
ncbs
National Centre for Biological Sciences
Tata Institute of Fundamental Research
Annual Report
2024-2025

Contents

Director's Note

L S Shashidhara
Centre Director

Future science historians may remember this period 2024-25 for several reasons. Mainly, we had an exciting announcement of a complete wiring map (connectome) of an adult brain of *Drosophila*, and a worrying news of further increase in global average temperature, moving above 1.5 degrees Celsius (Bengaluru had its impact both ways. Extremely hot and dry pre-summer days and incessant rains during post-monsoon days both in 2024 and 2025). While the former will help push the frontiers of brain science (across all model organisms and humans) further, the latter should motivate us to take up "climate change biology" to discover fundamental mechanisms of adaptation to fast-changing environments at cellular, organismal, population and ecosystem levels. Long-term ecological monitoring is key, and I am happy that NCBS faculty and students are scaling up their work in this area.

What started as a fun interaction with ChatGPT in 2023, has now in a full-blown AI world. All our IT and computational tools are upgraded, helping us do our research more effectively and perhaps taking us to newer avenues. Several opportunities and grants have come to the NCBS community to integrate AI tools in our research. We have established exchange of faculty and post-doctoral fellows with Imperial College London to strengthen our capacity to use AI in our research. A few weeks ago, NCBS and ICTS jointly established a Centre for Artificial Learning and Intelligence for Biological Research and Education (CALIBRE) with the help of a generous philanthropic donation from a friend of science, Mr Vishal Gupta. We hope to have some breakthroughs from NCBS across scales of biology – origin of life, cellular organisation and physiology, neuroscience, ecology, etc.

At NCBS, we welcomed two new faculty this year (Priti Agarwal and Pratik Kumar), as well as several new staff and students. In 2024-25, we also saw many accomplished scientists taking over the academic leadership positions of the Centre. This year too, our faculty have received major peer recognitions. Uma Ramakrishnan was elected as an Associate member of the prestigious European Molecular Biology Organisation. Sanja Sane and P V Shivaprasad were elected as Fellows of Indian National Science Academy (INSA). Abhilasha Joshi is awarded the first Murty Trust Faculty Fellowship as part of a new philanthropic initiative by the Murty Trust to elevate Indian science.

Throughout the year NCBS was buzzing with activities from our Archives, Science Communication, Popularisation, Educational outreach teams. We were also more visible in the city through several training and awareness workshops that we organised on AMR, environmental surveillance for human and animal pathogens, and through joint activities with NIMHANS, Science Gallery Bengaluru, Visveswaraya Science and Technology Museum etc. Our academic community-driven program to give basic and advanced courses on genetics, evolution, ecology and conservation to probationary and mid-career forest officers of Indian Forest Service cadre is continuing with increased enthusiasm. In addition, this year we saw launching of the Indica School of Field Ecology and Conservation with generous philanthropic support from the Murty Trust. The aim of this school is to conduct rigorous hands-on training of PhD students in ecology, wildlife biology and conservation.

Let me take this opportunity to thank all our scientific, technical, and administrative staff for their wonderful support and help.

NCBS Awards

- **Dr. Deepa Agashe** has been elected as a Fellow of the *Indian Academy of Sciences*.
- **Dr. Amey Redkar** appointed as the Head of a Max Planck Partner Group with the *Max Planck Institute of Molecular Plant Physiology*, Germany.
- **Prof. Vatsala Thirumalai** received the fellowship from *International Union of Physiological Sciences.*
- **Prof. Uma Ramakrishnan** is elected as an Associate Member of *EMBO*.
- **Prof. Mahesh Sankaran** was awarded the *J.C. Bose Grant* 2025 by the *Anusandhan National Research Foundation*.
- **Dr. Deepa Agashe** received the Rashtriya Vigyan Puraskar: Vigyan Yuva (Shanti Swarup Bhatnagar Award) 2025, conferred by the *Government of India*.
- **Dr. Anjana Badrinarayanan** has been selected for the Infosys Prize 2025 in Biological Sciences by the *Infosys Foundation*.
- **Prof. P V Shivaprasad** received the *Tata Transformation Prize* 2025.
- **Dr. Soumyashree Das** has been elected as *EMBO Global Investigator*.
- **Dr. Tapomoy Bhattacharjee** has been elected as *EMBO Young Investigator*.
- **Dr. Tapomoy Bhattacharjee** received the *Merck Young Scientist Award* for Scientific Excellence in Biology.

Dean of Faculty

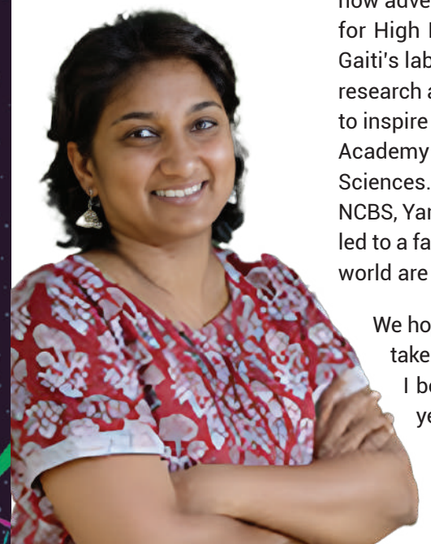
Uma Ramakrishnan

NCBS seems like an academic haven. Lovely buildings, researchers working on varied and interesting topics, a great ambience, an amazing line up of talks, workshops and meetings, active discussions in the colonnade, a great canteen, and clean (mostly) bathrooms. But the real reason NCBS is an academic haven is its culture. Science requires tenacity, strong ethics, disruptive ideas, a non-hierarchical approach, exploration, intense hard work and passion, but most importantly, leadership.

Leaders are those who inspire us, and make us better than we imagined we could be. They allow us to join hands in pursuit of a shared purpose, whether that be scientific knowledge, capacity building or work of deep societal impact. While all researchers are bitten by the wonder bug, only some choose to tackle large, ambitious, out of the box projects. Great scientific leaders who put together complex and innovative ideas, work effectively with teams, and build much more than just knowledge. They continue to build cultures of doing science. This is how the culture of science at NCBS spreads across the country and world, little by little.

While much interesting, novel and impactful science is conducted at NCBS, we rarely talk about the people that catalyse these scientific journeys. Many faculty at NCBS have truly imbibed this culture of adventure, ambition and above all, leadership. Sometimes this leads them away from NCBS, to pursue these dreams in the best way possible. But even after they move away from NCBS to novel horizons, they continue to lead, inspire and create, and take science to the next level, creating a continuum.

In this years' annual report, we are thrilled to present to you four such individuals, who have built much more than their science, in India and internationally. Vijay Raghavan, who co-founded NCBS, valued and initiated a unique culture of science at NCBS. His empathy and eye for excellence led him to successfully head the department of biotechnology as secretary, and then become India's principal scientific advisor, Government of India. Shona's (Sumantra Chatterjee) fascination with the brain, and decades of research on how adverse experiences affect us led him to establish a unique institution, the Centre for High Impact Neuroscience and Translational Applications (CHINTA). Peep into Gaiti's lab, and you might just see her on the bench! Gaiti is legendary for her excellent research and commitment to science, truly representing the NCBS spirit. She continues to inspire many through her role in the past as the Vice president of the Indian National Academy of Sciences (INSA) and as the current secretary of the Indian Academy of Sciences. Yamuna Krishnan and I started at the NCBS a week apart. As a chemist at NCBS, Yamuna mastered the needs of biologists, and her phenomenal research success led to a faculty position at the University of Chicago. Today, many scientists around the world are fascinated by and interested in the tools she builds to interrogate biology.



We hope you will enjoy reading their stories, and better understand what made them take these bold directions. As someone who has been at NCBS for over two decades, I believe that its inherent institutional culture has contributed to their journeys, yet allowed them to remain unique as individuals. I hope you will feel the same.

Dean of Academics

R Sowdhamini

The academic growth of a Centre or a lab is measured by yardsticks such as sustainability, networking, collaborations, research publications, and funding support. But the most important yardstick is the profile of outgoing students, postdoctoral fellows, and trainees. Indeed, training STEM students towards excellence in research remains one of the primary goals of NCBS. In 2026, NCBS is reaching a milestone of 30 years since its inception. So, it is a good time to look back and ask few questions – how are our students doing? Where are they and what are they doing?

Our Academic Office was recently in touch with close to 60 Alumni and we have followed their career growth closely. A majority of them remained in research – 18 as Associate or Assistant Professors, 7 as Principal Investigators or Senior Scientists and 22 are currently Postdoctoral Fellows. Few are in industry and translational research – 12 are in senior positions in companies, like Founders or Vice President or CEO. Some have moved to allied areas of research such as Research Management, and Funding Agencies. Few others are in Science Writing or teaching or enabling other students to set their path towards their career dreams. They also form strong bonds with each other, be part of networking which is beneficial for our younger and current students in job-finding and in collaborations.

The academic journey of a PhD or Integrated PhD student is a long one. This timeframe is quite crucial for the student to mature as an individual scientist and equally valuable to the lab where the student works. The students also leave useful impacts to the lab through their skillsets and contribute to the overall growth and excellence of science emerging from that lab. Besides, we make a conscious attempt to retain the overall biological question open-ended, collaborative and inclusive so that the student can also creatively add elements or digress from the original idea if they wish. We have often had students who had showed interest to apply three or more techniques to address their research problem. Hence, NCBS has always strived to be inclusive of students' interests either in pursuing a high-risk or a multi-disciplinary problem. NCBS faculty believe that such skillsets will add value to the research training at NCBS.

NCBS student community guarantees talents in various forms of art. These range from photography, dramatics, dance, and music. Our campus has been fortunate and hugely benefited by their presence. The bondage and collaborations we form with our Alumni lasts for the entire life. Some of our NCBS Alumni kept in touch with us over time. Indeed, we have been in long-term collaboration with few. For example, Dr Shameer Khader from my lab passed out in the year 2011, but we had maintained productive collaborations until 2020 through emails! When we celebrated 25 years of existence of our CAPS lab through virtual seminars, it was amazing to know that all my Lab Alumni, whom we contacted, including Dr Parantu Shah (my very first MSc student between 1998-2000) came online without any reminders and presented their research experience in NCBS that happened years ago. It is great to see our Alumni do very well and happy that they are in touch with NCBS over times. Our interactions move from training to independence to interdependence – making a smooth continuum!

Dean of Research

Vatsala Thirumalai

As a neurobiologist, memories are of deep interest to me. For each of us, our personal memories define who we are, what we hold dear and how we see ourselves in the future. So, it is with institutions, countries and civilizations. Collective memories, bring forth stories, transformative moments, and weave a continuum of reminiscences be it at institutions like NCBS or in countries like our own. These lived experiences and narratives shape how we see ourselves and how the world sees us.

NCBS is at an interesting phase where it is neither too young nor too old. As a young adult institution, we are bursting with new ideas, innovation and endless possibilities. At the same time, we look back and cherish the successes that define who we are today. Who are we? We are a collection of individuals with a shared dream: to pursue science passionately, rigorously, honestly and with the humility to learn at every step. Our past is testament that we have turned these dreams to reality and continue to do so. Throughout its existence, NCBS has been home to these ideals which are now imbibed into our institutional culture.

The theme of this annual report, Continuum, captures this essence exceptionally well. NCBS stands for excellence in fundamental research in the field of biological sciences. In true biological style, we have evolved slowly but surely, keeping our core principles intact, while adapting to the ever-changing research landscape. When NCBS was started over 33 years ago, it was among a handful such institutions dotting the country. Today, advanced and fundamental biological research is being conducted across the country, including at the IITs, traditionally considered as engineering and technology powerhouses. And we are proud that NCBS has contributed in no small measure to this transformation – our alumni are part of these new endeavours, driving cutting edge biological research at IITs, IISERs and public and private Universities in all corners of our great nation. Students, post-doctoral fellows and faculty alumni have gone on to leadership positions in academia and outside, shaping science communication, research policy, non-governmental organizations, grants administration, biotech industry and beyond. They carry with them the NCBS culture and are truly our ambassadors for integrity, excellence, and freedom of thought.

Locally, the BLiSC was conceptualized, incubated and nurtured by NCBS resulting in three other world class organizations within our campus. With these sister organizations, we continue to push the frontiers of research in all its flavours: fundamental, translational, resource generation, therapy development, product development, etc., In line with this, the aspirations of our community continue to expand, be it in entrepreneurship, societal engagement, interdisciplinarity or a collaboration of science with the arts. As always, NCBS continues to evolve with these exciting new dreams and the willingness to turn them to reality.

Looking to the future, we hope to draw inspiration from our past to take bold new steps. We hope to continue to surprise ourselves with what we can do to touch newer and greater heights. More details on these in the next annual report. Until then…

Our Research Interests

Biophysics, Biochemistry, and Bioinformatics

Genetics and Development

Cellular Organization and Signalling

Theory, Simulation, and Modelling of Biological Systems

Neurobiology

Ecology and Evolution

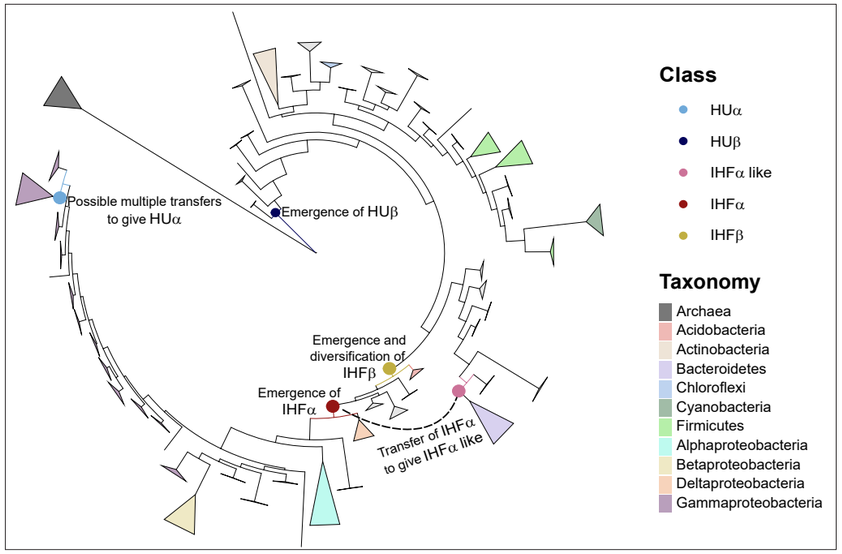
Biochemistry, Biophysics and Bioinformatics

Adaptation, the Bacterial Way!

Aswin Seshasayee

Bacterial adaptation is multipronged. Not only do bacteria regulate what molecules are produced when, but they also adapt by changing their genotype. We ask how these phenomena operate and evolve using computation.

Regulation of transcription is a critical component of bacterial adaptation to their environments. We are interested in the structure and evolution of these networks. Our current work deals with the evolution of transcription factors, which are key proteins in gene regulation. Transcription factor activity is one among several nucleic acid binding functions, but unlike DNA compaction, it is not absolutely essential for the existence of minimal cellular life forms. We ask how these transcription factors evolved, and how they might be evolutionarily related to other DNA binding proteins.



