AX positive foci disappear in control cells after post 24hrs of radiation but was remained in *DRASTIC* knockdown cells. These observations suggest that repair activity is impaired in the absence of *DRASTIC*.

LncRNAs often facilitated its effects through binding to proteins specially RNA binding proteins. To investigate the molecular insight into the biological activity of *DRASTIC*, we performed in vitro RNA pulldown with HeLa S3 whole cell lysates, followed by mass spectrometry to analyze *DRASTIC* allied proteins. Proteome analysis revealed that several proteins involved in the NHEJ pathway were only present in *DRASTIC* associated samples. RBMX (hnRNP-G), RNA binding proteins known to regulate cell cycle proteins and repair mechanism, was strongly enriched in the *DRASTIC* pull-down sample. RBMX is predominantly nuclear protein. Given the known role of RBMX in regulating repair mechanism, we selected RBMX for further analysis.

To validate the proteomics data, we analyzed the *DRASTIC* pulldown protein samples by western analysis with RBMX antibody. We observed robust signal for RBMX in pull down samples but not in beads alone, confirming that RBMX is indeed specifically present in the *DRASTIC* binding protein complex. For further confirmation, that RBMX associates with *DRASTIC*, we performed RNA immunoprecipitation (RNA-IP) from UV cross-linked HeLa cells. Notably, significant enrichment of approx. 9-fold of *DRASTIC* was observed in the RBMX IP. However, loss of *DRASTIC* didn't alter RBMX expression, but RBMX protein gets redistributed and form bigger aggregates upon *DRASTIC* depletion. As it is well known that depletion of RBMX cause DNA damage and impairment of repair mechanism, we have checked various damage and repair markers in RBMX depleted condition, and it is consistent with the previous known fact. In addition to that RBMX is also required to maintain sister chromatid cohesion, so we have performed metaphase spread in *DRASTIC* knock down cells and interestingly we observed that upon *DRASTIC* depletion percentage of chromosomal abnormalities (loss of cohesion and arm breakage) increase upon *DRASTIC* loss, this suggests *DRASTIC* mediated RBMX effect. In addition, knockdown of RBMX using siRNA resulted in the decreased level of *DRASTIC*, this shows that RBMX stabilizes *DRASTIC* levels. These data indicate that *DRASTIC* directly interacts with RNA binding protein RBMX.

We next studied the molecular mechanism underlying *DRASTIC* – RBMX mediated DSBs repair. To clarify this hypothesis, we performed RBMX-IP in the presence and absence of *DRASTIC* and examined the co-expression of different HR and NHEJ repair pathway related proteins. We tested well known HR pathway related protein BRCA2 and FUS co-expression with RBMX in the presence and absence of *DRASTIC*. This experiment suggested that homologous recombination pathway is not altered in the absence of *DRASTIC* RNA. Next, we tested whether NHEJ pathway are affected by *DRASTIC* depletion. To test this, we performed RBMX IP in the presence and absence of *DRASTIC* and check whether Ku70, Ku80 and DNAPKcs can form complex or not. In the control cells, these repair proteins were able to form complex but not in the absence of *DRASTIC*. These results support the idea and confirm the hypothesis that *DRASTIC* boosts repair via the NHEJ pathway not by HR.

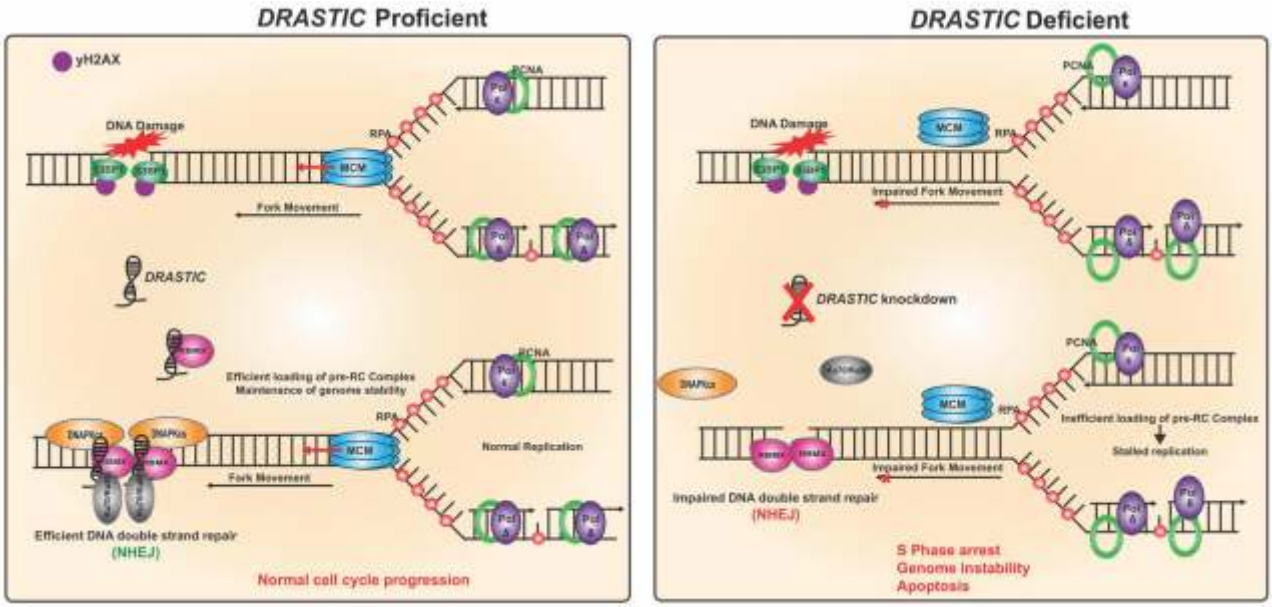

Fig. legend: In *DRASTIC* proficient cells, efficient loading of pre-RC components maintains proper DNA replication and *DRASTIC* along with RBMX efficiently repair the DSBs site through NHEJ pathway and maintains the genomic stability. In *DRASTIC* deficient cells, loading of pre-RC components are compromised leads to impaired fork movement and RBMX alone is unable to repair the DSBs site, leads to genomic instability.

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

Objectives of the study

- To investigate the in vivo role of IL-3 on bone resorption and formation using animal model of human osteoporosis.
- Phenotypic characterization of IL-3 knockout mice for skeletal architecture.
- To conduct cohort study to analyze the serum samples of human osteoporotic patients for the level of IL-3.

Summary

Bone homeostasis is maintained by coordinated activities of bone resorbing osteoclasts and bone forming osteoblasts. An imbalance in activities of these two cell types leads to pathological bone loss in important musculoskeletal and autoimmune diseases including osteoporosis, bone metastasis and rheumatoid arthritis. Pathophysiology of bone remodeling in these diseases is regulated by various osteotropic factors including cytokines secreted by activated T cells. IL-3, a cytokine secreted by T cells is known to stimulate the proliferation, survival and differentiation of hematopoietic stem cells. We have previously demonstrated that IL-3 inhibits pathological bone loss by inhibiting the differentiation of osteoclasts in presence of various proinflammatory cytokines and by promoting the differentiation of osteoblasts and bone regeneration. Recently, we have shown that IL-3 protect ovariectomy (OVX)-induced trabecular bone loss in Balb/c mouse model of human osteoporosis. IL-3 also improved bone mineral density (BMD) in osteoporotic mice. In further investigation we evaluated whether IL-3 can protect femoral and tibial bone loss in other strains of mice. We also investigated the physiological role of IL-3 on bone remodeling by characterising IL-3 knockout mice for skeletal architecture parameters.

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To understand the in vivo role of IL-3 on pathological bone remodeling we performed OVX in 8-10 weeks old C57BL/6J mice and IL-3 treatment was started before the initiation of disease process to mimic the pre-osteopenic condition. Femur and tibia bones were excised and subjected to μ-CT analysis. We evaluated the 3D images of trabecular bone of distal femur metaphysis and observed that IL-3 prevented OVX-induced bone loss (Figure 1A). IL-3 significantly prevented bone loss by improving femur trabecular bone parameters such as trabecular BMD, bone volume (BV), BV/tissue volume (BV/TV), bone surface (BS), BS/BV, BS/TV, trabecular thickness (Tb.Th.), trabecular separation (Tb.Sp.), trabecular number (Tb.N.), trabecular pattern factor (Tb.Pf.), connectivity density (Conn.Dn.), and structural model index (SMI) (Figure 1B). In addition, IL-3 also prevented the trabecular bone loss in proximal tibial metaphysis by improving the BMD as well as all the structural skeletal parameters (data not shown). These results indicate that IL-3 prevent osteopenia in different strains of mice. We also examined the effect of IL-3 on bone formation marker procollagen type I N-terminal propeptide (PINP) and bone resorption marker C-terminal cross-linking telopeptide of type I collagen (CTX-I). However, IL-3 showed no significant effect on these biochemical markers.

We further evaluated the skeletal structural parameters of IL-3 knockout mice (B6.129S2(B10)-Il3^{tm1Tyb}/J) of C57BL/6J background obtained from Jackson Laboratory. Knockout and wild type mice were sacrificed, and femur and tibia bones were excised and subjected to μ-CT analysis. 3D images of trabecular bone of distal femur metaphysis confirmed a significant bone loss in IL-3 knockout mice as compared to wildtype mice (Figure 2A). This data was further substantiated from the decrease in trabecular BMD as well as structural skeletal parameters like BV/TV, BS/TV, Tb.Sp., Tb.N., and Tb.Conn. Dn. (Figure 2B). These results further suggest that IL-3 lay a key physiological role in bone remodeling. We also checked any alteration in hemopoiesis of IL-3 knockout and wildtype mice. However, we observed no abnormalities in general hemopoiesis in both the mice. In conclusion, our results indicate that IL-3 can prevent the post-OVX bone loss in mouse model of human osteoporosis in different mice strain without affecting hemopoiesis.

Future Research Plans

Serum samples of IL-3 knockout mice will be evaluated for bone resorption and formation markers. We will also evaluate the therapeutic effect of IL-3 on pathological bone loss in OVX mice. IL-3 will be administrated from day 30 post-ovariectomy to evaluate the anabolic effect of IL-3 in mice by μ-CT. Also, the serum samples of human osteoporotic patients will be evaluated for determining the level of IL-3 along with other cytokines.

Figure 1

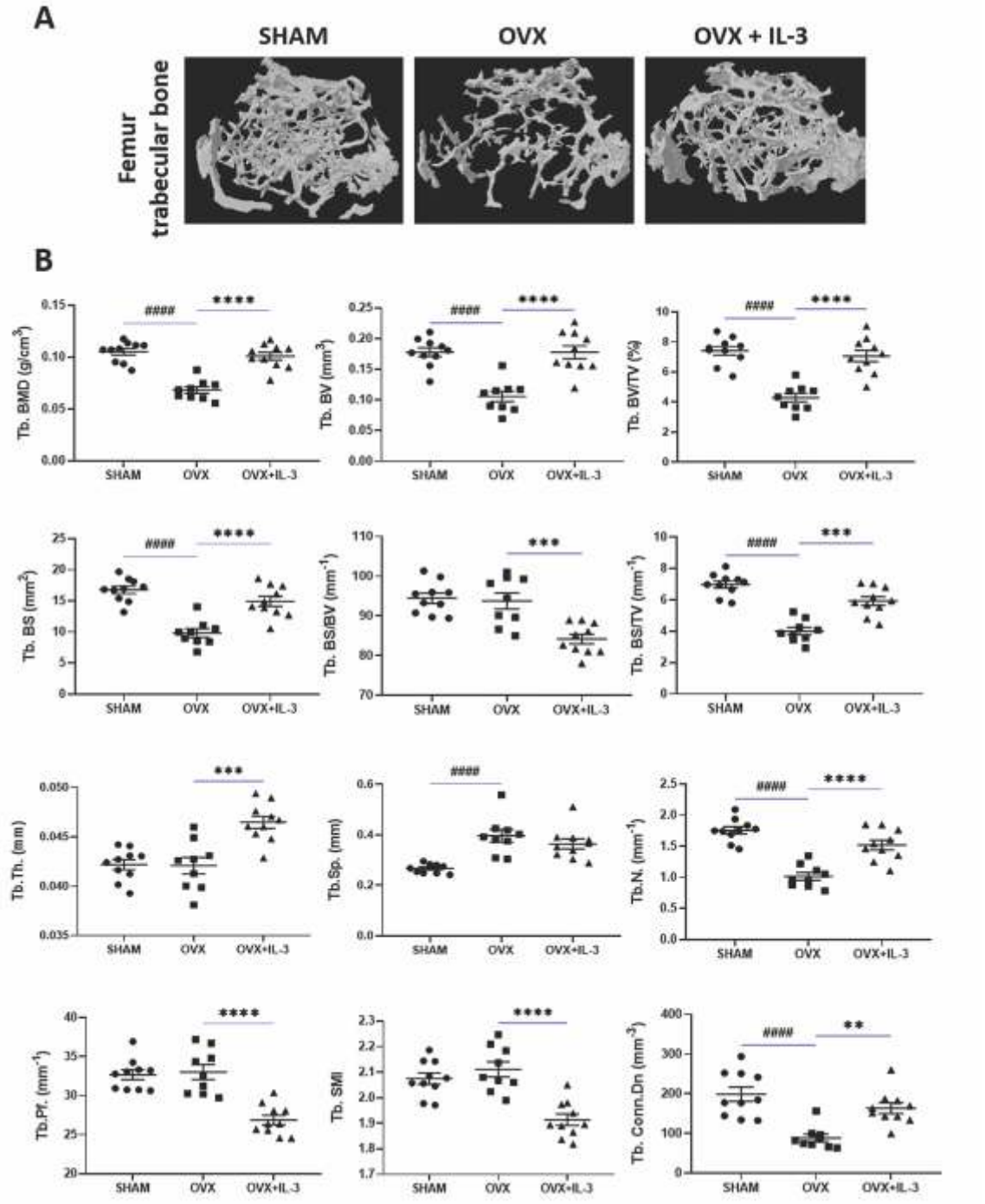

Fig. 1. : IL-3 prevents OVX-induced bone loss in distal femur metaphysis of C57BL/6J mice. After 38 days post-OVX the femoral bones were excised and subjected μ-CT analysis. (A) Representative 3D images of femur trabecular bone. (B) Structural skeletal parameters of distal femur trabecular bone. Significance was calculated by a one-way ANOVA followed by a post hoc Bonferroni multiple comparison test. Data is presented as mean ± SEM, n = 9-10 mice/group. ##p ≤ 0.01 ###p ≤ 0.001 ####p ≤ 0.0001 vs SHAM and *p ≤ 0.05, **p < 0.01, ***p < 0.001 vs OVX

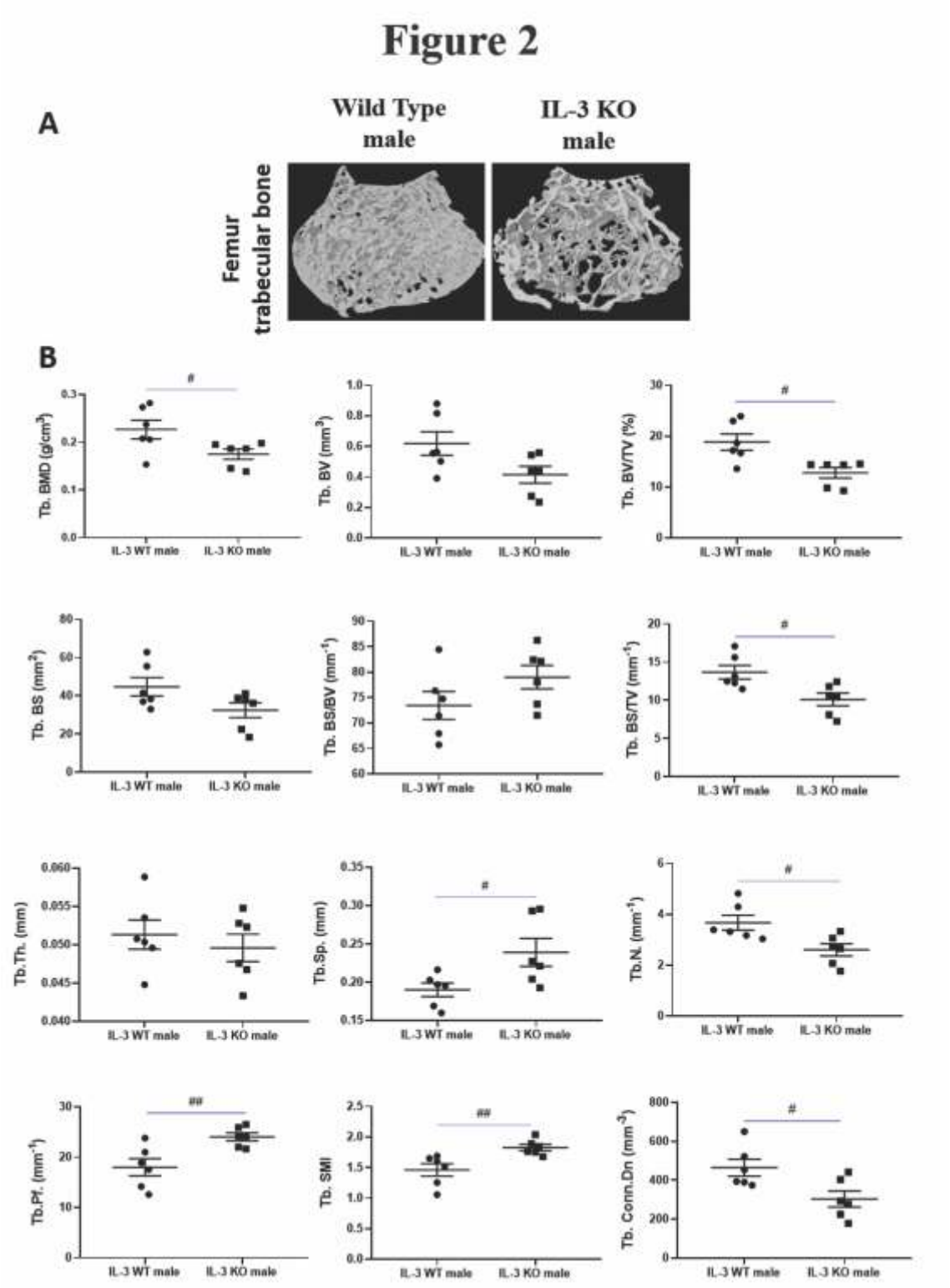

Fig. 2. IL-3 knockout mice showed significant decrease in skeletal parameters of femur trabecular bone. Femur of 8-10 weeks old IL-3 knockout and wildtype mice were excised and subjected to μ-CT analysis. (A) Representative 3D images of femur trabecular bone. (B) Structural skeletal parameters of distal femur trabecular bone. Significance was calculated by a one-way ANOVA followed by a post hoc Bonferroni multiple comparison test. Data is presented as mean ± SEM, #$p \leq 0.05$, ##$p < 0.01$ vs IL-3 wildtype mice.

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Understanding Genomic Factors Associated with the Pathogenicity of '*Candidatus* Phytoplasma' Associated with Soybean 'No Pod' and Parthenium Phyllody Disease

Objectives of the study

- Isolation, enrichment, sequencing, assembly and analysis of the genome of 'Peanut Witches' Broom' phytoplasma strains associated with soybean 'no pod' and parthenium phyllody disease.
- Mining Phytoplasma genomes. Identification of putative effector genes governing pathogenicity, mobile elements and virulence factors. The understanding evolutionary aspect of the phytoplasma genome through comparative genomics.
- Exploring the role of genome sequence in phytoplasma taxonomy. Establishing additional marker gene understanding taxonomy of 16SrII group phytoplasma strains.
- Identification of known and unknown sap-sucking insect vectors associated with transmission of 'Peanut Witches' Broom' phytoplasma.

Summary

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.

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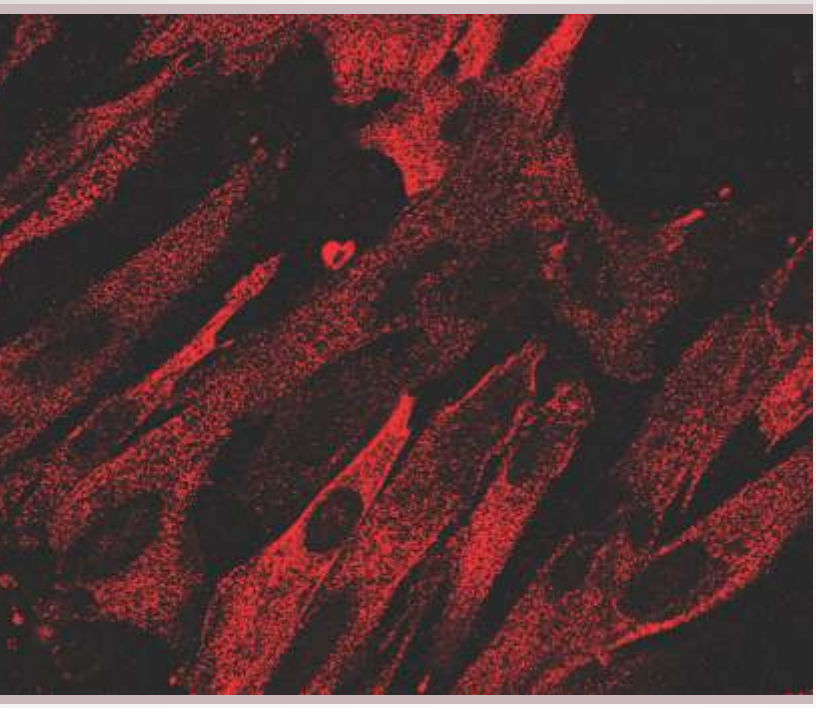
Main findings & Significance

The complete phytoplasma genomes of 'Peanut Winches' broom' (PWB) strains revealed the highly rearranged nature of phytoplasma genomes, heterogeneity in the gene synteny in taxonomically identical strains, the presence of unique Potential Mobile Units (PMUs), presence of sequence-variable mosaics (SVMs) of clustered genes, repetitive extragenic palindromes, absence of several SAP proteins found in taxonomically distinct strains and the presence of genes encoding for pathogen movement. The 'Peanut Winches' broom' also possesses unique effector proteins found in no other phytoplasmas. The whole-genome sequence also revealed that the strain associated with soybean and parthenium phyllody belongs to new novel phytoplasma species. 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.



Support Units & Other Facilities

Experimental Animal Facility

Dr. B. Ramanamurthy

(Scientist and Facility In-charge)

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 the Purpose of Control and Supervision of Experiments on Animals" (CPCSEA) and operates in compliance within the guidelines laid down by the Committee. It is a facility for 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 Team

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 total number of mice lines, inbred, outbred, and mutant and hybrids, being maintained at the Experimental Animal Facility stands at 60. 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. During the period a total of 356 mice (both mutants and inbreds) have been screened for genetic quality.

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. Supplied 4805 laboratory animals to the on-going research projects during the period.

More than 75 Institutional Animal Ethics Committee (IAEC) approved projects of 24 Scientists have been supported for the conduct of experiments in animal and majority of these projects are ongoing. 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 2021-22, a total of 13 fellows underwent the one credit course which comprised of both theory and practical sessions.

As per the rules and regulations framed by the Committee for the Purpose of Control and Supervision of Experiments on Animals (CPCSEA) Govt. of India, the EAF provides the requisite oversight on the conduct of experiments on laboratory animals in the Institute. During the reporting period 3 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:
Guest Faculty lecture: "Breeding and Supply of Lab Animals Special Context To Rodents" – delivered at the National Online Training Programme on Lab Animals in Bio-Medical Research (22 Sep.), organized by the Dept. of animal genetics and Breeding, College of Veterinary & Animal Sciences, Parbhani. Maharashtra Animal and Fishery Sciences University, Nagpur; 21 -27 September 2021.
Audience: More than 500 registered participants comprising of Veterinary/M.Pharm./B.Pharm./D.Pharm. /B.Sc. /Science Students, Scientists, Faculty, Veterinarian, Industry personnel.

Dr. Rahul M. Bankar:
Online lecture: 'Bio methodology for laboratory Rodents' – delivered at the National online training programme on Basics & Ethics of Laboratory Animal Experimentation in Biomedical Research' (20 Dec. 2021), organized by Krantisinh Nana Patil College of Veterinary Science, Shirwal; 20-24 December 2021.

Proteomics Facility

Dr. Srikanth Rapole

(Scientist and Facility In-charge)

The Team

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:

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 MSn 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 190 samples from April-2021 to March-2022.

Equipment in the Proteomics Facility

Orbitrap Fusion Tribrid LC-MS/MS system

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 24 samples from April-2021to March-2022.

4800 LC-MALDI-TOF/TOF

4000 Q-Trap LC-MS/MS

AGILENT GC-MS

Participation in Outreach Activities of NCCS

Visit of students from
Dr. DY Patil ACS College, Pune
28 March 2022

Visit of students from
Kendriya Vidyalaya, Pune, under the DST-STUTI programme organized in collaboration with ICT, Mumbai.
17 February 2022

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 20 samples from April-2021 to March-2022.

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.

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 2021-22, a total of 15 research students underwent the extensive one-week training at Proteomics facility. These training programs help them to use advanced mass spectrometry approaches in their projects.

Proteomics facility staff actively participated in the open National Science Day programme, and demonstrated mass spectrometry instruments and technologies to the students from various schools, colleges and Universities, and general public. During the year 2021-22, a total of 156 students and teachers visited proteomics facility, and were given exposure to sample processing stages before submitting to advanced mass spectrometry instruments; staff of proteomics facility demonstrated its working and applications.

Bioinformatics and High Performance Computing Facility

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

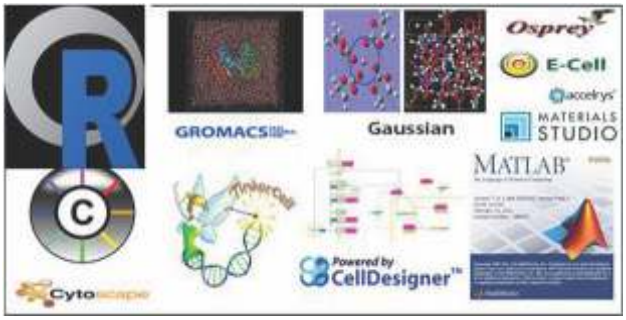
High End Desktop (4 in number)
HP workstations of Intel Core 2 Duo @3.00GHz with 8 GB of DDR2 memory, 320 GB of SATA storage and 19" LCD wide Display with Linux/Windows OS
HP Elite Desktop of Intel i7 processor, 3.4GHz with 16GB RAM, 2TB SATA storage and 21.1" LCD wide display with Windows 8.1 Professional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

Dates: 5/6/2021, 12/6/2021, 19/6/2021, 26/6/2021, 3/7/2021,10/7/2021, 21/7/2021, 16/9/2021, 23/9/2021,30/9/2021, 2/10/2021, 21/10/2021, 23/10/2021, 27/10/2021, 13/11/2021, 20/11/2021, 25/11/2021

Online training programme for the NCCS students 2021. Online workshop was organised for students

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 436 volumes per year. The library holds approximately fifteen thousand one hundred seventy-nine bound journals, three thousand eight hundred ninety-one books, and three hundred forty-nine Ph.D. theses of NCCS research students. Ten scientific journals and twenty-three other periodicals in print form are subscribed. The online journal consortium of DBT, DeLCON, currently subscribes 994 e-journals from 13 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. The library has purchased Grammarly for the NCCS staff and students, to help improve the language of Ph.D. theses, reports and manuscripts. 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 and Facility In-charge)

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 and training to NCCS Staff, personnel of extra-mural projects and students. Routine support includes setup and configuration of servers, desktops, laptops, printers, scanners, software, network services, as well as their management and maintenance.

The section is also responsible for providing secured network services including the design of campus-wide LAN/WAN solutions, intranet solutions, besides making available basic computing infrastructure required for the implementation of ongoing R&D projects. Three internet links are installed at NCCS, viz. 100Mbps from NKN, 100Mbps from Tata Communications Ltd. and 100Mbps from BSNL, Pune. Internet facilities are extended to all institute users, visitors to the guest house, students' hostel, and staff quarters. The present network security system has been upgraded with the latest Sophos firewall XG4400 and Sophos Antivirus with Intercept-X for desktops and laptops to provide a cohesive secured working environment.

Technical Support Services provided:

- Wired and Wireless Networking Solutions & Services to Desktops, Laptops and Mobile phones.
- Setting up temporary wifi network for Conferences, seminars and meetings.
  - Provided technical help in organising online interviews for project posts, JRF posts, NCCS staff assessment, NCCS Foundation Day etc.
  - EMBO workshop organised in February 2022.
- Providing internet connectivity to all scientists, staff and students through NKN, BSNL and Tata links.
- Computer hardware infrastructure procurement, installation, configuration and maintenance.
- Providing user support services including new desktop specifications, software and hardware installations, printers, scanners and other computer related devices.
- Co-ordinating e-mail Service from the 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.
- Managing internet connectivity issues which includes call logging in case of link failure, troubleshooting, link testing, restoring link failure issues etc.
- Web Services - 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.
- Providing Technical support for 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.

New Initiatives:

1. New Internet Leased Line (ILL) from BSNL

A new fiber optic based ILL connectivity of 100 MBPS (1:1) bandwidth from BSNL, Pune, has been installed and configured in the Computer Server room to cater 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.

2. Establishment of new Data Centre (DC)

Critical inputs required for establishment of new state-of-the-art Data Centre (DC) for NCCS were provided. This DC will provide centralized NCCS IT operations involving computing servers and network infrastructure to store, analyse, manage and disseminate data. As a beginning, the DC will house 3 Nos. of Smart racks collocating all servers and network devices. The work for establishing the DC is in final stages.