A model for the evolution of the HU/IHF family of DNA binding proteins on a bacterial phylogenetic tree. IHF is a sequence-specific transcription factor, while HU is a non-specific DNA shaping protein.

We ask these questions in both bacteria as well as in eukaryotes, which have elaborated their own unique set of transcription factor sequence families. We have identified evidence suggesting that a sub-family of sequence-specific binding, characteristic of transcription factors, might have evolved from a branch of its non-specific DNA binding relative in bacteria through co-option of pre-existing amino acid residues as well as new residues. In eukaryotes, large expansions of transcription factors appear to have happened in more recently diverged multi-cellular branches, whereas most of their non-transcription factor relatives emerged earlier.

PUBLICATIONS

1. Nandy M., Krishnaswamy M., Sharda M. and Seshasayee ASN*. The evolution of sequence specificity in a DNA binding protein family. Journal of Molecular Biology, 2025, 437:169177.
2. Dubey A., Muthu G., Seshasayee ASN*. Evolution of transcription factor-containing superfamilies in eukaryotes. Journal of Molecular Biology, 2025, 437:168959.

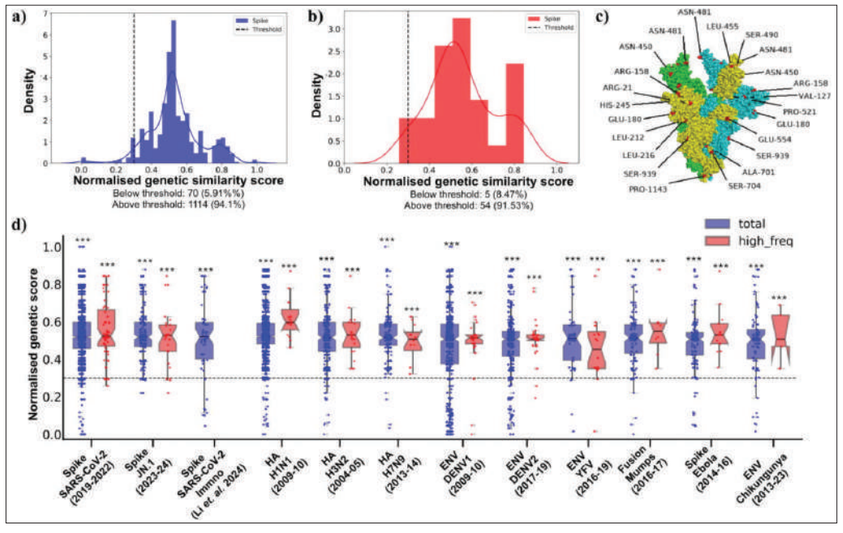
Computational Approaches to Protein Science

R. Sowdhamini

We employ computational algorithms to enable efficient annotation of functions to unknown gene products. Our projects are geared towards modelling protein-protein/ligand interactions, and plant genomics, aided by collaborative ventures.

Genome sequencing projects have enormous potential to benefit human endeavours. However, just as acquiring a language's vocabulary does not enable one to speak it, databases that list the amino acid compositions of proteins do not directly tell us much about the higher-level structures and functions of these proteins. Functionally, similar proteins may have <25% sequence overlap. Proteins with very similar amino acid sequences are 'no-brainers', but the real test—is to detect the "essential" similarities in proteins, whose non-critical sections have experienced random rearrangements during evolution.

We seek to provide structural rationale for disease-causing mutations. Explicit computational pipelines have been devised to recognise parts of the genome that retain genic regions and applied in DNA or RNA assemblies of select medicinal plants. Finally, we have exploited the availability of structural information of small molecules of natural origin to identify potential inhibitors for target proteins. The efficacy of these inhibitors has been verified using in *vitro* assays and biophysical studies.



Merged mutations tends to be closer to genetic score from wild-type. (a and b) Distribution of normalised genetic score among total and high-frequency mutations within spike protein respectively. (c) High-frequency mutations during recent surge in pandemic cases by JN.1 represented on Spike protein structure (PDB: 6VSB). (d) The distribution of normalised genetic score among ssRNA viral pandemics.

Figure taken from J Mol Biol 2024 436(19):168716. doi: 10.1016/j.jmb.2024.168716.

PUBLICATIONS

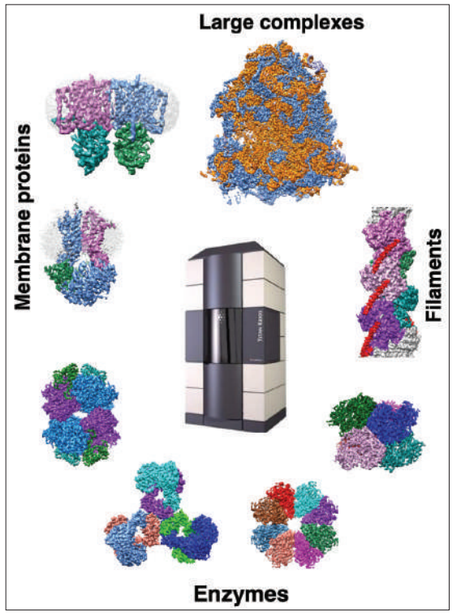
1. Abhishek Sharma, CR Chandrashekar, Sudhir Krishna and Ramanathan Sowdhamini (2024) Computational Analysis of the accumulation of mutations in therapeutically important RNA viral proteins during pandemics with special emphasis on SARS-CoV-2 Journal of Molecular Biology 2024 Oct 1;436(19):168716.
2. Shailya Verma and R. Sowdhamini (2025) Toll-like receptor 4 pathway evolutionary trajectory and functional emergence Frontiers in Immunology (in press).

Structures of Macromolecules and Dynamics

Vinothkumar K R

Our research is driven by the curiosity of how macromolecules function in the cell. We study macromolecules that function in the membrane, those that regulate translation and interesting microbial enzymes.

The lab's theme is 'Macromolecular Structure and Dynamics' and the research areas that we study include membrane proteins, microbial enzymes, and large macromolecules such as ribosomes (Fig 1). Within the broad area of membrane proteins, we are working towards understanding the mechanism of peptide and antibiotic resistance in bacteria, cleavage of transmembrane proteins by intramembrane proteases and membrane receptors. We also work on select microbial enzymes that have interesting catalytic mechanisms and for their use as test samples for cryoEM (to understand the behaviour of specimens during freezing and also to optimize data collection) in particular at air-water interface. One of the projects that we have been working on is the metabotropic glutamate receptor, mGlu5, a class C G-protein coupled receptor. We have been interested in understanding how different ligands bind in the transmembrane domain to inhibit or promote signalling (1).



A gallery of macromolecules studied in our lab using cryoEM as the major technique. These include membrane proteins, enzymes, filamentous structures, and large complexes such as ribosomes.

PUBLICATIONS

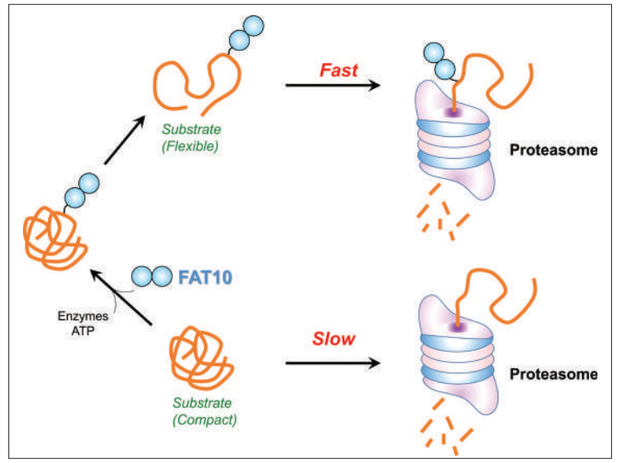
1. Cannone, G., et al., Conformational diversity in class C GPCR positive allosteric modulation, Nat. Comm, 16.619. 2025.
2. Kumari, J., et al., Distinct filament morphology and membrane tethering features of the dual FtsZs in Odinarchaeota EmboJ, V44, 5940-5964. 2025.

Ubiquitin-Like Signaling in Host-Pathogen Interactions

Ranabir Das

Post-translational modifications of substrate proteins with Ubiquitin-like small proteins regulate their function and lifetime. Studying the molecular interactions of these modifications reveals why and how they are crucial in host-pathogen interactions.

We study the relevance of the ubiquitin-proteasome pathway in host-pathogen interactions. Most substrate proteins are posttranslationally modified by a small protein ubiquitin for degradation. Recently, we studied an auxiliary proteasome-targeting protein known as Fat10 activated during infection.



Ubiquitin substrates require unfoldases, such as Cdc48, to unfold the substrate before it engages with the proteasome. Our studies showed that Fat10 substrates do not require unfoldases, suggesting that Fat10 significantly impacts the substrate's structure by unknown mechanisms. We find that Fat10 has a malleable native structure that unfolds rapidly, efficiently engages with the proteasome, and ensures fast substrate degradation. Moreover, Fat10 reduces the substrate's thermodynamic stability in cellular and in-vitro conditions. The thermodynamic coupling between the substrate and Fat10 increases partially disordered regions in the substrate-tag conjugate, ensuring rapid degradation. The quantum of Fat10's destabilizing effect is modulated by the substrate size, structure, and the conjugation site. Further information on novel interactions of Fat10 will be interesting to understand host inflammatory response to microbial infection.

PUBLICATIONS

1. Negi H, Ravichandran A, Dasgupta P, Reddy S, Das R*, "Plasticity of the proteasome-targeting signal Fat10 enhances substrate degradation," Elife, 2024. 13: e91122.
2. Reddy PP, Phale A, and Das R*, "Structural analysis of genetic variants of the human tumor suppressor PALB2 coiled-coil domain," Bioscience Reports, 2025, 45(3): BSR20241173.

Deciphering Genetic and Molecular Alterations in Cancers

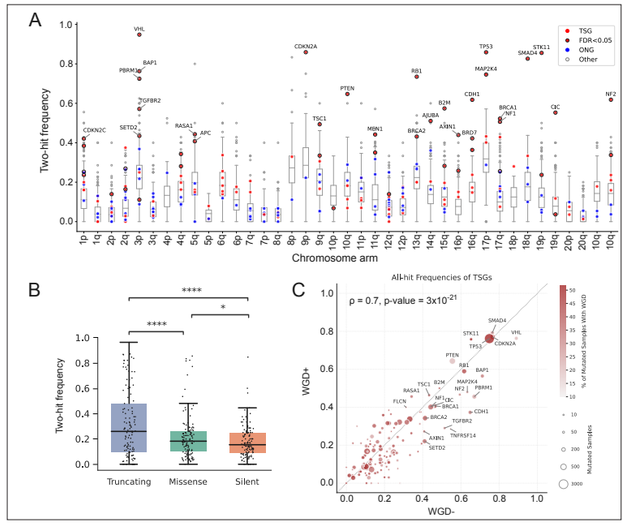
Sabarinathan Radhakrishnan

HONORS AND AWARDS

DBT/Wellcome Trust India Alliance Intermediate Fellowship (2021-2025).

We are interested in understanding the genetic and molecular alterations responsible for cancer development and resistance to treatments, using computational and functional genomics approaches.

Tumor suppressor genes (TSGs) typically undergo biallelic inactivation, often through deletion of one allele and point mutation of the other, during cancer evolution. Recent cancer genomics studies revealed that the frequency of biallelic inactivation differs among TSGs; however, the mechanisms underlying this variability remain unclear. Through our systematic analysis, we determined that this variability can be partially explained by the chromosome context, with certain chromosome arms being more susceptible to arm-level deletions, increasing the likelihood of biallelic inactivation of all genes on that arm due to genetic linkage (Figure A). The consequence of the point mutation matters as well, as truncating mutations accompany deletion of the other allele are observed at higher rates than missense mutations (Figure B). Furthermore, we observed that biallelic inactivation rates are unaffected by whole genome doubling, possibly because the TSG mutations precede genome doubling during cancer evolution (Figure C). This suggests that biallelic inactivation of TSGs are early-events of cancer evolution and thus can be useful for cancer screening.



A) Pancancer two-hit frequencies of genes mapped to chromosome arms: distributions for other genes (grey box plots with outliers) are overlaid with values for tumor suppressor genes or TSGs (red) and oncogenes or ONGs (blue). TSGs with a statistically significant association between point mutations and deletions (FDR<0.05) are outlined in black.

B) Pancancer two-hit frequencies of TSGs associated with different point mutation categories.

C) Pan-cancer all-hit frequencies of TSGs in tumours with and without whole-genome duplication (WGD). Bubble size indicates the number of samples with point mutations, and bubble color represents the proportion of mutated samples with WGD.

PUBLICATIONS

1. Parida P, Mukherjee N, Singh A, Lewis S, Sharan K, Mallya S, Singh A, Das SS, Rao M, Higginson DS, Sabarinathan R, Damerla RR. Precise identification of viral–host integration events in HPV-positive cervical cancers by targeted long-read sequencing. Tumour Virus Research, 2025, 20:200325.
2. Singh AK, Walavalkar K, Tavernari D, Ciriello G, Notani D, Sabarinathan R. Cis regulatory effect of HPV integration is constrained by host chromatin architecture in cervical cancers. Molecular Oncology, 2024, 18(5):1189-1208.

Understanding Physical Control over Biological Behavior and Cellular State

Tapomoy Bhattacharjee

HONORS AND AWARDS

EMBO Young Investigator.

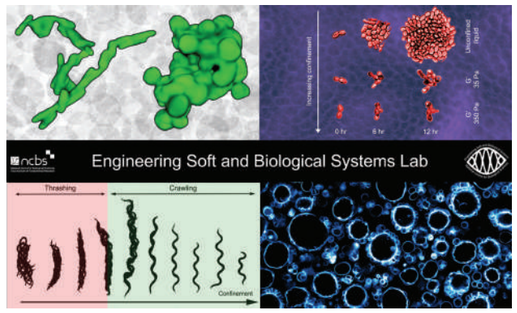
Merck Young Scientist Award for Scientific Excellence.

We aim to discover new physical and biological principles emerging from the interactions between living organisms and their complex, three-dimensional microenvironments.

Our group seeks to quantitatively elucidate generalizable biophysical principles governing growth, motility, and cellular state/fate across different biological scales. Leveraging state-of-the-art materials science, we engineer mechanically tunable 3D platforms that mimic the spatial architecture of natural niches such as soil, mucus, and tissues. Using these, we explore how the physical components of a microenvironment orchestrate biological behavior, as exemplified by two major research directions.

Physical confinement as an active modulator of growth and motility: Current understanding of environmental regulation over biological matter is largely based on chemical signalling, metabolic regulation, mechanotransduction, and inter-species interactions. While biochemical and multi-omics approaches focus on specific molecular agents, physical science approaches leverage the non-linear dynamics of living systems to learn new physics. In contrast, we have pioneered a conceptualization of physical microenvironmental properties as an active regulator of biological processes across scales. We show that 3D confinement acts as a selective pressure on bacterial communities, environmental mechanics govern transitions in nematode motility, and growth under confinement mechanically constrains cell cycle progression in yeast.

Combinatorial oxo-mechanical regulation dictates cell state: We have recently discovered a new paradigm of oxo-mechanical regulation where the cellular state is driven by combinatorial cues of oxygen partial pressures and microenvironment mechanics. Combining quantitative morphometries and multi-omics, we discovered that altered genomic accessibility driven by the cell's external mechanical milieu enables differential responses to oxygen availability. These findings will redefine how we interrogate and model biological events such as embryogenesis, wound healing, and cell fate transitions - all of which feature dynamically changing oxomechanical landscapes.



Physico-chemical regulation of life under confinement: Bacterial growth in mucus mimics reveals that 3D confinement selectively confers cell shape-dependent growth. Similarly, under elevated physical confinement a fundamentally unique mode of physical regulation over yeast budding emerges without invoking biochemical regulatory modules. Distinct modes of undulatory worm motion emerge under different degrees of physical confinement. Finally, our work on ovarian cancer spheroids reveals how distinct chemical cues reprogram cellular and multicellular phenotypes.

PUBLICATIONS

1. M Sreepadmanabh, M Ganesh, J Langthasa, R Bhat, T Bhattacharjee*; Distinct Chemical Cues Reprogram Cellular and Multicellular Phenotypes in Ovarian Cancer Spheroids; Small 21 (44), e06120.
2. M Sreepadmanabh#, Saheli Dey#, Sayan Kundu, Ashitha B. Arun, Sandhya P. Koushika, Shashi Thutupalli, Duncan Hewitt, and Tapomoy Bhattacharjee*; Physical Confinement Regulates Transitions in Nematode Motility; PRX Life 3, 043014.

Genetics and Development

Profiling of Aggressive Breast Tumours to Predict Treatment Response

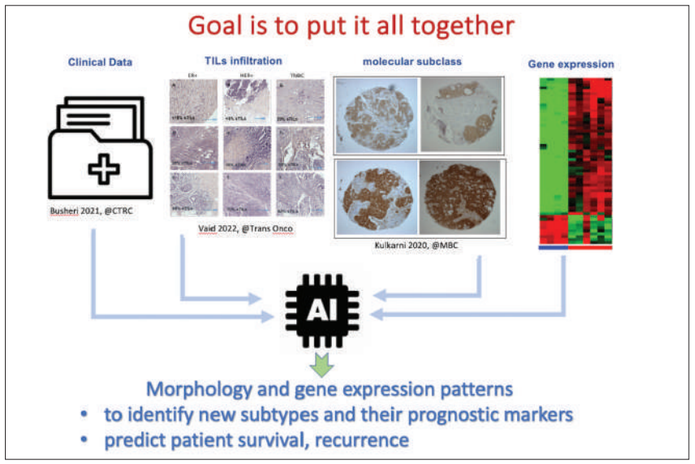
L S Shashidhara

Breast cancer is the commonest cancer worldwide, with 50% mortality in India. With the expected doubling of incidence in India, we need to streamline efforts to reduce this mortality.

There is an urgent need to combat the aggressive form of breast cancer in India that presents at younger age in high proportion. The studies that are undertaken will identify novel biomarkers to predict the aggressive subtypes of breast cancer:

- What are the molecular profiles of the aggressive breast cancer subtypes in India that we can identify as targetable with current clinical treatments that are already implemented in Western populations?
- Are there any novel molecular profiles within the Indian the aggressive breast cancer subtypes, which could be developed as prognostic and diagnostic strategies?

With these questions, profiling of the aggressive breast cancer subtypes with cellular and molecular markers is undertaken for the identification of distinct molecular characteristics within an Indian cohort that stratifies aggressive subset. Results so far have provided some leads that may facilitate the development of clinically implementable prognostic and therapeutic options for better clinical management, and hopefully, better long-term outcomes.



PUBLICATIONS

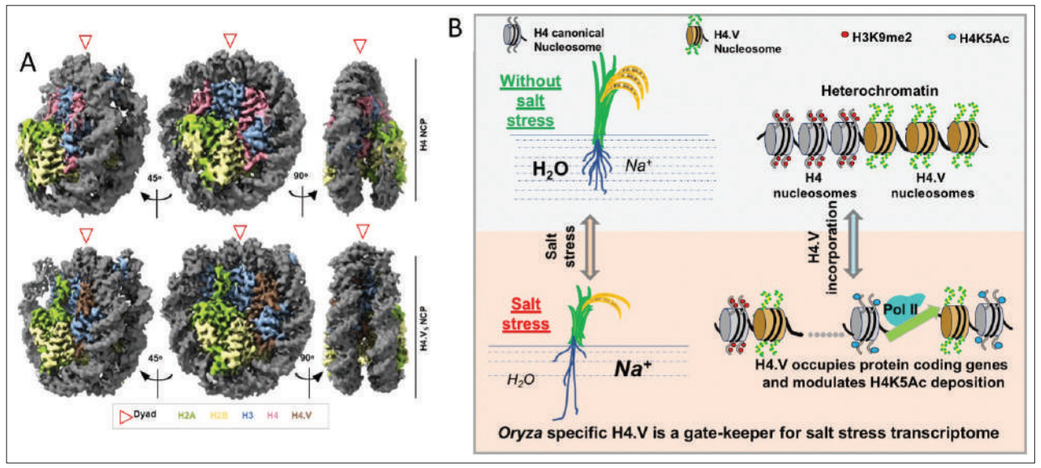
1. Pooja Vaid, Anirudha Puntambekar, Pranali Kanse, Shweta Kadu, Piyush Agrawal, Aditi Khatpe, Rituja Banale, Ruhi Reddy, Devaki A. Kelkar, Sridhar Hannenhalli, L S Shashidhara, Chaitanyanand Koppiker and Madhura Kulkarni. "Molecular Profiling of a Triple-negative Breast Cancer Cohort in India for EGFR and AR expression analyzed for patient outcomes showed a distinct subset of cellular co-expression." Submitted to Journal of Pathology & Clinical Research and MedRxiv, 2024.10. 25.24316141.
2. Bhavesh Vasave, Rishabh Kulkarni, Aadya Atreya, Dr. C. B. Koppiker, L S Shashidhara, Madhura Kulkarni. "Investigation of Regulation of YAP Driven Tumorigenesis by Promoter Proximal Pausing Complex in breast cancer." Submitted to Review Commons.

Epigenetics and Small Silencing RNAs

P V Shivaprasad

A number of epigenetic regulatory layers are superimposed on the genome. We study mechanisms of small (s)RNA-mediated epigenetics and other signalling pathways, focusing on the functional significance of these regulatory layers.

sRNAs are a group of key molecules resulting from RNA silencing pathways. They regulate transcription and translation of their target RNAs by associating with Argonaute protein effectors. sRNAs are also important factors in initiating and maintaining heritable changes in gene expression without changes in DNA sequence ('epigenetics'). sRNAs and epigenome modifications impact every aspect of eukaryotic development and disease. Our laboratory is interested in understanding the pathways and mechanisms that generate sRNAs and epigenome modifications in plants. We use various biochemical, genetic, bioinformatic, and whole-genome approaches in a wide variety of model organisms. During the reporting period, we have discovered the role of a transcription factor named WRKY53 that plays a key role in a cascade of peptide mediated signalling operating in rice upon wounding (Harshith et al., 2024; Harshith et al., 2025). We also identified functions of chromatin remodelers named CLS3 and CLSY4 that are upstream players regulating genome imprinting and rice grain quality (Pal et al., 2024; Pal et al., 2025). We also identified the first histone H4 variant named H4.V among plants and identified its structural and biochemical properties that make it a unique histone variant (Gandhivel et al., 2025). H4.V is a gatekeeper for active H4K4me3 marks, playing a pivotal role in salt stress signalling (*Figure 1*).



Novel Histone variant H4.V is a gatekeeper for salt stress transcriptome. A. CryoEM structures of canonical (top) and variant (bottom) nucleosome core particles. B. Schematic showing how H4.V activates salt stress specific genes. Adopted from Gandhivel et al., 2025.

PUBLICATIONS

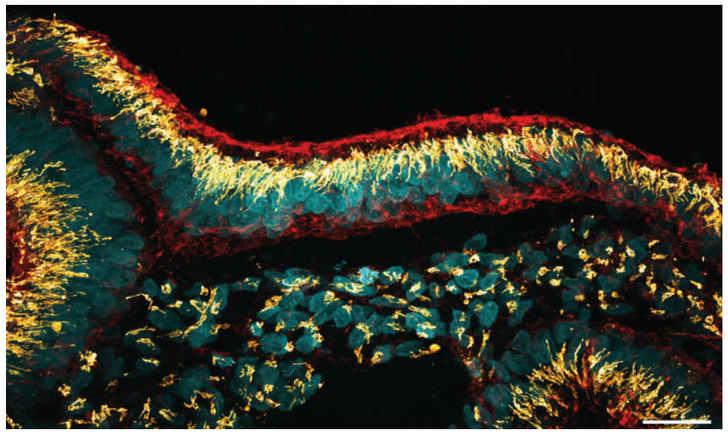
1. Hari Sundar G Vivek, Paula Sotelo-Parrilla, Steffi Raju, Shaileshanand Jha, Anjitha Gireesh, Fabian Gut, K.R. Vinothkumar, Frédéric Berger, A. Arockia Jeyaprakash, P.V. Shivaprasad. Oryza genera-specific novel Histone H4 variant predisposes H4 Lysine5 Acetylation marks to modulate salt stress responses. Nature Plants, 2025, 11:790-807.
2. Avik Pal, Vivek Hari Sundar, Amruta Nair, P.V. Shivaprasad. Upstream regulator of genomic imprinting in rice endosperm is a small RNA-associated chromatin remodeler. Nature Communications, 2024, 15:7807,.

How the Inner Ear Takes Shape

Raj Ladher

We are using the inner ear to understand how developmental signals transform embryonic cells into the complex organs, focusing on integrating cellular identity and shape in morphogenesis and function.

We study how a simple patch of cells transforms into the complex structure of the inner ear. These cells, originally destined to become skin, receive a series of developmental signals that change their identity, shape, and behavior — ultimately giving rise to sensory hair cells that convert sound vibrations into electrical signals for the brain. Using molecular, cellular, imaging, and computational approaches, we aim to uncover how developmental programs guide these remarkable transformations and drive the morphogenesis of the inner ear.



An otic vesicle undergoing epithelial fusion, stained for Cdh1 (red), Laminin (magenta), F-actin (green), and nuclei (cyan). The otic placode forms in the surface ectoderm, pseudo-stratifies and then invaginates to create a cup that closes into a vesicle. As the vesicle fuses and separates from the surface ectoderm, the edge cells temporarily acquire partial epithelial-to-mesenchymal characteristics (Tamilkumar et al., 2025).

Section through the otic place, the precursor of the inner ear. Shown is staging for actin filaments (in red), the nucleus (in cyan) and the Golgi apparatus (in gold). The otic placode consists of elongated epithelial cells that have long filamentous golgi cisternae. From Shivangi Pandey.

HONORS AND AWARDS

TIFR – B. M. Udgaonkar Excellence in Teaching Biology.

President, Indian Society for Developmental Biology.

PUBLICATIONS

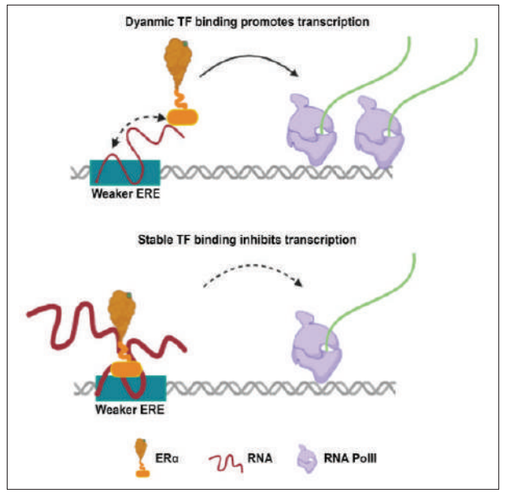
1. Tamilkumar VN, Purushothama H, Ladher RK. Epithelial fusion is mediated by a partial epithelial-mesenchymal transition. Biol Open. 2025 Sep 15;14(9):bio062213. doi: 10.1242/bio.062213.
2. Kaushik R, Pandey S, Prakash A, Ganatra F, Abe T, Kiyonari H, Ladher RK. Role of Pcdh15 in the development of intrinsic polarity of inner ear hair cells. PLoS Genet. 2025 Aug 13;21(8):e1011825. doi: 10.1371/journal.pgen.1011825.
3. Prakash A, Raman S, Kaushik R, Manchanda P, Iyer AS, Ladher RK. Coupling between spatial compartments integrates morphogenetic patterning in the organ of Corti. PLoS Biol. 2025 Sep 9;23(9):e3003350. doi: 10.1371/journal.pbio.3003350.

Distal Enhancers and RNA Dynamics in Hormone-Induced Gene Transcription

Dimple Notani

My group is interested in understanding the dynamic interplay between regulatory elements, non-coding RNAs, and chromatin-architecture in signaling-driven gene regulation.

Ligand-induced transcriptional responses are orchestrated by distal regulatory elements called enhancers. These responses, particularly to hormones, are often rapid and depend on swift transcription factor (TF) binding at cognate enhancers, followed by communication with promoters that display burst-like transcriptional activity. Traditionally, strong and stable TF binding at high-affinity DNA motifs was considered essential for robust gene activation. However, recent findings from our lab and others show that many functional enhancers unexpectedly harbor weaker TF motifs.



Binding of estrogen-activated transcription factor, ERα is stabilized at weaker motifs via its interaction with RNA. This RNA mediated stabilization of ERα on chromatin fine-tunes ligand induced transcription of estrogen responsive genes (Soota et al., 2024).

We recently discovered that such weak motifs, with the assistance of enhancer RNAs (eRNAs), play a critical role in facilitating fast and dynamic transcriptional responses. These RNAs interact directly with TFs, stabilizing binding at weak sites and enabling efficient promoter communication. Our results reveal that RNA functions as a molecular modulator, promoting timely transcriptional bursts during acute ligand signaling. Evolution may have favored weak motifs because they provide flexibility and reversibility, particularly in transitioning between acute and chronic signaling states.

HONORS AND AWARDS

India Alliance DBT-Wellcome Trust Senior Fellowship.

INSA Associate Fellow.

INSA Distinguished Lecture Fellowship.