3. Secured SSL Certificate for NCCS website

The GeoTrust SSL certificate already installed on the NCCS website has been renewed for the next one year i.e. up to September 2022, whereby all website visitors will have secure protected access. This not only affirms NCCS identity but also provides better search engine ranking and visibility.

4. Upgradation of Tata Internet Connectivity

The 30 Mbps (1:1) internet bandwidth from TATA Communications Ltd., Pune has been upgraded to 100 Mbps (1:1), which is being used for DNS resolution, NCCS website, E-mail and the scientific website (DelCon) browsing and for MANAV project server.

5. Project Management Software Server

The detailed technical specifications for computer server and storage were provided to the project management cell for installing & running project Management software (SFACTS).

6. New NCCS Website

The development of a new NCCS website was in the final stages. The website is based on Content Management System (CMS) for role-based editing and approval of information. This website is GIGW Complaint (Guidelines for Indian Government website) and will be hosted after third-party security audit.

Other Activities:

Mr. R. J. Solanki

1. Attended the virtual Conference on 'Offensive or Defensive cybersecurity - what's right for your business? Find out at ETCISO Annual Conclave'; 16 March 2022. Virtual https://ciso.economictimes.indiatimes.com/annual-summit
2. Was a member of the panel at NCL, Pune, constituted to interview candidates (online mode) for project positions of the CSIR Jigyasa project on 20 August 2021.

Bio-Imaging Facility

The Team

- Dr. Arunkarthick S. – Scientist & Facility In-Charge
- Dr. Ashwini N. Atre – Technical Officer B
- Mrs. Trupti P. Kulkarni – Technician C
- Mr. Sourav Chowdhury – Technical Assistant (operator for HCA system provide by Thermo Fisher Scientific, posted in NCCS)
- Ms. Tejashree Dhamale – Technical Assistant (Operator for HCA System provided by Thermo Fisher Scientific, posted in NCCS)

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. In addition, the facility offers workshops related to microscopy, including those designed to train students in modern and classical methods to prepare microscope slides. 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 2021-2022

The numbers of samples imaged during this year were approximately 4278 in-house samples, plus 116 samples received from other institutes. 85 live samples were imaged during the said year.

Bio-Imaging facility staff with the SpinSR microscope

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	Olympus Spinning Disk Super Resolution Microscope	30 August - 03 September 2021	10 PhD Students 3 Technicians 2 Faculty members
2	Image Analysis using Fiji/ImageJ - a Basic course workshop	Through September 2021	1 Post Doc 2 Technicians 26 PhD students
3	High Content Screening Training Workshop on Cellnsight CX7 LZR	22 - 23 November 2021	3 PhD Students. 2 Technicians 2 Faculty members
4	Light Microscopy and Confocal Microscopy Techniques.	24 Nov. 2021	1 Faculty member from Dr. D. Y. Patil Dental College & Hospital, Pimpri, Pune. 2 M.Sc. students from Amity University, Mumbai. 1 M.Sc. student from the Institute of Science, Mumbai. 1 Technician from NCCS.
5	Olympus Spinning Disk Super Resolution Microscope and Olympus FV3000 Confocal microscope	28 February to 01 March 2022	2 Technicians 4 PhD students (including 1 from IISER-Pune) 1 Faculty member
6	Zeiss LSM880 Confocal microscope with Airyscan	02 March 2022	1 PhD Student 3 Technicians 2 Faculty members

The Bio-Imaging facility organized technical seminars on Olympus SpinSR10 spinning disk confocal super resolution microscope by Olympus India on 30 August 2021 and 28 February 2022.

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. A basic training course on 'Image Analysis using Fiji/ImageJ' was conducted on 08, 15, 22 and 29 September 2021. Thirty PhD students, two postdoctoral researchers and three technicians benefited from this training.

3. Outreach

- Technical talk and hands-on training: 'Light Microsopy and Confocal Microscopy Techniques' - organized at the Agharkar Research Institute, Pune, on 04 October 2021. Seventeen PhD students, three technicians and two faculty members received training.
- A demonstration was organized for students of AMITY University, Mumbai, Institute of Science, Mumbai and a faculty member of D.Y. Patil Dental College, Pimpri, Pune on 24 Nov 2021.
- An open day was organized at NCCS under DST – STUTI in

association with ICT, Mumbai, on 23rd February 2022. About 100 students of class 11th and 12th from nearby schools visited the facility.

- Visits to the facility were organized for MSc. students of D.Y. Patil ACS College, Pimpri, Pune, on 28th and 29th March 2022.

2. Technical Talks

- 'Thermo Fisher Cell Sorter: BIGFOOT'
  Speaker: Badri Natarajan Narayanan (Manager-Field Applications, Global Service Support & Customer Service for Flow Cytometry Applications, Thermo Fisher Scientific)
  Date: 03 September 2021
- Instant SIM Super Resolution Microscope from Visitech International'
  Speaker: Mr. Steven Coleman (Operational Director, Visitech)
  Date: 21 October 2021

5. Facility Staff Training for Vaccine Testing

Mrs. Trupti P. Kulkarni received training for vaccine testing techniques at the Serum Institute of India Pvt. Ltd. such as Spectrophotometric Analysis, Determination of pH, Determination of Osmolality, Container Closure Integrity Testing, Bacterial Endotoxin Testing, Determination of Ratio of Virus Particle Concentration and Infectious Titre (P:I Ratio) in ChAdOx1-nCoV19 Vaccine Samples.

6. Participation in IISF 2021

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 2021).

FACS Facility

The Team

Dr. Arunkarthick S. - Scientist & Facility In-Charge

Mr. Amit Salunkhe - Technician C

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., in ensuring the FACS facility's smooth functioning.

Instruments Available in the FACS Core Facility

Six flow cytometer machines purchased from Becton Dickinson (BD) are available in the FACS core facility. These are operated on a rotation basis by three dedicated operators. Of the six flow cytometers, three are analyzers, and three are sorters.

Benchtop Analysers:

1) FACS Calibur: 2 Lasers, 4 Colours. 2b-2r (Blue 488 nm, Red 633 nm)
2) FACS Canto II (Old): 3 Lasers, 8 Colours. 4b-2r-2v (Blue 488 nm, Red 633 nm, Violet 405 nm)
3) FACS Canto II (New): 3 Lasers, 8 Colours. 4b-2r-2v (Blue 488 nm, Red 633 nm, Violet 405 nm)

Cell Sorters:

1) ARIA II SORP: 4 Lasers, 11 Colours. 5b-2r-2v-2uv. (Blue 488 nm, Red 640 nm, Violet 405 nm, UV 355 nm)
2) 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)
3) ARIA III STD: 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 check.

The usage of the six instruments for the period under consideration is summarized below-

Immunophenotyping & Cell Cycle Analysis:

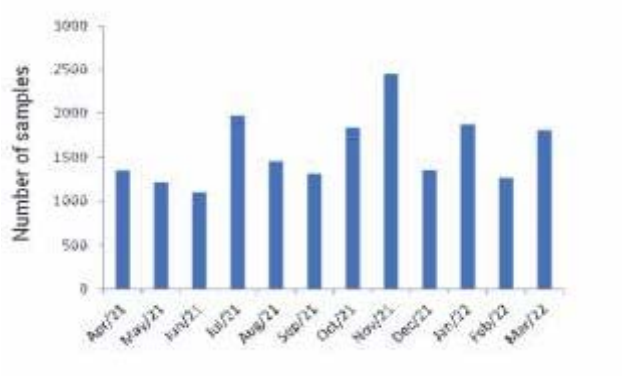
Equipment used	Surface / Intracellular Staining	DNA Cell Cycle analysis	Usage of Instruments after office Hrs.	Total samples acquired	Total samples acquired
FACS Calibur	78	177	54	309	618
FACS Canto II (Old)	523	38	827	1388	2776
FACS Canto II (New)	10365	831	4949	16145	32290
Total	10966	1046	5830	17842	35684

Sterile Sorting:

Equipment used	Sorting	Acquisition*	Total samples sorted/Analyzed
FACS Aria II SORP	27	41	68
FACS Aria III SORP	137	565	702
FACS Aria III Standard	188	563	751
Total	**352**	**1169**	**1521**

*Includes analysis of samples that require UV laser on sorters. We do not have UV laser in our analyzers.

Figure : Monthly usage of FACS facility (samples analyzed)



Samples from outside users:

In the light of 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 ARI, Bharti Vidyapeeth Deemed University (BVDU), and Abeda Inamdar Sr. College in Pune utilized our facility during the year under review. The facility acquired around 491 samples for surface/intracellular staining and DNA cell cycle analysis. Total revenue generated Rs. 99120 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 permits 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. Outreach program and Visits

Due to COVID19 pandemic such activities were badly hampered in this year.

- Under the scheme "Synergistic Training program Utilizing the Scientific and Technological Infrastructure" (STUTI), the visit of 110 students of Std 11th and 12th from Kendriya Vidyalaya, Pune, was organized by the Institute of chemical technology (ICT), Mumbai at NCCS, Pune on 23rd February 2022.
- 03 students and a Sinhgad Dental College and Hospital professor visited FACS Facility on 16th March 2021.
- Fifty-two students and a lecturer from Dr. D. Y. Patil ACS College, Pimpri, Pune, visited the FACS facility on 28th March 2022 and 29th March 2022 in batches.

2. Participation of staff:

- Staff members attended the 23rd INDO-US Flow Cytometry workshop (Online) from 27th January 2022 to 1st February 2022.
- For the vaccine testing facility, staff members attended training at Serum Institute of India Pvt. Ltd. from 19th - to 21st April 2021.
- Staff member's attened discussion session **'जिज्ञासा'- वैज्ञानिक व्याख्यान श्रृंखला के अंतर्गत चर्चा 'करोना का भय कब तक'** on 25th March 2022, by Dr. Satyajit Rath, IISER, Pune.

3. COVID-19 related work:

The staff members from the FACS facility were involved in SARS-CoV-2 Genomics Consortium (INSACOG) project and the Vaccine testing facility development at NCCS.

Other Facilities

1) Protein crystallization and X-ray diffraction facility

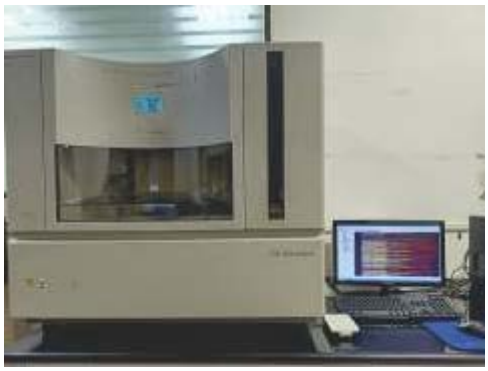
Team members

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

Dr. Janesh Kumar

Description

A new 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.



2) DNA sequencing facility

The Team

Dr. Dhiraj Dhotre (Scientist and Facility In-charge)

Dr. Sarang Satoor (Technical Officer)

Mr. Vikas Patil (Technician)

Mrs. Kruttika Phadke (Technician)

The central sequencing facility of NCCS is located at the National Centre for Microbial Resource (NCMR) and houses two Sanger-based instruments from Applied Biosystems (3730 and 3730xl), along with all sequence and data analysis software. The facility offers services related to sequencing of plasmids, PCR products and cloned inserts; primer walking; and genotyping and fragment analysis, to researchers from NCCS and other organizations. This facility caters to the needs of research institutions and industrial clients across the country, for the identification of bacterial and fungal isolates. In addition, the facility serves as the back-bone of culture authentication and identification for NCMR's preservation activities.

Over the year 2021-22, a total of 13152 sequencing reactions were run on the machine. The facility provided support to the internal institutional research activity by delivering 11052 sequencing reactions. 525 services against payment were provided to 156 different academic and research institutions from 17 states across the country. Bacterial identification using 16S rRNA gene sequencing and fungal identification using the ITS region sequence were mainly performed. For the identification of bioprospection cultures stored in the biobank at NCMR, 5025 cultures were processed. Also, 925 cultures were validated for various deposits in the culture collection during this year.

a) Name of the machine: ABI 3730XL DNA Analyzer.
b) Number of 96-well plates run on the machine during the said period: 137.
b) Number of sample reactions run on the machine during the said period: 13152.
c) No. of in-house users: 33
d) No. of extramural users benefited: 156 different institutions/universities from 17 states (Assam, Bihar, Haryana, Himachal, Gujarat, Rajasthan, Jammu & Kashmir, Karnataka, Kerala, Maharashtra, M.P., Punjab, Sikkim, Tamil Nadu, Tripura, U.P., Uttarakhand and West Bengal).

3) Surface Plasmon Resonance Facility (SPR) Facility

The Team

Dr. Arunkarthick S. - Scientist and Facility In-Charge (arun@nccs.res.in)

Ms. Mary Beulaa Jayapragasam - Technical Specialist, Cytiva (formerly GE Healthcare Life Sciences), and posted at NCCS from June 2019

Name of the Instrument: Biacore T200 (Installed on June 4th, 2019)

A versatile system for high quality characterization of molecular interactions ranging from ions to viruses in real time using label free detection based on the phenomenon of surface plasmon resonance (SPR). Capable of reliable ligand-binding assays, even for the most complex biologics.

The SPR facility offers these services:

- Expert consultation and service by technical specialist.
- Assistance with Biacore T200 software for reliable kinetic analysis.
- Conducts regular training programs to develop skilled manpower.

Biacore T200 usage during the period under review:

Pi's Name	No Of Samples	Chips Used	Total Number Of Hours Used
Dr. Shailza Singh	4	NTA-1 & CM5-1	19h 30min
Dr. Janesh Kumar	11	L1-1	103h 59min
Dr. Shekhar Mande	3	CAP-1	4h 53min
Dr. Shailza Singh	4	NTA-1 & CM5-1	252h 32min
Dr. Arvind Sahu	10	CM5-5	78h 23min
Dr.Vasudev Shastry	3	NTA-1	19h 4min
Dr. Akanksha Chaturvedi	2	Protein A & NTA -1	5h 39min
Total	37		484h

Training imparted during the period under review (Intramural)

Training Details	Date(s) of Training	No. of Participants
SPR training and examination (with the chip CM5-FC 1,2)	9 - 11 March 2022 (3 Days)	* Ph.D. Scholars: 12 * Technical Staff:3 * Postdoctoral researchers: 2

Trainees who received the SPR training

Other activities:

Outreach program and visits

- Under the scheme "Synergistic Training program Utilizing the Scientific and Technological Infrastructure" (STUTI) the visit of 110 students of std 11th and 12th from Kendriya Vidyalaya, Pune was organized by Institute of Chemical Technology (ICT), Mumbai at NCCS, Pune on 23rd February 2022.
- A professor and 03 students from Sinhgad Dental College and Hospital has visited the SPR facility on 16th March 2022.
- A lecturer and 52 students from Dr. D.Y. Patil Arts, Commerce & Science College, Pimpri, Pune has visited SPR facility on 28th March 2022 and 29th March 2022 in batches.

4) Scanning Electron Microscopy

The Team

Dr. Amit Yadav, Scientist & Facility In-charge

Mr. Vipool Thorat, Technician 'B', NCMR

Description

EVO 18 provides excellent quality imaging results with the capability to handle all material types including bio-samples. EVO 18 used LaB6 as electron source with high brightness upgrade path. EVO18 has improved low kV performance and enhanced topography information offered by the 5-segment diode BSE detector. Inducted in 2019, SEM has processed over 160 samples from researchers from and outside NCCS. These samples primarily included bacterial cells, fungal mycelium and spores, archaea, nanoparticles, cancer cells and others.

NCCS Centre of Excellence: "National Centre for Microbial Resource" (NCCS-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 technologi¬cal 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, DBT established "centre for excellence, National Centre for Microbial Resource", 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 MALDI-TOF, 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 Department of Biotechnology (DBT) established the MCC in June 2008- which is now called National Centre for Microbial Resource (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 IDA under the Budapest Treaty and Designated National Repository under 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 International Depositary Authority (IDA) for deposit of Micro-organisms under the Budapest Treaty for protection of intellectual property rights and Serve as Designated National Repository 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 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 resource, 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 1,35,470 bacterial 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 3,710 bacterial and fungal cultures were deposited by various researchers across India in NCMR for their long-term preservation.
- Total 11,722 services were provided by the NCMR so far; in 2021-22 NCMR provided 3,298 services to industry and academia across India.
- Establishment of AMR repository: NCMR has started the repository of AMR isolates and in 2021-22, it has received 1200 isolated in total.
- In 2021-22 NCMR has published 26 research papers including 2 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	1,35,470
General Deposit Cultures	3,710
Bacteria + Archaea	2,347
Fungi	1,363
PLSL Microbial Cultures	2,841
Fungi	2,036
Bacteria	296
Actinobacteria	509
Secure deposits at IDA	300
IDA Deposits	238
Safe Deposits	62
Other Resources	159
Genomic DNA	152
Plasmids	7
Total Number of Holdings	1,45,243

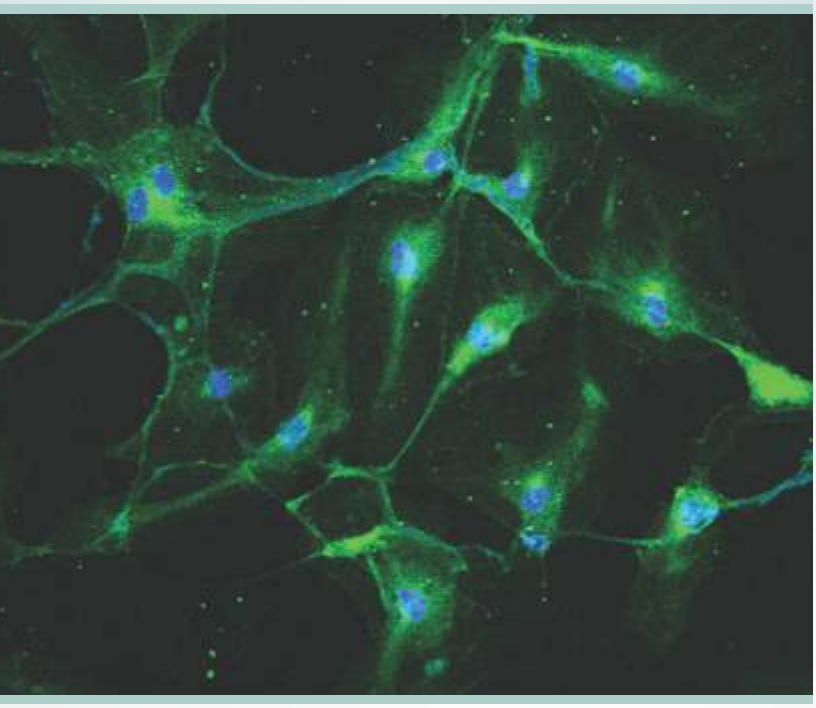
Major achievements during the year 2021-22

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

- Bioprospecting cultures: Out of total ~1.4 lakh bioprospecting cultures at NCMR, a total of 78,381 are pure cultures which are preserved in deep freezer and liquid nitrogen. A major portion of the microbial mission cultures (77,712) have been processed for identification using rRNA gene sequencing and MALDI-TOF, of which 65,098 have been processed since the establishment of NCMR.
- 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), 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 isolates for genome sequencing.
- NCMR Scientists are publishing papers in various aspects of Microbiology since 2009 and 183 research papers are published from April 2017. In 2021-22 NCMR has published 26 research papers.
- Total 68 novel taxa have been published by NCMR since 2009, 29 of which were published from April 2017- October 2021. In 2021-22, NCMR published 2 novel bacterial taxa.
- Revenue generated through the number of several services provided by NCMR to academia and industry. Custom services and/or project were undertaken by the NCMR from many industries for finding solutions or obtaining data though various microbiology related projects. Custom project grants worth ₹ 116.71 lakhs were received at NCMR from industries on various research aspect. Additionally, by Oct 2021, total amount of grants received through extramural research projects is ₹843 lakhs. The revenue generated through inhouse facilities and expertise was ₹ 19.19 lakhs in 2016-17 which went up to ₹38.73 lakhs in 2019-20. In 2021-22, NCMR has earned the revenue of ₹18 lakhs.
- NCMR scientists are engaged in research proposals for extramural funding. Currently there are 10 extramural projects running at NCMR funded by DBT, SERB-DST, MOES, NMPB, etc. Since 2017, NCMR faculties have been awarded project grants of ₹843.04 lakhs in total.

List of Abbreviations

MCC: Microbial Culture Collection
NCMR: National Centre for Microbial Resource
PLSL: Piramal Life Science Limited
NCCS: National Centre for Cell Science
IDA: International Depository Authority
AMR: Anti-Microbial Resistance



COVID-19 Related Initiatives

Contributions of NCCS Towards the National Efforts Against COVID-19

Prof. Rajesh Gokhale (Secretary, DBT) and Padma Shri Vaidya Rajesh Kotecha (Secretary, Ministry of Ayush) visited the COVID-19 Vaccine Testing Facility constructed at NCCS
16 March 2022

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 during 2021-22 as well, through various activities, which are summarized below.

1] Vaccine Testing Facility

To meet the massive national demand for COVID-19 vaccines, the Government of India proactively decided to set up additional vaccine testing facilities to expedite the process of vaccine testing and batch release certification. Through diligent efforts, a state-of-the-art Vaccine Testing Facility was constructed at NCCS on a war footing, with generous support from the PM CARES Trust Fund, and with guidance from the Secretary, Department of Biotechnology, Government of India, the Central Drugs Standard Control Organisation, and CDL-Kasauli. The facility includes clearly-demarcated sterility testing and clean rooms. The validation of the facility was completed during the said year, along with confirmation of the functionality as per regulatory requirements.

The Gazette Notification for NCCS to perform the function of Central Drugs Laboratory as an additional facility in respect of COVID-19 vaccine was released on June 28, 2021, with validity for a period of 12 months. The Vaccine Testing Facility is completely ready to test the existing COVID-19 vaccines. As per the directions received from DCGI, parallel testing of batches of both Covishield and Covaxin vaccines were conducted.

2] Research Initiatives

The COVID-19-related research undertaken at NCCS are summarized below.

a) Studies on perturbations in the nasopharyngeal microbiome associated with COVID-19

Aims & Objectives: This cross-sectional study was intended to understand the perturbation in the nasopharyngeal microbiome composition within the

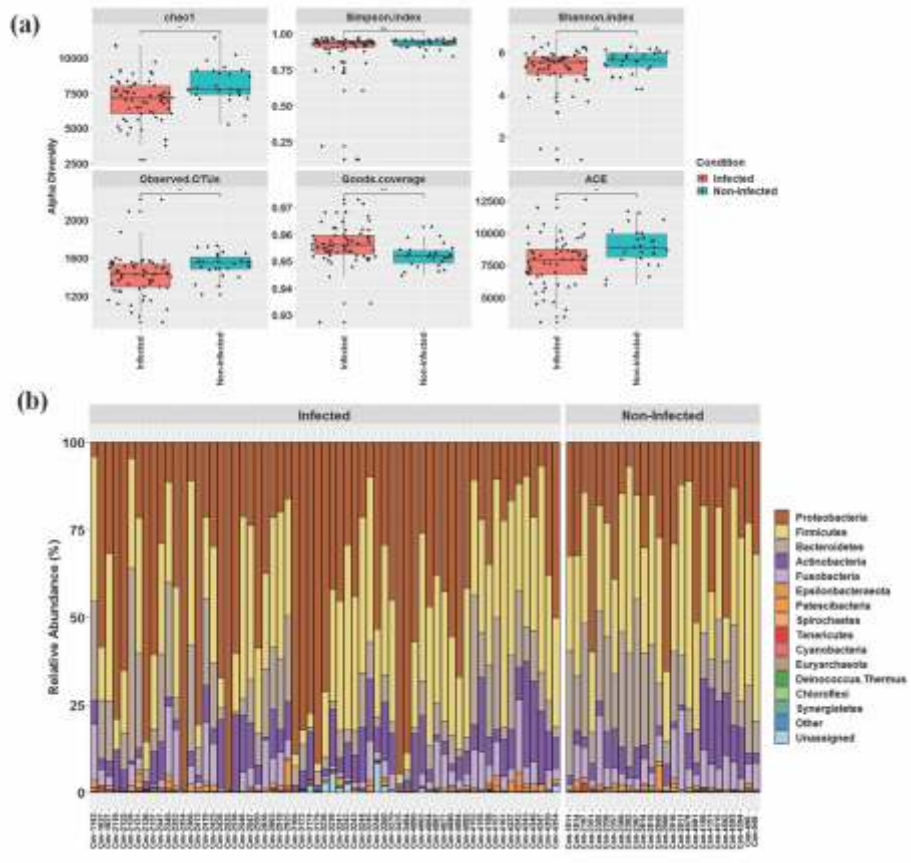


Figure : Comparison of alpha diversity parameters and taxonomic distribution (at phylum-level) across SARS-CoV-2 infected and non-infected individuals. (a) Box-whisker plots of alpha diversity indices and its comparison using Wilcoxon signed-rank test between SARS-CoV-2 infected and non-infected individuals. (b) Relative abundance (%) of major phyla between the infected and non-infected individuals.

infected and non-infected individuals using 16S rRNA gene based targeted amplicon sequencing and their association with host types and the prevalence of opportunistic pathogens at the stage of infection.

Relevance & importance of the work: The purpose of the study was to get an insight into how the viral infection alters the microbial community composition. This study would be helpful in devising the strategies to combat severity of the disease via manipulating the host microbiome and to further manage the effect of virus on the host immunity and reduce the infection rate in the patient.

Major outcomes and their significance: nasal microbiome of COVID-19 patients reported the higher abundance of specific opportunistic pathogens suggesting that the inflammatory environment caused by SARS-CoV-2 infection leads to the prevalence of bacterial pathogens that may result in secondary infection. Increment in pathogenic bacteria in the nasal microbiome of COVID-19 patients is due to the accumulation of mucus and hyper-inflammatory environment that supports their growth. These opportunistic pathogens generally impair the host immunity and lead to the secondary infection. This study further highlighted the reduction of short-chain fatty acid producing bacteria (immunomodulatory potential) in the COVID-19 patients due to hyperinflammatory environment which leads to the increment in opportunistic pathogen. Furthermore, this study has also revealed why some individuals remains asymptomatic. Nasal microbiome of the symptomatic and asymptomatic individuals is found to be different. This suggests that asymptomatic patients are colonized by bacterial taxa which prevent the full-fledged infection of SARS-CoV-2. This study further demonstrated that distinct microbial groups are associated with various age groups and gender and responded differently to SARS-CoV-2 infection. Overall, this study reports how viral infection enhances the pathogenic bacteria which lead to the secondary infection. The findings of this study were recently published in the international journal, 'Microbes and Infection'.

Collaborators: Rajesh Karyakarte (Professor), Dr. Suvarna Josh,

and Rashmita Das (PhD): all the collaborators are affiliated to the BJ Medical College, Pune.

Source of funding: This work was supported by the 'Department of Biotechnology (DBT), Government of India' (by Grant No. BT/Coord.II/01/03/2016), and DBT/Wellcome Trust India Alliance (IA/E/17/1/503700).

b) Generation of neutralizing human monoclonal antibodies against SARS-CoV2

Relevance & importance of the work: Such Antibodies generated from conlavescent individuals can be utilized in prophylactics and therapeutics.

Major outcomes and their significance: We generated human monoclonal antibodies that are able to neutralize both Wuhan and Delta strain of SARS-CoV2.

Collaborators: Dr. Arvind Sahu, Scientist G, NCCS, Dr. Radha Chauhan, Scientist F, NCCS, Dr. Debasis Nayak, Associate Professor, IISER Bhopal, PreOmix Technologies, Gurgaon, and Bharat Biotech International Limited, Hyderabad.

Source of funding: CSIR-NMITLI

c) Studies on 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 find 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, Director, NCCS, and Dr. Debasis Nayak, Associate Professor, IISER Bhopal.

Source of funding: AFMC and NCCS intramural funds.

d) Machine Learning-based Research

Using machine learning, the possibility of using anthraquinolone and quinolizine derivatives as an ally of future treatment for COVID-19 was explored in silico by Dr. Shailza Singh and her team. A research article based on this work was published in Scientific Reports. A peptide, "P2", that were identified using machine learning & subsequently tested by an industry partner, showed 23% neutralizing of the COVID-19 pseudovirus at a concentration of 1000 µg/ml, while undiluted peptide showed 57% neutralizing. These outcomes serve as a proof-of-concept, which could be scaled up as a project subsequently.

3] SARS-CoV-2 viral genome sequencing from clinical samples

NCCS was a participant of the nationwide consortium created for viral genome sequencing, called the Indian SARS-CoV-2 Genomics Consortium (INSACOG), funded by the DBT, Government of India.

Aims & Objectives of this consortium:

- Genomic Surveillance for SARS-CoV-2 in India.
- Sentinel surveillance of SARS-CoV-2 by whole genome sequencing and variant analysis.
- Sharing the whole genome sequence data and metadata with IGIB (data hub) Uploading the results at IHIP portal.
- Data upload to the GISAID database.

Relevance & importance of the work: The Indian SARS-CoV-2 Genomics Consortium (INSACOG), a consortium of 52 Laboratories is a Pan-India network to monitor genomic variations in the SARS-CoV-2 by a sentinel sequencing effort. The network carries out whole genome sequencing of SARS-CoV-2 virus across the nation, aiding the understanding of how the virus spreads and evolves, and provide information to aid public health response. It is jointly initiated by the Union Health Ministry of Health, and Department of Biotechnology (DBT) with Council for Scientific & Industrial Research (CSIR) and Indian Council of Medical Research (ICMR). The INSACOG DataHub developed & maintained at the National Institute of Biomedical Genomics is an effort to store and analyze the whole genome sequence of SARS-CoV-2. Such surveillance activities help us to identify variants circulating in the population and helps administrators to take decisive actions.

Major outcomes and their significance: The SARS-CoV-2 genome surveillance initiative has been successful in establishing sentinel surveillance in India through INSACOG. NCCS, which served as one of the INSACOG Genome Sequencing Laboratories (IGSLs), received SARS-CoV2 infected samples from the state of Goa and Maharashtra. So far 5974 samples have been processed, of which 3439 have been sequenced at NCCS. The remaining samples could not be sequenced due to poor quality of DNA. More than 2100

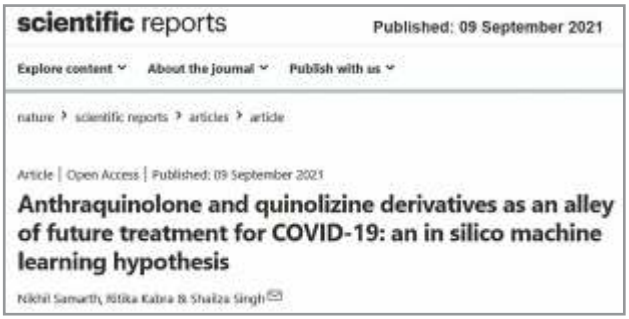
samples were sent out for sequencing (outsourced at respective associated labs). The genome sequencing and analysis team shared big sequencing data along with the sample metadata with database mirroring centers (IGIB). We also performed variant analysis on this sequenced data and submitted this to IHIP portal regularly. Moreover, we have submitted 2077 sequences to the GISAID server and 2864 sample data on the IGIB server. Our sequencing efforts have contributed to the identification and reporting of new variants of concern (eg: Omicron B.1.1.529 and its sub lineages BA.2 etc.) in the state of Goa and Maharashtra. Through this project the sequencing efforts of our team at NCCS will continue to ascertain the status of new SARS-CoV-2 variants which pose a threat to human community.

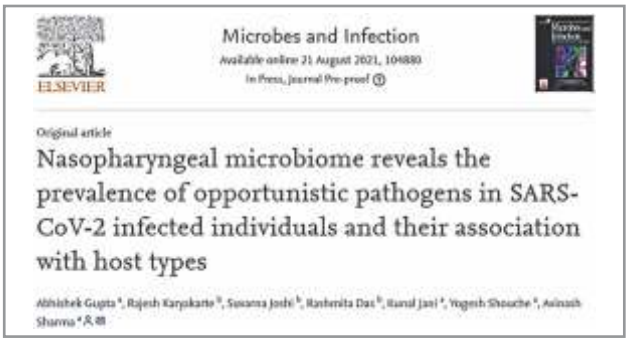
Collaborators (Name, designation, affiliation):

The Indian SARS-CoV-2 Genomics Consortium (INSACOG), is a pan-India network of 52 laboratories.

4] Publications

(with NCCS scientists as lead authors or coauthors; details are included in the common publications list at the end of the annual report)





5] COVID-19-related Outreach

NCCS organized and the faculty were engaged in various oureach activities in Hindi, Marathi and English, to help spread awareness, dispel myths and answer questions about diverse aspects of COVID-19, including and especially those related to the second wave of the pandemic. These are listed under the "Outreach" section of the annual report.

6] Survey to assess the impact of COVID-19 on STEM researchers in India

Relevance & importance of the work: At the beginning of the pandemic, a number of surveys were conducted in western countries to understand the impact of the pandemic on researchers. However, no such survey was conducted in India. This study was an attempt to understand the impact of the pandemic specifically on Indian STEM researchers. Additionally, we also interviewed heads of institutes, funding bodies and scientific suppliers to obtain a holistic view of how everyone involved in the scientific pocess was affected. Through the medium of a survey and in-depth interviews we attempted to understand how the pandemic affected the scientific fabric in our country. To reach out to a wider cross-section of participants, the survey was made available in ten Indian regional languages (Hindi, Marathi, Tamil, Kannada, Telugu, Bengali, Gujarati, Malayalam, Oriya, and Assamese), in addition to English.

Major outcomes and their significance: Both the survey results and in-depth interviews indicated that those having greater support from their universities, family, and friends reported better mental health. However, this relationship between university support and better mental health was prevalent among men. Our results also showed that disruptions to grant disbursal led to gendered differences in terms of procurement of of lab supplies and lower mental health. Furthermore, about 51% of ECRs faced core research issues, which reduced scientific productivity significantly. Other details about this survey are available online (https://www.monkprayogshala.in/ia-survey).

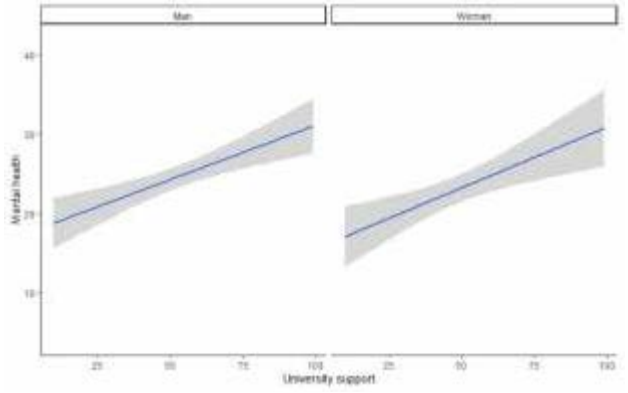


Figure: Early career researchers experienced a negative impact of the pandemic on their mental well-being.

This survey was led by Dr. Deepa Subramanyam, and was conducted in association with the DBT Wellcome Trust India Alliance, Monk Prayogshala. Source of funding: DBT Wellcome Trust India Alliance.

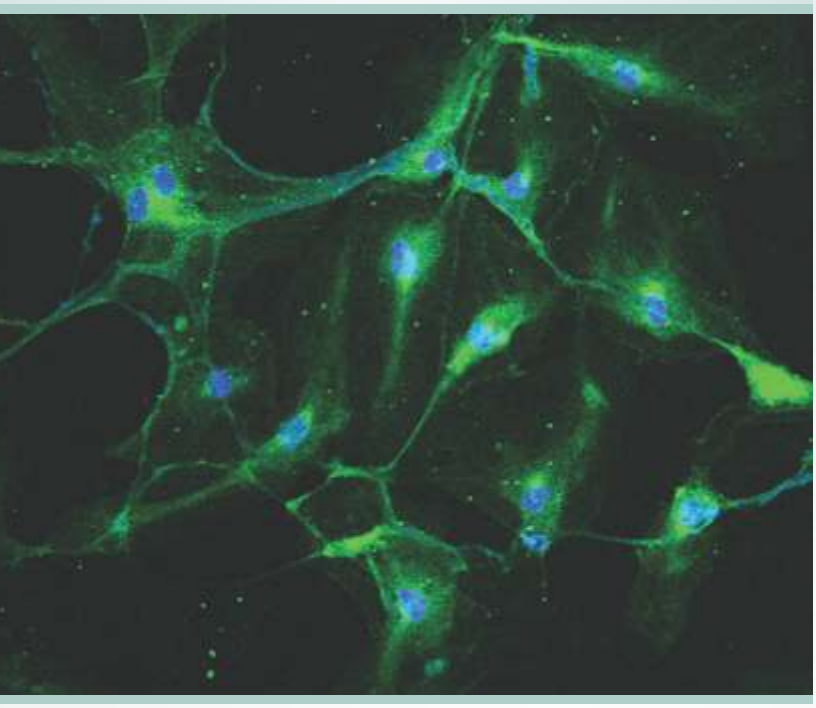
7] Miscellaneous

Honouring the contributions of the NCCS COVID-19 Team 28 January 2022

Dr. Rajesh Karyakarte (Vice Dean, Professor & Head, Microbiology, B. J. Govt. Medical College, Pune), and Dr. Manoj Kumar Bhat (Director, NCCS), presented certificates to members of the DBT-NCCS COVID-19 team in appreciation of their contributions to the national efforts against the pandemic.

Spreading Awareness About Vaccination

Posters and banners announcing the availability of free vaccines at Government centres for everyone above 18 years of age, from 21 June 2021, were displayed in Hindi, Marathi and English at the entrance of NCCS and across the campus.



Other Information

Publications & Patents

Publications

RESEARCH ARTICLES

1. Agarwal DM, Dhotre DP, Kumbhare SV, Gaike AH, Brashier BB, Shouche YS, Juvekar SK, Salvi SS. Disruptions in oral and nasal microbiota in biomass and tobacco smoke associated chronic obstructive pulmonary disease. Archives of Microbiology. 2021 Jul;203(5):2087-2099.
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2. Assad R, Reshi ZA, Mir SH, Rashid I, Shouche Y, Dhotre D. (2021). Chapter 17: Bioprospecting appraisal of Himalayan pindrow fir for pharmacological applications. In: Bhat RA, Hakeem KR and Dervash MA (eds). Phytomedicine. Elsevier Inc., pp. 461–482.
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22. Zutshi S, Kumar S, Chauhan P, Saha B. (2022). Revisiting the Principles of Designing a Vaccine. In: Thomas, S. (eds), Vaccine Design. Methods in Molecular Biology, vol 2410. Humana, New York, NY. https://doi.org/10.1007/978-1-0716-1884-4_3

Patents

Patent Applications Filed / Granted

Sr.No.	Title	Inventors	Applicant	PCT/ Country	Patent No./ Application No.	Date of Filing / Grant
1	A tumor deconstruction platform for the analysis of intra -tumor heterogeneity	Sharmila Bapat, Rutika Naik	NCCS	Europe	3097418	28.04.2021 (Granted)
2	A Monoclonal Antibody Targeting the Tumor Regenerative Hierarchy	Sharmila Bapat, Rajkumar Kalra, Avinash Mali, P.B. Parab	NCCS	India	374150	10.08.2021 (Granted)
3	Electrospun nano-fiber scaffold for repair of skin lesions	Prof. Jayesh Bellare; Amit Kumar Jaiswal; Dr. Vaijayanti Kale; Dr. Meghana Kanitkar	IIT-Bombay & NCCS	India	364716	15.04.2021 (Granted)
4	DAF-MCP chimeric protein, process to manufacture the same and use of the chimeric protein for treating pathological conditions involving the complement system	Arvind Sahu, Hina Ojha, Payel Ghosh, Sagar Barage, Hemendra Singh Panwar	NCCS	USA	17/603,444	13.10.2021 (Filed)
5	DAF-MCP chimeric protein, process to manufacture the same and use of the chimeric protein for treating pathological conditions involving the complement system	Arvind Sahu, Hina Ojha, Payel Ghosh, Sagar Barage, Hemendra Singh Panwar	NCCS	South Korea	10-2021-7036801	10.11.2021 (Filed)
6	DAF-MCP chimeric protein, process to manufacture the same and use of the chimeric protein for treating pathological conditions involving the complement system	Arvind Sahu, Hina Ojha, Payel Ghosh, Sagar Barage, Hemendra Singh Panwar	NCCS	Europe	20790534.0	05.11.2021 (Filed)

Patent Applications Filed / Granted

Sr.No.	Title	Inventors	Applicant	PCT/ Country	Patent No./ Application No.	Date of Filing / Grant
7	A Novel Anti-Cancer Combination	Dipti Athavale, Manoj Kumar Bhat	NCCS	PCT (India)	PCT/IN2021/050345	07.04.2021 (Filed)
8	Method for preparing drug loaded-fluorescent GQDs embedded mesoporous silica nanostructure for tumor ablation	Rajendra Prasad, Nishant Kumar Jain, Manali Jadhav, Rohit Srivastava, Amit Singh Yadav, Mahadeo Gorain, Gopal C. Kundu	IIT, Bombay & NCCS	India	202121021279	11.05.2021 (Filed)
9	Red Emissive Liposomal Nanopitchers as Theranostics and a process for preparing the same	Rohit Srivastava, Janhavi Devrukhkar, Rajendra Prasad, Barkha Singh, Deepak Singh Chauhan, Gopal Kundu, Mahadeo Gorain, Amit Singh Yadav	IIT, Bombay & NCCS	India	202121022522	20.05.2021 (Filed)
10	Novel Combination of Serotonin Receptor (5-HTR2B) Antagonist and an Immunomodulator for inhibition of cancer	Dr. Girdhari Lal, Surojit Karmakar	NCCS	India	202121044467	30.09.2021 (Filed)
11	DAF-MCP chimeric protein, process to manufacture the same and use of the chimeric protein for treating pathological conditions involving the complement system	Arvind Sahu, Hina Ojha, Payel Ghosh, Sagar Barage, Hemendra Singh Panwar	NCCS	India	202117049723	29.10.2021 (Filed)

LICENSED CELL LINE

A cell line developed by NCCS (CHO-HIRc-mycGLUT4eGFP cell line) that was licensed to Applied Biological Materials (ABM), Inc., Canada, is now available commercially in the ABM online catalogue. This cell line, which can serve as a cell-based in vitro assay system to screen GLUT4 translocation modulators, is a valuable tool for diabetes research.

Extramural Funding

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

No.	PI(s) from NCCS	Title	Start Date	End Date	Collaborator(s) agency	Funding	Country
1	Dr. Bhaskar Saha	JC BOSE Fellow	06.11.2018	05.11.2023	Nil	SERB	India
2	Dr. Gaurav Das	Neurobiology of food choice driven by nutrient specific memories and diet.	21.02.2018	20.02.2023	Nil	SERB	India
3	Dr. Jyoti Singh	Understanding the role of RNAi - mediated antiviral host defense against DNA Viruses.	01.01.2018	31.12.2022	Dr. V. Sivaprasad CSRTI, Mysore	DBT/ Wellcome Trust India Alliance	India
4	Dr. Janesh Kumar	Centre of Excellance in Biomolecular Structure and Function on Host-Pathogens Interactions.	28.12.2016	27.12.2021 Extended upto 27.06.2022	Dr. Sharmistha Banerjee, Dr. Krishnaveni Mishra Department of Biochemistry, University of Hyderabad, Telangana	DBT	India
5	Director, NCCS, Pune	Establishment of A Pune Biotech Cluster, ''Model Organism to Human Disease.	29.06.2018	28.06.2021 Extended upto 28.06.2024	Dr. Jayant B Udgaonkar, IISER, Pune, MH	DBT	India
6	Dr. Janesh Kumar	Structural perspective of molecular interactions in pathogenicity: Role of regulatory proteins of HIV-1 and heat shock proteins of M. Tuberculosis	28.12.2016	27.12.2021 Extended upto 27.06.2022	Dr. Shekhar Mande, Dr. Sharmistha Banerjee, Associate Professor. Department of Biochemistry, School of Life Sciences, University of Hyderabad, Hyderabad.	DBT	India

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No.	PI(s) from NCCS	Title	Start Date	End Date	Collaborator(s) agency	Funding	Country
7	Dr. G. C. Mishra	Regulation & differentiation of T helper 17 & T regulatory cells in collagen induced arthritis by modulating antigen presenting dendritic cells.	16.11.2018	02.09.2023	Nil	NASI	India
8	Dr. Debashis Mitra	Centre of Excellence in Biomolecular -Cellular Stress Proteins in HIV Infection: Biochemical and functional characterization.	28.12.2016	27.12.2021 Extended upto 27.06.2022	Nil	DBT	India
9	Dr. Radha Chauhan	Centre of Excellence in Biomolecular -Structural & functional role of Nuclear Envelope in HIV infection.	28.12.2016	27.12.2021 Extended upto 27.06.2022	Dr. Krishnaveni Mishra & Dr. Sharmistha Banerjee Dept. Of Biochemistry, University of Hyderabad, Hyderabad, Telangana.	DBT	India
10	Dr. Avinash Sharma	Establishment of Center of Excellence for "National Center for Microbial Resource (NCMR)"	30.03.2017	29.03.2020 Extended upto 30.09.2022	Nil	DBT	India
11	Dr. Debashis Mitra	Host Cell Factors in HIV Pathogenesis (JC Bose Fellowship)	18.05.2018	30.06.2020 Extended upto 28.05.2023	Nil	SERB	India
12	Dr. M.V.K. Sastry	MANAV Human Atlas Initiative	27.02.2019	26.02.2022 Extended upto 26.08.2022	Dr. N. Balasubramanian IISER, Pune & Dr. Anamika Krishnapal Persistent Systems Limited, Pune Dr. Kundan Sengupta, IISER, Pune Mr. Vivek Kulkarni Persistent Systems Limited, Pune	DBT	India
13	Dr. Amitabha Majumdar	Generation of knockout and Gal4 collection using CRISPR and recombineering for studying the in vivo function and DnaJ domain containing protein in Drosophila Melanogaster.	05.03.2019	04.03.2022 Extended upto 05.03.2023	Nil	DBT	India
14	Dr. Jomon Joseph	Characterization of acute necrotizing encephalopathy-1(AEN-1) associated mutations in Nup358.	07.03.2019	06.03.2022 Extended upto 06.09.2022	Nil	DBT	India

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

No.	PI(s) from NCCS	Title	Start Date	End Date	Collaborator(s) agency	Funding	Country
15	Dr. Arvind Sahu	Role of complement anaphlyatoxins C3a,C4a and C5a generated intracellularly in the infection locale in providing protection against viral infection.	12.03.2019	11.03.2022 Extended upto 11.09.2022	Nil	DBT	India
16	Dr. Dhiraj Dhotre	Understanding the network of active metabolic pathways functioning in indegeous microbial community: essential for maintaining major biogeochemical cycles and their survival/nutrient acquisition in oligotrophic glacier ecosystem.	05.07.2019	04.07.2022 Extended upto 31.03.2023	Dr. Runa Anthony ESSO, NCPOR, Goa	NCPOR	India
17	Dr. Deepa Subramanyam	Role of actin remodelling and membrane fluctuations in regulation of embryonic stem cell pluripotency	05.07.2019	04.07.2022 Extended upto 04.07.2023	Dr. Bidisha Sinha Dept. of Biological Sciences, IISER, Kolkata	DBT	India
18	Dr. Dhiraj Dhotre	Impact of mass bathing on the natural microbiota of the river Ganges; a concern to human health	26.09.2019	25.09.2022	Prof. Shanthy Sundaram Centre of Biotechnology University of Allahabad Allahabad, UP	DBT	India
19	Dr. Girdhari Lal	Effect of neuro-immune communication in the gut inflammation and auto-immunity	01.07.2019	30.06.2024	Nil	DST	India
20	Dr. Srikanth Rapole	A CRISPR-based gene therapy approach for targeting the breast cancer stem cells in vivo	29.10.2019	28.10.2022	Dr. Gopal Kundu (PI)	SERB	India

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

No.	PI(s) from NCCS	Title	Start Date	End Date	Collaborator(s) agency	Funding	Country
21	Dr. Dhiraj Dhotre	Human Microbiome Initiative of select Endogamous Population of India	09.03.2020	08.03.2022 Extended upto 08.09.2022	Dr. Girish Shreekrishna Tillu, Associate Professor, AYUSH - Center of Excellence, SPPU, Pune. Prof. Shaunak Kulkarni Professor, Department of Anthropology, SPPU, Pune. Prof. Balakrishnan S Ramakrishna Professor, SRM Institutes for Medical Science, Chennai, Tamilnadu. Dr. Sarangthem Indira Devi, Scientist C, Microbial Resources Division, Institute of Bioresources & Sustainable Development, Imphal, Manipur. Dr. Subramanya Kumar Assistant Professor, Institute of Trans-Disciplinary Health Science & Technology, Bangalore, Karnataka. Dr. Sanjay Kamlakar Juvekar Senior Research Scientist, KEMHRC, Pune, Maharashtra. Prof. Govind K Makharia Professor, All India Institute of Medical Sciences, New Delhi.	DBT	India
22	Dr. Priyanka Dutta	Functional Characterization of the Novel Actin-Interacting Protein Kaptin and its Regulation of Cytoskeleton Dynamics in Neurons.	19.02.2020	18.02.2023	Dr. Sankar Maiti Department of Biological Sciences, IISER, Kolkata, West Bengal. Dr. Aurnab Ghose Biology, IISER, Pune.	SERB	India
23	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.	01.10.2020	30.09.2023	Dr. R. Sundararaj, Scientist 'G' Institute of Wood Science and Technology (IWST), Bangalore.	Ministry of Ayush	India

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

No.	PI(s) from NCCS	Title	Start Date	End Date	Collaborator(s) agency	Funding	Country
24	Dr. Yogesh Shouche	Study on distribution, function, and genomic reconstruction of deep-subsurface abundant and rare microbial communities in different depth of the rock (Basalt - granite Zone) at Koyan - Waran region	05.02.2020	04.02.2022 Extended upto 04.08.2022	NIL	Ministry of Earth Science	India
25	Dr. Punam Nagvenkar	Establishment of GMP-Compliant National Repository for banking, safe deposit and supply of characterized mammalian cells for us in biopharma	01.10.2019	30.09.2023	Nil	BIRAC	India
26	Dr. Sharmila Bapat	Proteogenomics based identification and Characterization of a novel ITGB8 isoform in ovarian cancer and elucidation of its functional relevance.	27.03.2020	26.03.2023	Nil	SERB	India
27	Dr. Gaurav Das	The neurophysiological pathways of emesis in Drosophila melanogaster	12.06.2020	11.06.2023	Nil	SERB	India
28	Dr. Arvind Sahu	J C Bose Fellowship	25.11.2020	24.11.2024	Nil	SERB	India
29	Dr. Jomon Joseph	Characterization of inter-cellular transport of Ran GTPase	27.08.2020	26.08.2023	Nil	DBT	India
30	Dr. Vidisha Tripathi	Deciphering the role of long noncoding RNAs (lncRNAs) in mediating replication stress response during cell division	21.02.2020	20.02.2023	Nil	SERB	India
31	Dr. Deepika Puri	Epigenetic mechanisms of regulation of autophagy in development, differentiation and disease.	30.07.2018	29.07.2024	Nil	DST	India
32	Dr. Vidisha Tripathi	Comprehensive characterization of novel lncRNA-protein network orchestrating the mammalian cell cycle program	03.12.2020	02.12.2023	Nil	DBT	India
33	Dr. Janesh Kumar	Structural investigations of GluK2 and GluK3 kainate receptors in lipidic environment	22.03.2021	21.03.2024	Nil	SERB	India

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

No.	PI(s) from NCCS	Title	Start Date	End Date	Collaborator(s) agency	Funding	Country
34	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	22.03.2021	21.03.2024	Nil	SERB	India
35	Dr. Deepa Subramanyam	Understanding the role of clathrin mediated endocytosis in neural development and function	15.02.2021	14.02.2024	Nil	ICMR	India
36	Co-PI: Dr. Amit Yadav & Dr. Dhiraj Dhotre	Genomic based approaches for characterization of the microbial antibiotic resistance and resistome in dairy production system	25.03.2021	24.03.2024	Dr. Rashmi H M, Scientist (Senior Scale), Diary Microbiology Division, ICAR-NDRI, Karnal	ICMR	India
37	Dr. Dhiraj Dhotre	Genomic surveillance for SARS-CoV-2 in India: Indian SARS-CoV-2 Genomics Consortium (INSACOG)	26.03.2021	25.07.2021 Extended upto 25.07.2022	National Institute of Animal Biotechnology (NIAB), Hyderabad	DBT	India
38	Dr. Punam Nagvenkar & Dr. Yogesh Shouche	DBT - NCCS CDL Vaccine Testing Facility	13.01.2021	28.06.2021 Extended upto 27.06.2022	Dr. Sachin Kumar, Scientist II, Medical Oncology, All India Institute of Medical Sciences, Delhi; Dr. Surendra Kumar Sharawat, Scientist I, Medical Oncology, All India Institute of Medical Sciences, Delhi; Dr. Prabhat Singh Malik, Associate Professor, Medical Oncology, All India Institute of Medical Sciences, Delhi; Dr. Sunil Kumar, Professor, Surgical Oncology, All India Institute of Medical Sciences, Delhi;	DBT	India
39	Dr. Priyanka Dutta	Dissecting Formin-2 Function and Regulation: Insights into Novel Modalities of Cytoskeleton Remodeling	01.05.2018	30.04.2023	Nil	DST	India
40	Dr. Girdhari Lal	Understanding the anti - tumor activity of natural killer (NK) and improving its adoptive cellular therapy potential to control tumor growth	14.06.2018	13.06.2021	Nil	DST	India

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No.	PI(s) from NCCS	Title	Start Date	End Date	Collaborator(s) agency	Funding	Country
41	Dr. Srikanth Rapole	Acquisition of Modern Orbitrap mass spectrometer for establishing state of the art proteomics facility at National Centre for Cell Science.	12.07.2016	11.07.2021	Nil	DBT	India
42	Dr. Mohan Wani	Regulation of development of pathogenic T - helper 17 cells in collagen induced arthritis	25.10.2018	24.10.2021	Nil	DST	India
43	Dr. Radha Chauhan (PI: Dr. Shekhar Mande, Former Director, NCCS)	Assessment of antimicrobial and plant growth promoting potential of Indigenous Endophytic Bacterial Strains of Manipur.	11.09.2018	10.09.2021 Extended upto 10.03.2022	Dr. Debananda S Ningthoujam, Department of Biochemistry, Manipur University Imphal, Manipur; Dr. Sharmistha Banerjee, Department of Biochemistry, Hyderabad Central University, Hyderabad, Telangana	DBT	India
44	Dr. Manas Santra	Quest for Cancer Drugs: Screening and Bioassay guided phytochemical Investigation of selected Endemic medicinal plants of Eastern Himalaya.	18.09.2018	17.09.2021 Extended upto 17.03.2022	Dr. Dwipen Kakati Dept. of Chemistry Rajiv Gandhi University, Itanagar, Arunanchal Pradesh Dr. Ashish K Bhattacharya Div. of Organic Chemistry NCL, Pune, MH Prof. Mohan Chandra Kalita Biotechnology, Gauhati University, Guwahati, Assam; Dr. Temin Payum Dept of Botany Jawaharlal Nehru College, Pasighat, Itanagar Dr. Jogendra Chandra Kalita Dept of Zoology, Gauhati University, Assam Dr. Kandarpa K Saikia Dept of Bioengineering & Technology Gauhati University, Guahati, Assam	DBT	India

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No.	PI(s) from NCCS	Title	Start Date	End Date	Collaborator(s) agency	Funding	Country
45	Dr. Mohan Wani	To evaluate the translational potential of IL - 3 for the treatment of osteoporosis and osteoarthritis	29.06.2018	28.06.2021	Nil	DBT	India
46	Dr. Zahid Kamal	Decoding organism related evolution of surviving, a hub protein.	01.07.2015	30.06.2020 Extended upto 31.12.2021	Dr. Chandra Shekhar Prabhakar Institute for Stem Cell Biology & Regenerative Medicine, Hyderabad	DBT-Wellcome	India
47	Dr. Radha Chauhan	Establishing the Structural and functional role of Nup155 and Nup35 in Nup93 subcomplex of the nuclear pore Complex.	11.10.2018	10.10.2021	Nil	DBT	India
48	Dr. Arvind Sahu	Generation of neutralizing human monoclonal antibodies against the SARS - CoV2 virus as therapeutic strategy to contain the COVID - 19 Pandemic	29.05.2020 30.11.2021	28.05.2021 Extended upto	Dr. D.N. Nayak IIT, Indore. Dr. Krishna Ella Bharat Biotech International Ltd., Hyderabad. Dr. Kanury V.S. Rao PredOmix Technologies Pvt.Ltd., Gurugram, Haryana.	CSIR	India
49	Dr. Akanksha Chaturvedi	Production of pseudotyped SARS-CoV-2 in BSL-2 setting using vesicular stomatitis virus VSV platform for candidate vaccine development and biomedical research use	06.06.2020	05.06.2021	Dr. Debasis Nayak, Associate Professor IIT Indore Simrol Campus, Khandwa Road, Simrol, Indore, Madhya Pradesh	BIRAC	India
50	Dr. Sharmila Bapat	Development of a predictive algorithm for precision medicine in ovarian Cancer	07.07.2017	06.07.2020 Extended upto 31.03.2022	Nil	DBT	India
51	Dr. Deepa Subramanyam	Dissecting the individual roles of Clta and Cltb in early mammalian development through selective CRISPR-Cas9-based knockout and knockin models	27.03.2018	26.03.2021 Extended upto 26.03.2022	Nil	DBT	India
52	Dr. Srikanth Rapole	Molecular analyses of extra-cellular vesicles isolated from bone marrow-derived mesenchymal stromal cells treated with specific signaling modifiers and assessment of their effects on the fate of hematopoietic stem cells	26.03.2018	25.03.2021 Extended upto 25.03.2022	Dr. Anuradha Vaidya & Dr. Swagata Roy Biotechnology, Symbiosis School of Biomedical Sciences, Pune (MH)	DBT	India

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

No.	PI(s) from NCCS	Title	Start Date	End Date	Collaborator(s) agency	Funding	Country
53	Dr. Vasudevan Seshadri	Development of a stable and inducible CRISPR-Cas9 system for high throughput site specific genome editing in plasmodium falciparum	04.10.2018	03.10.2021 Extended upto 03.04.2022	Dr. Krishanpal Karmodiya, Dept. of Biology, IISER, Pune Prof. Mrinal Kanti Battacharyya Dept. of Biochemistry University of Hyderabad	DBT	India
54	Dr. Debashis Mitra	Synthesis and development of novel HSP90 inhibitors as potential anti - HIV candidate molecules and elucidation of their mechanism of inhibition	15.10.2018	14.10.2021 Extended upto 31.03.2022	Dr. Ashoke Sharon, Department of Chemistry, Birla Institute of Technology, Mesra, Ranchi, Jharkhand	DST	India
55	Dr. Akanksha Chaturvedi	Elucidating the role for Toll-like receptor 9 mediated extracellular vesicle release from B cells	27.03.2020	26.03.2022	Nil	SERB	India
56	Dr. Janesh Kumar	Development of Nanobodies as prophylactic and therapeutic candidates against SARS-CoV-2 virus.	17.11.2020	16.11.2021 Extended upto 16.05.2022	Nil	SERB	India
57	Dr. Manas Santra	Elucidation of the role of long noncoding RNA-Ginir as a biomarker in lung tumorigenesis	19.08.2021	18.08.2024	Dr. Sachin Kumar, Scientist II, Medical Oncology, All India Institute of Medical Sciences, Delhi; Dr. Surendra Kumar Sharawat, Scientist I, Medical Oncology, All India Institute of Medical Sciences, Delhi; Dr. Prabhat Singh Malik, Associate Professor, Medical Oncology, All India Institute of Medical Sciences, Delhi;	DBT	India
58	Dr. Ajay Pillai	IRMI Research Management Grant	01.10.2021	30.09.2022	Nil	DBT-Wellcome	India