PUBLICATIONS

1. Bohra D, Islam Z, Nidharshan S, Mazumder A, Notani D. Acute Activation of Genes Through Transcriptional Condensates Impact Non-target Genes in a Chromatin Domain. eLife, 2025, 13:RP102417. doi: https://doi.org/10.7554/eLife.102417.2.
2. Soota D, Saravanan B, Mann R, Kharbanda T, Notani D. 2024. RNA fine-tunes estrogen receptor-alpha binding on low-affinity DNA motifs for transcriptional regulation. EMBO Journal, 2025, 43(21), 5186-5210. doi: https://doi.org/10.1038/s44318-024-00225-y.

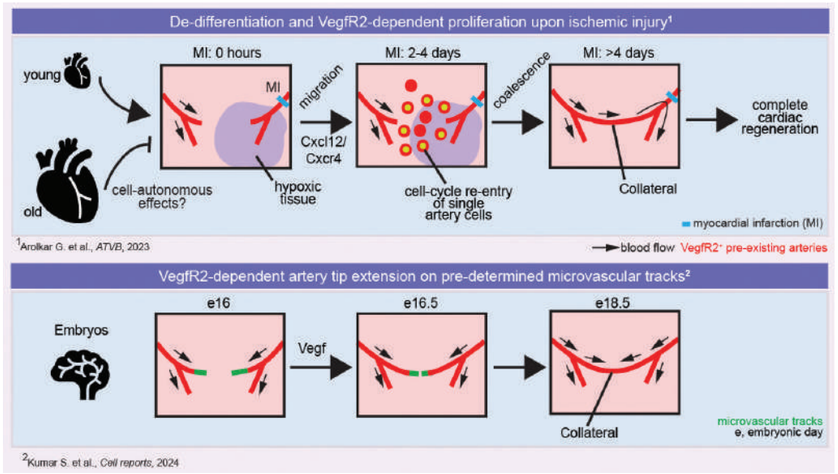
Investigating the Role of Endothelial Cells in Vascular Growth and Regeneration

Soumyashree Das

We investigate mechanisms by which arteries are built, maintained, and remodeled in response to biological cues. We also study how formation of new arteries contribute to tissue regeneration.

Our group studies how arteries develop, sustain, and remodel. Specifically, we investigate cellular mechanisms, molecular drivers, and physiological triggers which facilitate the *de novo* formation of collaterals. Collateral arteries are life-savers during myocardial infarction or stroke where an artery is occluded. Using mouse genetics, single cell RNA sequencing analyses and whole heart confocal imaging at single-cell resolution, we show that young mouse artery cells can de-differentiate and proliferate in response to myocardial infarction; a phenomenon absent in older hearts. Using *in vivo* live imaging of mouse embryos, we show that artery cells extend on pre-determined microvascular tracks to build pial collaterals in brain. Our study reveals that Vegf/VegfR2 axis facilitates pial artery-tip extensions in the developing brain, but drives coronary proliferation in injured hearts.

Thus, while developmental pathways reactivate in response to injury, their mode of action may be distinct. Together, our work suggests organ-specific mechanisms drive collateral formation in the heart and brain.

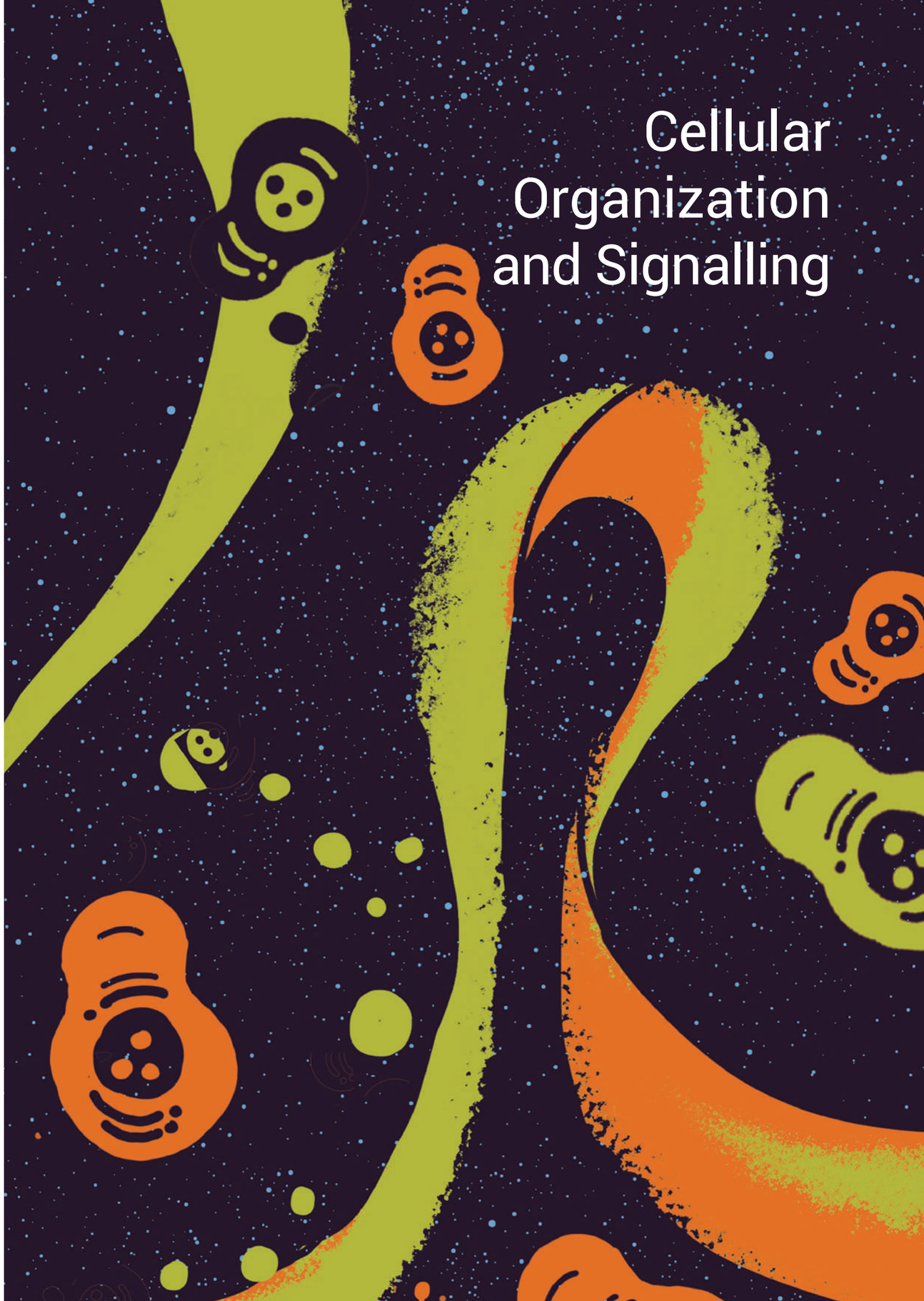


KEY FINDINGS

- Collateral building mechanisms are organ-specific.
- Arterial plasticity determines regenerative capacity.
- Vascular growth guides tissue repair.
- Developmental pathways reactivate during regeneration.

PUBLICATIONS

1. Ghosh S, Bishnoi B, Das S. Artery regeneration: Molecules, mechanisms and impact on organ function. Seminars in Cell & Developmental Biology, 2025.
2. Kumar S, Ghosh S, Shanavas N, Sivaramakrishnan V, Dwari M, Das S. (2024). Development of Pial Collaterals by Extension of Pre-existing Artery Tips. Cell Reports, 2025.



Mechanisms of Membrane Organization and Endocytosis

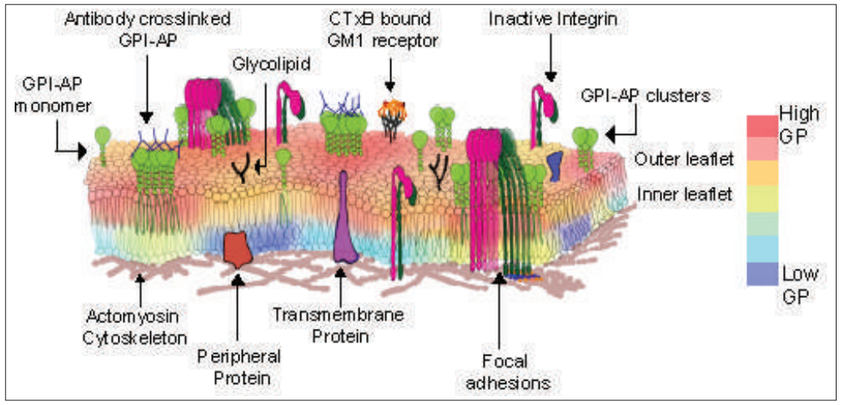
Satyajit Mayor

Our laboratory studies physico-chemical rules that govern organisation of cell membrane components in a living cell and how this connects to cellular and organismal physiology. In this context we explore how functional signalling complexes and responsive endocytic platforms are built.

The plasma membrane that demarcates the boundary of a cell is a macromolecular assembly teeming with activity and local heterogeneities. It is the site where information transfer and endocytic activities take place modulated by the local organization and structure of the membrane. By studying the membrane *in vivo* and *in vitro*, our laboratory has provided a new understanding of the membrane as an asymmetric lipid bilayer, which behaves as an active composite in conjunction with the energy consuming cortical actin scaffold building nanoscale clusters and mesoscopic domains (nano-hubs, aka *active emulsions*) [1, 2]. We hypothesize that information flow across the membrane is mediated by the creation of these nanoclusters and their spatial regulation in the cell membrane. In parallel we continue to study the mechanism and function of a specific clathrin and dynamin-independent endocytic process involved in regulating global composition and tension in the cell. This endocytic process has been implicated in cell migration by regulating integrin receptors at the cell surface, and in building a multi-tiered morphogen gradient by promoting the internalizing of the Wingless morphogen via a non-signalling receptor.

HONORS AND AWARDS

Leverhulme International Professorship awarded by the Leverhulm Trust to be held at the University of Warwick, UK, 2024-2029



Schematic shows the asymmetric membrane bilayer of a living cell as visualized using a new solvatochromic probe that responds to lipid packing (low to high GP values) developed in the laboratory (see *https://doi.org/10.1101/2024.07.23.604763*)

PUBLICATIONS

1. Asokan MS, et. al., Mayor S. Immunogenicity of SARS-CoV-2 vaccines BBV152 (COVAXIN®) and ChAdOx1 nCoV-19 (COVISHIELD™) in seronegative and seropositive individuals in India: a multicentre, nonrandomised observational study. Lancet Reg Health Southeast Asia. 2024 Feb 27;22:100361. doi: 10.1016/j.lansea.2024.100361. PMID: 38482152.
2. MacDonald E, et. al. Growth factor-triggered de-sialylation controls glycolipid-lectin-driven endocytosis. Nat Cell Biol. 2025 Mar;27(3):449-463. doi: 10.1038/s41556-025-01616-x. Epub 2025 Feb 21. Erratum in: Nat Cell Biol. 2025 Mar;27(3):545. doi: 10.1038/s41556-025-01643-8. PMID: 39984654.

Phosphoinositide Signalling in Cell Biology

Raghu Padinjat

Chemical messengers derived from phosphatidylinositol are an evolutionarily conserved mechanism of signalling. They regulate key cellular and biological processes. We study the logic underlying lipid signalling and its relevance to biomedical science.

Our long-term scientific interest is to understand cellular communication mediated by lipid molecules generated by the metabolism of phosphatidylinositol. Phosphoinositide signals provide molecular control for key subcellular processes such as membrane remodelling, cytoskeletal function, transcription, and translation. Through these processes, this signalling pathway orchestrates basic cellular behaviours such as cell division, shape changes, polarised movement, and cell death; and these behaviours play key roles in a number of physiological processes including early embryogenesis, lymphocyte development, and function, as well as neuronal activity.

Image: Vaisaly R Nath, Padinjat lab, National Centre for Biological Sciences.

The overall goal of our work is to understand how the architecture of this signalling cascade is designed to optimally deliver physiological outputs. The work is multidisciplinary and done using a combination of Drosophila and human disease models. Over the last year, we have uncovered the function of key enzymes that regulate lipid signalling and provided a molecular mechanism by which they control cellular processes. These include the mechanism by which lipid molecules are exchanged between cellular compartments, the control of membrane turnover and receptor activity by lipids, and a quantitative model of the turnover of lipids during critical cell signalling reactions important for brain function.

We also study the function of phosphoinositides in neuronal cell biology and brain disorders using human iPSC-derived neural cells in cell culture. The goal of this work is to uncover the function of altered phosphoinositide signalling in brain disorders.

Merged confocal microscopy image of an adult *Drosophila* eye. The individual ommatidia that make up the compound eye are seen as repeating units. In each ommatidium the expanded apical plasma membrane of the photoreceptor folded into microvilli; seven rhabdomeres are seen per ommatidium. Image depicts the localization of the calcium-binding mutant of the membrane contact site protein, dEsyt (Cyan), RDGB (green) and phalloidin labelling F-actin (Red).

PUBLICATIONS

1. Krishnan H, Suhail Muzaffar S, Sharma S, Ramya V, Ghosh A, R Sowdhamini, R & Raghu P*. The conserved biochemical activity and function of an early metazoan phosphatidylinositol 5 phosphate 4-kinase regulates growth and development. J.Cell.Sci. 2025 138, jcs263881. doi:10.1242/jcs.263881.
2. Nath VR, Krishnan H, Mishra S, Raghu P*. Ca^{2+} binding to Esyt is required to modulate membrane contact site density in *Drosophila* photoreceptors. J.Cell.Biol. 2025 224 (5): e202407190. https://doi.org/10.1083/jcb.202407190.

Cell Biology of Host-Pathogen Interactions

Varadharajan Sundaramurthy

The broad goal of our lab is to understand the interactions between the intracellular pathogens and host cells at multiple levels (molecular, cellular, tissue) and exploit this knowledge for host-directed therapeutics against infectious diseases.

The broad goal of our lab is to understand the pathogenesis mechanisms of intracellular pathogens and the ways in which they modulate fundamental host cellular processes. Of particular interest for us is the modulation of host trafficking pathways such as endocytosis, lysosomes, and autophagy during bacterial (M. tuberculosis) and viral (SARS-Cov2) infections, both in cell culture and animal models of infection. Simultaneously, we aim to exploit this knowledge for drug discovery to identify small molecules that can be used as adjuncts in host directed therapeutics.

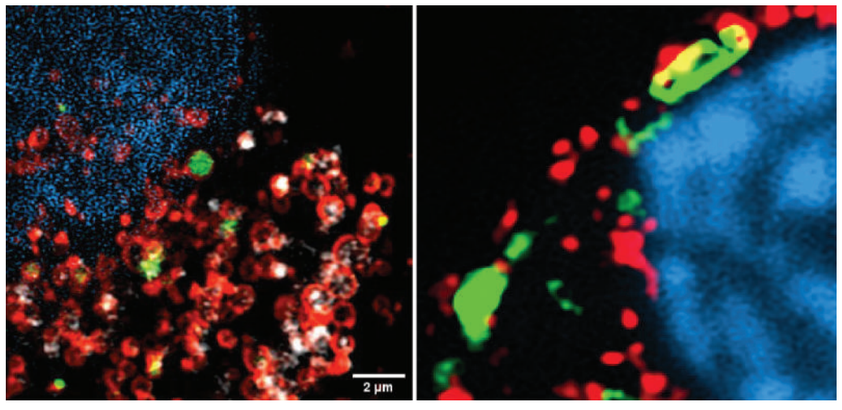
Our recent results show a dramatic rewiring of lysosomal pathways during infection; concomitantly, endosomal and autophagic pathways are actively altered by, and alter the infection dynamics. We are trying to understand these modulations from both the host and the pathogen perspectives.