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

No.	PI(s) from NCCS	Title	Start Date	End Date	Collaborator(s) agency	Funding	Country
59	Dr. Avinash Sharma	Bioprospecting of Marine microbial diversity for various products under the Marine Bioresource and Biotechnology Network Programme	28.09.2021	27.09.2024	Annamalai University, Parangipettai; Central Drug Research Institute, Lucknow; Central Salt & Marine Chemicals Research Institute, Bhavnagar; Cochin University of Science and Technology, Cochin; Goa University, Goa; Indian Institute of Technology Bombay, Mumbai; National Centre for Polar and Ocean Research, Goa; Periyar University Salem, Salem; Sathyabama Institute of Science and Technology, Chennai	DBT	India
60	Dr. Deepa Subramanyam	Identifying interactors of E-cadherin in embryonic stem cells	31.12.2021	30.12.2024	Nil	SERB	India
61	Dr. Santosh Kumar	Identification and characterization of downstream effector proteins for Gao, the major neural G protein in brain tissue `	20.12.2021	19.12.2024	Dr. Gurpal Singh, UGC Assistant Professor, University Institute of Pharmaceutical Sciences, Pharmaceutical Dr. Ravi Pratap Barnwal UGC-Assistant Professor, Department of Biophysics, Dr. Bharat Bajaj	DBT	India
62	Dr. Santosh Kumar	Delineation of the major brain G protein, G o mediated signaling pathway using C. elegans model system	30.12.2021	29.12.2024	Dr. Gurpal Singh, UGC Assistant Professor, University Institute of Pharmaceutical Sciences, Dr. Ravi Pratap Barnwal UGC-Assistant Professor, Department of Biophysics	SERB	India
63	Dr. Amitabha Majumdar	Studying the liquid-liquid phase separation properties associated with a transcriptional co-activator	21.01.2022	20.01.2025	Nil	SERB	India
64	Dr. Kalita Jupitara	Structure and function of trans-synaptic complexes mediated by Neurexin, Cerebellin and GluD receptors	03.02.2022	02.02.2025	Nil	DBT	India

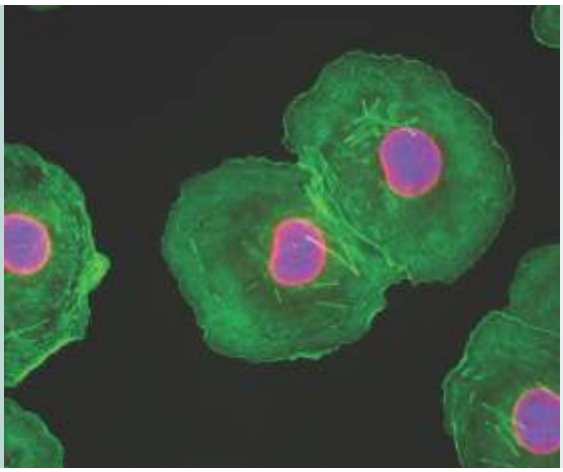
EXTRAMURAL FUNDING

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

No.	PI(s) from NCCS	Title	Start Date	End Date	Collaborator(s) agency	Funding	Country
65	Dr. Manas Santra	Clinical role of a pair of novel mutations in BCR-ABL 1 towards therapy switch in inatinibresistant chronic myeloid leukemia	14.11.2021	13.11.2024	Nil	Lady Tata Memorial Trust	India
66	Dr. Akanksha Chaturvedi	Precision antibodies engineering centre (PACE)	03.03.2022	02.03.2027	Dr. Debasis Nayak, Associate Professor, Biological Sciences, IIT, Indore; Dr. Ram Kumar Mishra, Associate Professor, Biological Sciences, IIT, Bhopal; Dr. Sanjeev Shukla, Associate Professor, Biological Sciences, IIT, Bhopal; Dr. Satyendra Kumar Singh, Associate Professor, Centre for Advance Research, King George Medical University	SERB	India
67	Dr. Jomon Joseph	Understanding the functions of Annulate Lamellae, an underexplored cell organelle	22.03.2022	21.03.2025	Nil	SERB	India
68	Dr. Shailza Singh	System regulatory networks of autophagy proteins in leishmania: Implication towards drug design	31.03.2022	30.03.2025	Nil	ICMR	India

Parties with whom MoA / MoU were signed for research collaborations

- Biotech Consortium India Limited (BCIL), New Delhi, India.
- The University of Queensland, Australia.
- National Medicinal Plants Board (NMPB), Ministry of AYUSH, New Delhi, India
- Department of Biotechnology, New Delhi, India.



Awards / Honours

Awards / Honours - NCCS Faculty

Sharmila Bapat

- Re-elected as a member of the Indian Academy of Sciences Council for a second term (2022-2024).

Akanksha Chaturvedi

- Selected to receive the MACS Project Grant 2021 awarded by Miltenyi Biotec Asia Pacific, for studying the dynamics of antibody response in SARS-CoV2-infected patients.
- Dr. Akanksha Chaturvedi's SERB IRHPA grant on antibody engineering titled "Precision Antibody CEntre (PACE)" was approved. This is a multi-institutional grant between DBT-NCCS, IISER Bhopal, and KGMU for 5 years.

Jomon Joseph

- Elected Member, Guha Research Conference, India

Janesh Kumar

- DBT/Wellcome Trust India Alliance -Senior Fellowship.
- Awarded the EMBO grant for organizing an EMBO Practical Course on 'Cryo electron microscopy and 3D image processing' from 03 July – 15 July 2022. Co-awardees: Dr. Radha Chauhan from DBT-NCCS, Dr. Gayathri Pananghat and Dr. Kayarat Saikrishnan from IISER-Pune and Dr. Kiran Kulkarni from CSIR-NCL.
- Guest edited a special issue of Neuropharmacology journal on "Orphan glutamate delta receptors"

Girdhari Lal

- Elected as a member of the Publication Committee of the Society of Leukocyte Biology.
  https://www.leukocytebiology.org/publication-committee

Nibedita Lenka

- Chairperson, Institutional Ethical Committee and Member, IC-SCR, OCT Therapies & Research Pvt. Ltd. Mumbai.
- Inducted as Editorial Board Member, Stem Cell Review and Reports, Springer-Nature, May 2021.

Srikanth Rapole

- General Secretary, Proteomics society of India (PSI)
- Associate Editor, Journal of Proteins and Proteomics

Avinash Sharma

- *Marisediminicola senii*, a novel microorganism from Antarctica, discovered by Dr. Avinash Sharma and his team, was featured in an article titled, 'White', published on Fiftytwo.in. This was article on the contributions made by Indian scientists to research associated with Antarctica.

Nishant Singhal

- Designated as Topic Editor for the research papers to be published on the theme, 'Down Syndrome: Genetic and Epigenetic Influences on this Multi-faceted Condition' in the international journals, 'Frontiers in Genetics' & 'Frontiers of Pediatrics'.

Deepa Subramanyam

- A survey led by Dr. Deepa Subramanyam to understand the impact of COVID-19 on STEM researchers in India was featured by Nature India (03 March 2022). This DBT/Wellcome Trust India Alliance-funded survey was conducted in association with the academic research non-profit, Monk Prayogshala.

Mohan Wani

- Elected Fellow of the National Academy of Medical Sciences (India).
- FNAVS, Fellow, National Academy of Veterinary Sciences (NAVS), India, 2021.
- The 'Dr. P. E. Kulkarni Oration Award-2021' awarde by the Indian Society for Veterinary Surgery, at Pantanagar, Uttarakhand; 24 February 2022.

Amit Yadav

- Best Innovative Idea' award at the 'Anti-Microbial Resistance Dx Bootcamp' organised by IIT Delhi in association with the University of Edinburgh, UK; 28-29 March 2022.

Awards / Honours – Postdoctoral Scientists, Students & Technical Staff

- Radha Chauhan's group
  - **Dr. Ekta Shukla:** 3rd Prize for oral presentation (Title: 'Host-HIV interactome: Offering New Hope for Therapeutic Targets') at the International Conference on Infectious Diseases and Immunopathology') 2021; Dept. of Biotechnology, Savitribai Phule Pune University; 22-24 April, 2021.

- Jomon Joseph's group
  - **Poulomi Banerjee (PhD student)**, was interviewed for the 'First Person' series by the Journal of Cell Science (JCS). She is the first author of a paper published by Dr. Jomon Joseph and his group published in (JCS) in February 2022. The first authors of selected papers published in this journal are interviewd for this series by JCS.

- Janesh Kumar's group
  - **Jupitara Kalita (Research Associate):** Awarded MK Bhan-Young Researcher Fellowship (2020-21).
  - **Jupitara Kalita (Research Associate):** Awarded SERB-NPDF postdoctoral fellowship (2021).
  - **Ameya Bendra (Research Associate):** Awarded 1st Prize for oral presentation at the International Conference on Infectious Diseases and Immunopathology' 2021; Dept. of Biotechnology, Savitribai Phule Pune University; 22-24 April, 2021.
  - **Anshul Assaiya (PhD student):** Best Oral presentation award at the 48th National Seminar on Crystallography held at IIT Roorkee; 25-27 November 2021.
  - **Juhi Yadav (PhD student):** Best Poster presentation award at the 48th National Seminar on Crystallography held at IIT Roorkee; 25-27 November 2021.
  - **Sneha Hakke (Project Assistant):** Best Poster presentation award at the 48th National Seminar on Crystallography held at IIT Roorkee; 25-27 November 2021.

- Girdhari Lal's group
  - **Miss Namrita Halder (PhD student):** Best Oral Presentation Award at the virtual 5th Annual Conference of the Society of Inflammation Research (SIRCON 2021), Bangalore; 02-03 October 2021.

- Manas Kumar Santra's group
  - **Tanisha Sharma:** Best Oral Presentation Award at the 41st Annual International Conference of Indian Association for Cancer Research (IACR) IACR-2022, 'Combating Cancer: Biology to Therapy to Drug Resistance'," & An International Symposium on: Cancer & Stem Cells, organised by Amity Institute of Molecular Medicine & Stem Cell Research (AIMMSCR), Amity University, Noida, India; 02-05 March 2022.
  - **Ganesh Kumar Barik:** Best poster Award at the 41st Annual International Conference of Indian Association for Cancer Research (IACR) IACR-2022, 'Combating Cancer: Biology to Therapy to Drug Resistance'," & An International Symposium on: Cancer & Stem Cells, organised by Amity Institute of Molecular Medicine & Stem Cell Research (AIMMSCR), Amity University, Noida, India; 02-05 March 2022.

- Vidisha Tripathi's group
  - **Tejashri Dhamale (MTech, student of the Dept. of Technology, SPPU, who carried out her 1-year dissertation with Dr. Vidish Tripathi):** Best Thesis Award for her MTech dissertation, 'Understanding the role of long noncoding RNAs in replication stress'.

Project Scientists, Alumni and Others

- Dr. Praveen Rahi (Project Scientist, NCCS-NCMR) was made a member of the Editorial Board of the International Journal of Systematic and Evolutionary, the official journal of the International Committee on Systematics of Prokaryotes.
- Dr. Praveen Rahi (Project Scientist, NCCS-NCMR) was recognised by the Microbiology Society as an 'Outstanding Reviewer 2021' for International Journal of Systematic and Evolutionary Microbiology.
- NCCS alumnus, Dr. Ananth Burada, received the DBT/Wellcome Trust India Alliance Early Career Fellowship. He will be pursuing his postdoctoral research at IISc, Bengaluru.
- Abhishek Keer from Dr. Yogesh Shouche's research group received the Bill & Melinda Gates Foundation Travel Award for scientists from low and low-middle income countries, to participate in the World Microbe Forum, 20-24 June 2021.
- A start-up proposal of Dr. Mahesh Patil, former Research Associate from Dr. Manoj Bhat's group at NCCS, was selected for the BIRAC-BIG grant of INR 50 lakhs, during the 19th BIG call. He and his team achieved the highest score (82.24) among the BIG proposals in the area of Industrial Biotechnology, clean energy and environment. Dr. Patil will serve as Director of Aves FoodTech Pvt Ltd., which aims to develop socially-beneficial functional food products for a healthy India.

Research Fellows awarded with Ph. D. Degrees

(01.04.2021 – 31.03.2022)

No.	Research Scholar	Title of the Thesis	Date of award of Ph.D. (dd/mm/yyyy)	Research Guide
1	Mr. Rahul Bodkhe	Gut microbial community structure analysis in celiac disease	27.04.2021	Dr. Yogesh Shouche
2	Mr. Raj Kumar Gour	Investigation of phenotypic features of extended RD-1 locus of mycobacterial species: Cell surface proteins and their roles	06.05.2021	Dr. M. V. Krishnasastry
3	Ms. N. N. V. Radharani	Role of tumor associated macrophages (TAMs) in regulation of cancer stem cells (CSCs)-mediated breast tumor growth and angiogenesis	21.05.2021	Dr. Gopal Kundu
4	Mr. Arpankumar Choksi	Understanding the structure-function relationship of SMAR1(BANP)	14.06.2021	Dr. Samit Chattopadhyay
5	Mr. Satish Kumar	Metagenomic and functional profiling of Lonar Lake and inflow 'dhara'.	02.07.2021	Dr. Yogesh Shouche
6	Ms. Dinisha Kamble	Role of NRF2 in breast cancer stem cells resistance and tumor recurrence	29.07.2021	Dr. Sandhya Sitasawad
7	Ms. Deepti Tomar	Role of hypoxia modulated microRNAs in regulating breast tumor angiogenesis and progression	02.09.2021	Dr. Gopal Kundu
8	Mr. Kailash Chand	Studies on the expression profile and functional role of various HSP40 isoforms during HIV-1 infection	22.10.2021	Dr. Debashis Mitra
9	Ms. Anshul Assaiya	Structural and functional characterization of ionotropic receptors	02.11.2021	Dr. Janesh Kumar
10	Ms. Richa Pant	To decipher the role of nuclear matrix binding protein SMAR1 in adipogenesis: Its implication in obesity related cancers.	16.11.2021	Dr. Samit Chattopadhay
11	Ms. Shehnaz Bano	Delineating the mechanism of insulin resistance	25.11.2021	Dr. Vasudevan Seshadri
12	Ms. Priyanka	Mechanistic insights into LPS regulated cancer progression: Fine-tuning of tumor suppressor SMAR1.	06.12.2021	Dr. Samit Chattopadhay
13	Mr. Vibhuti Kumar Shah	Studies on chromatin remodelling protein SMAR1 in CD4+ memory T cell differentiation.	06.12.2021	Dr. Samit Chattopadhay
14	Ms. Bhawna Burdak	Structural studies on Nup93●Nup188 sub complex of the vertebrate nuclear pore complex.	27.12.2021	Dr. Radha Chauhan
15	Ms. Surbhi Dhingra	Structural investigations into ionotropic glutamate receptor functions	07.02.2022	Dr. Janesh Kumar
16	Ms. Yashika Agrawal	Understanding the Role of FBXO41 in tumour	15.02.2022	Dr. Manas Kumar Santra
17	Ms. Sangeeta Niranjan	Exploring structural and biochemical basis of Nup155 in NPC assembly	17.02.2022	Dr. Radha Chauhan
18	Ms. Arya Ghate	Role of complement in macrophage differentiation and polarization	18.02.2022	Dr. Arvind Sahu
19	Mr. Jatin Behari	Functional characterization of PIP4K2A, an RNA binding protein	08.03.2022	Dr. Vasudevan Seshadri
20	Mr. Anurag Kumar	Systems biology of thiol-redox system in *L. major*	15.03.2022	Dr. Shailza Singh
21	Ms. Poulomi Banerjee	Regulation of the DEAD-box RNA helicase DDX19 by SUMOylation	21.03.2022	Dr. Jomon Joseph
22	Mr. Pranay Ramteke	Hyperglycemia associated molecular and metabolic reprogramming in breast cancer	25.03.2022	Dr. Manoj Kumar Bhat

POSTDOCTORAL FELLOWS, EARLY-CAREER & OTHER SCIENTISTS AT NCCS

No.	Name	Designation	Tenure at NCCS (dd/mm/yyyy) From	To	PI whose research group they were affiliated with
1	Dr. G. C. Mishra	NASI Platinum Jubilee Chair	04/09/2018	03/09/2023	-
2	Dr. Jyoti Singh	Wellcome Trust DBT India Alliance Early Career Fellow	01/01/2018	31/12/2022	Dr. Janesh Kumar
3	Dr. Priyanka Dutta	DST Inspire Faculty Fellow	01/05/2018	30/04/2023	Dr. Radha Chauhan
4	Dr. Deepika Puri	DST Inspire Faculty Fellow	30/07/2018	20/06/2022	Dr. Deepa Subramanyam
5	Dr. Khushman Taunk	CSIR-RA	22/08/2019	31/08/2022	Dr. Srikanth Rapole
6	Dr. Upasana Narula	ICMR-RA	15/02/2021	14/02/2022	Dr. Nibedita Lenka
7	Dr. Archana Rajendran	SERB-N-PDF	15/03/2021	14/02/2023	Dr. Nibedita Lenka
8	Dr. Jupitara Kalita	MK Bhan Young Researcher Fellow	08/10/2021	07/10/2024	Dr. Janesh Kumar
9	Dr. Bhuvaneshwaran SP	DBT RA	22/03/2022	21/03/2025	Dr. Nibedita Lenka
10	Dr. Avinash Sharma	Wellcome Trust DBT India Alliance Early Career Fellow	09/01/2019	16/05/2021	Dr. Vasudevan Seshadri
11	Dr. Manjushree Bahir	DST WOS-A Fellow	27/10/2017	26/04/2021	Dr. Nibedita Lenka
12	Dr. Bhargab Kalita	DBT-RA-II	01/07/2019	30/06/2021	Dr. Srikanth Rapole
13	Dr. Rajesh Vinnakota	DBT-RA-I	01/04/2021	05/08/2021	Dr. Janesh Kumar
14	Dr. Parshuram Sonawane	DBT-RA-II	01/03/2020	14/10/2021	Dr. Radha Chauhan
15	Dr. Ameya Bendre	DBT-RA-III	01/01/2019	14/10/2021	Dr. Janesh Kumar
16	Dr. Md. Zahid Kamal	Wellcome Trust DBT India Alliance Early Career Fellow	07/01/2015	31/12/2021	Dr. Janesh Kumar
17	Dr. Dharmendra Pal Singh	ICMR-RA	01/12/2021	30/04/2022	Dr. Girdhari Lal

Other Capacity-Building Activities

Dr. Sharmila Bapat served as the external mentor for Dr. Shilpa Rao, Asst. Professor at the Department of Neuropathology, NIMHANS, who was awarded the DBT-Wellcome Trust India Alliance fellowship for the project, 'Analysis of mitochondrial alterations in glioblastoma cells derived from primary culture', under the guidance of Dr. Vani Santosh, MD. FAMS, Professor, Department of Neuropathology.

Teaching, Training and Outreach

Teaching and Training

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

Scientist	Topic / Symposium	Class / Department	Institution	Date
Dr. Dhiraj Dhotre	'Genomics and Bioinformatics' Talk delivered at the 'Frontiers in Biotechnology-DBT Star Scheme' event. organized by the,,. Over 200 UG and PG students and faculty participated.	UG and PG students and faculty (>200)	Modern College, Ganeshkhind, Pune	07.10. 2021
Dr. Dhiraj Dhotre	'Gut Brain Axis' Talk delivered at the 'Frontiers in Biotechnology-DBT Star Scheme' event	UG and PG students, and faculty (>200)	Indian Women Scientists' Association, Vashi, Navi Mumbai, in association with the Dept. of Microbiology, Kishinchand Chellaram College (HSNC University), Mumbai	21.10.2021
Dr. Janesh Kumar	'Single-Particle Cryo-EM: Revolution in structural Biology' (special lecture on upcoming technology)	MSc and PhD students (~50)	Institute of Bioinformatics and Biotechnology, S. P. Pune University	25.11.2021
Dr. Santosh Kumar	'Bioprocess Technology and Animal Biotechnology'	B.Sc. Department of Biotechnology	Panjab University, Chandigarh	01.04.2021 to 31.05.2021
Dr. Santosh Kumar	'Physiology of human body'	M.Sc. Department of Biotechnology	NIPER Mohali	27.12.2021 to 28.12.2021
Dr. Arvind Sahu	'Molecular mimicry: A viral strategy to evade the complement system' (online guest lecture)	M.Sc. Department of Microbiology	M. S. University of Baroda, Vadodara	13.09.2021
Dr. Arvind Sahu	'The Complement System' (online guest lecture)	M.Sc.	Institute of Science, Nirma University, Ahmedabad	07.10.2021 & 08.10.2021
Dr. Manas Kumar Santra	'Reaching the drop through the ocean: Proteomics to capture dynamic interactions to understand cancer' (Annual Meeting of Proteomics Society)	M.Sc. and Ph.D. students and faculty	Centre for Cellular & Molecular Biology	23.10.2021
Dr. Manas Kumar Santra	'Cell cycle and cyclins: Save it to cherish or leave it to perish' (Advanced National Training)	M.Sc. and Ph.D. students	West Bengal University of Animal and Fishery Sciences	11.11.2021
Dr. Vasudevan Seshadri	'RNA-protein interactions regulating insulin biosynthesis'	PhD students (and senior researchers)	EMBO lecture course, NCCS, Pune	09.02.2022
Dr. Vasudevan Seshadri	'PIP4K2A - Moonlighting as an RNA binding protein' (webinar)	PhD students (and senior researchers)	SBC, Mumbai Chapter	05.02.2022
Dr. Avinash Sharma	'An insight into the amazing world of microbiology'	M.Sc. Biotechnology	Baba Ghulam Shah Badshah University, Rajouri, J&K.	22.09.2021
Dr. Avinash Sharma	'Anthropogenic activities and its impact on natural microbiota of Godavari river'	M.Sc. Department of Biotechnology	GIET University, Odisha	24.01.2022
Dr. Deepa Subramanyam (invited speaker)	'What regulates stem cell pluripotency? A role for intracellular trafficking'	Proteus Club - BS/MS, Integrated PhD and PhD students	IISER Trivandrum.	08.10.2021

Classes taught by NCCS scientists for the Ph.D. course work (2021)

(for Ph.D. students from various organizations in Pune, who are registered with the S.P. Pune University, Department of Biotechnology)

Scientist	Topic / Module
Dr. Arunkarthick	Advances in cell biology
Dr. Sharmila Bapat	Coordinator of the Cancer Biology Coursework (Elective) Advances in Cancer Biology, Cell biology: Introduction to Cancer Biology - Hallmarks of Cancer; Nobel Awards relevant to Cancer; Tumor Metastases; CSCs & Cellular Plasticity
Dr. Akanksha Chaturvedi	Advance and Applied Immunology Course
Dr. Radha Chauhan	Course coordinator for Structural Biology Advances in Structural biology Quantitative methods (Instructor)
Dr. Gaurav Das	Research Communication
Dr. Dhiraj Dhotre	Research communication NGS techniques
Dr. Jomon Joseph	Advances in cell biology
Dr. Janesh Kumar	Research communication Structural biology / Membrane Proteins Quantitative methods
Dr. Girdhari Lal	Tumor Immunology Transplantation Immunology
Dr. Amitabha Majumdar	Neuroscience
Dr. Ajay Pillai	Research ethics
Dr. B. Ramanamurthy	Laboratory Animal experimentation and ethics
Dr. Srikanth Rapole	Proteomics basics and applications, Mass spectrometry Instrumentation, MS-based proteomics and PTMs characterization, Quantitative Proteomics, Cancer Biomarkers Quantitative methods
Dr. Manas Kumar Santra	Molecular Biology/Transcription Cancer Biology/Cell cycle/Apoptosis/Epigenetics Overall course coordinator
Dr. Vasudevan Seshadri	Protein Translation and its regulation, Molecular Biology Quantitative methods - Q-PCR, Microarray Linkage analysis
Dr. Shailza Singh	Mathematics for Biosciences-Computer Applications
Dr. Sandhya Sitasawad	Cancer Biology (Tumor Angiogenesis) Research ethics (Biosafety)
Dr. Deepa Subramanyam	Stem Cells, Development and Neurobiology
Dr. Vidisha Tripathi	Molecular biology Cancer Biology
Dr. Chitra Arvind (guest speaker)	Research ethics

Other Workshops / Training Programmes / Demonstrations Conducted

(in addition to the workshops mentioned in the reports of the cell repository & central support units)

In-house Training

(workshops conducted to upskill the PhD students, technical staff and scientists of NCCS)

- Dr. Shailza Singh imparted training to Ph.D. students of NCCS at an NGS Workshop Series; 5, 12, 19, 26 June and 3, 10 and 21 Juy 2021.
- Sample preparation and mass spec analysis of the proteome' – Training imparted by the Proteomics Facility in multiple batches for the PhD students; 15-18 November 2021; 20-23 December 2021.
- Other training sessions organized by the central facilities are included under their respective reports.

Training provided to extramural participants

(in addition to the IAS Summer Training Fellows, 6 moths' / 1-year Project Trainees, students of the Ph.D. course work and cell repository workshop participants)

- Free virtual workshop on RanBP2/Nup358 and Acute Necrotizing Encephalopathy (ANE) - Jointly organized by Dr. Jomon Joseph (Scientist, NCCS) & Dr. Alex Palazzo (University of Toronto, Canada); 10-12 November 2021. Target audience: Clinicians and researchers working on nuclear pores, RanBP2/Nup358, viruses and ANE (http://www.palazzolab.com/workshop-on-ranbp2nup358-and-ane).
- Dr. Shailza Singh imparted training online to external participants on the themes, Molecular Dynamics Simulations, Docking, Molecular Modeling, Network Biology etc. at a virtual 'International Workshop in Bioinformatics and Big Data'; 17 July 2021. More than 70 participants received training.
- Dr. Deepa Subramanyam imparted hands-on lab training to BS/MS students of IISER-Pune; February-April 2022.
- Molecular Phylogeny: Bacteria and Fungi': Virtual workshop organized by NCCS-NCMR for Faculty and PhD students (Participants: 10 faculty members & 2 PhD students from the Vivekanand Arts College, Sardar Dalipsingh Commerce & Science College, Aurangabad, Shri Shivaji Science College, Amravati, etc.); 01 May 2021.

Other Talks Delivered by NCCS Faculty

S. Arunkarthick

- Light Microscopy & Confocal Microscopy Techniques': Invited talk delivered at the DST - Agarkar Research Institute (ARI), Pune; 04 October 2021.
- Introduction to Biacore and its applications': Talk delivered at an in-house seminar; 09 March 2022.

Sharmila Bapat

- Cancer Stem Cells and Tumor Heterogeneity - Invited talk at the 5-Day online Faculty Enrichment Programme (FEP) on "Cutting Edge Science in Cellular and Molecular Biomedicine" conducted at Amity University, India; 27-31 July 2021.
- Tumor Heterogeneity - Invited talk at the online webminar of the World Cancer Research Day (WCRD; an initiative of the Spanish Association Against Cancer-SAAC) in collaboration with the Indian Association for Cancer Research (IACR); 24 September 2021.
- 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).

Manoj Kumar Bhat

- Talk about NCCS at the 'PDF Meeting 2021', organized jointly by IndiaBioscience and the Department of Biotechnology (DBT), Government of India; 20 May 2021.

Akanksha Chaturvedi

- Human monoclonal antibodies in infectious disease': Talk delivered at Nanaji Deshmush Veterinary Science University, College of Veterinary Science & Animal Husbandry, Department of Veterinary Microbiology, Mhow (M.P.); 22 October 2022.

Radha Chauhan

- The intrinsic plasticity of nucleoporins and their role in NPC assembly and functions': Invited talk delivered at the International symposium RanBP2/Nup358 & ANE, 10 November 2021.
- 'Structural biology and role of GN Ramachandran': Invited talk delivered at the S.P. Pune University Biotechnology Department; 11 August 2021.
- Methods for epitope mapping in antigen-antibody interactions': Invited talk delivered at the 21-day workshop on 'Immunology - a tool for disease management' organized by the Nanaji Deshmukh Veterinary Science University College of Veterinary Science & Animal Husbandry, Mhow; 22 October 2021.
- The intrinsic plasticity of nucleoporins and their role in NPC assembly and functions': Talk delivered at the virtual International Workshop on RanBP2/Nup358 and Acute Necrotizing Encephalopathy (10-12 Nov 2021); 12 November, 2021.

Jomon Joseph

- Speaker at the virtual 'Workshop on RanBP2/Nup358 and Acute Necrotizing Encephalopathy'; 10-12 November 2021.

Janesh Kumar

- Functional implications of N-terminal alternative splicing of GluK1 kainate receptors": Invited talk delivered at the virtual Symposium on Structural Dynamics of Ion Channels and Receptors, organized by the School of Biological Sciences, IIT Delhi; 24 February 2022.
- Structural and Functional insights into modulation of kainate receptors by auxiliary Neto proteins': Invited (virtual) talk delivered at the 48th National Seminar on Crystallography held at IIT Roorkee; 25-27 Nov 2021.
- Invited talk "Single-Particle CryoEM: Boon for structural Biology" Institute of Bioinformatics & Biotechnology (IBB), Savitribai Phule Pune University, Pune held on 9 November 2021 (Virtual mode).

Girdhari Lal

- A good education, discipline, and territorial restriction of immune cells are important for mounting an effective immunity': Invited talk delivererd at the short-term program in Pharmaceutical Sciences organized by Poona College of Pharmacy, Bharti Vidyapeeth University, Pune; 12 January 2022.
- Exploiting the neuroimmune communication in anti-tumor immunotherapy' (Karmakar S, Lal G): Invited talk delivered at the 47th Annual Conference of Indian Immunology Society organized at IICB, Kolkata; 18-19 December 2021.
- Chemokine receptor CCR6 signaling alters the Th17 cell metabolism and promotes its pathogenic function' (Meitei HT, Kulkarni N, Sharma PK, Mujeeb VR, Srivastava S, Shirolkar A, Rapole S, Lal G): Oral presentation delivered at the 47th Annual Conference of Indian Immunology Society organized at IICT Kolkata; 18-19th December 2021.
- Chemokine receptor CCR6 signaling in CD4 T cells drive the metabolic adaptation of inflammatory Th17 cells in inflammatory colitis' (Meitei HT and Lal G): Oral presentation delivered at the 3rd National Biomedical Research Competition-2021 (NBRCCOM 2021) organized by Society of Young Biomedical Scientists, India; 06-10 December 2021.
- Immunological mechanism of neuroinflammatory diseases': Invited talk delivered at the Virtual Bi-monthly lecture series on

Immunology and Inflammation organized by Society of Inflammation Research, Bangalore; 20 November 2021.

- Current status of Immuno-oncology research in India- Challenges and remedies': Invited talk (virtual) delivered at the 3rd Annual Congress of Immuno-Oncology Society of India 2021; 08-10 October 2021.
- Contribution of gamma-delta T cells in allogenic transplantation tolerance': Invited talk (virtual) delivered at the 13th Annual Conference and Workshop organized by the the Cytometry Society, India, and the Post-Graduate Institute of Medical Education and Research, Chandigarh (TCS-2021); 29-30 October 2021.
- Education and Learning of Immune Cells in Health and Diseases': Invited Keynote Address on the occasion of Orientation program at Amity University, Haryana; 04 September 2021.
- Opportunity for CD4 T cell migration, plasticity, and its communication at the gut-brain axis': Invited (virtual) talk at Innovation Center, Tata Chemicals Limited, Pune; 30 June 2021.
- NK cell role in Inflammation and regulation': Invited talk delivered at the virtual Bi-monthly lecture series on Immunology and Inflammation organized by Society of Inflammation Research, Bangalore on 09 May 2021.
- Pathophysiological importance of gut-tropic chemokine receptors in inflammation and autoimmunity': Invited talk delivered at the International Conference on Infectious diseases and immunopathology (IDIP-2021), organized by the Department of Biotechnology, SPPU, Pune; 22-24 April 2021.
- CCR9 intrinsic signaling in dendritic cells promotes the differentiation of of Foxp3+ regulatory CD4 T cells in the gut': Virtual talk delivered at the 12th International Congress of Autoimmunity; 28 May - 01 June 2021.
- Plasticity of T cells in pathophysiology of disease': Talk delivered at the virtual bi-monthly lecture series on 'Immunology & Inflammation' organized by the Society of Inflammation Research; 31 July - 01 August 2021.
- Neuroimmune communication in health and Disease: The Gut Feeling': Talk delivered online at the webinar series organized by the Translational Outcomes Research group, Department of Zoology, University of Calcutta; 05 December 2021.

Nibedita Lenka

- Chemo-preventive and therapeutic potential of dithiolethione in glioblastoma' (U. Kapoor, N. Lenka): Talk delivered at the 35th Annual Meeting of Society of Neurochemistry, India (SNCI) and the International Conference on "Neurodegeneration and Cognition: Recent Advances in Neurological Diseases", Univ. of Hyderabad, India, Dec. 2-4, 2021 (Invited Speaker).
- Viewing Life forms: Stem Cells, Looking Within and Beyond ': Talk delivered online at the BIRAC SITARE-BIIS Programme organized by the Society for Research and Initiatives for Sustainable Technologies and Institutions (SRISTI), Ahmedabad, Gujarat on 03 March (BIIS-10) and on 24 March (BIIS-11) 2022.

Ajay Pillai

- Academic Challenges in Licensing and Commercialization of Patents from Cell Based Drug Discovery': Talk delivered by Dr. Ajay Pillai at the AICTE-sponsored Online Short-Term Training Program (STTP) organized by Bharati Vidyapeeth College of Pharmacy, Kolhapur, for faculty; 04 & 25 September 2021.
- Research Proposal writing and Research Ethics': Topic covered as a resource person at an online training on "Scientific Project Management" organized by IISER Pune in association with DST; 11 January 2022.
- Tips to writing successful grants': Talk delivered at the virtual India EMBO Lecture Course on RNA Binding Proteins organized by NCCS; 08-11 February 2022.

Srikanth Rapole

- Mass spectrometry-based proteomics': Invited talk at PSI education day organized by Centre for Cellular and Molecular Biology (CCMB), October 21, 2022 at Hyderabad.
- Identification of candidate cancer biomarkers/targets using mass spectrometry-based proteomics': Invited talk at Proteomics advanced winter school 2021 organized by IIT-Bombay, November 8-19, 2021 at Mumbai.
- Clinical Proteomics': Talk delivered at the online DST-Faculty Development Program organized by IIT-Bombay; 11 November 2021.

Arvind Sahu

- Molecular mimicry: a viral strategy to evade the complement system': Invited talk delivered at the International Conference on Infectious Diseases and Immunopathology (IDIP-2021), organized by the Department of Biotechnology, Savitribai Phule Pune University; 23 April, 2021.
- COVID-19: the way ahead?': Invited talk delivered at Jagrujkta Abhiyan for COVID-19 Pandemic, jointly organized by NASI HQ and Pune Chapter; 07 September 2021.
- Viruses strike back against the complement system': Invited online talk delivered at the 87th Annual Meeting of Indian Academy of Sciences, Bengaluru; 12 November 2021.
- Virus-complement interactions: a tale of virus-encoded complement regulators': Online guest lecture delivered at the National Institute of Virology, Pune, "08 March 2022.
- Chaired a session on COVID-19 immunology at the 5th Annual Web-Conference of Society of Inflammation Research – SIRCON 2021, attended by researchers from all over the world; 02 October 2021. The speakers were: Dr. Aymeric Silvin, France; Dr. Julie Rayes, UK; Dr. Florian Krammer, USA.

Manas Kumar Santra

- Cell cycle and cyclins: Save it to cherish or leave it to perish': Talk delivered online at the Advanced National Training on "Recent Advances in Veterinary Pathology for intensive livestock development", organized by the West Bengal University of Animal and Fishery Sciences, Kolkata; 11 November, 2021.

Avinash Sharma

- Importance of microbial resource centres in conserving microbial diversity': Invited Talk delivered at the Fresher Course; Ecosystems Restoration and Disaster Management; National Institute of Disaster Management, New Delhi and Society for Environment and Development, New Delhi; 23 July 2021.
- Understanding Life in Extreme Environments; from conventional cultivation to high throughput sequencing': Invited Talk; Three-day National Webinar on Technological Advances in Applied Microbiology; Department of Microbiology, Goa University; 10 November 2021.
- Microbial Genomics': Invited Talk; AICTE Training and Learning (ATAL) Academy sponsored FDP on Multi-omics Data Science; Indian Institute of Technology, Jodhpur: 21 December 2021.
- Journey to the Coldest Continent on Earth': Invited Talk; Climate change and food security issues challenges and strategies; Bhaskaracharya College Of Applied Sciences (University of Delhi); 07 January 2022.
- Anthropogenic activities and its impact on natural microbiota of the Godavari river': Virtual talk delivered at the Induction / Refresher programme on 'Role of Biotechnology in Mitigation of Pollution and Restoration of Environment', organized by the Department of Biotechnology, GIET University, Odisha; 24 January 2022.

Shailza Singh

- Signaling cascades driving immunology towards synthetic biology': Invited talk at the Department of Biotechnology, AIIMS Delhi, under the Seminar Series in Molecular Medicine; 24 April 2021.
- Invited talk-cum-online training imparted in the field of Molecular Dynamics Simulations at an International Workshop in Bioinformatics and Big Data; 17 July 2021.
- Synthetic biology based Therapeutics for Infectious Disease Leishmaniasis: From methods to devices': Invited talk delivered at the online National Conference on Computational and Biochemical Drug Discovery [NCCBDD-2021] at IIT(BHU), Varanasi; 11-12 September 2021.
- Artificial Intelligence and Machine Learning for AatmaNirbhar Bharat': Invited lecture in the third Lecture of the AatmNirbhar Bharat Saptah Expert Lecture Series on the Role of Research and Innovation for AatmaNirbhar Bharat organized under the aegis of Shiksha Sanskriti Utthan Nyas (North East); 27 September 2021.

- Systems driven Synthetic Machines for Therapeutics in Infection Model': Invited talk delivered at the Pandit Ravi Shankar Shukla University, Raipur; 16-17 December 2021.
- Molecular Dynamics Simulations using Desmond': Invited talk delivered at the 'Workshop on Basic to Advanced Bionformatics, Genomics and Data Sciences'; 23 October 2021.

Deepa Subramanyam

- Move it around – trafficking and cell fate decisions in stem cells': Invited talk at the 1st Subhash Mukhopadhyaya symposium, 13-15 January 2022.
- Regulation of Clathrin-Mediated Endocytosis in the Context of Huntingtin Aggregates': Invited talk at the American Society for Cell Biology. 01-10 December 2021.
- Research during the pandemic – results from the COVID survey': Invited tal at the India Alliance Annual Conclave. 25-28 October 2021.
- Balancing pluripotency in mouse embryonic stem cells through the action of intracellular trafficking pathways': Invited talk at IBAB, Bangalore; 26 April 2021.

Mohan Wani

- 'Stem cell therapy in animal models of degenerative diseases': Talk delivered at the 44th Annual Congress of the Indian Society for Veterinary Surgery, College of Veterinary and Animal Sciences, G. B. Pant University of Agriculture and Technology, Pantnagar (Uttarakhand); 24 February 2022.

Amit Yadav

- Containment of phytoplasma diseases through management of insect vectors and accreditation of seedlings': Invited talk at a training programme on 'Integrated Pest and Disease Management' organized by Indian Council of Forestry Research and Education (ICFRE)- Forest Protection Division, Institute of Wood Science and Technology, Bangalore Indian Forest Service (IFS) officers. 17 December 2021.
- Genotaxonomy of SCGS Phytoplasma achieved through targeted Hybrid Metagenomic Assemblies of Plant Microbiomes '*Candidatus* Phytoplasma sacchari', a case study': Invited talk at a symposium on 'National Symposium on Sustainable Plant Health Management midst Covid Pandemic: Challenges and Strategies' organized by ICAR-Central Plantation Crops Research Institute, Kasargod, Kerala & Indian Phytopathological Society, South Zone Chapter. 02 December 2021.
- Phytoplasma Diseases of Oilseed Crops and their Management with emphasis to North-East Himalayan region (NEHR)': Lead lecture at the two-day National Webinar on 'Plant Diseases in Eastern and Northeastern India: Current Dynamics and Proposed Action Plan for Their Management organized by Department of Plant Pathology, College of Agriculture, Tripura (CAT) in collaboration with All India Coordinated Research Project on pigeon pea (Tripura Centre), CAT in association with ICAR - National Bureau of Agricultural Insect Resources (NBAIR), Bengaluru; 24 June 2021.
- Genome-based taxonomy of phytoplasma: '*Candidatus* Phytoplasma sacchari' a case study': Invited talk at the 8th Academic Congress of Asia Organization of Mycoplasmology (AOM) 2021, Nanjing-China (Online Conference), Nanjing, CHINA; 24-25 September 2021.
- A talk on NCCS's initiative on AMR through the AMR repository was delivered at the "Antimicrobial Resistance Dx Bootcamp" & AMR Policy workshop at IIT, Delhi, organized by UKIERI (UK-India Education and Research Initiative); 28, 29 March 2022.

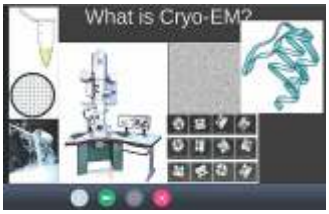
Other Outreach

National Science Day at NCCS 28 February, 2022

'Artificial Intelligence (AI) in Biology: Cracking protein structures with CASSPER & CoRNeA'

A virtual public talk and panel discussion was organized on this topic to align with the Government's theme for 2022, "Integrated Approach in S&T for a Sustainable Future". In addition to being a public event, it was aimed at engaging students and faculty from DBT Star Colleges under the Science Setu initiative of DBT. This event was served to celebrate 'Azadi Ka Amrit Mahotsav'.

Multi-disciplinary panellists: Dr. Radha Chauhan & Dr. Janesh Kumar - Scientists, National Centre for Cell Science, Pune; Dr. Ninan Sajeeth Philip - Dean & Director, Artificial Intelligence Research and Intelligent Systems (airis4D), Thelliyoor; Dr. Ajit Kembhavi -



Professor Emeritus, Inter-University Centre for Astronomy and Astrophysics (IUCAA), Pune.




India International Science Festival (IISF 2021) 10-13 December 2021

NCCS joined the nation in celebrating the scientific achievements of India as part of the 'Bharat Ka Amrit Mahotsav' by showcasing its research and other activities, and achievements at the IISF 2021 Science & Technology Expo at Panaji, Goa. 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 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.




Vidnyanotsav Science Awareness Programme 23 February 2022

An open day was organized at DBT-NCCS in partnership with the Institute of Chemical Technology (ICT), Mumbai, under DST's 'Synergistic Training program Utilizing the Scientific and Technological Infrastructure' (STUTI) scheme. Over 100 school students plus faculty members from Kendriya Vidyalaya schools in Pune visited the laboratories at DBT-NCCS and interacted with the scientists.

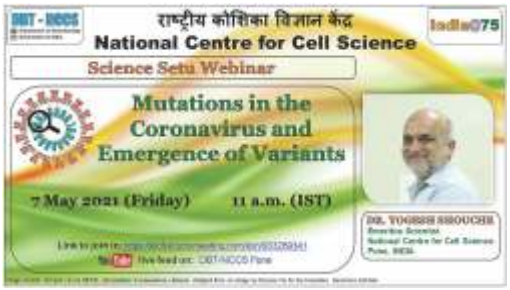
Other activities under the umbrella of 'Azadi ka Amrut Mahotsav' and 'DBT Science Setu'

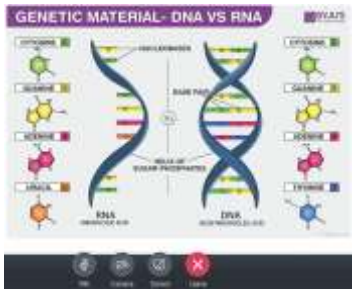
(organized to commemorate 75 years of India's independence, and engage students and faculty from DBT Star colleges under the

aegis of the DBT's 'Science Setu' initiative)

a) 'Azadi ka Amrut Mahotsav' - DBT 'Science Setu' Webinar:

'Mutations in the Coronavirus & Emergence of Variants'





A public webinar by Dr. Yogesh Shouche (Emeritus Scientist, DBT-NCCS); 7 May 2021.

b) 'Azadi ka Amrut Mahotsav' - DBT 'Science Setu' Webinar:

'MicFunPred: Software developed to eavesdrop on microbial communities': Public talk by Dr. Dhiraj Dhotre, Scientist, NCCS; 16

November 2021.

This webinar was organized to celebrate and create awareness about the contemporary achievements of Indian scientists. Dr. Dhotre spoke about an indigenously-developed software created by him and his team for microbiome studies, which will serve as a valuable tool for the Indian Human Microbiome initiative being spearheaded by DBT-NCCS.

c) 'Azadi ka Amrut Mahotsav' - DBT 'Science Setu' Webinar:

'Friends Forever? We & the microbes in our body' – Public webinar by Dr. Yogesh Shouche (Emeritus Scientist, NCCS, Pune); 23 July

2021.

d) Cell Biology Lecture Series (CBLS)

The Cell Biology Lecture Series was introduced to serve as an open platform for students and young researchers to interact with scientists from diverse fields of cell biology virtually and in-person.

The first talk in this series was by Dr. Aurnab Ghose (IISER, Pune): 'Through a Formin Lens, darkly: insights into cytoskeleton remodelling in neurons'; 14 March 2022.

e) Data Science Webinar series:

Organized under the auspices of the 'Manav: Human Atlas Initiative', a collaborative project between DBT-NCCS, IISER-Pune and Persistent Systems (PS), funded by the DBT and co-funded by PS. The webinars were open to all. Students and faculty from DBT Star colleges attended the 'Manav' data science webinars as part of the 'Science Setu' initiative of NCCS. During 2021-22, thirteen webinars were organized in this series.

f) Participation in 'Vigyan Sarvatra Pujyate'

(Initiative of the Office of the PSA and Ministry of Culture, along with DST-Vigyan Prasar, to commemorate 'Azadi Ka Amrut Mahotsav')

- Vigyan Sarvatra Pujyate Mega Expo': DBT-NCCS showcased its research and other activities and achievements at this expo




organized at the Jawaharlal Nehru Stadium, New Delhi; 22-28 February 2022.

- Dr. Sharmila Bapat served as a member of DBT Expert Committee for coordinating and implementing 75 talks conducted by DBT-AIs during the Mega Exposition held at at Pragati Maidan, New Delhi, to showcase the STI accomplishments and activities; 22 - 28February 2022.
- **देशतली सूक्ष्म जीवशास्त्र व जैवतंत्रज्ञानाची पायाभरणी**': Talk delivered in Marathi by Dr. Yogesh Shouche at the festival organized by the Satyhaye College, Mumbai; 23 February 2022.

g) Other External Events:

Dr. Srikanth Rapole delivered an invited (virtual) talk on 'Identification of potential targets and biomarkers for multiple myeloma using global proteomic, metabolomic and molecular approaches' at the 'Integrated Genomics and Proteomics Approach for Cancer Research' event organized by ACTREC, Mumbai, to celebrate 'Azadi Ka Amrit Mahotsav'; 4 December 2021. The audience of ~650 participants included researchers (M.Sc., Ph.D.) and faculty.

Other Open Days at NCCS

After a precautionary pandemic-induced hiatus in the practice of organizing visits to NCCS, we threw open our doors again for visitors towards the end of 2021-22. The following open days were organized (in addition to the 'Vidnyanotsav Science Awareness Programme'):

(I) Fifty-one PG students and one faculty member from the Department of Microbiology, D.Y. Patil ACS College, Pimpri, visited on 28 & 29 March 2022.
(ii) Three students and one faculty member from the Sinhagad Dental College & Hospital, Pune, visited on 16 March 2022.
(iii) Twenty-six UG and twenty-six PG students, and four faculty members from the Department of Zoology, Prof. Ram Krishna More College, Akurdi, Pune, visited in March 2022.

The visitors were familiarized with the high-end tools and techniques used in cell biology and microbiology research, as well as with the activities and services of NCCS.

COVID-19-Related Outreach

- A public talk on **'करोना महामारी की सीख'** (Lessons learned from the Corona Pandemic) by Dr. Rajesh Karyakarte (Dy Dean & Head of the Department of Microbiology, B. J. Medical College, Pune), was organized on the occasion of the "Hindi Diwas" at NCCS; 20 September 2021.
- Questions on COVID were invited from the general public for the first session in the **'जिज्ञासा'** science series in Hindi initiated by NCCS. Dr. Satyajit Rath answered the questions at a virtual open Q&A session organized on 25th March, 2022.
- A webinar on 'Mutations in the Coronavirus & Emergence of Variants' by Dr. Yogesh Shouche (Emeritus Scientist, DBT-NCCS) was organized for the general public, and especially students and faculty from DBT Star colleges; 07 May 2021. Over 400 people attended, including students and faculty from DBT Star colleges through the 'Science Setu' initiative.
- Dr. Arvind Sahu participated as a panelist in an online panel discussion in Marathi on 'The Need & the Science Behind Covid Appropriate Behaviour and Vaccination' organized by the Council of Scientific and Industrial Research and Vidnyan Bharati; 10 April 2021. The other panelists were: Dr Shekhar C Mande, DG-CSIR, Lt Gen Madhuri Kanitkar, AVSM VSM (DCIDS Medical), Dr Shashank Joshi, Member, Maharashtra COVID Task Force, and Dr Prashant Joshi, AIIMS-Nagpur.
- Dr. Arvind Sahu & Dr. Yogesh Shouche participated in a discussion to answer questions from the public about the second wave of COVID-19, in a webinar organized in Marathi by 'Bhavatal', titled, **'कोरोनाची दुसरी लाट'**; 24 April 2021.
- The following articles by our scientists were published in the April 2021 issue of the Marathi magazine, 'Bhavatal' -
  - Dr. Arvind Sahu & Dr. Yogesh Shouche: **'कोरोनाची दुसरी लाटः महाराष्ट्रात एप्रिल संपेपर्यंत धीर धरा!'** ('The second wave of Corona: Be patient in Maharashtra till April ends!).
  - Dr. Yogesh Shouche: **'कोरोना विषाणू: म्युटेशन, व्हेरिएंट आणि दाहकता'** ('The Corona virus: Mutations, variants and intensity').
- Dr. Yogesh Shouche gave a talk on 'COVID pandemic and its impact on biodiversity' at the webinar organized by the Maharashtra State Biodiversity Board on the occasion of the International Biodiversity Day; 22 May 2021.
- An article in Marathi titled, "**करोनाचे गूढ उकलेल**" (Can the Corona riddle be solved?) was published by Dr. Yogesh Shouche in Maharashtra Times (29 June 2021).
- An article in Marathi titled, **'विषाणूचे मूळ...'** (Source of the virus...) was published in Marathi by Dr. Yogesh Shouche in Saaptahik Sakal (Date on issue: 03 July 2021).
- Dr. Arvind Sahu delivered a talk on, 'COVID-19: the way ahead?' at a webinar on 'Jagrujkta Abhiyan for COVID-19 Pandemic', jointly organized by NASI HQs and Pune Chapter; 07 September 2021.
- Dr. Deepa Subramanyam participated as a panelist in a panel discussion on 'Assessing the impact of COVID-19 on the STEM community in India', at the India Alliance Annual Conclave; 26 October 2021.
- Corona variants in Maharashtra: Do we need to worry?': Invited talk delivered online by Dr. Yogesh Shouche for the School of Life Sciences, Swami Ramanand Teerth Marathwada University, Nanded; 15 November 2021.
- **'लसनिर्मितीचे जागतिक केंद्र'**: Article published by Dr. Yogesh Shouche in the Marathi newspaper, Loksatta; 26 February 2022.

YouTube Videos

To help spread awareness and popularize science, NCCS scientists and students shared their research in the 'Biotech Talks' series on the YouTube channel, 'The Curious Biotechnologist':

- Phytoplasmas – Dr. Amit Yadav.
- What is a Scientific Temper? (Opinions of Indian scientists) – NCCS faculty shared their thoughts about this topic.
- Plant and Microbe Interactions – Dr. Praveen Rahi.
- Antimicrobial Resistance – Dr. Yogesh Shouche.
- Ayurveda and the Human Microbiome: Dr. Diptaraj Chaudhari.
- The Human Microbiome: by Abhijit Kulkarni (PhD student).

Other Extramural Outreach by NCCS Faculty

- Viewing life forms: Stem Cells, Looking Within and Beyond': Talk delivered by Dr. Nibedita Lenka, as Eminent Speaker at:
  - The 10th BIRAC-SITARE Biotechnology Innovation Ignition School (BIIS) online workshop for selected groups of undergraduate students in India, SRISTI, Ahmedabad, 03 March 2022.
  - The 11th BIRAC-SITARE Biotechnology Innovation Ignition School (BIIS) online workshop for selected groups of undergraduate students in India, SRISTI, Ahmedabad, 24 March 2022.
- Mass Spectrometry based Proteomics': Talk delivered by Dr. Srikanth Rapole at the Virtual 'PSI Education Day', organized by CCMB, Hyderabad; 20 October 2021. Around 50 PhD students participated.
- An insight into the amazing world of microbiology' – Virtual talk delivered by Dr. Avinash Sharma for the faculty and Masters students of Baba Ghulam Shah Badshah University, Rajouri, J&K; 22 September 2021. About 42 faculty members & Masters students attended.
- Webinar on 'Microbes: Invisible Friends or Foe?'
  Dr. Yogesh Shouche gave a talk for the Vikhe Patil Memorial School, Pune, which was attended by over 500 school students on 24 April 2021.
- Cryogenic Electron microscopy (CryoEM): A structural biology revolution': Invited virtual talk delivered by Dr. Janesh Kumar for a BRNS-supported Popular Science lecture series organized by the Indian Women Scientists' Association, Vashi, Navi Mumbai, in association with the Jai Hind College, Mumbai; 09 December 2021. ~110 Faculty members, group leaders, Scientists, Industry representatives, and BSc, MSc and PhD students attended.

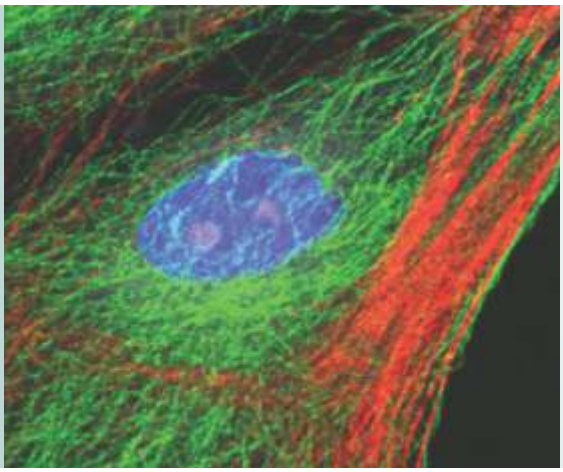
International Women's Day 08 March 2022

a) Popular Science Talk:

'Live, dead and the very dead: Tracing evolution in deep time using seashells'
by Dr Devapriya Chattopadhyay (IISER, Pune)

b) Panel Discussion: 'Diversity in Indian Science: issues and solutions'.

The above events were open to all and the students and faculty of DBT Star Colleges were also specially invited, under the 'DBT Science Setu' programme.



Conferences & Other Events

Conferences / Workshops */ Meetings / Other Events Participated in*

Participation by the NCCS Faculty

Sharmila Bapat

- External advisory board member of the 'Global Cancer Conference' organized by the Global Cancer Consortium; 2-4 December 2021. https://glocacon.org/advisory-board/

Nibedita Lenka

- 6th Annual Cell and Gene Therapy Symposium, Sept. 1-3, 2021, CMC, Vellore.
- Virtual global conference on Brainstorming VSELs – The Future of Stem Cells, Nov. 8-9, 2021.
- Workshop on RanBP2/NUP358 and Acute Necrotizing Encephalopathy (ANE), Nov. 10-12, 2021.
- 1st Subhash Mukhopadhyay (e) symposium organized by S.M. Centre for Stem Cell Biology and Regenerative Medicine, Adamas University, Kolkata and IISc. Bengaluru, Jan 13 – 15, 2022.
- EMBO India Lecture course on RNA binding proteins: From RNA bonding to condensation and aggregation, Pune, India, Feb 7-11, 2022.
- Attended International Society for Stem Cell Research (ISSCR) convened resource events on "Stem Cell based Embryo Models and "Digital-computational stem cell biology", Apr-May, 2020.

Jyoti Rao

- Attended the '10th Training Programme on Science and Technology for Rural Societies for Women Scientists & Technologists' organized online by the Indian Institute of Public Administration (IIPA), New Delhi; 21-25 February 2022.

Vidisha Tripathi

- Vidisha Tripathi; 26th Annual Meeting of the RNA Society; May 25-June 4, 2021.

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

Sharmila Bapat's group

- Aravindan Narayanan: Attended the 12th International MaxQuant Summer School (online; organized by Dr. Cox, Max Plank Institute of Biochemistry) on Computational Mass Spectrometry- Based Proteomics, June 21-25, 2021.

Gaurav Das's group

- Ms Radhika Mohandasan: Attended the "2021 Neurobiology of Drosophila (virtual) Meeting" organized by CSHL. She presented a poster titled, "Enhanced olfactory memory detection in trap-design Y-mazes allows the study of novel memory phenotypes in Drosophila".

Jomon Joseph's group

- Rimpi Saikia: 'Regulation of Autophagy by the Annulate Lamellae-Resident nucleoporin Nup358' (Rimpi Saikia, Misha K.R. and Jomon Joseph), presented at the Americal Society for Cell Biology (ASCB) annual meeting, 01-10 December 2021.

Janesh Kumar's group

- Anshul Assaiya, 48th National Seminar on Crystallography, IIT Roorkee, 25-27 Nov 2021.
- Juhi Yadav, 48th National Seminar on Crystallography, IIT Roorkee, 25-27 Nov 2021.

- Suparna Bhar, 48th National Seminar on Crystallography, IIT Roorkee, 25-27 Nov 2021.
- Swathy Suriyadas, 48th National Seminar on Crystallography, IIT Roorkee, 25-27 Nov 2021.
- Sneha Hakke, 48th National Seminar on Crystallography, IIT Roorkee, 25-27 Nov 2021.

Girdhari Lal's group

- Namrita Halder: Made an oral presentation, 'Acetylcholine receptors control the CD4+ T cells response during gut inflammation and autoimmunity' (Halder N, Kumar D, Lal G.), at the virtual 5th Annual conference of the Society of Inflammation Research (SIRCON 21); 02, 03 October 2021. (Best Oral Presentation Award).
- Thoihen Meitei Heikrujam (Senior Research Fellow): Delivered a talk on 'Immune mechanisms and inflammations in gastroenterology' at the virtual bi-monthly lecture series on Immunology & Inflammation (4th series: Autoimmunity and Inflammation), organized by the Society of Inflammation Research, Bangalore; 20 November 2021.