Ongoing projects are centred on the following questions:

A) How and why does Mtb infection remodel lysosomes?

B) What are the causes and consequences of cell to cell variability of endocytosis during intracellular infections?

C) Mechanisms of drug tolerance for Mtb in vivo.



Mammalian cells stained for lysosomes (red) containing different cargo (green, white) in the left panel, or interacting with mitochondria (green) in right panel. Cell nucleus is shown in blue.

PUBLICATIONS

1. Combating Tuberculosis: Obstacles, Innovations, and the Road Ahead. Sundaramurthy V, Strauss E. ACS Infect Dis. 2025 Jul 11;11(7):1754-1755. doi: 10.1021/acsinfecdis.5c00495. PMID: 406412912.
2. *M. tuberculosis* surface sulfoglycolipid SL-1 activates the mechanosensitive channel TRPV4 to enhance lysosomal biogenesis and exocytosis in macrophages. Umar I, Gulzar SE, Sundaramurthy V. Mol Biol Cell. 2025 Jun 1;36(6):ar76. doi: 10.1091/mbc.E24-12-0560. Epub 2025 Apr 30. PMID: 40305098.

Understanding How Microbes Maintain and Modify Their Genomes

Anjana Badrinarayanan

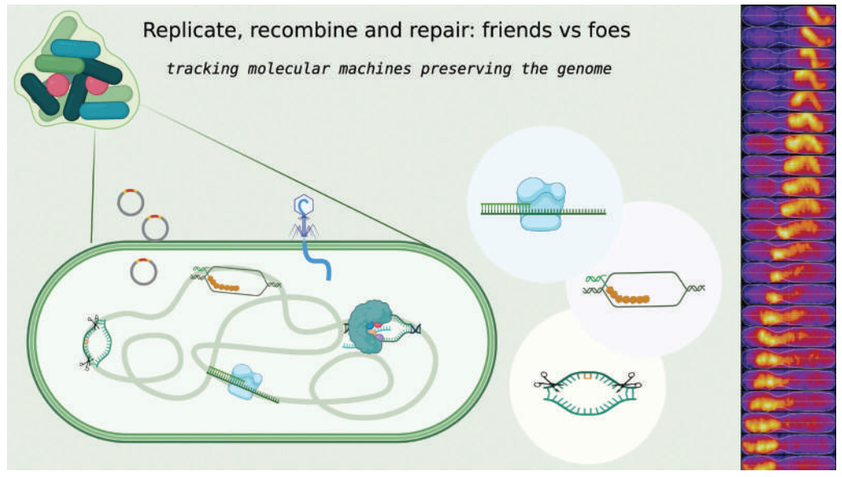
DNA underpins life and must be faithfully preserved. Constant stress challenges genomes. Though costly, this also enables change. In bacteria, this capacity drives rapid adaptation across varied, often hostile environments.

Our lab studies the molecular mechanisms that maintain and modify microbial genomes, with a focus on DNA replication, recombination, and repair. These processes not only preserve genome integrity but also generate diversity that fuels evolution and antibiotic resistance. We are particularly interested in how these pathways shape the structure and dynamics of the bacterial chromosome and how they interact with extrachromosomal elements like plasmids and bacteriophage genomes. By understanding how cells manage and respond to these dynamic DNA elements, we aim to uncover fundamental principles of microbial survival and adaptation.

HONORS AND AWARDS

Eric and Wendy Schmidt Global Faculty Fellow (Imperial College, London).

Editorial board member, PLOS Biology.



The schematic illustrates the pathways of DNA replication, recombination, repair, and transcriptional responses to stress that are essential for genome maintenance. Apart from acting on the bacterial genome, these pathways are also regulated during acquisition of horizontal DNA, for example, during phage infection or uptake of plasmids. The panel on top shows a kymographic representation of a time lapse movie of the recombination protein RecA during homology search.

PUBLICATIONS

1. Adhikashreni I, Joseph A, Phadke S and Badrinarayanan A. *Live-tracking of replisomes reveals nutrient-dependent regulation of replication elongation rates in Caulobacter crescentus*., Current Biology. 2025 Mar 27:S0960-9822(25)00294-5. doi: 10.1016/j.cub.2025.03.009.
2. Seshadri A and Badrinarayanan A. *Exonuclease action of replicative polymerase gamma drives damage-induced mitochondrial DNA clearance*., EMBO Reports. Jan 31. 2025 doi: 10.1038/s44319-025-00380-1.

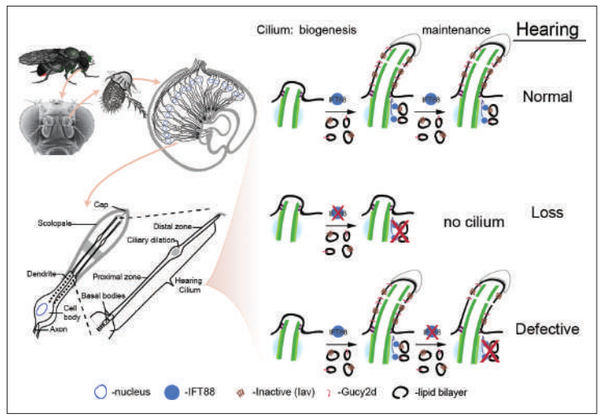
Organelle Biology: In Physiology and Diseases

Swadhin Jana

The Organelle Biology Laboratory (OBL) investigates mechanisms for building, diversity, evolution, and maintaining organelles, primarily cytoskeleton, centrosome, and cilium (i.e., 3Cs), in various organisms (growing in distinct environmental conditions) using a multifaceted approach.

Essential eukaryotic structures, the cytoskeleton, centrosome, cilium, mitochondria and lysosome, are implicated in numerous human diseases, including degenerative diseases, cancer and ciliopathies (combined affect one in every three individuals). Despite these organelles' importance to human health, our knowledge of their roles in pathologies is limited.

The OBL primarily focuses on the Cytoskeleton, Centrosome and Cilium (3Cs) and their involvement in numerous signalling processes vital for organism development and homeostasis. We, for example, ask



Summary of our findings reported in *Werner S et al., 2024, LSA*

1) What controls the organisation of several critical building blocks of the 3Cs?
2) How are different portions of these structures assembled?
3) How are these vital structures maintained and go wary with pathological conditions?

We have been applying various approaches/ techniques/tools (including bio-physics, bio-chemistry and bio-informatics, genetics, transcriptomics, proteomics, advanced imaging, electrophysiology and animal behaviour) in various organisms (prevailing in distinct environmental conditions).

HONORS AND AWARDS

Following Research Grant(s) were completed with good evaluation:

1. Principal Investigator, Mechanisms of maintenance of cilia and their consequences on the organism's homeostasis, Funder: FCT (Portugal, Horizon 2020). Completed: 2024.

Following Research Grant(s) are/were ongoing/initiated through/on 2024:

1. Principal Investigator, Deciphering the roles of yet underappreciated ciliopathy-related proteins in centrosome-cilium assembly and homeostasis in Drosophila, Funder: CEFIPRA (Indo-French), Ongoing.
2. Principal Investigator, Mechanistic Insight into Mono-to-Oligogenic Inheritance Patterns in Ciliopathies, Funder: DBT (India), Ongoing.
3. Co-Principal Investigator, (Micro) Biology of the Abysss: Equi-pressure sampling and bio-diversity quantification, Funder: MoES (India), Ongoing.
4. Co-Principal Investigator, Elucidating molecular mechanisms of chromosome segregation by in vitro reconstitution of kinetochore-microtubule interactions, Funder: SERB/ANRF (India), Ongoing.

PUBLICATIONS

1. Active EB1 surges promote tubulin influx into the growing outer segments of the bipartite olfactory cilia in *Drosophila*. Agarwal RG, Iyer D, Barbora A, Gadgil Y, Jana SC , Ray K . Preprint. DOI: 10.1101/2024.09.10.612170.
2. IFT88 maintains sensory function by localising signalling proteins along Drosophila cilia. Werner S, Okenve-Ramos P, Hehlert P, Zitouni S, Priya P, Mendonça S, Sporbert A, Spalthoff C, Göpfert MC, Jana SC , Bettencourt-Dias M . Life Science Alliance. 2024-05 DOI: 10.26508/lsa.202302289.

The Molecular Foundations of Fungal Pathogenesis

Amey Redkar

We are interested in understanding the genetic and molecular basis of plant infections by fungal pathogens and use pathogenomics to identify effectors and unravel the molecular processes that provoke plant diseases.

Fungi have a devastating impact on human nutrition and health. Each year, fungal pathogens provoke enormous agricultural losses and impose a major threat to public health. Yet, how fungal pathogens have evolved the ability to colonize plants remains elusive. Our work elucidates the fungal crosstalk with roots, which determines compatibility, targeted by pathogenic effectors, and the signal transduction during host re-programming. We aim to identify the host signals, that succeeds the fungus to reach the vasculature and cause systemic infections. To understand the evolution of pathogenicity that adapts fungi to xylem, we explore evolutionary plant microbe interactions (EvoMPMI) by using phylogenomics.

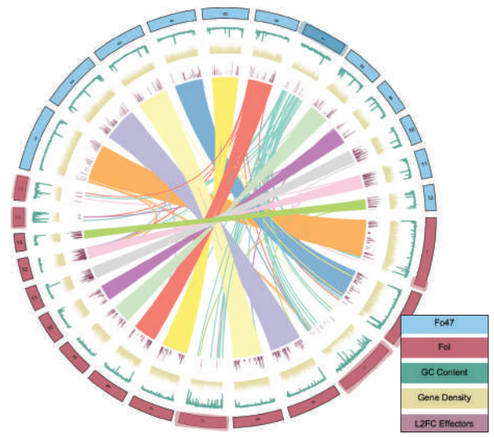
A key highlight from this year, is our work on understanding how fungal pathogens adapt to evolutionarily distant plant lineages to establish broad-spectrum associations. We have defined a core effector complement shared across different isolates of the vascular wilt fungus *Fusarium oxysporum* (Fo) and have unravelled effector clusters across the three highly syntenic fast-core chromosomes that show an enhanced transcriptional activation, to execute a role in plant associations across evolutionarily divergent host lineages and lifestyles. Our findings have revealed an unexpected role of these fast core chromosomes in fungi, for establishing compatibility across diverse plants and define evolutionarily conserved gene networks essential for fungus-plant associations.

HONORS AND AWARDS

Max Planck Partner Group Award, Max Planck Society, Germany (2025-30).

India Bioscience Outreach Grant, DBT, India (2024-25).

Member, Screening-cum-Selection Committee for Climate Resilient Agriculture BioE3, DBT-India (2025-onwards).



Genes encoded on fast core chromosomes drive plant associations in F. oxysporum: Circos plot showing synteny between genome assemblies of F. oxysporum isolates Fol and Fo47. Blue/Red, Karyotypes of assembled chromosomes; Green, GC content (%); Yellow, Gene density, both calculated in 10 kb windows; Mauve, Log2FC of in planta upregulated genes encoding predicted secreted proteins, for the sake of visibility, gene -start and end- were multiplied by 10 to increase the effective gene length; Syntenic relationships shown by linking syntenic gene blocks (single copy orthogroups) in each genome pair. Core chromosomes can be identified through synteny between Fol and Fo47, whereas accessory chromosomes show no or reduced synteny. Lineage-specific regions are highlighted.

PUBLICATIONS

1. Srivastava V, Kaushik Siddharth L. S., Zechmann B, Pullagurla N.J, Di Pietro A, Laha D, Redkar A. Transcriptional plasticity of fast core chromosomes governs establishment of a fungal pathogen on evolutionarily distant plant lineages. Biorxiv 10.1101/2025.03.27.645276v1 2025.
2. Chhillar H, Jo L, Redkar A, Kajala K, Jones JDG, Ding P*. Cell-type specific execution of effector-triggered immunity. Biorxiv 10.1101/2025.06.28.662111 2025.

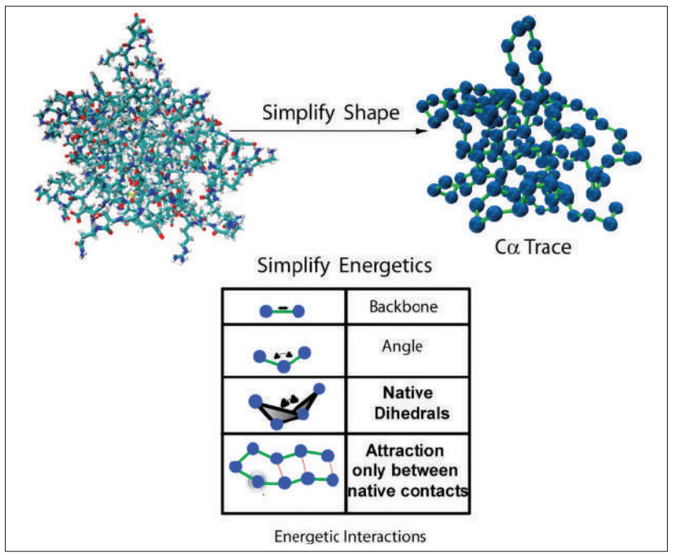
Theory, Simulations and Modeling of Biological Systems

Computational Dynamics of Biomolecular Self-Assembly

Shachi Gosavi

My group uses computational methods, specifically molecular dynamics simulations of coarse-grained and structure-based models, to understand the dynamics of protein folding and self-assembly.

Natural proteins fold robustly because of a funnel-shaped energy landscape. This funnel shape arises because native interactions dominate the folding landscape, while interactions not present in the native state (i.e. non-native interactions) contribute only in an average way. Structure based models (SBMs) of proteins ignore non-native interactions by encoding only the folded structure of the protein into the energy function. This energy function can then be used to perform molecular dynamics (MD) simulations. The advantage of using SBMs is that they simplify the energy function such that long time-scale biomolecular motions such as protein folding, large conformational transitions and protein self-assembly can be easily sampled. We have been using and developing SBMs to understand mechanisms of biomolecular self-assembly, including those of multimerization and domain-swapping in viral proteins and how pieces of a protein (self-peptides) interact with the whole protein.



Cartoon of a structure-based model coarse-grained to a single Cα bead per residue.

PUBLICATIONS

1. S Lall, P Balaram, MK Mathew, S Gosavi, Sequence of the SARS-CoV-2 Spike Transmembrane Domain Encodes Conformational Dynamics, The Journal of Physical Chemistry B 129, 194-209, 2024.