Amitabha Majumdar's group

- Meghal Desai, Hemant Singh, Deepika Bhujbal, Jagyanseni Naik and Neelanjana Das participated in the India|EMBO Lecture Course on 'RNA binding proteins: From RNA binding to condensation and aggregation'; 08 – 11 February 2022.

Srikanth Rapole's group

- Praneeta Bhavsar presented a poster entitled "Identification of potential therapeutic targets associated with Breast Cancer resistant to Doxorubicin and Ionization Radiation" at the India-EMBO lecture course on 'RNA binding proteins: From RNA binding to condensation and aggregation' organized by National Centre for Cell Science (NCCS), February 8-11, 2022 at Pune.
- Dr. D. Venkateshwarlu Naik (Technician 'C') attended the EMBO virtual workshop on 'Target Proteomics: Experimental design and data analysis'; 29 November – 03 December 2021.

Shailza Singh's group

- Nikhil Samarth: Presented a poster, 'EGFR mediated autophagy signaling in NSCLC through Systems perspective', at the 44th Indian Biophysical Society Meeting (IBS 2022); 30 March 2022.
- Shweta Khandibharad: Presented a poster, 'Regulation of iNOS by NFAT5 in Leishmaniasis: Systems perspective' at the 44th Indian Biophysical Society Meeting (IBS 2022); 31 March 2022.

Deepa Subramanyam's group

- Sinjini Bhattacharyya: Presented 'E-CADHERIN regulates the stability and activity of β-CATENIN in mouse embryonic stem cells (Sinjini Bhattacharyya, Ridim D. Mote, Jacob W. Freimer, Surya Bansi Singh, Sandhya Arumugam, Yadavalli V. Narayana, Raghav Rajan and Deepa Subramanyam) at the American Society for Cell Biology, 01-10 December 2021.

Vidisha Tripathi's group

- Sonali Jathar: Presented 'Regulation of cellular quiescence by MIR503HG' at the Keystone Symposia's eSymposia on non-coding RNAs: Biology and Applications 11-14 May 2021.
- Juhi Srivastava: Presented 'Regulation of cellular proliferation by long noncoding RNAs' at the Virtual Conference on Cancer Biology: Advances and Challenges, Deshbandhu College, University of Delhi, 11-13 November 2021.
- Juhi Srivastava: Presented 'Regulation of cellular proliferation by long noncoding RNAs' at the RNA Binding Proteins: From RNA binding to condensation and aggregation, EMBO virtual India; 8-11 February 2022.
- Vikas Dongardive: Presented 'Investigating the role of novel lncRNA lnc667 during cell cycle progression' at the RNA Binding Proteins: From RNA binding to condensation and aggregation, EMBO virtual India; 8-11 February 2022.

Amit Yadav's group

- Kiran Kirdat: 'Genome Based Taxonomy of Sugarcane Grassy Shoot (SCGS) Phytoplasma Achieved through Targeted Hybrid Metagenomic Assemblies of Plant Microbiomes' (Kiran Kirdat, Bhavesh Tiwarekar, Vipool Thorat, Shivaji Sathe, Amit Yadav) - Presented at the XXIII Biennial Congress of the International Organization for Mycoplasmology (IOM), Tel Aviv. Israel; 08, 09 November 2021.
- Kiran Kirdat: 'Genome Sequencing of Not-Yet Cultivated Phytoplasmas Achieved through enrichment of Plant Microbiome' (Kiran Kirdat, Bhavesh Tiwarekar, Vipool Thorat and Amit Yadav) - Presented at the XXIII Biennial Congress of the International Organization for Mycoplasmology (IOM), Tel Aviv. Israel; 08, 09 November 2021.

Others

- Mr. V.A. Argade, Officer 'C' (Accounts) – 10th Training Programme on Financial Management in Scientific Organizations held in digital mode; 17-21 January, 2022.
- Mr. Amit S. Salunkhe, Technician 'C'(Lab) - 23rd Online Indo-US Flow Cytometry workshop; 27 January - 01 February, 2022.

Conferences & Other Events Organized

NCCS Foundation Day

(26 August 2021)

Foundation Day Oration
by
Dr. Renu Swarup
Secretary, DBT

Special Address
by
Dr. Sanjay Singh
CEO, Gennova Biopharmaceuticals

India|EMBO Virtual Lecture Course: 08 – 11 February 2022

'RNA binding proteins: From RNA binding to condensation and aggregation'

Organizer: Dr. Amitabha Majumdar (NCCS, Pune)

Co-Organizers: Dr. Vasudevan Seshadri (NCCS, Pune), Dr. Tania Bose (S. P. Pune University), Dr. Florence Besse (Institut de Biologie Valrose, France)

26 speakers and 145 participants

Workshop on 'RanBP2/Nup358 and Acute Necrotizing Encephalopathy' 10-12 November 2021

This free, virtual workshop was co-organized by Dr. Jomon Joseph (NCCS) and Professor Alex Palazzo, (University of Toronto, Canada).

Many basic scientists and clinicians presented their work on this disease, and on the interactions between RanBP2/Nup358, viral infections, the innate immune response and other cellular processes, at this workshop.

Other Talks Delivered by Invitees

Celebrating India@75 by Showcasing the Work of Contemporary Scientists in India and by the Indian Diaspora

- Cancer: a curious case of development gone awry' – by Dr. Masum Saini (DBT/Wellcome Trust India Alliance Early Career Fellow, Regional Centre for Biotechnology, Faridabad); 11 June 2021.
- Structure-function studies of solute transport in malaria parasites' - by Dr. Sanjay Desai M.D., Ph.D. (National Institutes of Health, Bethesda, Maryland U.S.A.); 24 September 2021 (open to all).
- NCCS Alumni Seminar Series
  - 'Emergence of Cancer Stem Cell Heterogeneity in Oral Cancer Through Population Dynamics' – by Dr. Sandeep Singh (Associate Professor, NIBMG, Kalyani); 30 July 2021.
  - 'Roles of transcriptional enhancers in genome organization and gene regulation' – by Dr. Dimple Notani (NCBS, Bengaluru); 06 August 2021.
  - Dynamic Regulation of Chromatin Modifiers in Development and Disease' – by Dr. Shravanti Rampalli (Institute for Genomics and Integrative Biology, New Delhi, India); 13 August 2021.
  - 'Understanding anti-tumor functions of Th9 and NK cells' – by Dr. Amit Awasthi (THSTI, Faridabad); 20 August 2021.
  - '*Drosophila* as a model to study human neurodegenerative disease mechanisms' – by Dr. Baskar Bakthavachalu (IIT Mandi); 27 August 2021.

Technical Seminars

- Technical Presentation on newly launched Spectral Cell-Sorter: BIGFOOT by Badri Natarajan Narayanan, Manager- Field Applications, Global Service Support & Customer Service for Flow Cytometry Applications, Thermo Fisher Scientific; 03 September 2021.
- Instant SIM Super Resolution Microscope from Visitech International' (Visitech Instant SIM)': Webinar organized by Dr. Arunkarthick S. and the Bioimaging Facility for the faculty, staff & students of NCCS; 21 October 2021. The webinar was presented by Mr. Steven Coleman, Visitech, Operational Director, to familiarize the participants with the VT-iSIM technology and its applications.
- mFISH/mBAND, FISH, and Karyotyping System' - Presentation/Demonstration by Carl Zeiss; 10 November, 2021.

Speak your Science (SyS) Seminar Series

A seminar series commemorating the 75th year of India's independence.
Twelve seminars were delivered mainly by early- and mid-career researchers, including PhD students, postdoctoral scientists and faculty members of NCCS, as well as by invited speakers like NCCS alumni and international invitees. Seminars by NCCS researchers were mainly in-house, while those by external speakers were open to all,

Other Happenings

Promoting Yoga

a) International Day of Yoga 21 June, 2021



The International Day of Yoga was celebrated at NCCS with a yoga session for members of the NCCS family. They were encouraged to observe the IDY by practicing the 45-minutes 'Common Yoga Protocol' (CYP) at 7.00am on 21.06.2021, with family members at home, and in a COVID-19-compliant manner, and were made aware that this day is celebrated to promote the culture of Yoga, and to recognize the immense positive impact of Yoga on health and well-being. IDY 2021 was also publicized with posts on social media, announcement on the NCCS website, and displays on LCD screens located across the NCCS campus.

b) Surya Namaskars on Makar Sankranti under Azadi ka Amrit Mahotsav celebrations

Members of the NCCS family participated in the virtual 'Surya Namaskar' initiative of the Ministry of AYUSH, Government of India, organized on 14 January 2022.

Sadbhavana Diwas 20 August 2021


The 'Sadbhava Pledge' was administered by the Director, Dr. Manoj Kumar Bhat, to observe Sadbhavana Diwas at NCCS.

Samvidhan Diwas 26 November 2021



The Acting Director, Dr. Arvind Sahu. administered the preamble to the staff and students of DBT-NCCS on the occasion of the Constitution Day, to commemorate the anniversary of the Constitution of India being adopted by the Constituent Assembly.

Vigilance Awareness Week October 2021



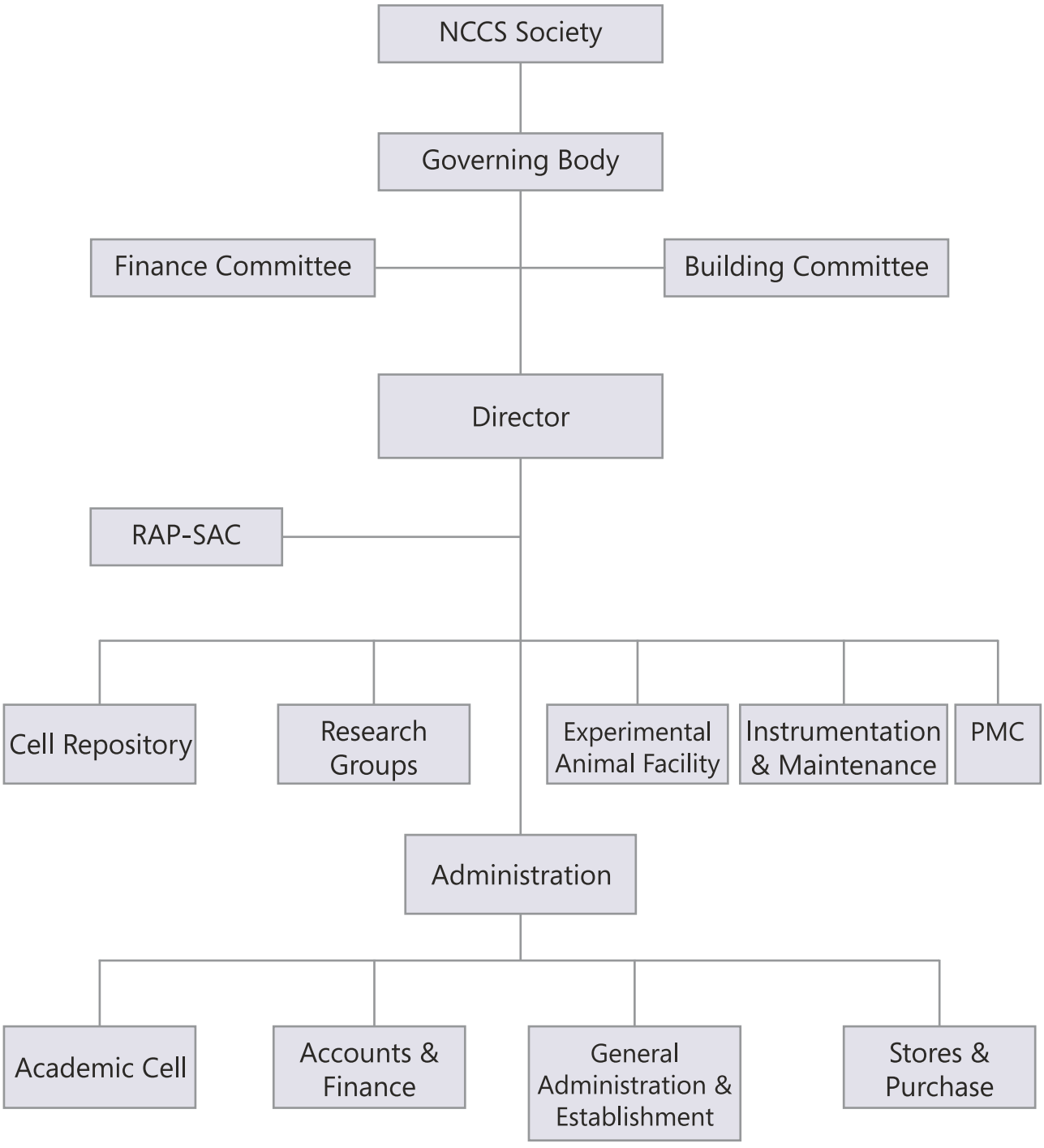
The NCCS family took a 'Pledge of Integrity' on 26 October 2021 in observance of the Vigilance Awareness Week, and to promote an 'Independent India @75: Self Reliance with Integrity''.

Visit by Prof. Rajesh Gokhale (Secretary, DBT) and Padma Shri Vaidya Rajesh Kotecha (Secretary, Ministry of Ayush) 16 March 2022

Prof. Rajesh Gokhale
addressed and interacted with the NCCS family

Vaidya Rajesh Kotecha
addressed the NCCS family


NCCS Organization



NCCS Committees

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10 **Dr. Manoj Kumar Bhat** — Ex-officio Member Secretary
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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, 2022)

Scientists	:	32
Administrative Staff	:	38
Technical Staff	:	69
Total	:	139

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 Ms. Sandra Fernandes, Officer 'B' (Administration) as the 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 2021 Vigilance Awareness Week was observed from 26th October to 1st November, 2021 with the theme "स्वतंत्र भारत @75: सत्यनिष्ठा से आत्मनिर्भरता" ("Independent India @ 75: Self Reliance with Integrity") and integrity pledge was taken by 125 employees at NCCS on 26.10.2021 at 11:00 am. We spread awareness and campaign about "Complaints under PIDPI (Public Interest Disclosure and Protection of Informers" by displaying two posters provided by the Central Vigilance Commission at many places in the organization and on the digital display screens in the entire institute. We also actively use social media platforms including emails, WhatsApp, Facebook etc. We made provision on our website for redressal of grievances. We have a provision of complaint and suggestion box in the public place.

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 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 07 through 21 September,

2021. Various competitions were organized on online as well as offline platforms. As always, an overwhelming response was received from the staff and students for the 'Hindi essay writing', 'Hindi handwriting & dictation', 'Translation', and 'Hindi Elocution' competitions. Dr (Mrs). Swati Chaddha, Hindi Officer at CSIR-NCL, Mrs. Archana Nair, Sr. Hindi Officer at AFMC, Pune, Dr. Shailza Singh, Scientist at NCCS, Dr. Omprakash Sharma, Project Scientist at the NCCS-NCMR CoE, 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 18th September, 2021. Dr. Rajesh Karyakarte, Deputy Dean, B. J. Medical College, Pune, graced the function as the Chief Guest. Dr. Manoj Kumar Bhat, Director, NCCS administered the Official Language pledge A message received from the Secretary, DBT, on the occasion of the Hindi Day was displayed on the projector screen, and also read out aloud for the benefit of the audience members who had joined the event virtually. The Chief Guest, Dr. Karyakarte, made a presentation in Hindi about the challeges faced by clinics and research institutes during COVID-19. Dr. Manoj Kumar Bhat, Director, NCCS, gave an overview of the day-to-day activities conducted in Hindi at the Institute. The ninth issue of the annual Hindi magazine, 'Meemansa' was released at the hands of the Chief Guest, Director, NCCS and Dr. G. C. Mishra, Former Director, NCCS, who was a special invitee on this occasion. The Hindi Day event was compered by Mrs. Prachi Dani, Accounts Officer, NCCS.

Other Activities

(a) Workshop:

A virtual workshop was held in Hindi on 25 July 2021 on the topic, **'धारा 3(3) का अनुपालन एवं राजभाषा प्रबंधन'** by Dr. Swati Chaddha, Hindi Officer, CSIR-NCL, Pune.

(b) Jigyasa:

Taking science to the masses in the Official Language in commemoration of India@75: NCCS initiated the **'जिज्ञासा'** seminar series in Hindi in March 2022. The first seminar in this series, titled **'करोना का भय कब तक'**, was aimed at providing a platform for the general public to get their doubts about COVID-19 clarified. A google form was created to invite questions, and circulated to various institutes, universities, and other organsiations across India. An overwhelming response was received from a wide audience. These questions were answered by the guest expert, Dr. Satyajit Rath, Former Scientist, NII, New Delhi, and Hon. Prof. IISER, Pune, at a Q&A session led by Dr. Shailza Singh, Scientist, NCCS. This discussion was conducted in the NCCS auditorium on 25th March, 2022, and was broadcast via live feed on the YouTube channel of NCCS (DBT-NCCS Pune). A recording of this session was also uploaded on this YouTube channel.

Chief Guest, Dr. Rajesh Karyakarte (Deputy Dean, B. J. Medical College, Pune) spoke on the occasion of the Hindi Diwas, 18 September, 2021.


'जिज्ञासा' seminar series:
Q&A on **'करोना का भय कब तक'** by Dr. Satyajit Rath and Dr. Shailza Singh

NATIONAL CENTRE FOR CELL SCIENCE

An Autonomous Institute of
Department of Biotechnology, Govt of India
NCCS Complex, Savitribai Phule Pune University Campus,
Ganeshkhind, Shivaji Nagar, Pune 411007.

AUDITED STATEMENTS OF ACCOUNT

FOR

F.Y. 2021-2022

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 2022, 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.

Date: 22/08/2022
Place: Pune

BHIDE & SHAH * PUNE-30. * CHARTERED ACCOUNTANTS

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

(SAMIR V.BHIDE)
PARTNER
M.NO.46274
UDIN: 22046274APQDTX4713

NATIONAL CENTRE FOR CELL SCIENCE, PUNE - 411 007.

BALANCE SHEET AS AT 31.03.2022

Amount (Rs.)

CORPUS/CAPITAL FUND AND LIABILITIES	Schedule	2021-2022	2020-2021
CORPUS/CAPITAL FUND	1	86,66,00,788.44	98,54,58,821.88
GENERAL RESERVE	2	-	-
EARMARKED/ENDOWMENT FUNDS	3	38,44,77,655.47	43,86,74,950.88
CURRENT-LIABILITIES & PROVISIONS	4	9,20,36,689.31	11,65,54,291.44
Total		**1,34,31,15,133.22**	**1,54,06,88,064.20**
ASSETS			
FIXED ASSETS	5	77,26,33,368.00	83,14,76,037.00
CURRENT ASSETS, LOANS, ADVANCES	6	57,04,81,765.22	70,92,12,027.20
MISCELLANEOUS EXPENDITURES			
(to the extent not written off or adjusted)			
Total		**1,34,31,15,133.22**	**1,54,06,88,064.20**
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: 22/08/2022
Place: Pune

राष्ट्रीय कोशिका विज्ञान केंद्र पुना

BHIDE & SHAH CHARTERED ACCOUNTANTS PUNE-30.

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

DIRECTOR
NCCS
Dr. Mohan R. Wani
Director, NCCS, Pune

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

NATIONAL CENTRE FOR CELL SCIENCE, PUNE - 411 007.

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31.03.2022

Amount (Rs.)

INCOME	Schedule	2021-2022	2020-2021
INCOME FROM SALES/SERVICE	7	95,72,085.00	1,04,00,337.00
GRANTS/SUBSIDIES	8	39,11,75,327.00	40,10,00,000.00
FEES/SUBSCRIPTIONS	9	3,392.00	-
INTEREST EARNED	10	52,292.00	70,317.00
OTHER INCOME	11	41,96,905.00	27,67,000.71
TOAL (A)		**40,50,00,001.00**	**41,42,37,654.71**
EXPENDITURE			
ESTABLISHMENT EXPENSES	12	24,72,15,232.00	23,43,37,150.00
OTHER ADMINISTRATIVE EXPENSES	13	16,96,78,025.44	17,35,15,850.24
RECIATION	5	10,69,77,769.00	11,81,72,466.00
TOTAL (B)		**52,38,71,026.44**	**52,60,25,466.24**
BALANCE BEING SURPLUS/(DEFICIT) CARRIED TO			
CORPUS/CAPITAL FUND		**(11,88,71,025.44)**	**(11,17,87,811.53)**
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: 22/08/2022

e: Pune

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

BHIDE & SHAH CHARTERED ACCOUNTANTS PUNE-30.

DIRECTOR
NCCS
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.

RECEIPTS & PAYMENTS ACCOUNTS FOR THE YEAR ENDED 31ST MARCH 2022

Receipts	Amount	Amount	Payments	Amount	Amount
Opening Balance		68,79,79,220.96	**ESTABLISHMENT EXPENSES**		8,51,78,146.00
Bank Accounts			Admin Charges	5,25,988.00	
Bank of India-CSR 8574	36,76,848.54		Salaries	3,46,52,158.00	
NCCS Employee Welfare Current A/c 0538	2,22,775.00				
NCCS Bank Accounts			**OTHER ADMINISTRATIVE EXPENSES**		33,32,743.57
Bank of India -4911	30,15,31,265.34		Bank Charges	51,803.57	
State Bank of India	29,15,760.17		Professional Expenses for R & D	43,02,632.94	
Project Bank Accounts			Rent Rates and Taxes	13,453.00	
Bank of India -4912	35,35,26,999.47		Welfare Bank Charges	486.78	
Bank of India (SERB-8403)	2,10,07,185.44		Consumables	4,69,491.28	
Bank of India (Vaccine Facility 8783)	10,46,48,387.00		Contingencies	21,45,517.00	
Cash-in-hand	50,000.00		TA-DA	3,01,409.00	
			Work On Contract	48,000.00	
GRANTS/SUBSIDIES		39,11,75,327.00	**Payment Against Provisions**		6,56,47,461.00
Grant in Aid General	17,11,78,680.00		Provision for Leave Encashment & Gratuity	1,38,98,581.00	
Grant in Aid Salary	21,99,96,647.00		Provision for Works On Contract	5,17,48,880.00	
CORPUS/CAPITAL FUND		12,992.00	**Purchase of Fixed Assets**		5,17,91,050.00
Corpus/Capital Fund	12,992.00		Library	7,39,790.00	
			Capital W.I.P-Building	31,86,918.00	
Earmarked Fund (As per attached Annexure I)		80,70,67,294.65	Capital WIP - Equipment	15,46,650.00	
			Equipments	3,00,68,858.00	
Sales Accounts		92,915.00	NCCS Building	1,62,46,834.00	
Income from Sales/ Services	92,915.00				
			Earmarked Fund (As per attached Annexure II)		15,05,51,875.13
Indirect Incomes		34,84,128.00			
Cooh MIS INCOME	160.00				
Guest House	1,15,674.00		**Payment against Current Liabilities**		59,12,49,965.17
Interest Earned	31,18,388.00		Hostel Charges Recovery-Payable	1,54,431.00	
Interest Earned on Covid Testing Receipts A/c 8574	1,07,995.00		Medical Insurance -Payable	3,62,523.00	
Interest on Income Tax Refund	50,828.00		Payable to Staff Welfare Trf.A/c 5% User Charges	7,22,738.00	
License Fees (Quarters)	5,855.00		Duties & Taxes	4,85,29,889.00	
Tender Fees	3,392.00		Sundry Creditors	31,27,28,336.17	
Usage of Premises for ATM	82,036.00		Earnest Money Deposit	1,01,778.00	
			Performance Bank Guarantee	3,16,585.00	
Academic Other Income		12,42,282.00	Salary Payable	18,77,85,757.00	
Application Fees	18,300.00		Security Deposit	5,47,928.00	
Hostel Charges Recovery	3,53,182.00				
Ph.D Fees	8,70,800.00		**Payment against Current Assets**		7,11,779.00
			Loans & Advances (Asset)	7,11,779.00	
			Closing Balance		55,08,36,254.81
Current Liabilities		12,69,387.00	Bank Accounts		
Credits - Salary-Employees Welfare	1,65,200.00		Bank of India-CSR 8574	37,84,843.54	
Credits to NCCS Staff Welfare 5%User Charges A/c	2,36,650.00		NCCS Employee Welfare Current A/c 0538	6,24,138.22	
Student - Caution Money	2,70,000.00		NCCS Bank Accounts		
Transport Charges Recovery	5,97,537.00		Bank of India -4911	11,58,16,248.37	
			State Bank of India	1,18,76,953.46	
Collection from Debtors		1,80,95,847.07	Project Bank Accounts		
Sundry Debtors	1,79,86,887.07		Bank of India -4912	32,38,62,075.56	
Receivable	1,08,760.00		Bank of India (SERB-8403)	3,36,71,528.12	
			Bank of India (Vaccine Facility 8783)	5,90,39,636.38	
OTHER ADMINISTRATIVE EXPENSES		20,82,131.00	Bank of India -EMBO Local	48,206.80	
Electricity & Power	20,76,325.00		Bank of India -EMBO Foreign	20,62,624.34	
Fellowship - JOEEBAS	5,806.00		Cash-in-hand	50,000.00	
Total		1,41,33,01,324.68	**Total**		1,41,33,01,324.68

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

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
Dr. Mohan R. Wani
Director, NCCS, Pune

BHIDE & SHAH CHARTERED ACCOUNTANTS PUNE-30.

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 31.03.2022

SCHEDULE 1 - CORPUS/CAPITAL FUND

(Amount-Rs.)

Particulars	2021-22	2020-21
SCHEDULE 1- CORPUS/CAPITAL FUND:		
Balance at the beginning of the year	98,54,58,821.88	1,02,72,46,633.41
Add /(Deduct) : Balance of net income /(expenditure)	-	-
Deduct : Capital grants written off	-	-
Less: Deduction from TSA Account [Note: A (6) (v) Accounting Significant Policies]	8,99,87,008.00	-
	89,54,71,813.88	1,02,72,46,633.41
Add : Contribution towards Capital Fund	9,00,00,000.00	7,00,00,000.00
Add : General Reserve	-	-
	98,54,71,813.88	1,09,72,46,633.41
Add/(Deduct) : Bal. Of net income/(expenditure) transferred from the Income and Expenditure A/c.	(11,88,71,025.44)	(11,17,87,811.53)
BALANCE AS AT THE YEAR - END	**86,66,00,788.44**	**98,54,58,821.88**

राष्ट्रीय कोशिका विज्ञान केंद्र पुणे

BHIDE & SHAH CHARTERED ACCOUNTANTS PUNE-30.

NATIONAL CENTRE FOR CELL SCIENCE, PUNE - 411 007.

SCHEDULES FORMING PART OF BALANCE SHEET AS ON 31.03.2022

SCHEDULE 2 -GENERAL RESERVE

Amount (Rs.)

Particulars	2021-22	2020-21
General Reserve	-	-
Grand Total	-	-

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 31.03.2022

SCHEDULE-3 EARMARKED/ENDOWMENT FUND

(Amount-Rs.)

No.	Name of the Project & P.I.	Opening	Additions	Interest &	Total	Utilization/Expenditure			Closing
		Balance	Grant. Recd.	Other Receipts		Capital	Revenue	Total	Balance
1	AB/JK/DBT-RA-DR. AJINKYA BENDRE	24,160.00	6,40,140.00	805.00	6,65,105.00	-	6,65,105.00	6,65,105.00	-
2	AB/MW/BIOCARE/07/9813-AMRUTA BARHANPURKAR	(2,88,776.00)	-	-	(2,88,776.00)	-	-	-	(2,88,776.00)
3	AC/BIRAC/COVID-0032-DR. AKANKSHA CHATURVEDI	3,68,851.00	-	2,905.00	3,71,756.00	-	3,33,365.00	3,33,365.00	38,391.00
4	AC/SERB/CRG/004981-DR. AKANKSHA CHATURVEDI	18,47,606.00	-	74,176.00	19,21,782.00	3,50,000.00	10,01,320.00	13,51,320.00	5,70,462.00
5	AC/SERB/IPA/000148-DR. AKANKSHA CHATURVEDI	-	28,58,360.00	-	28,58,360.00	-	1,00,000.00	1,00,000.00	27,58,360.00
6	AM/BT/PR-25893-DR. MAJUMDAR	3,32,308.08	21,82,218.00	35,667.00	25,50,193.08	-	9,52,661.00	9,52,661.00	15,97,532.08
7	AM/DBT-WELLCOME-DR. MAJUMDAR	(9,72,758.14)	9,35,702.00	-	(37,056.14)	-	-	-	(37,056.14)
8	AM/ECR/SERB/000429-DR, MAJUMDAR	4,15,669.18	-	3,801.00	4,19,470.18	-	4,19,470.18	4,19,470.18	-
9	AM/SERB/003130-DR. MAJUMDAR	-	23,34,900.00	7,263.00	23,42,163.00	-	1,53,700.00	1,53,700.00	21,88,463.00
10	AP/DBT-WELLCOME-DR. PILLAI	-	5,00,000.00	9,098.00	5,09,098.00	-	2,26,681.00	2,26,681.00	2,82,417.00
11	AS/BT/PR-10852-DR. SHIRAS	(33,236.00)	-	-	(33,236.00)	-	-	-	(33,236.00)
12	AS/BT/PR-15178-DR. SHIRAS	4,29,507.57	-	5,205.00	4,34,712.57	-	4,34,712.57	4,34,712.57	-
13	AS/BT/PR-28506-DR. A K SAHU	9,63,615.20	16,76,440.00	14,854.00	26,54,909.20	-	23,66,280.00	23,66,280.00	2,88,629.20
14	AS/BT/PR8739-DR. SHIRAS	62,293.00	-	2,141.00	64,434.00	-	-	-	64,434.00
15	AS/BT/PR-9725-DR. A K SAHU	(1,94,337.00)	-	-	(1,94,337.00)	-	-	-	(1,94,337.00)
16	AS/CSIR-NMITLI-DR. A K SAHU	10,15,447.36	38,37,267.00	88,697.00	49,41,411.36	-	29,26,816.00	29,26,816.00	20,14,595.36
17	AS/DST-551/IPSC (CORE)-DR, SHIRAS	1,08,164.00	-	-	1,08,164.00	-	1,08,164.00	1,08,164.00	-
18	AS/DST/VI-D&P/551-DR. SHIRAS	6,58,051.28	-	13,935.00	6,71,986.28	-	8,694.00	8,694.00	6,63,292.28
19	AS/ICMR/90-DR. SHIRAS	(32,924.00)	-	-	(32,924.00)	-	-	-	(32,924.00)
20	AS/PR-14258-DR. SHIRAS	(73,843.00)	-	-	(73,843.00)	-	-	-	(73,843.00)
21	AS/SERB/JCB/000020-DR. A K SAHU	10,35,587.00	-	50,063.00	10,85,650.00	-	7,69,656.00	7,69,656.00	3,15,994.00
22	AS/UNILEVER-DR. SHIRAS	6,71,914.00	-	-	6,71,914.00	-	-	-	6,71,914.00
23	AS/WELLCOME-DR. AVINASH SHARMA	21,94,609.00	3,75,870.00	76,928.00	26,47,407.00	-	7,60,566.63	7,60,566.63	18,86,840.37
24	ASHWINI DHAMANGE/GM/NASI/620/3	2,81,103.00	5,61,297.00	12,149.00	8,54,549.00	-	3,65,342.00	3,65,342.00	4,89,207.00
25	AY/KR-03/NMPB-IV-DR. AMIT YADAV	5,25,515.22	9,18,000.00	5,339.00	14,48,854.22	-	5,76,854.22	5,76,854.22	8,72,000.00
26	BAHIR/WOS-LS-602-DR. BAHIR	(5,06,091.00)	8,00,000.00	-	2,93,909.00	-	1,43,176.00	1,43,176.00	1,50,733.00
27	BIVALKAR/WOS-A/LS/2016-DR. BIVALKAR	(1,60,453.00)	-	-	(1,60,453.00)	-	-	-	(1,60,453.00)
28	BK/SR/DBT-RA/DR. BHARGAB KALITA	3,455.32	1,94,780.00	-	1,98,235.32	-	1,98,235.32	1,98,235.32	-
29	BS/INFECT-ERA/33-DR. BHASKAR SAHA	2,49,129.51	-	-	2,49,129.51	-	2,49,129.51	2,49,129.51	-
30	BS/BT/PR10785 - DR. SAHA	(4,60,986.00)	-	-	(4,60,986.00)	-	-	-	(4,60,986.00)
31	BS/BT/PR-[illegible]-DR. SAHA-27.09.11TO26.09.16	(6,56,982.00)	-	-	(6,56,982.00)	-	-	-	(6,56,982.00)
32	BS/BT/PR-7[illegible]-DR. BHASKAR SAHA	(1,17,090.00)	-	-	(1,17,090.00)	-	-	-	(1,17,090.00)

BHIDE & SHAH CHARTERED ACCOUNTANTS PUNE-30.

SCHEDULE-3 EARMARKED/ENDOWMENT FUND

(Amount-Rs.)

No.	Name of the Project & P.I.	Opening	Additions	Interest &	Total	Utilization/Expenditure			Closing
		Balance	Grant. Recd.	Other Receipts		Capital	Revenue	Total	Balance
33	BS/DST/INDO-UK/P-123-DR. SAHA	1,81,774.99	-	-	1,81,774.99	-	1,81,774.99	1,81,774.99	-
34	BS/PR-14435-DR. SAHA	(4,21,933.00)	-	-	(4,21,933.00)	-	-	-	(4,21,933.00)
35	BS/SERB/JCB-DR. SAHA	2,88,264.34	16,00,000.00	43,772.00	19,32,036.34	-	11,54,612.00	11,54,612.00	7,77,424.34
36	CICS-ISRF FELLOWSHIP-MR. SUJIT SHAH	,8,975.00	-	308.00	9,283.00	-	-	-	9,283.00
37	CSIR	(1,98,31,068.05)	2,20,891.00	-	(1,96,10,177.05)	-	56,863.00	56,863.00	(1,96,67,040.05)
38	CSIR-RA FELLOWSHIP	(13,25,946.00)	-	-	(13,25,946.00)	-	-	-	(13,25,946.00)
39	DBT-BINC FELLOWSHIP	98,111.00	3,79,200.00	2,568.00	4,79,879.00	-	2,18,201.00	2,18,201.00	2,61,678.00
40	DBT FELLOWSHIP	(4,53,546.47)	1,49,37,116.00	85,460.00	1,45,69,029.53	-	1,17,19,654.60	1,17,19,654.60	28,49,374.93
41	DBT-JRF PROGRAMME	1,36,218.00	-	4,677.00	1,40,895.00	-	-	-	1,40,895.00
42	DBT - POF PROGRAMME	23,59,325.00	(21,86,319.00)	37,292.00	2,10,298.00	-	-	-	2,10,298.00
43	DBT TWAS FELLOWSHIP	37,713.00	-	1,585.00	39,298.00	-	-	-	39,298.00
44	DM/BIRAC-DR. MITRA	(2,22,629.00)	2,20,256.00	-	(2,373.00)	-	(2,373.00)	(2,373.00)	-
45	DM/BT/HRD/35/01/03-DR.MITRA	(46,996.00)	-	-	(46,996.00)	-	-	-	(46,996.00)
46	DM/BT/PR-14226-DR. MITRA	(4,76,857.00)	-	-	(4,76,857.00)	-	-	-	(4,76,857.00)
47	DM/BT/PR-15450-DR. MITRA	1,35,494.78	-	4,218.00	1,39,712.78	-	77,828.78	77,828.78	61,884.00
48	DM/SERB/003331-DR. MITRA	2,17,174.00	6,00,000.00	8,513.00	8,25,687.00	-	5,73,916.00	5,73,916.00	2,51,771.00
49	DM/JCB/18-19-DR. MITRA	7,14,013.27	15,00,000.00	42,052.00	22,56,065.27	-	20,15,925.00	20,15,925.00	2,40,140.27
50	DM/THSTI-DR. MITRA	(18,445.00)	-	-	(18,445.00)	-	-	-	(18,445.00)
51	DP/PACER-POP/BS-01-DR. DHIRAJ PAUL	1,18,905.83	9,22,000.00	6,346.00	10,47,251.83	-	6,80,087.00	6,80,087.00	3,67,164.83
52	DS/BATTELE INDIA-DR. DEEPA	(22,472.00)	-	-	(22,472.00)	-	-	-	(22,472.00)
53	DS/BT/PR-25883 - DR. DEEPA	8,48,223.38	1,75,452.00	20,048.00	10,43,723.38	-	8,09,284.82	8,09,284.82	2,34,438.56
54	DS/BT/PR-30450-DR. DEEPA	15,08,051.22	11,04,954.00	22,460.00	26,35,465.22	-	14,86,018.28	14,86,018.28	11,49,446.94
55	DS/ICMR-2020-307E/SCR-DR. DEEPA	15,05,118.00	-	44,482.00	15,49,600.00	-	12,23,018.77	12,23,018.77	3,26,581.23
56	DS/SERB/CRG/002728-DR. DEEPA	-	19,14,000.00	11,907.00	19,25,907.00	-	1,43,939.00	1,43,939.00	17,81,968.00
57	DST INSPIRE FELLOWSHIP	(59,099.00)	10,75,413.00	21,714.00	10,38,028.00	-	7,78,247.00	7,78,247.00	2,59,781.00
58	DS/WELLCOMETRUST-DR. DEEPA	(12,19,289.00)	7,27,829.00	-	(4,91,460.00)	-	-	-	(4,91,460.00)
59	EMBO RNA	-	27,74,060.34	-	27,74,060.34	-	6,64,371.20	6,64,371.20	21,09,689.14
60	GD/CRG/2019-005587 - DR. GAURAV DAS	6,60,398.21	9,00,000.00	17,352.00	15,77,750.21	-	10,95,803.78	10,95,803.78	4,81,946.43
61	GD/SB/52/RUN-04B/2017-DR. GAURAV DAS	3,10,215.00	4,10,000.00	10,965.00	7,31,180.00	18,880.00	4,75,134.00	4,94,014.00	2,37,166.00
62	GK/5TH INTERNATIONAL CONF. TRANSLATION RES.-DR. KUNDU	2,83,533.44	-	-	2,83,533.44	-	-	-	2,83,533.44
63	GK/BT/MED/30/VNCI-Hr/BRCA-DR. KUNDU	(3,44,805.00)	-	-	(3,44,805.00)	-	-	-	(3,44,805.00)
64	GK/BT/PR-14430-DR. KUNDU	1,09,525.00	-	3,764.00	1,13,289.00	-	-	-	1,13,289.00
65	GK/BT/PR-2573-DR.KUNDU	(3,52,346.00)	-	-	(3,52,346.00)	-	6,842.00	6,842.00	(3,59,188.00)
66	GK/BT/PR-3041-DR.KUNDU	(3,68,191.00)	-	-	(3,68,191.00)	-		-	(3,68,191.00)
67	GK/BT/PR-15[illegible]-DR. KUNDU	(1,08,652.00)	-	-	(1,08,652.00)	-		-	(1,08,652.00)

BHIDE & SHAH CHARTERED ACCOUNTANTS PUNE-30.

SCHEDULE-3 EARMARKED/ENDOWMENT FUND

(Amount-Rs.)

No.	Name of the Project & P.I.	Opening	Additions	Interest &	Total	Utilization/Expenditure			Closing
		Balance	Grant. Recd.	Other Receipts		Capital	Revenue	Total	Balance
68	GK/BT/PR-7665-DR. KUNDU	(5,12,786.00)	-	-	(5,12,786.00)	-	-	-	(5,12,786.00)
69	GK/CSIR-DR. KUNDU	(47,957.00)	-	-	(47,957.00)	-	-	-	(47,957.00)
70	GK/DST/IMRCD/INNO-INDIGO-DR. KUNDU	2,03,261.00	-	6,985.00	2,10,246.00	-	-	-	2,10,246.00
71	GK/MANAV/BT/PR-27731-DR. KUNDU	1,58,39,779.00	18,44,994.00	3,61,666.00	1,80,46,439.00	1,58,769.00	1,24,24,665.00	1,25,83,434.00	54,63,005.00
72	GK/PR-12730-DR. KUNDU	(5,34,424.00)	-	-	(5,34,424.00)	-	-	-	(5,34,424.00)
73	GK/BT/PR-17945	9,200.00	-	-	9,200.00	-	9,200.00	9,200.00	-
74	GK/SERB/002298-DR. KUNDU	7,38,487.28	-	15,258.00	7,53,745.28	-	5,06,046.90	5,06,046.90	2,47,698.38
75	GK/SR/SO/HS-70-DR. KUNDU	(3,32,350.00)	-	-	(3,32,350.00)	-	-	-	(3,32,350.00)
76	GL/BT/03/IYBA-DR. LAL	(5,62,237.00)	-	-	(5,62,237.00)	-	-	-	(5,62,237.00)
77	GL/BT/PR-14156-DR. LAL	2,34,610.80	-	2,509.00	2,37,119.80	-	2,37,119.80	2,37,119.80	-
78	GL/BT/PR-15533-DR. LAL	3,08,287.00	-	-	3,08,287.00	-	3,08,287.00	3,08,287.00	-
79	GL/DST/SJF/LSA-01-DR. LAL	(72,195.53)	30,00,000.00	33,057.00	29,60,861.47	-	29,05,693.78	29,05,693.78	55,167.69
80	GL/EMR/2016/007108-DR. LAL	3,37,609.41	-	-	3,37,609.41	-	3,37,609.41	3,37,609.41	-
81	GL/KEMHRC-DR. LAL	7,97,346.20	-	-	7,97,346.20	-	79,089.00	79,089.00	7,18,257.20
82	GL/KEMHRC-II-DR. LAL	64,95,137.32	-	-	64,95,137.32	-	2,80,183.04	2,80,183.04	62,14,954.28
83	GM/NASI PLATINUM JUBILEE CHAIR-DR. MISHRA	10,78,843.00	25,73,364.00	48,261.00	37,00,468.00	-	30,00,063.84	30,00,063.84	7,00,404.16
84	ICMR	(23,26,022.02)	42,70,279.00	80,063.00	20,24,319.98	-	35,58,900.33	35,58,900.33	(15,34,580.35)
85	INSPIRE FACULTY AWARD-DEEPIKA PURI	12,36,116.00	22,72,000.00	52,733.00	35,60,849.00	-	23,60,792.99	23,60,792.99	12,00,056.01
86	INSPIRE FACULTY AWARD-DR. DEBASRI MUKHARJEE	(42,253.00)	-	-	(42,253.00)	-	-	-	(42,253.00)
87	INSPIRE FACULTY AWARD-DR. JYOTI SINGH	(3,497.00)	-	-	(3,497.00)	-	-	-	(3,497.00)
88	INSPIRE FACULTY AWARD-PRIYANKA DUTTA	3,26,054.09	21,32,883.00	42,813.00	25,01,750.09	-	17,40,033.00	17,40,033.00	7,61,717.09
89	INTRAMURAL PROJECT-IM-001	1,47,126.26	-	1,037.00	1,48,163.26	-	1,72,531.62	1,72,531.62	(24,368.36)
90	INTRAMURAL PROJECT-IM-002	7,16,472.25	-	5,410.00	7,21,882.25	-	11,70,350.93	11,70,350.93	(4,48,468.68)
91	IUSSTF FELLOWSHIP	13,147.00	-	452.00	13,599.00	-	-	-	13,599.00
92	JJ/BT/PR-14537-DR.JOSEPH	(4,88,490.00)	-	-	(4,88,490.00)	-	-	-	(4,88,490.00)
93	JJ/BT/PR-27451-DR. JOSEPH	(13,008.00)	18,17,329.00	8,429.00	18,12,750.00	-	19,41,275.22	19,41,275.22	(1,28,525.22)
94	JJ/BT/PR32331-DR. JOSEPH	9,03,581.43	-	15,229.00	9,18,810.43	-	8,46,575.00	8,46,575.00	72,235.43
95	JJ/PR-727-DR. JOSEPH	(2,59,430.00)	-	-	(2,59,430.00)	-	-	-	(2,59,430.00)
96	JJ/SERB/001092	(85,886.00)	-	-	(85,886.00)	-	-	-	(85,886.00)
97	JJ/SERB/000352-DR. JOSEPH	-	26,54,740.00	-	26,54,740.00	-	2,40,130.00	2,40,130.00	24,14,610.00
98	JK/DBT/MK-YRFP-DR. JUPITARA KALITA	-	29,72,000.00	-	29,72,000.00	-	4,33,065.00	4,33,065.00	25,38,935.00
99	JK/SERB/003971-DR. JANESH KUMAR	17,48,200.00	13,00,000.00	63,258.00	31,11,458.00	-	16,55,291.00	16,55,291.00	14,56,167.00
100	JK/SERB/CVD/000298-DR. JANESH KUMAR	9,51,742.51	-	36,513.00	9,88,255.51	-	7,19,364.51	7,19,364.51	2,68,891.00
101	JS/WELLCOME - DR. JYOTI SINGH	5,11,471.42	17,35,751.00	25,002.00	22,72,224.42	-	18,53,465.00	18,53,465.00	4,18,759.42
102	[illegible]	3,89,922.70	-	-	3,89,922.70	-	3,89,922.70	3,89,922.70	-

SCHEDULE-3 EARMARKED/ENDOWMENT FUND

(Amount-Rs.)

No.	Name of the Project & P.I.	Opening	Additions	Interest &	Total	Utilization/Expenditure			Closing
		Balance	Grant. Recd.	Other Receipts		Capital	Revenue	Total	Balance
103	LL/BT/PR-12696-DR. LIMAYE	42,897.10	-	-	42,897.10	-	42,897.10	42,897.10	0.00
104	LL/BT/PR-23620-DR. LIMAYE	2,09,222.00	-	4,855.00	2,14,077.00	-	1,61,651.00	1,61,651.00	52,426.00
105	LL/DAE/378/BRNS-DR. LIMAYE	(1,08,965.00)	-	-	(1,08,965.00)	-	-	-	(1,08,965.00)
106	LL/JAI RESEARCH FOUNDATION-DR. LIMAYE	(25,46,806.00)	-	-	(25,46,806.00)	-	-	-	(25,46,806.00)
107	MB/BIRAC/BT/CRS0400/PACE-DR. BHAT	14,055.67	66,944.00	89.00	81,088.67	-	81,000.00	81,000.00	88.67
108	MB/BT/PR-23968 - DR. BHAT	18,77,22,688.49	-	55,95,573.00	19,33,18,261.49	61,91,691.00	4,53,99,186.07	5,15,90,877.07	14,17,27,384.42
109	MB/ITC/CONSULTANCY - DR. BHAT	8,23,389.00	-	-	8,23,389.00	-	8,076.92	8,076.92	8,15,312.08
110	MS/BT/PR-15889-DR. MANAS SANTRA	(1,60,649.00)	-	-	(1,60,649.00)	-	-	-	(1,60,649.00)
111	MS/BT/PR-25181-DR. MANAS SANTRA	7,59,246.00	-	10,338.00	7,69,584.00	-	6,11,682.00	6,11,682.00	1,57,902.00
112	MS/BT/PR-36142-DR. MANAS SANTRA	-	18,11,280.00	-	18,11,280.00	-	18,17,480.00	18,17,480.00	(6,200.00)
113	MS/CSIR/37/(1655)/15/EMR-II-DR. MANAS SANTRA	39,755.00	-	1,366.00	41,121.00	-	-	-	41,121.00
114	MS/EMR/002277-DR. MANAS SANTRA	53,023.00	-	-	53,023.00	-	53,023.00	53,023.00	-
115	MS/HRD/NBA/39-DR. MANAS SANTRA	6,005.71	4,97,448.00	6,471.00	5,09,924.71	-	3,00,385.69	3,00,385.69	2,09,539.02
116	MS/LADY TATA FELLOWSHIP-DR. MANAS SANTRA	-	4,00,000.00	-	4,00,000.00	-	50,000.00	50,000.00	3,50,000.00
117	MS/PR-152/TWINNING-DR. MANAS SANTRA	60.00	-	2.00	62.00	-	62.00	62.00	-
118	MS/SERB/CRG/005433-DR. MANAS SANTRA	24,89,600.00	8,50,000.00	87,804.00	34,27,404.00	-	22,18,656.32	22,18,656.32	12,08,747.68
119	MS/UNILEVER-DR. SANTRA	20,00,399.50	-	-	20,00,399.50	-	-	-	20,00,399.50
120	MW/BHU-DR. WANI	20,959.00	-	721.00	21,680.00	-	-	-	21,680.00
121	MW/HRD/35/01/04/2018-DR. WANI	48,538.00	5,54,824.00	9,637.00	6,12,999.00	-	60,084.00	60,084.00	5,52,915.00
122	MW/SERB/004441-DR. WANI	7,83,553.90	6,00,000.00	15,105.00	13,98,658.90	-	11,92,177.53	11,92,177.53	2,06,481.37
123	MW/SPPU/AYUSH-DR. WANI	60,871.74	1,00,000.00	4,408.00	1,65,279.74	-	1,41,511.00	1,41,511.00	23,768.74
124	NAM S&T FELLOWSHIP	7,866.00	-	270.00	8,136.00	-	-	-	8,136.00
125	NAS/141/7/2014-15-DR. RANI LEKHA	(2,34,000.00)	-	-	(2,34,000.00)	-	-	-	(2,34,000.00)
126	NE/SB/FT/CS-067/2014-DR. N D ERANDE	(75,165.00)	-	-	(75,165.00)	-	-	-	(75,165.00)
127	NL/BT/MUTAGENESIS(INDO-AUS)-DR.LENKA	(13,208.00)	-	-	(13,208.00)	-	-	-	(13,208.00)
128	NL/BT/PR-16655-DR. LENKA	2,36,351.00	-	2,455.00	2,38,806.00	-	2,38,806.00	2,38,806.00	-
129	NL/BT/PR-8219/31.03.14-30.03.16-Dr. Lenka	(1,10,957.00)	-	-	(1,10,957.00)	-	-	-	(1,10,957.00)
130	OP/EMR/2016/006589-DR. OM PRAKASH	(3,361.00)	6,50,000.00	7,098.00	6,53,737.00	-	5,72,247.00	5,72,247.00	81,490.00
131	OP/YSS/BT/PR-13969-DR. OM PRAKASH	4,82,597.00	-	13,119.00	4,95,716.00	-	-	-	4,95,716.00
132	PD/SERB/CRG/001727-DR. PRIYANKA DUTTA	8,845.00	4,00,000.00	8,676.00	4,17,521.00	-	2,37,274.00	2,37,274.00	1,80,247.00
133	PN/BT/NBM0166/04/19/BIRAC-DR. NAGVENKAR	12,58,14,039.00	-	28,57,635.00	12,86,71,674.00	-	13,81,880.64	13,81,880.64	12,72,89,793.36
134	PN/CVTF-DR. NAGVENKAR	10,42,79,144.00	-	23,24,604.00	10,66,03,748.00	3,78,38,971.00	1,09,71,830.57	4,88,10,801.57	5,77,92,946.43
135	PR/NMHS-DR. PRAVEEN RAHI	5,67,685.00	-	14,644.00	5,82,329.00	[illegible]	1,06,290.03	3,93,990.03	1,88,338.97
136	Project Overheads	2,14,04,366.35	38,98,931.97	-	2,53,03,298.32	-	6,18,904.83	6,18,904.83	2,46,84,393.49
137	[illegible]-DR. PARSHURAM SONAWANE	26,589.39	5,76,900.00	4,369.00	6,07,858.39	-	4,39,225.00	4,39,225.00	1,68,633.39

SCHEDULE-3 EARMARKED/ENDOWMENT FUND

(Amount-Rs.)

No.	Name of the Project & P.I.	Opening	Additions	Interest &	Total	Utilization/Expenditure			Closing
		Balance	Grant. Recd.	Other Receipts		Capital	Revenue	Total	Balance
138	PS/ICMR/53/6/BM-DR. PADMA SHASTRY	(6,60,992.00)	-	-	(6,60,992.00)	-	-	-	(6,60,992.00)
139	PUNE BIOCLUSTER-DR. SHEKHAR MANDE	2,55,78,288.96	-	5,10,095.00	2,60,88,383.96	-	65,26,455.00	65,26,455.00	1,95,61,928.96
140	PV/JJ/DBT-RA-PALLAVI VARSHNEY	(2,731.00)	-	-	(2,731.00)	-	-	-	(2,731.00)
141	RC/BT/PR-15450-DR. RADHA CHAUHAN	(951.85)	-	-	(951.85)	-	1,41,431.00	1,41,431.00	(1,42,382.85)
142	RC/BT/PR-26398-DR. RADHA CHAUHAN	5,47,567.00	21,31,002.00	44,259.00	27,22,828.00	-	20,36,736.39	20,36,736.39	6,86,091.61
143	RC/BT/PR7118/15-18-DR. RADHA CHAUHAN	(96,573.00)	-	-	(96,573.00)	-	-	-	(96,573.00)
144	RC/SB/SO/BB-0030/13-16-DR.RADHA CHAUHAN	(2,46,623.00)	-	-	(2,46,623.00)	-	-	-	(2,46,623.00)
145	RC/SERB/000272-DR. RADHA CHAUHAN	(8,820.00)	-	-	(8,820.00)	-	-	-	(8,820.00)
146	RS/BT/PR-25368-DR. ROHIT SHARMA	54,974.00	6,31,266.00	1,086.00	6,87,326.00	-	22,896.00	22,896.00	6,64,430.00
147	RS/BT/PR-25490-DR. ROHIT SHARMA	3,71,226.00	-	3,200.00	3,74,426.00	-	2,65,569.00	2,65,569.00	1,08,857.00
148	RS/BT/PR-29526-DR. ROHIT SHARMA	85,105.00	-	2,241.00	87,346.00	-	39,227.00	39,227.00	48,119.00
149	RV/DBT-RA/DR. RAJESH VINNAKOTA	-	2,55,020.00	235.00	2,55,255.00	-	2,55,255.00	2,55,255.00	-
150	SANDHYA/DAE/35/14/31-BRNS-DR. SANDHYA	55,078.65	-	2,423.00	57,501.65	-	-	-	57,501.65
151	SANDHYA/SR/SO/BB-0119-DR.SANDHYA	(33,598.00)	-	-	(33,598.00)	-	-	-	(33,598.00)
152	SB/BT/11465-DR. BAPAT	(3,72,384.00)	-	-	(3,72,384.00)	-	-	-	(3,72,384.00)
153	SB/HRD-35/01/04-DR. BAPAT	1,50,939.21	7,54,736.00	5,462.00	9,11,137.21	-	8,41,692.57	8,41,692.57	69,444.64
154	SB/CRG/2019/001157 - DR. BAPAT	9,06,169.20	13,00,000.00	64,019.00	22,70,188.20	4,10,000.00	12,83,010.13	16,93,010.13	5,77,178.07
155	SB/GODAVARI BIOREFINERIES-DR. BAPAT	18,600.00	-	-	18,600.00	-	-	-	18,600.00
156	SB/INDO AUSTRALIA SYMPOSIUM-DR. BAPAT	(16,664.00)	-	-	(16,664.00)	-	-	-	(16,664.00)
157	SC/AMRITA THERAPEUTICS-DR. SAMIT	(1,08,000.00)	-	-	(1,08,000.00)	-	-	-	(1,08,000.00)
158	SC/BT-11381-DR.SAMIT	(5,30,464.00)	-	-	(5,30,464.00)	-	-	-	(5,30,464.00)
159	SC/CSIR/37(1572)-DR.SAMIT	(2,27,473.00)	-	-	(2,27,473.00)	-	-	-	(2,27,473.00)
160	SC/SB/52/JCB-II/2013-18-DR.SAMIT	1,34,344.00	-	-	1,34,344.00	-	1,34,344.00	1,34,344.00	-
161	SERB PDF	20,58,662.00	11,18,400.00	70,929.00	32,47,991.00	-	20,54,977.00	20,54,977.00	11,93,014.00
162	SK/BT/PR-38584-DR. SANTOSH KUMAR	-	38,01,280.00	31,053.00	38,32,333.00	3,54,000.00	6,27,381.00	9,81,381.00	28,50,952.00
163	SK/SERB/000732-DR. SANTOSH KUMAR	-	23,21,900.00	14,445.00	23,36,345.00	-	5,64,509.42	5,64,509.42	17,71,835.58
164	SK/YS/BT/PR-19641-DR. SNEHAL KULKARNI	1,86,181.00	-	6,045.00	1,92,226.00	-	16,035.00	16,035.00	1,76,191.00
165	SM/BT/47/TE/TBP-DR. MANDE	(90,175.00)	-	-	(90,175.00)	-	-	-	(90,175.00)
166	SM/BT/IN/NEW INDIGO/05/SB/TB-OMICS-DR.MANDE	(32,671.30)	-	-	(32,671.30)	-	-	-	(32,671.30)
167	SM/BT/NEW INDIGO/18-DR. MANDE	(6,59,959.00)	-	-	(6,59,959.00)	-	-	-	(6,59,959.00)
168	SM/BT/PR-15450 (CORE GRANT)-DR. MANDE	2,43,844.00	-	1,666.00	2,45,510.00	-	6,53,658.32	6,53,658.32	(4,08,148.32)
169	SM/BT/PR-15450 (PROJECT 1)-DR. MANDE	5,70,504.91	-	4,912.00	5,75,416.91	-	6,19,423.06	6,19,423.06	(44,006.15)
170	SM/BT/PR-25395-DR. MANDE	3,53,959.00	-	5,083.00	3,59,042.00	-	2,87,732.19	2,87,732.19	71,309.81
171	SM/BT/PR-3260/BRB/2012-17	8,89,032.00	-	25,343.00	9,14,375.00	-	2,86,403.00	2,86,403.00	6,27,972.00
172	SM/BT/PR-3261-DR.SEKHAR,NCCS	2,64,614.00	-	6,291.00	2,70,905.00	-	-	-	2,70,905.00

BHIDE & SHAH CHARTERED ACCOUNTANTS PUNE-30.

SCHEDULE-3 EARMARKED/ENDOWMENT FUND

(Amount-Rs.)