The Whats, Hows and Whys of the Eukaryotic Cell Plan

Mukund Thattai

We use the membrane traffic system as a window to study the mechanistic and evolutionary origins of the eukaryotic cell plan, using tools from mathematics, physics, and computer science.

As a physicist practising biology, I am interested in how cellular complexity emerges from molecular rules. My group is based within the Simons Centre for the Study of Living Machines at NCBS. We use biophysical, mathematical, and computational principles to understand how cells work. We have been deeply involved in developing evolutionary cell biology as a rigorous field of study.

We ask:
What? We study the evolution of proteins involved in membrane traffic, to shed light on the natural history and diversity of this system across species and time.

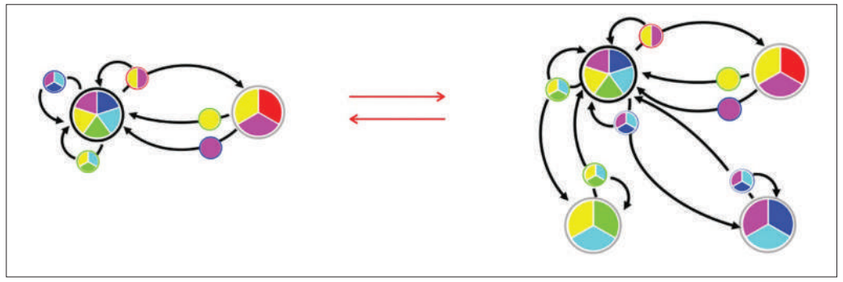
HONORS AND AWARDS

Infosys Prize in Physical Sciences, 2023.

Fellow, Indian Academy of Sciences.

How? We use mathematical and computational methods to understand how the global structure of the membrane traffic system emerges from local molecular interactions.

Why? We explore the selective advantage of having intracellular organelles and intra-organellar transport, with particular focus on the structure and function of the Golgi apparatus.



The eukaryotic endomembrane traffic consists of membrane-bounded compartments that exchange matter via transport vesicles. These systems can be abstractly represented and analysed as directed graphs, with different colours corresponding to different types of molecular cargo. We study how new compartments and exchange fluxes can be added to these systems over evolutionary time, driven by the duplication and diversification of vesicle traffic regulatory genes.

PUBLICATIONS

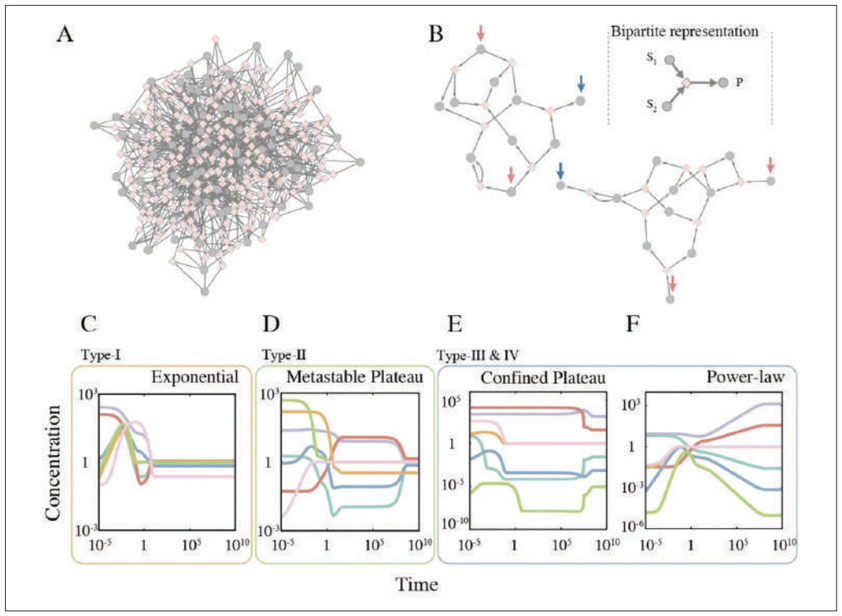
1. Thattai, M. A Tubules-First Model for the Origin of Eukaryotic Membrane Traffic. EcoEvoRxiv, to appear in Annual Reviews of Biophysics 2026.
2. Thattai, M. (2024) Wisdom of (molecular) crowds: How a snake's temperature-sensing superpower separates information from mis-information. J Biosciences 49:83.

Non-equilibrium Dynamics of Living Systems Across Scales

Sandeep Krishna

I study the complex, far-from-equilibrium dynamics of biological systems, ranging from gene networks to cells to populations.

At the sub-cellular level, I use a combination of experimental data and mathematical models to study the dynamics of gene regulatory networks, metabolic networks, and oscillatory signalling pathways. At a cellular level, I examine decision-making, such as the lysis-lysogeny decision in bacteriophage infections. Finally, at an ecosystem level, I have been studying microbial and ecological communities to understand phenomena related to cooperation, communication and symmetry breaking in populations.



In ref [2] we characterize the out-of-steady-state behavior of a class of artificial chemical reaction networks consisting of the ligation and splitting reactions of polymers. Within this class ((A) shows the complete chemical network for polymers of length 6), we examine minimal networks (such as those shown in B)) that can convert a given set of nutrients (red arrows) to a specified set of biomass precursors (blue arrows).

We find three distinct types of relaxation dynamics after a large perturbation from a steady-state (C-F): exponential-, power-law-, and plateau-dominated. We computationally show that we can predict this dynamical behavior from simple features of the network's stoichiometric matrix. Our work builds a theoretical basis for understanding non-equilibrium dynamics in complex metabolic networks.

PUBLICATIONS

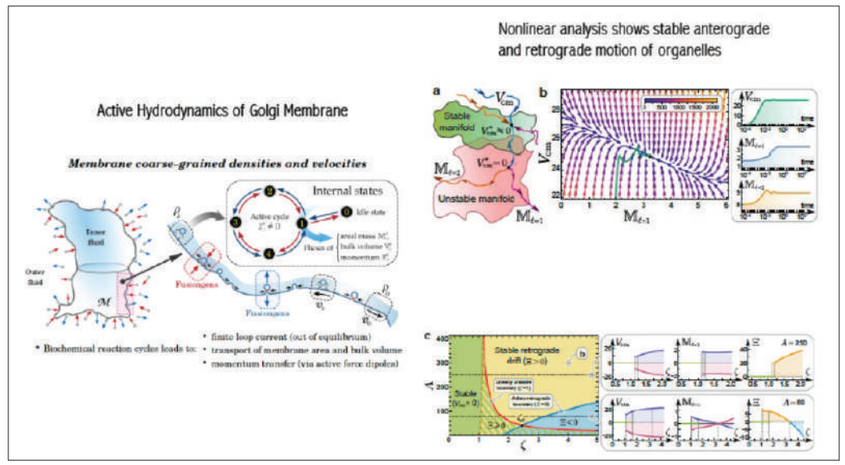
1. S Buddh, S Krishna, D Agashe Oikos, Density dependent survival drives variation in density dependent population growth of an insect pest, 2024,12: e10813.
2. Y Himeoka, JB Kirkegaard, N Mitarai, S Krishna, Roles of network topology in the relaxation dynamics of simple chemical reaction network models, Scientific Reports, 2024, 14 (1): 22187.

Theoretical Approaches in Cell Biology: Physics of Active, Evolving Systems

Madan Rao

We look for new physical principles underlying the non-equilibrium organisation of the living state, arising from the interplay between active mechanics, molecular organisation, geometry, information processing, and control in diverse cellular contexts such as the cell surface, cytoskeletal patterning, chromatin organisation, organelle biogenesis, and tissue morphogenesis.

How do living systems, driven far from equilibrium, self-organise (evolve) to perform, "engineering tasks", such as information processing, computation, and control? We explore new physical principles underlying biological organisation across scales, from functional biomolecules, to subcellular, cellular, and tissue scale organisation. We study the mesoscale organisation at the cell membrane driven by active stresses arising from the actomyosin cortex, leading to active segregation and active emulsions. We are interested in the emergence and inheritance of intracellular patterning, e.g., the nonequilibrium assembly and morphodynamics of a system of organelles, such as the Golgi. We work on the dynamics of the active cytoskeleton and cellular force patterning. We have been studying the morphogenesis, patterning, excitability, and homeostatic control in epithelial tissues, driven by an interplay between active mechanics and geometry. A recent focus has been cellular inference and control in the context of tissue development. In addition, we study the unusual mechanical response, segregation, and pattern formation in active soft matter, that exhibit non-reciprocity, enhanced memory, and fragile elasticity. Our theoretical studies are often supported by collaborations with experimental groups.



PUBLICATIONS

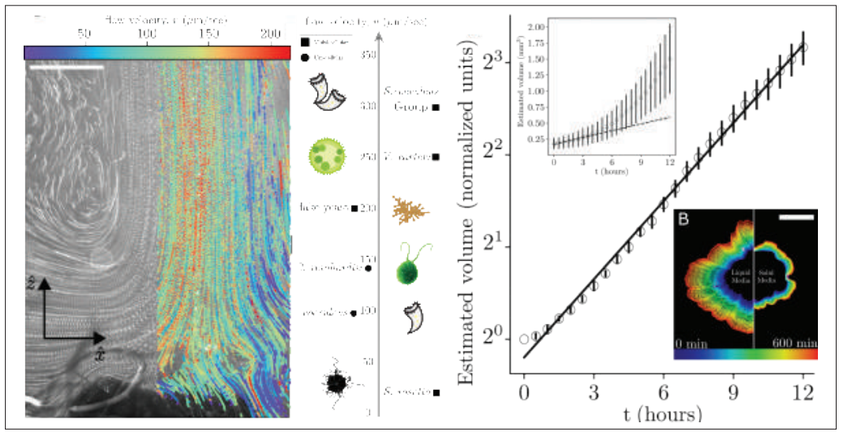
1. Gowrishankar K, Rao M. Cortical actin and the spatiotemporal organisation of cell surface molecules. Nature India. 2024 Jan 2.
2. Prakash A, Weninger J, Singh N, Raman S, Rao M, Kruse K, Ladher RK. Junctional force patterning drives both positional order and planar polarity in the auditory epithelia. Nature Communications. 2025 Apr 26;16(1):3927.

Living Metamaterials: Towards a Synthetic Biology from a Physical Perspective

Shashi Thutupalli

We are interested in the underlying principles of emergence and organization in living systems—towards this goal, we develop quantitative experiments combined with conceptual frameworks.

A key highlight this year addresses a century-old question: how nascent multicellular organisms overcome biophysical constraints on nutrient transport, a central challenge for multicellularity. Our work offers a novel perspective on circumventing these constraints during the transition to multicellularity, exemplifying our research program of a physical perspective on a synthetic biology of the laboratory. Using snowflake yeast (lab-evolved multicellular yeast), we show that simple biophysical mechanisms sustain exponential growth without sophisticated transport systems, challenging the view that flagella or complex transport are required for large size. This emergent advective transport arises from conserved principles—metabolism-triggered buoyant instabilities—plus a multicellular innovation: increased body size from cellular entanglement. Critically, these flows precede any genetically encoded nutrient-transport adaptations. Altogether, these discoveries suggest that inherent physical properties of newly evolved groups acted as "biophysical scaffolds," enabling exploration of novel phenotypes later refined by adaptation. Behaviors once thought to require dedicated structures may arise from co-opted latent physical processes, opening new evolutionary paths.



Metabolically driven flows enable exponential macroscopic growth in snowflake yeast. The flows produced by this laboratory-generated organism are comparable in strength to extant multicellular organisms.

PUBLICATIONS

1. Narayanasamy N., Bingham E., Fadero T., Bozdag G.O., Ratcliff W.C., Yunker P., Thutupalli S. Metabolically driven flows enable exponential growth in macroscopic multicellular yeast. Science Advances, 2025, 11(25): eadr6399. doi:10.1126/sciadv.adr6399.
2. Kumar M., Sane S., Murali A., Thutupalli S. Temperature switchable self-propulsion activity of liquid crystalline microdroplets. Soft Matter, 2025, 21: 3782-3788. doi:10.1039/D4SM01382D.

Integrative Structural Biology of Large Macromolecular Assemblies

Shruthi Viswanath

Using an integrative approach, we develop and apply methods to determine protein organization in cells by characterizing their structures in binary complexes, macromolecular assemblies, and nanoscale architectures.

Highlights from the last year are mentioned.

1. **Desmosome structure:** By integrating cryo-ET maps with immuno-EM, X-ray, biochemical, homology, and bioinformatics data, we determined the most complete structure of the desmosomal outer dense plaque (PDB 9A8U, journal cover), explaining its mechanical resilience and rationalizing epithelial and cardiac disease mutations.

2. **Disobind**: A deep-learning method to predict binding sites for an IDR and its partner, directly from sequences. In contrast to other methods, Disobind incorporates partner context and does not require structures or alignments. It outperforms AlphaFold and other disorder-interface predictors.

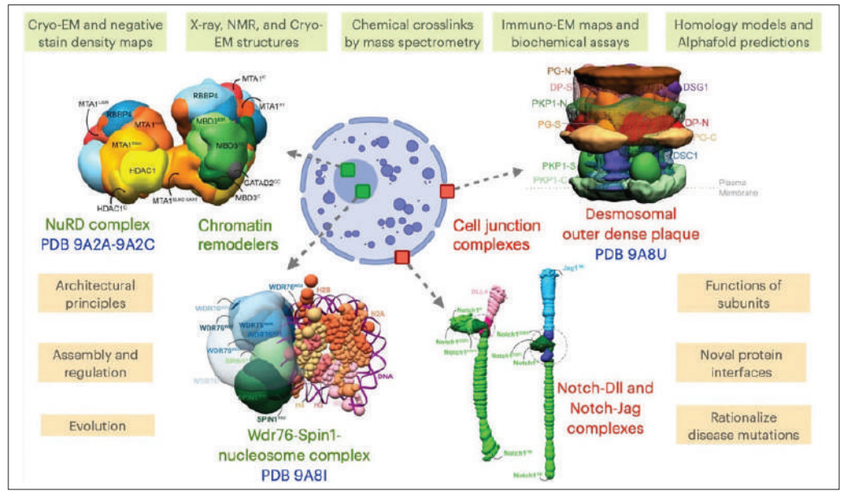
3. **PickET**: An unsupervised approach for macromolecule localization in cryo-ET tomograms. It is tested on more than 100 diverse tomograms, that vary in sample types, sample preparation conditions, microscope hardware, and image processing workflows. PickET localizes molecules of varying size, shape, and abundance, enabling efficient, scalable, high-throughput analysis.

HONORS AND AWARDS

Editor's pick journal cover image (Molecular architecture of desmosomes, Protein Science Jan 2025).

Biophysical Society Travel Awards (Kartik Majila, Shruthi Viswanath).

EMBO Travel Award (Shreyas Arvindekar).



Integrative modeling systems Assemblies characterized by my lab are shown, along with the information that was incorporated (green background), and the insights derived (orange background).

PUBLICATIONS

1. S. Pasani, K. Menon, S. Viswanath, The molecular architecture of the desmosomal outer dense plaque by integrative structural modeling, Protein Science, Journal cover image, 2024.
2. K. Majila, V. Ullanat, S. Viswanath, A deep learning method for predicting interactions for intrinsically disordered regions of proteins, biorxiv, 2024.

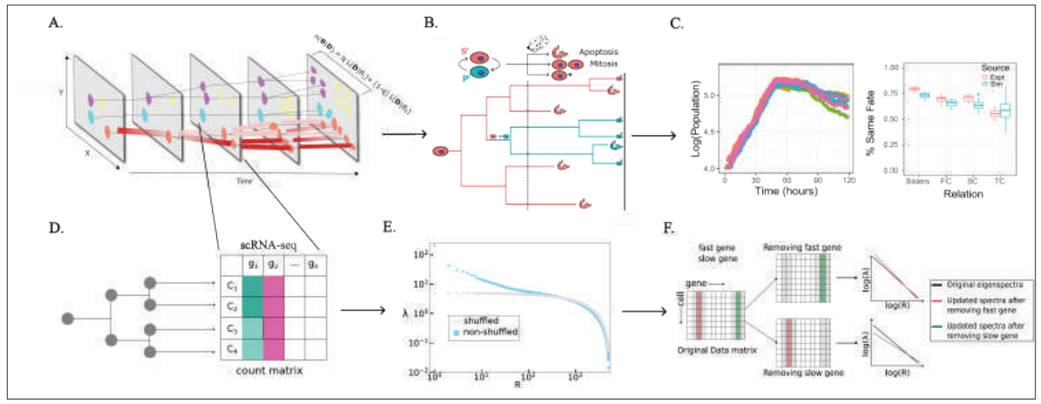
Quantitative Cell Biology: Oscillations and Proliferation in Development and Disease

Shaon Chakrabarti

My research combines theory and experiments to study cellular oscillations and proliferation at the single-cell level: their underlying physical principles, control mechanisms, and consequences in development and disease.

My lab continues to explore a variety of research directions with cell proliferation and oscillations forming the unifying element within somewhat disparate cell biology questions.

We have successfully established single-molecule FISH protocols to quantify circadian phase in a spatially resolved manner. We have imaged multiple circadian clock genes and demonstrated how circadian phase inference can be made from as low as 20 cells (see Figure below). We have established a simple theoretical framework for understanding how population growth laws emerge in cancer cells during treatment with anti-cancer therapies, from fluctuations (non-genetic heterogeneity) at the single-cell level (Figure A-C). These fluctuations induce a variety of lineage correlation patterns, which we are using as probes to understand how the circadian clock drives cell proliferation, and also to infer the phase of the circadian clock in single cells. The fluctuations can also be used to identify inheritable genes based upon underlying lineage correlations (Figure D-F).



(A-C) Theoretical framework for understanding how population growth laws emerge in cancer cells during treatment with anti-cancer therapies, from fluctuations (non-genetic heterogeneity) at the single cell level.

(D-F) Fluctuations in gene expression can also be used to identify inheritable genes based upon underlying lineage correlations from scRNA-seq data.

PUBLICATIONS

1. A. Nikhat, A. Shaikh and S. Chakrabarti*, "Combining lineage correlations and a small molecule inhibitor to detect circadian control of the cell cycle", iScience 28 (4), 2025.
2. A. Iyer, A. Alva, A. Granada and S. Chakrabarti*, "Inheritable cell-states shape drug-persister correlations and population dynamics in cancer cells", PLOS Computational Biology, 21 (9), 2025.

Emergence and Control in Development and Evolution

Archishman Raju

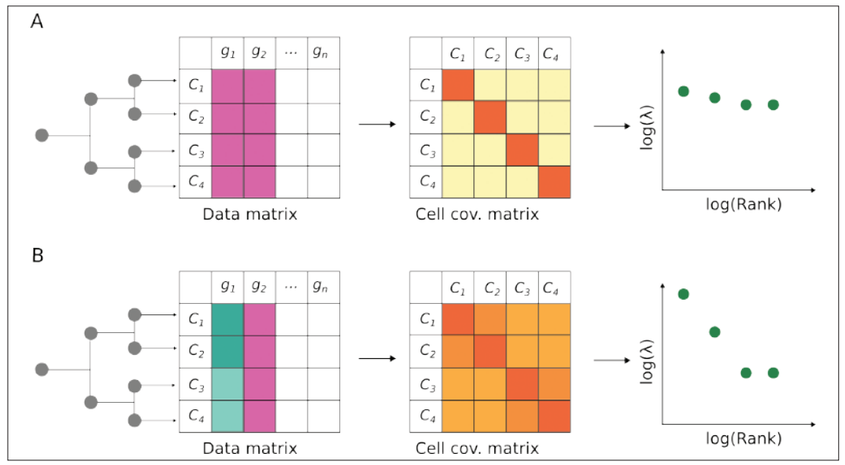
Our lab is interested in the theoretical modeling of developmental dynamics to make minimally parameterized models of data and conceptually clarify and quantitatively model the link between development and evolution.

Our lab is broadly interested in the mathematical modeling of developmental biology, with a particular interest in cell fate specification and pattern formation.

Over the past year, we have completed work on using a mathematical technique called normal form theory to understand the behaviour of Turing patterns. We have also completed work on identifying "memory genes" i.e., genes that fluctuate slowly compared to division times from single cell RNA seq data.

We have also worked on a computational evolution study on developmental trajectories to understand the phenomenon of phenocopying, or why environmental signals can induce phenotypes that are very similar to known mutants.

Other projects include: studying how pulsatile signals can regulate cell fate in the context of ERK signaling, creating a quantitative model for developmental fates of heterochronic mutants in C.elegans, creating a Waddington landscape model for the epithelial-to-Mesenchymal Transition.



The data matrix of gene expression in each cell at a given time point can be used to construct a cell covariance matrix by multiplying it by its transpose. A) If genes fluctuate quickly compared to cell division times, the cell covariance matrix is high on the diagonals and noisy everywhere else. This leads to a flat eigenvalue spectrum. B) If some genes (shown in green) fluctuate slowly compared to cell division times, then these memory genes can create correlations in sisters, cousins etc. This leads to a separation in the eigenvalue spectrum which can be used to identify these genes.

PUBLICATIONS

1. Shinde, Shubham, and Archishman Raju. "A Waddingtonian description of the dynamics of Turing patterns." bioRxiv, 2025: 2025-06.
2. Ghosh, Suvranil, Shaon Chakrabarti, and Archishman Raju. "Identifying memory gene expression from single sample scRNA-seq data using power law signatures." bioRxiv, 2025: 2025-01.

Neurobiology

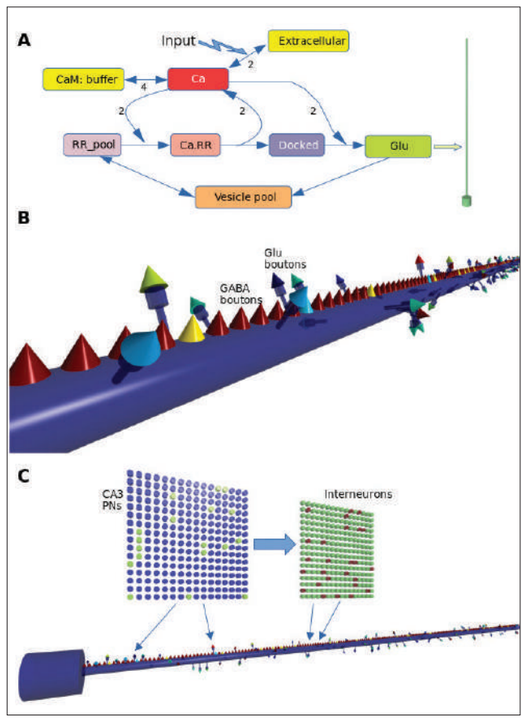
Brain Computation and Memory: From Molecules to Behavior

Upinder Bhalla

We study how pattern recognition and memory formation emerge from molecular, electrical, and mechanical signaling in neurons. We use computer models and experiments including optical recordings, optogenetics, and electrophysiology.

In vivo, we use 2-photon imaging of hippocampal activity in mice to see how time is encoded during rhythmic stimuli and time-separated stimuli. We find that time cell sequences continue long past task demands and contain modality information.

In vitro, we use optogenetics in mouse brain slices to deliver precise patterned stimuli to the hippocampal network while monitoring responses. We have characterized heterogeneity and stochasticity in memory processes, and have found that single cells detect mismatches in sequences of spatiotemporal input patterns.



In silico, we build models of synaptic signaling in health and disease using custom tools to manage, access, and analyze the data. We are developing a synaptic signaling atlas incorporating high-throughput mass-spectrometry data to measure the time course of responses of thousands of proteins following stimulation. We use data and models to examine mechanisms underlying cell and network dysfunction in aging, psychiatric diseases, and neurodevelopmental disorders.

As lead of a DBT-Wellcome Alliance Team Science consortium, we are developing technologies for human ultrasound brain imaging.

Molecules-to-Network model of hippocampus CA1 plasticity. A: Molecular signalling in presynaptic boutons. B: Close-up of CA1 neuron model dendrite with presynaptic boutons as cones. Boutons on the dendrite are inhibitory and on the spines are excitatory. C: Network model of CA3 patterned activity projecting directory to CA1 neuron on the spines, and onto interneurons and then to the CA1 neuron as inhibitory inputs.

PUBLICATIONS

1. Somashekar, BP, Bhalla US. Discriminating neural ensemble patterns through dendritic computations in randomly connected feedforward networks. eLife https://doi.org/10.7554/eLife.100664.1 2024.
2. Viswan NA, Tribut, A, Gasparyan M, Radulescu O, Bhalla US. Mathematical basis and toolchain for hierarchical optimization of biochemical networks. PLoS Computational Biology 20 (12), e1012624 2024.

Physics, Neurobiology, and Ecophysiology of Insect Flight and Insect Architecture

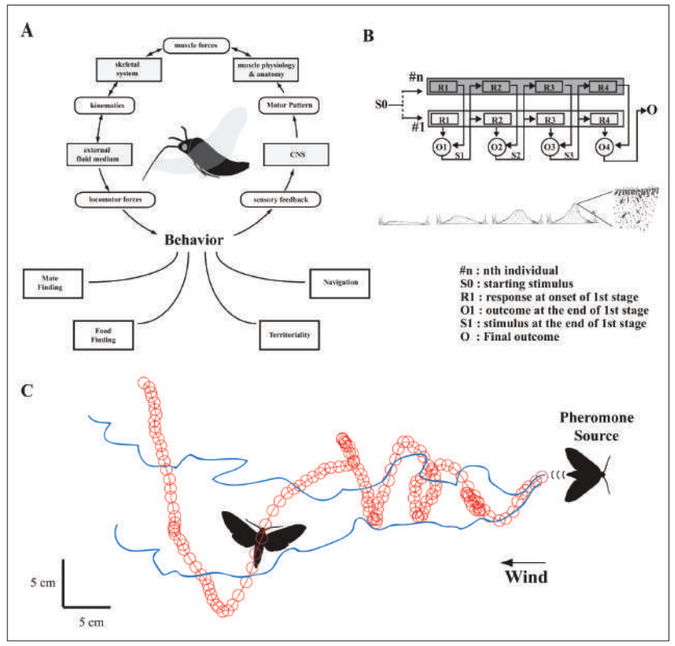
Sanjay P Sane

We study the physics, neurobiology, and ecophysiology of insect flight and insect architecture, including flight-related behaviours such as aerial manoeuvers, territorial chases, short/long-distance navigation, and individual or collective nest-building.

Our laboratory works on three major themes. The first theme focuses on *insect flight*, encompassing detailed investigations of flight behaviors from physics and physiology to, more recently, flight energetics. We study the sensorimotor control of flight in hawkmoths, flies, and other insects, including the neurobiology of mechanosensing by antennae and legs, the role of antennal mechanosensors in flight control, odor-guided navigation toward food sources or mates, and the mechanics of the thoracic exoskeleton and flight musculature that coordinate wing movements. A related line of work examines jumping in arboreal insects.

The second theme examines *insect architecture*, focusing on how social insects such as termites collectively construct large nest structures without a central blueprint, and how communication among individuals gives rise to coordinated collective behavior.

The third theme addresses *mating-related behaviors* in flies and moths, investigating how insects guard territories and how they use visual and olfactory cues to locate mates. Across these themes, our laboratory integrates physics, engineering, biomechanics, neurobiology, muscle mechanics, and behavioral experiments, using a broadly comparative framework to understand function at the organismal level.



The three themes of study (A) ***Insect flight*** in which examine flight-related behaviors at all levels using multidisciplinary tools (B) ***Insect architecture*** in which we study how insects collectively build large nests through close intercommunication, and (C) ***Insect mating behavior*** in which we investigate the sensorimotor basis of insect mate finding and territoriality.

PUBLICATIONS

1. Manjunath, M., & Sane, SP* (2025). Mechanosensory cephalic bristles mediate rapid flight initiation in hawkmoths. Journal of Comparative Physiology A, 1-15.
2. Virdi, S., Sane, SP* (2025). Structure of the Femoral Chordotonal Organ in the Oleander hawkmoth, Daphnis nerii. Journal of Comparative Neurology, 533(2), e70022.

Development, Modulation, and Function of Motor Systems

Vatsala Thirumalai

In vertebrates, locomotion is generated by multiple circuits in the brain and spinal cord acting in a coordinated fashion. We study how these circuits assemble and how they function at all stages of life.

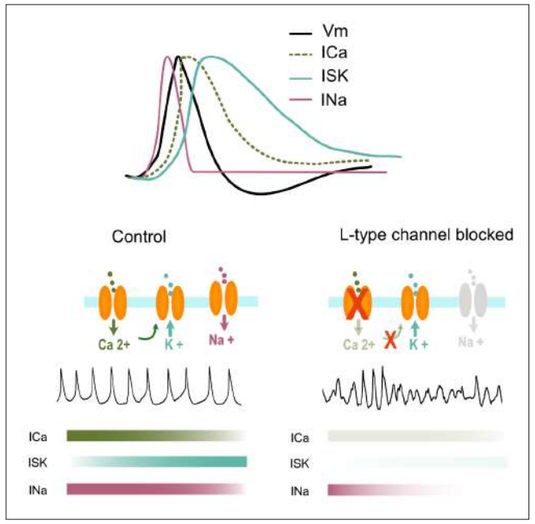
My lab focuses on the function and development of brain circuits that control locomotion using the small freshwater fish zebrafish as our model system. Our work aims to understand how disparate circuits in the optic tectum, cerebellum, hindbrain, and spinal cord work together to generate appropriate locomotor behaviour. We also examine how locomotory circuits are assembled de novo, quite early in development, when much of the nervous system is immature.

We use a range of techniques to probe how single neurons compute, how such computations are integrated circuit-wide, and how behavior is generated. Some of the tools we use include genome editing, whole-cell patch clamping, calcium imaging, and high speed videography of larval swim kinematics. Lately, we have also forayed into building models of neurons to ask how their activity patterns are generated.