No.	Name of the Project & P.I.	Opening	Additions	Interest &	Total	Utilization/Expenditure			Closing
		Balance	Grant. Recd.	Other Receipts		Capital	Revenue	Total	Balance
173	SM/DST/INDO-RUSSIA/23.04.14-22.04.16-Dr. Mande	(1,07,683.00)	-	-	(1,07,683.00)	-	-	-	(1,07,683.00)
174	SM/DST/INT/RFBR/P-89-DR. MANDE	(2,38,142.00)	-	-	(2,38,142.00)	-	-	-	(2,38,142.00)
175	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)
176	SR/BT/PR-10536-DR. SRIKANTH	(28,775.00)	-	-	(28,775.00)	-	-	-	(28,775.00)
177	SR/BT/PR-10855-DR. SRIKANTH	21,01,438.00	-	26,798.00	21,28,236.00	-	15,10,114.00	15,10,114.00	6,18,122.00
178	SR/BT/PR-4152/BRB/2013-DR.SRAPOLE	(44,269.00)	-	-	(44,269.00)	-	-	-	(44,269.00)
179	SR/DST/IMRCD/INNO-INDIGO-DR. SRIKANTH	(2,25,736.00)	-	-	(2,25,736.00)	-	-	-	(2,25,736.00)
180	SS/SB/39/2020/PHS/(BMS)/ICMR-DR. SHAILAZA SINGH	-	23,60,614.00	-	23,60,614.00	-	38,174.00	38,174.00	23,22,440.00
181	SS/BT/PR-10286-DR. S SINGH	(47,218.00)	-	-	(47,218.00)	-	-	-	(47,218.00)
182	SS/BT/PR-16065-DR. S SINGH	(3,50,867.00)	-	-	(3,50,867.00)	-	-	-	(3,50,867.00)
183	SS/NATL. CONF. ON EMERGING TRENDS-REGN. FEES	1,27,203.00	-	-	1,27,203.00	-	-	-	1,27,203.00
184	SS/NATIONAL CONF. ON EMERGING TRENDS IN OMS-DBT	(25.00)	-	-	(25.00)	-	(25.00)	(25.00)	-
185	SS/NATIONAL CONF. ON EMERGING TRENDS IN O.M.S.-NASI	(694.00)	-	-	(694.00)	-	-	-	(694.00)
186	SS/BT/LS-400-DR. SINGH	(1,303.00)	-	-	(1,303.00)	-	-	-	(1,303.00)
187	STRUCTURAL BASED DRUG DESIGNING (SBDD)	(1,57,063.00)	-	-	(1,57,063.00)	-	-	-	(1,57,063.00)
188	TL/SERB/SRG/2019/001818-DR. TUSHAR LODHA	2,65,858.36	4,50,000.00	12,574.00	7,28,432.36	-	6,18,182.00	6,18,182.00	1,10,250.36
189	TRAVEL GRANT - CD318	45,887.00	-	-	45,887.00	-	-	-	45,887.00
190	UGC	(81,78,156.50)	7,24,867.00	-	(74,53,289.50)	-	3,272.00	3,272.00	(74,56,561.50)
191	VK/BT/PR-14036-DR. KALE	(2,01,332.00)	-	-	(2,01,332.00)	-	-	-	(2,01,332.00)
192	VK/BT/PR-4227-DR.KALE	(37,115.00)	-	-	(37,115.00)	-	-	-	(37,115.00)
193	VK/DAE/PR-378/BRNS-DR.KALE	(2,47,647.00)	-	-	(2,47,647.00)	-	-	-	(2,47,647.00)
194	VS/BT/PR-14109-DR.SESHADRI	(1,36,955.00)	-	-	(1,36,955.00)	-	-	-	(1,36,955.00)
195	VS/BT/PR-25858-DR. TRIPATHY	4,43,742.88	-	9,949.00	4,53,691.88	-	4,21,120.00	4,21,120.00	32,571.88
196	VS/SERB/2014/001093-DR. SESHADRI	20,491.00	-	704.00	21,195.00	-	-	-	21,195.00
197	VT/BT/PR-31772-DR. TRIPATHY	4,59,417.07	-	8,149.00	4,67,566.07	-	3,93,961.00	3,93,961.00	73,605.07
198	VT/RLF-DR. VIDISHA TRIPATHI	(59,543.00)	-	-	(59,543.00)	-	-	-	(59,543.00)
199	VT/SERB/004159-DR. TRIPATHI	3,31,989.07	12,00,000.00	42,380.00	15,74,369.07	-	10,68,036.00	10,68,036.00	5,06,333.07
200	VT/SERB/000242-DR. TRIPATHI	(22,336.00)	-	-	(22,336.00)	-	-	-	(22,336.00)
201	YS/BHORUKA CHARITABLE TRUST-DR. SHOUCHE	51,619.00	-	-	51,619.00	-	-	-	51,619.00
202	YS/BIRAC-DR. SHOUCHE	(40,595.00)	-	-	(40,595.00)	-	-	-	(40,595.00)
203	YS/INSACOG - DR. SHOUCHE	61,44,640.00	1,63,94,085.00	46,884.00	2,25,85,609.00	-	2,19,13,285.00	2,19,13,285.00	6,72,324.00
204	YS/BT/PR-1489-DR. SHOUCHE	(3,98,473.00)	-	-	(3,98,473.00)	-	-	-	(3,98,473.00)
205	YS/BT/PR-14956-DR. SHOUCHE	(1,40,225.00)	-	-	(1,40,225.00)	-	-	-	(1,40,225.00)
206	YS/BT/PR-20390-DR. SHOUCHE	(3,48,479.00)	-	-	(3,48,479.00)	-	-	-	(3,48,479.00)
207	YS/BT/PR-20643-DR. SHOUCHE	5,75,165.52	12,12,992.00	19,583.00	18,07,740.52	-	15,13,337.00	15,13,337.00	2,94,403.52

BHIDE & SHAH CHARTERED ACCOUNTANTS PUNE-30

SCHEDULE-3 EARMARKED/ENDOWMENT FUND

(Amount-Rs.)

No.	Name of the Project & P.I.	Opening Balance	Additions Grant. Recd.	Interest & Other Receipts	Total	Utilization/Expenditure Capital	Revenue	Total	Closing Balance
208	YS/BT/PR-3461-DR.SHOUCHE	(1,68,241.00)	-	-	(1,68,241.00)	-	-	-	(1,68,241.00)
209	YS/BT/PR-41474-DR. SHOUCHE	-	4,97,600.00	2,032.00	4,99,632.00	-	51,281.00	51,281.00	4,48,351.00
210	YS/DNB-DR. SHOUCHE	(1,27,174.00)	-	-	(1,27,174.00)	-	-	-	(1,27,174.00)
211	YS/ES/PO/SEISMO/1(361)/2019	7,36,249.00	-	19,652.00	7,55,901.00	-	4,84,669.00	4,84,669.00	2,71,232.00
212	YS/ICMR/236-DR. SHOUCHE	-	17,70,341.00	53,015.00	18,23,356.00	-	12,48,042.00	12,48,042.00	5,75,314.00
213	YS/MCC-DR. SHOUCHE	(5,02,86,201.44)	-	-	(5,02,86,201.44)	-	-	-	(5,02,86,201.44)
214	YS/MS/RGSTC/FILE 2007-DR.SHOUCHE	0.00	0.00	0.00	0.00	-	50,400.00	50,400.00	(50,400.00)
215	YS/NCMR-DR. SHOUCHE	(1,03,43,684.60)	16,94,75,000.00	45,63,003.00	16,36,94,318.40	-	12,50,08,374.78	12,50,08,374.78	3,86,85,943.62
216	YS/TATA STEEL/PHASE-I-DR. SHOUCHE	(1,19,450.00)	-	-	(1,19,450.00)	-	-	-	(1,19,450.00)
217	YS/TATA STEEL/PHASE-II-DR. SHOUCHE	7,49,251.62	-	-	7,49,251.62	-	-	-	7,49,251.62
218	YS/UNILEVER-DR. SHOUCHE	64,782.00	-	-	64,782.00	-	-	-	64,782.00
219	ZK/WELLCOME-DR. ZAHID KAMAL	16,67,498.20	-	23,214.00	16,90,712.20	-	18,20,797.17	18,20,797.17	(1,30,084.97)
220	ITS/2018/2706-DR. AVINASH SHARMA	1,83,624.00	-	-	1,83,624.00	-	-	-	1,83,624.00
221	ITS/2018/003276-DR. PRAVEEN RAHI	71,002.00	-	-	71,002.00	-	-	-	71,002.00
222	JK/DST/FRG/DAAD/P-18-DR. JANESH	-	2,48,940.00	-	2,48,940.00	-	-	-	2,48,940.00
223	MASSTRICH UNIV. PROJECT	(3,50,730.00)	-	-	(3,50,730.00)	-	-	-	(3,50,730.00)
224	SPONSORSHIP FEE-SIGNALS FROM GUT SYMPOSIUM -ARUN K	1,40,000.00	-	-	1,40,000.00	-	-	-	1,40,000.00
225	SVETNER INNOVATIONS P LTD. - DR. SHOUCHE	23,600.00	-	-	23,600.00	-	-	-	23,600.00
226	TA/DA-CTEP CLAIM-MR. ROHAN KULKARNI,EX SRF. CSIR	(45,887.00)	-	-	(45,887.00)	-	-	-	(45,887.00)
	Total	**43,49,92,883.45**	**28,87,17,537.31**	**1,81,87,147.00**	**74,18,97,567.76**	**4,56,10,011.00**	**31,27,92,817.45**	**35,84,02,828.45**	**38,34,94,739.31**
No.	Name of the Project & P.I.	Opening Balance	Addition Unidentified during the year	Interest	Total identified and trf to project	Deletion		Total	Closing Balance
1	SUSPENSE A/C	36,82,067.43	-	1,02,162.00	37,84,229.43	-	28,01,313.27	28,01,313.27	9,82,916.16
	Grand Total	**43,86,74,950.88**	**28,87,17,537.31**	**1,82,89,309.00**	**74,56,81,797.19**	**4,56,10,011.00**	**31,55,94,130.72**	**36,12,04,141.72**	**38,44,77,655.47**

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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 31.03.2022

SCHEDULE 4 - CURRENT-LIABILITIES

Amount (Rs.)

Particulars	2021-22	2020-21
Canteen Deposit	10,000.00	10,000.00
Earnest Money Deposit	12,20,220.00	13,21,998.00
Gardening Contract Deposit	30,000.00	30,000.00
Laundry Deposit	500.00	500.00
Security Deposit	45,35,637.00	31,92,756.00
Security Deposit/ Caution Money	37,61,000.00	34,91,000.00
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	6,92,356.00	6,37,128.00
Tax Deducted at Source payable	12,08,860.00	7,57,686.00
Sundry Creditor	2,67,341.00	3,82,626.00
**Interest Earned Payble to DBT	34,70,568.00	83,95,549.20
Advance from Customers	25,74,419.31	34,16,988.24
EPF Payable	-	9,40,888.00
NPS Payable	-	4,51,504.00
Salary GSLI Payable (Mr. Mahadeo)	-	1,440.00
Salary Profession Tax Payable	54,400.00	52,100.00
Performance Gurantee Deposit (PBG)	8,39,718.00	10,33,430.00
Centre Reserve Funds	10,000.00	10,000.00
Contl.-Welfare Fund (Project)	7,95,575.00	7,95,575.00
Salary welfare payable	-	(1,225.00)
Payable to Staff Welfare trf.A/c 5% User Charges	-	2,36,650.00
Salary- Employee Welfare Deduction	6,24,625.00	2,22,775.00
Provision for Gratuity & Leave Encashment	6,60,50,947.00	7,99,49,528.00
Provision for Electricity & Power	-	33,67,540.00
Provision for Works on Contract	-	35,71,618.00
Provision for Charity Commissioner	27,69,205.00	25,15,157.00
Provision of Auditors Fee	2,12,400.00	2,12,400.00
Payable from Extra Mural projects	7,52,701.00	-
***Transport Allowance Recovery	5,97,537.00	-
Grand Total	**9,20,36,689.31**	**11,65,54,291.44**

Note

*Amount hold against M/s Shalaka Infra-Tech(I) Pvt. Ltd. due to non-completion of work within contract period.

**As per guideline of Department of Biotechnology, Government of India, Interest earned for F.Y. 2021-22 of Rs. 31,18,388.00 refunded to Department of Biotechnology through Bharatkosh vide Challan No. 25924213042200001086 dated 13.04.2022 and Rs. 3,52,180.00 will be refunded through Bharatkosh.

*** Transport Allowance Recovered as per C & AG Audit objection and amount kept under current liabilities of Dr. Bhat & Dr. Bhouche, as the proposal of reconsideration is sent to Department of Biotechnology, New Delhi dated 04.02.2022.

BHIDE & SHAH CHARTERED ACCOUNTANTS PUNE-30.

NATIONAL CENTRE FOR CELL SCIENCE, PUNE - 411 007.

SCHEDULES FORMING PART OF BALANCE SHEET AS ON 31.03.2022

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	20,58,875.00	5,14,719.00	-	25,73,594.00	1,28,67,969.00	1,33,82,688.00
b> Lease Hold Land - Baner - Compound Wall		17,48,412.00	-	-	17,48,412.00	62,443.00	62,443.00	-	1,24,886.00	16,23,526.00	16,85,969.00
2. BUILDINGS:	**4.87%**										
a> Jopasana		60,26,554.30	-	-	60,26,554.30	37,51,851.00	1,10,778.00	-	38,62,629.00	21,63,925.00	22,74,703.00
b> Jidnyasa		69,14,265.25	-	-	69,14,265.25	42,65,472.00	1,28,996.00	-	43,94,468.00	25,19,797.00	26,48,793.00
c> University Campus		51,37,75,672.46	1,62,46,834.00	-	53,00,22,506.46	17,80,58,489.00	1,69,66,404.00	-	19,50,24,893.00	33,49,97,613.00	33,57,17,183.00
3.Furniture & Fixtures	**25.89%**	7,42,61,217.73	-	-	7,42,61,217.73	6,09,79,020.00	34,38,761.00	-	6,44,17,781.00	98,43,437.00	1,32,82,198.00
4.Library Books	**18.10%**	10,26,40,067.25	7,39,790.00	-	10,33,79,857.25	8,46,82,224.00	33,79,772.00	-	8,80,61,996.00	1,53,17,861.00	1,79,57,843.00
5.Equipment											
a> Institute	**18.10%**	1,65,63,24,324.26	3,00,68,858.00	-	1,68,63,93,182.26	1,22,29,28,650.00	8,23,75,896.00	-	1,30,53,04,546.00	38,10,88,636.00	43,33,95,674.00
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		**2,37,86,43,971.25**	**4,70,55,482.00**	-	**2,42,56,99,453.25**	**1,55,82,98,917.00**	**10,69,77,769.00**	-	**1,66,52,76,686.00**	**76,04,22,766.00**	**82,03,45,053.00**
Capital WIP											
A) Advance CPWD		74,75,034.00	31,88,918.00	-	1,06,63,952.00	-	-	-	-	1,06,63,952.00	74,75,034.00
B) Advance (Advance Equipment-Cryoscientific)		-	15,46,650.00	-	15,46,650.00	-	-	-	-	15,46,650.00	-
C) Advance (Air Conditioner)*		36,55,950.00	-	* 36,55,950.00	-	-	-	-	-	-	36,55,950.00
Total B		**1,11,30,984.00**	**47,35,568.00**	**36,55,950.00**	**1,22,10,602.00**	-	-	-	-	**1,22,10,602.00**	**1,11,30,984.00**
Total (A+B)		**2,38,97,74,955.25**	**5,17,91,050.00**	**36,55,950.00**	**2,43,79,10,055.25**	**1,55,82,98,917.00**	**10,69,77,769.00**	-	**1,66,52,76,686.00**	**77,26,33,368.00**	**83,14,76,037.00**

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 Air Conditioner - Settled during the F.Y.2021-2022 hense actual expenditure is capitalised under Building (University Campus) Head.

NATIONAL CENTRE FOR CELL SCIENCE, PUNE - 411 007.

SCHEDULES FORMING PART OF BALANCE SHEET AS ON 31.03.2022

SCHEDULE 6 - CURRENT ASSET LOAN AND ADVANCES

Amount (Rs.)

Particulars		2021-22	2020-21
CURRENT ASSET			
Cash-in-hand		50,000.00	50,000.00
SAVING ACCOUNTS			
Bank of India - 4911		11,58,16,248.37	20,15,31,265.34
Bank of India - 4912		32,38,62,075.58	35,39,26,999.47
State Bank Of India		1,18,76,953.46	29,15,760.17
Bank of India-SERB 8403		3,36,71,528.12	2,10,07,185.44
Bank of India - 8574		37,84,843.54	36,76,848.54
Bank of India - 8783		5,90,39,636.38	10,46,48,387.00
Bank of India - NCCS Employee Welfare A/c 0538		6,24,138.22	2,22,775.00
Bank of India -EMBO Local-9071		48,206.80	-
Bank of India- EMBO Foreign-9072		20,62,624.34	-
TOTAL (A)		**55,08,36,254.81**	**68,79,79,220.96**
LOAN AND ADVANCES			
Advance-LTC		23,998.00	8,49,000.00
Advance - Contingency		54,704.00	1,94,676.00
Advance - Equipment		-	2,65,200.00
Staff Computer Advance		94,810.00	84,058.00
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	57,69,000.00
Deposit to DAE-University Campus-Phase I		2,07,948.00	2,08,000.00
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	2,82,200.00
Telephone Deposit		1,21,701.00	1,21,701.00
Prepaid Expenditure Postage		3,894.00	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 Receivable FY 2019-20		-	5,33,212.00
TDS & TCS Receivable FY 2020-21		1,41,569.64	1,41,569.64
TDS & TCS Receivable FY 2021-22		94,963.17	
Receivable		1,80,000.00	1,20,880.00
GST TDS Receivable		12,000.00	-
TOTAL (B)		**1,96,45,510.41**	**2,12,32,905.24**
GRAND TOTAL		**57,04,81,765.22**	**70,92,12,027.20**

BHIDE & SHAH CHARTERED ACCOUNTANTS PUNE-30.

राष्ट्रीय कोशिका विज्ञान केंद्र पुना

NATIONAL CENTRE FOR CELL SCIENCE, PUNE - 411 007.

SCHEDULES FORMING PART OF INCOME AND EXPENDITURE ACCOUNTS FOR THE YEAR ENDED 31.03.2022

SCHEDULE 7 - INCOME FROM SALES/SERVICE

Amount (Rs.)

Particulars	2021-22	2020-21
Cell Line Handling	92,53,861.00	44,61,773.00
LC-MS/MS Proteome Analysis (Digested Samples)	75,000.00	60,000.00
FACS Analysis Charges	87,000.00	14,000.00
Bio Imaging Facility	25,000.00	12,000.00
Cell Line Authentication	42,000.00	3,000.00
Proteomene Analysis of Chronomus Samples	89,224.00	-
Covid Testing Receipts	-	49,00,000.00
Donation-in-kind for Covid Testing	-	8,12,687.00
Plasmon Resonance Interactive Analysis Facility	-	1,36,877.00
Grand Total	**95,72,085.00**	**1,04,00,337.00**

राष्ट्रीय कोशिका विज्ञान केंद्र पुणा

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 31.03.2022

SCHEDULE 8 - GRANTS/SUBSIDIES

Amount (Rs.)

Particulars	2021-22	2020-21
GRANTS/SUBSIDIES	39,25,00,000.00	40,10,00,000.00
Less: Deduction from TSA Account [Note: A (6) (vi) Accounting Significant Policies]	13,24,673.00	-
Grand Total	**39,11,75,327.00**	**40,10,00,000.00**

राष्ट्रीय कोशिका विज्ञान केंद्र पुणा

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 31.03.2022

SCHEDULE 9 - FEES/SUBSCRIPTIONS

Amount (Rs.)

Particulars	2021-22	2020-21
Tender Fees	3,392.00	-
Grand Total	**3,392.00**	**-**

NATIONAL CENTRE FOR CELL SCIENCE, PUNE - 411 007.

SCHEDULES FORMING PART OF INCOME AND EXPENDITURE ACCOUNTS FOR THE YEAR ENDED 31.03.2022

SCHEDULE 10 - INTEREST EARNED

Amount (Rs.)

Particulars	2021-22	2020-21
Interest On Staff Computer Adv.	23,000.00	44,670.00
Interest On Staff HBA	23,472.00	23,472.00
Interest On Staff Vehicle	5,820.00	2,175.00
Grand Total	**52,292.00**	**70,317.00**

राष्ट्रीय कोशिका विज्ञान केंद्र पुणे

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 31.03.2022

SCHEDULE 11 - OTHER INCOME

Amount (Rs.)

Particulars	2021-22	2020-21
Ph.D Fees	12,28,800.00	13,53,900.00
Application Fee	18,300.00	2,03,418.40
Hostel Charges	3,70,326.00	2,50,765.00
Conti (Miscellaneous Income)	7,760.00	1,112.31
Sundry balances writeback	-	2,52,705.00
License Fee	2,49,451.00	2,36,195.00
Usage of Premises for ATM	82,036.00	1,03,308.00
Transit House Charges	-	65,735.00
Receipts from Guest House	1,15,674.00	45,336.00
Interest on Income Tax Refund for F.Y.2019-20	50,828.00	1,70,341.00
Interest earned on Covid Testing Recepits A/C No.8574	1,07,995.00	65,957.00
Sale of Scrap	19,41,735.00	18,228.00
Auditorium Charges	24,000.00	-
Grand Total	**41,96,905.00**	**27,67,000.71**

राष्ट्रीय कोशिका विज्ञान केंद्र पुणा

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 31.03.2022

SCHEDULE 12 - ESTABLISHMENT EXPENSES

Amount (Rs.)

Particulars	2021-22	2020-21
Salaries	22,61,29,805.00	21,74,45,702.00
Contribution to Provident Fund	1,28,83,224.00	1,15,78,530.00
*Contribution to NPS	82,02,203.00	53,12,918.00
Grand Total	**24,72,15,232.00**	**23,43,37,150.00**

* Arrears of Rs. 48,32,695.00 is paid towards National Pension Scheme (NPS) subscriber based on the Department of Biotechnology order dated 28.10.2021.

राष्ट्रीय कोशिका विज्ञान केंद्र पुणे

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 31.03.2022

SCHEDULE 13 - OTHER ADMINISTRATIVE EXPENSES

Amount (Rs.)

Particulars	2021-22	2020-21
Consumables	4,62,02,915.04	4,56,68,710.06
Contingencies (as per attached details)	2,03,30,479.31	2,26,51,705.05
Work On Contract	4,05,23,222.00	3,99,88,012.00
Electricity and Power	3,66,60,055.00	3,69,97,489.00
Rent Rates and Taxes	1,16,13,581.00	2,54,50,457.00
PMC Water Charges	29,56,978.00	22,32,518.00
User Charges @5% trf to Staff Welfare A/c	4,86,088.00	2,36,650.00
TA-DA	4,57,026.00	2,08,100.00
Bank Charges	52,290.15	74,609.13
Eligibility Fees	-	7,600.00
Fellowship-JGEEBILS	50,94,300.00	-
Professional Expenses for R & D	53,01,090.94	-
Grand Total	**16,96,78,025.44**	**17,35,15,850.24**

राष्ट्रीय कोशिका विज्ञान केंद्र पुणा

BHIDE & SHAH CHARTERED ACCOUNTANTS PUNE-30.

NATIONAL CENTRE FOR CELL SCIENCE, PUNE - 411 007.

SCHEDULES FORMING PART OF INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31.03.2022

CONTINGENCIES BIFURCATION

Amount (Rs.)

Particulars	2021-22
Conti-Local Conveyance	13,95,054.00
Conti-Advertisement and Publicity	8,39,845.00
Conti-Vehicle Petrol Expenses	1,10,401.00
Conti-Academic Recognition Fee	6,00,000.00
Conti-Auditors Remunerations	2,12,400.00
Conti-Fees Registration& Membership Charges	23,346.00
Conti-Honorarium	13,30,479.00
Conti-Hospitality Expenses	3,78,409.00
Conti-Laundry Expenses	1,02,630.00
Conti-Meeting Expenses	41,752.00
Conti-Membership Fees and Subscriptions	5,25,882.00
Conti-Miscellaneous Purchase	21,10,231.00
Conti-Miscellaneous Expenses	1,76,785.31
Conti-Postage and Telephone	24,29,273.00
Conti-Printing and Stationery	4,52,222.00
Conti-Professional & Legal Charges	8,91,018.00
Conti-Repairs and Maintenance	41,06,428.00
Conti-Repairs and Maintenance- Contract	42,39,382.00
Conti-Seminar / Symposia	3,38,978.00
Conti-Vehicle Insurance	25,964.00
Grand Total	**2,03,30,479.31**

राष्ट्रीय कोशिका विज्ञान केंद्र पुना

BHIDE & SHAH CHARTERED ACCOUNTANTS PUNE-30.

SCH. "14" : SIGNIFICANT ACCOUNTING POLICIES AND NOTES ON ACCOUNTS FOR THE YEAR 2021-2022

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 Delhi 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) Deduction from Corpus Capital Contribution of Rs. 8,99,87,008.00 represent unspent grant in the nature of Corpus Capital is writtend back through Treasury Single Account to the Government of India.

vi) Deduction from Recurring Expenditure of Rs. Corpus Capital Contribution of Rs. 13,24,673.00 represent unspent grant in the nature of Recurring Expenditure is writtend back through Treasury Single Account to the Government of India.

राष्ट्रीय कोशिका विज्ञान केंद्र पुना

BHIDE & SHAH CHARTERED ACCOUNTANTS PUNE-30.

7) FOREIGN CURRENCY TRANSACTION:

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

8) RETIREMENT BENEFITS :

Provision for Liability towards gratuity payable on death / retirement of employees is not made due to implementation of "Treasury Single Account", under which parking of funds by way of provision is not permitted. Accumulated funds upto F.Y.2020-2021 will be utilized for retirement benefits up to 2025-2026.

9) CURRENT ASSETS, LOANS & ADVANCES:

It is explained to us that, the value of all current assets, advances and deposits, outstanding 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. 48,41,27,718.80 are Unspent / and Rs. (9,96,50,063.33) (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. 9,82,916.16 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. 2021-2022 of Rs.66,31,92,502.68 for aquiring fixed assets in respect of resptective Project.

Date: 22/08/2022
Place: Pune

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
Dr. Mohan R. Wani
Director, NCCS, Pune

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

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

BHIDE & SHAH CHARTERED ACCOUNTANTS PUNE-30.

SCH. "15" : CONTINGENT LIABILITIES AND NOTES ON ACCOUNTS FOR THE YEAR 2021-2022

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)

* 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. 2021-2022. 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 :

a) The amount represent Interest Earned on Grant received, refunded to DBT, New Delhi as per their instructions.

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

5) Amounts of earlier year/s are regrouped to make them comparable with the current year wherever necessary.

राष्ट्रीय कोशिका विज्ञान केंद्र पुना

BHIDE & SHAH CHARTERED ACCOUNTANTS PUNE-30.

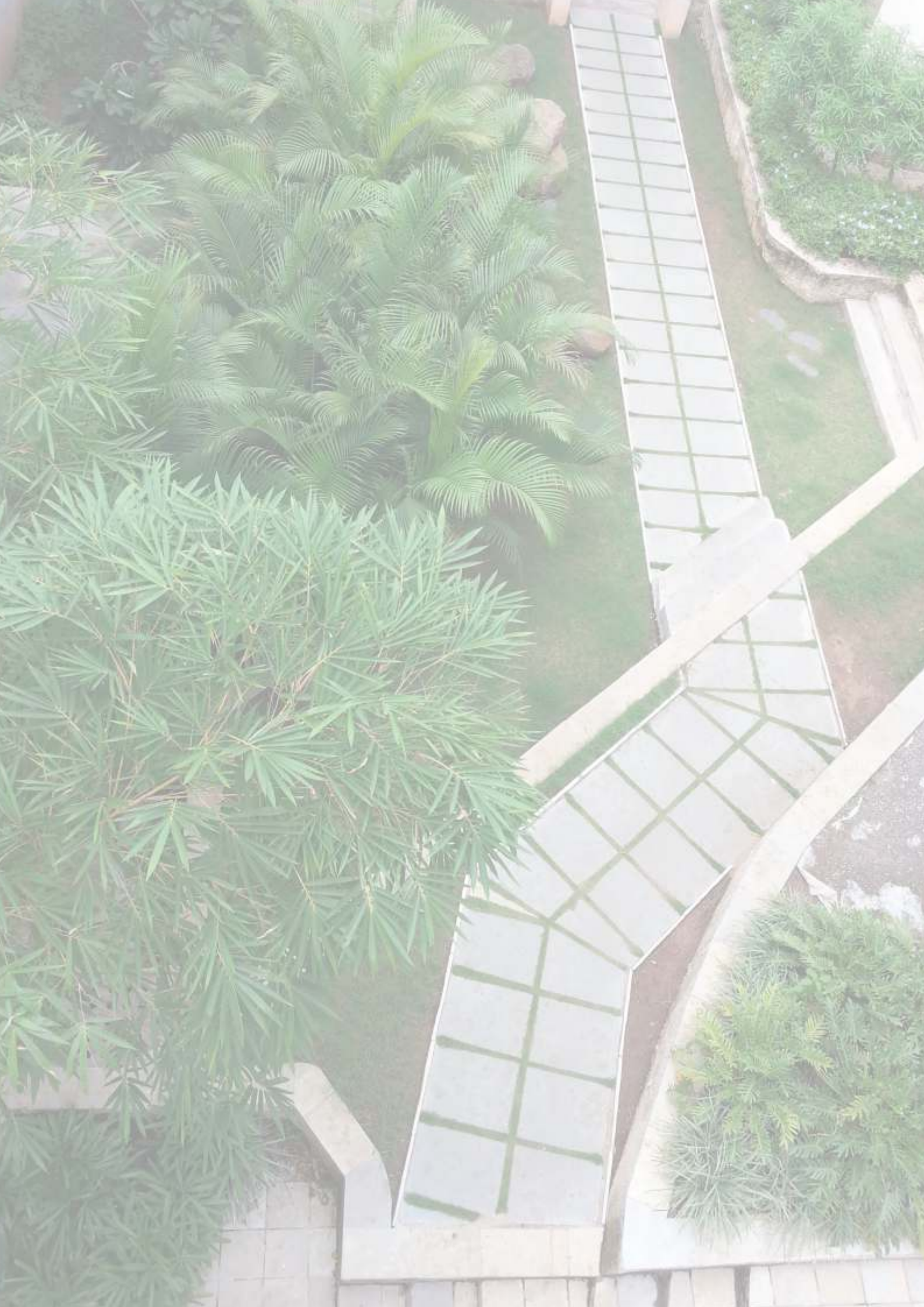
Date: 22/08/2022
Place: Pune

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

वैभव अ. अरबाडे
Vaibhav A. Arbade
अधिकारी 'C' (लेखा)
Officer 'C' (Accounts)
रा.को.वि.के./NCCS Pune-411007

DIRECTOR
NCCS
Dr. Mohan R. Wani
Director, NCCS, Pune

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



National Centre for Cell Science
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