HONORS AND AWARDS

Devi Award for Excellence in Scientific Research by the New Indian Express Group, 2024.

Fellowship of the International Union of Physiological Sciences in 2025.



Graphical abstract Legend: Top: The activation of voltage gated sodium channels (INa, pink), voltage gated calcium channels (ICa, dotted green), and SK-type channels (ISK, teal) during the action potential (Vm, black). Bottom: Under control conditions, sodium entry via voltage-gated sodium channels leads to depolarisation resulting in the activation of calcium channels. The elevation of intracellular calcium levels activates SK-type calcium-dependent potassium channels which repolarise the membrane, removing sodium channel inactivation. With L-type voltage-gated calcium channels blocked, this process is affected causing cessation of sustained tonic spiking.

PUBLICATIONS

1. Jadhav M*, Verma S* and Thirumalai V, Ionic conductances driving tonic firing in Purkinje neurons of larval zebrafish, J Physiol., 2025 in press. *co-first authors.
2. Aalok Varma, Sathvik Udupa, Mohini Sengupta, Prasanta Kumar Ghosh, Vatsala Thirumalai, A machine-learning tool to identify bistable states from calcium imaging data. J Physiol. 2024 Apr; 602(7):1243-1271. doi: 10.1113/JP284373.
3. Narayanan S, Varma A, Thirumalai V. Predictive neural computations in the cerebellum contribute to motor planning and faster behavioral responses in larval zebrafish. Sci Adv. 2024 Jan 5;10(1):eadi6470. doi: 10.1126/sciadv.adi6470. Epub 2024 Jan 3.

Brain Homeostasis and Neuroinflammation

Hiyaa Ghosh

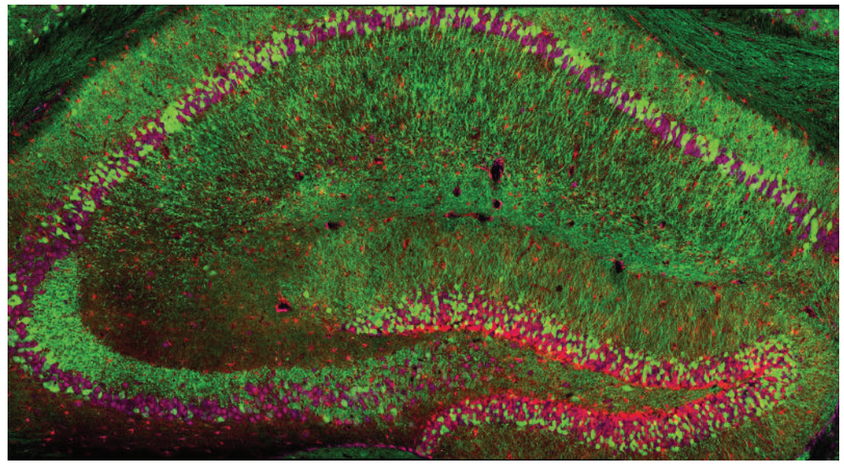
We seek to decipher the inbuilt compensatory mechanisms in neuronal and glial cells that allow for adult brain plasticity and adaptability during healthy and pathological conditions.

Our goal is to uncover fundamental mechanisms of adaptability in the adult brain. For this, we study structural and functional programs that allow compensatory changes in neurons and glial cells. Our studies have revealed that adult brain cells, including neurons, retain the flexibility to change their structure and function. We have also established mouse models of physiological perturbations that cause cognitive deficit and rescue over time, and two CRISPR-engineered mouse lines that model inducible loss-of-function of a schizophrenia risk-gene. Using these models, we examine how structural and functional flexibility potentials in neuron and glia may contribute to compensatory changes. We also study cellular heterogeneity in the context of adaptive advantage for plasticity and homeostasis in the adult brain. Using a suite of high-throughput and high-resolution tools, we investigate a) mechanisms of dendritic structural plasticity in neurons and its functional relevance in aging and neuro-pathologies, b) microglia and astrocyte heterogeneity, c) the role of adult neurogenesis and neural stem cells in mechanisms of stress resilience, and d) Tcf4's role in Schizophrenia.

HONORS AND AWARDS

Wellcome Trust-DBT Senior Fellowship.

EMBO Global Investigator.



Hippocampus in mouse brain section, showing designer drug receptor (DREADD) expression in select population of CA1 pyramidal neurons. The red neurons selectively express DREADD enabling selective and reversible switching off of only those neurons during a behavioural test. The green neurons remain unaltered during this manipulation.

PUBLICATIONS

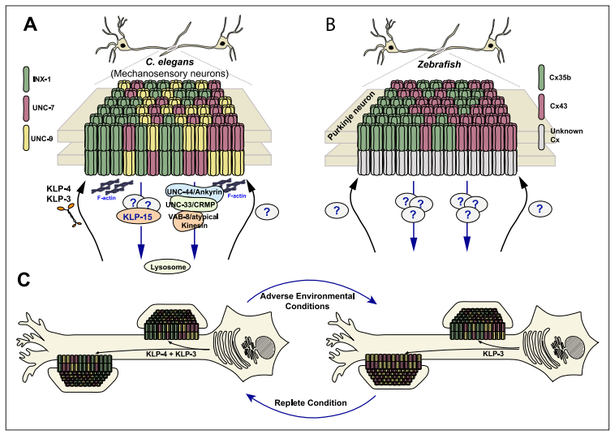
1. Sahasrabuddhe V, Ghosh, Cx3Cr1-Cre induction leads to microglial activation and IFN-1 signaling caused by DNA damage in early postnatal brain. HS.Cell Rep. 2022 Jan 18;38(3):110252. doi: 10.1016/j.celrep.2021.110252.
2. Sarkar D, Shariq M, Dwivedi D, Krishnan N, Naumann R, Bhalla US, Ghosh HS, Adult brain neurons require continual expression of the schizophrenia-risk gene Tcf4 for structural and functional integrity. Transl Psychiatry. 2021 Sep 25;11(1):494. doi: 10.1038/s41398-021-01618-x.
3. Shariq M, Sahasrabuddhe V, Krishna S, Radha S, Nruthyathi, Bellampalli R, Dwivedi A, Cheramangalam R, Reizis B, Hébert J, Ghosh HS, Adult neural stem cells have latent inflammatory potential that is kept suppressed by Tcf4 to facilitate adult neurogenesis. Sci Adv. 2021 May 21;7(21):eabf5606. doi: 10.1126/sciadv.abf5606. Print 2021 May.

Regulation of Electrical Synapse Formation and Function

Abhishek Bhattacharya

We investigate the fundamental principles regulating formation and function of electrical synapses, a conserved, critical, yet much understudied feature of the nervous system.

Understanding how an individual neuron finds a specific synaptic partner (synaptic specificity) and connects with different partners using synapses that bear distinct properties (functional diversity) have remained pivotal questions in neuroscience. While the complex biology of chemical synapses has been widely studied, electrical synapses have remained much understudied, despite playing conserved and critical roles in the establishment and functioning of the neural circuit. The overall research goal of our lab is to understand the fundamental molecular principles that regulate the establishment, maintenance, functioning, and plasticity of the electrical synapse connectome, areas that are still very poorly understood. We are working to understand



a) How individual neurons form molecularly and functionally distinct synapses with different synaptic partners,
b) Electrical synapse accessory proteins that regulate trafficking of synaptic components and synapse formation,
c) How plastic changes in the electrical synapse network is achieved in response to intrinsic and extrinsic cues, and
d) Establishment and functioning of glial gap junction network.

(A) Contrary to previous belief, our results show that even individual electrical synapses in the *C. elegans* nervous system can be formed by clustering molecularly-distinct gap junction channel types, giving them 'Heterochannel' configuration. In the mechanosensory circuit of *C. elegans*, electrical synapses are built by clustering three distinct channel types formed by three different gap junction proteins. These molecularly distinct channel types within individual synapses functionally collaborate to regulate circuital output. Within heterochannel synapses, synaptic trafficking of distinct gap junction channels is independently regulated by kinesins from two distinct, but conserved families, kinesin-3 and kinesin-14, which was not shown before. Similarly, turnover of different channel types present within individual heterochannel synapses is regulated independently by distinct atypical kinesins.

(B) Electrical synapses in cerebellar Purkinje neurons of larval zebrafish display heterochannel organization, where channels made of Cx35b and Cx43 colocalize.

(C) In mechanosensory neurons of *C. elegans*, molecular composition or the heterochannel code of electrical synapses changes in a strikingly synapse-specific manner under harsh environmental conditions, revealing a novel mechanism of single-synapse level synaptic plasticity.

PUBLICATIONS

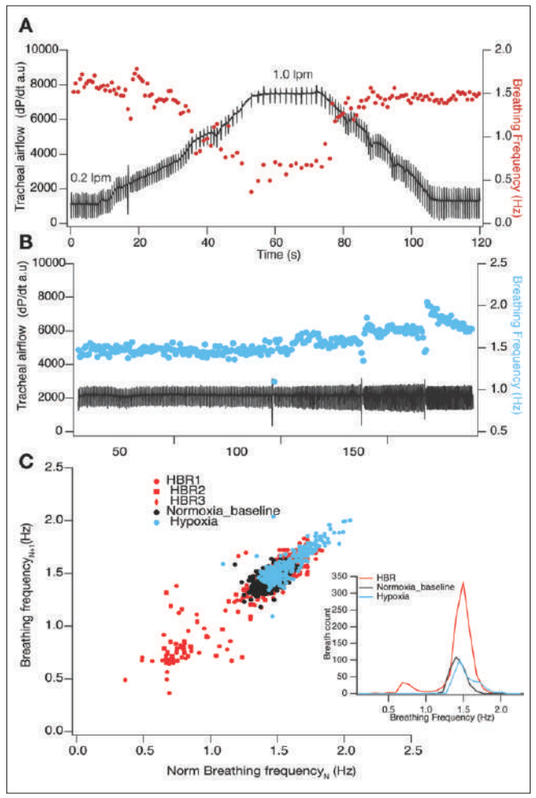
1. Vats, A., Sudhanand, M., Verma, S., Bandyopadhyay, A., Varma, N, Koushika, S. P., Thirumalai, V., Bhattacharya, A.* Molecular Configuration, Regulation and Function of Heterochannel Electrical Synapses. BioRxiv. Sep, 2025. (https://doi.org/10.1101/2025.09.14.675793).
2. Nils Rosenkranz, Alexandra N. Birtasu, Konstantin Wieland, Lisa Rehm, Rachita Sharma, Atal Vats, Sina Manger, Ayush Srivastava, Abhishek Bhattacharya, Gerhard Hummer, Achilleas S. Frangakis, Alexander Gottschalk In situ structure of a gap junction – stomatin complex. BioRxiv. Apr, 2025. Accepted Science Advances. (https:// doi.org/10.1101/2025.03.27.645584).

Neural Mechanisms Underlying Breathing Rhythms and Breathing-Modulated Behaviors

Sufyan Ashhad

We investigate the neuronal mechanisms responsible for generating and controlling breathing rhythms, employing an integrative and interdisciplinary approach that combines computational and experimental neuroscience.

Breathing is a fundamental motor behavior that must persist throughout life, and its pattern needs to be modulated to maintain homeostasis. Breathing rhythms are remarkably resilient yet highly adaptable, allowing for immediate adjustments to meet behavioral demands such as vocalization/speech, sniffing, and laughter. Further, several behavioral states exhibit a phasic relationship with breathing. Activities ranging from higher-order brain functions, such as cognition and memory, to motor behaviors like locomotion and orofacial movements, often show this phasic entrainment to breathing. This requires that the ventilation control system be equipped with robust mechanisms to detect changes, execute appropriate motor responses, and sense alterations resulting from those motor outputs. We utilize in vitro and in vivo electrophysiological recordings in rodents, along with computational modeling and psychophysical experiments in humans, to deepen our understanding of the mechanisms behind breathing rhythm generation, regulation, and breathing-modulated behaviors.



Breathing rhythm exhibits dual qualities of robustness and lability in mice.
A. Breathing response to lung inflation-induced inhibition (via Hering-Breuer Reflex, HBR) of the breathing central pattern generator.
B. Breathing response to hypoxic gas mix (10% O2) introduced at the onset of the recording.
C. Poincaré plot and histogram (inset) of instantaneous breathing frequency illustrating a discrete/quantal shift in the under HBR, while the response to hypoxia is a graded increase.

PUBLICATIONS

1. Sufyan Ashhad*, Valentin M. Slepukhin*, Jack L. Feldman, and Alex J. Levine. (2022) Microcircuit synchronization andheavy tailed synaptic weight distribution in preBötzinger Complex contribute to generation of breathing rhythm", The Journal of Neuroscience.
2. Sufyan Ashhad*, Kaiwen Kam*, Christopher A. Del Negro*, Jack L. Feldman (2022). "Breathing: rhythm, circuits, and emotion", Annual Review of Neuroscience.

Understanding the Principles of Cognitive-Motor Flexibility Across Organismal Lifespan

Abhilasha Joshi

We aim to understand how internal cognitive computations dynamically engage with ongoing actions during complex behaviors and how these interactions alter with age. We use an interdisciplinary approach to address this challenge, combining insights from neuroscience, behavior, biomechanics, and computational methods.

As animals move in complex environments, higher-order cognitive computations in the hippocampus—a brain region critical for navigation—reflect an internal map of the external world. This map is represented by the population firing rhythmically at ~8Hz and corresponds to sequential spatial representations at, behind, or ahead of the actual location of the animal. At the same time, other multidimensional behavior-relevant variables are computed and represented elsewhere in the brain. To navigate efficiently, the nervous system must appropriately connect these representations, and a malfunction of this coordination is a hallmark of aging-associated cognitive impairments. Our prior work (Joshi et al., 2023) found that the forelimb stepping cycle in freely behaving rats is rhythmic and peaks at around 8 Hz during movement, matching the approximately 8 Hz modulation of hippocampal activity and spatial representations during locomotion. Our group will investigate the extent of the synchronization between locomotor steps and hippocampal spatial representations to study their impact on cognition across the organismal lifespan.

HONORS AND AWARDS

2025 Prime Minister Early Career Research Grant (PMECRG).

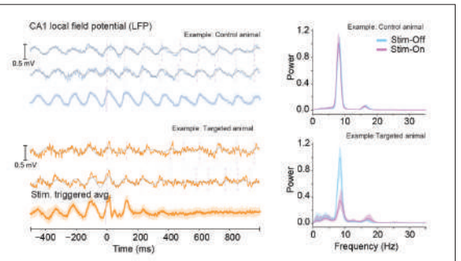
2025-2028 Simons Collaboration on Plasticity and Aging Brain Fellows to Faculty Award.

2025 ABLA/ ACBP travel award.

2025 Secured Simons Foundation and IBRO funding to co-organise Neural Mechanisms of Cognitive Function Meeting in Pipa, Brazil.

22mo rat at NCBS

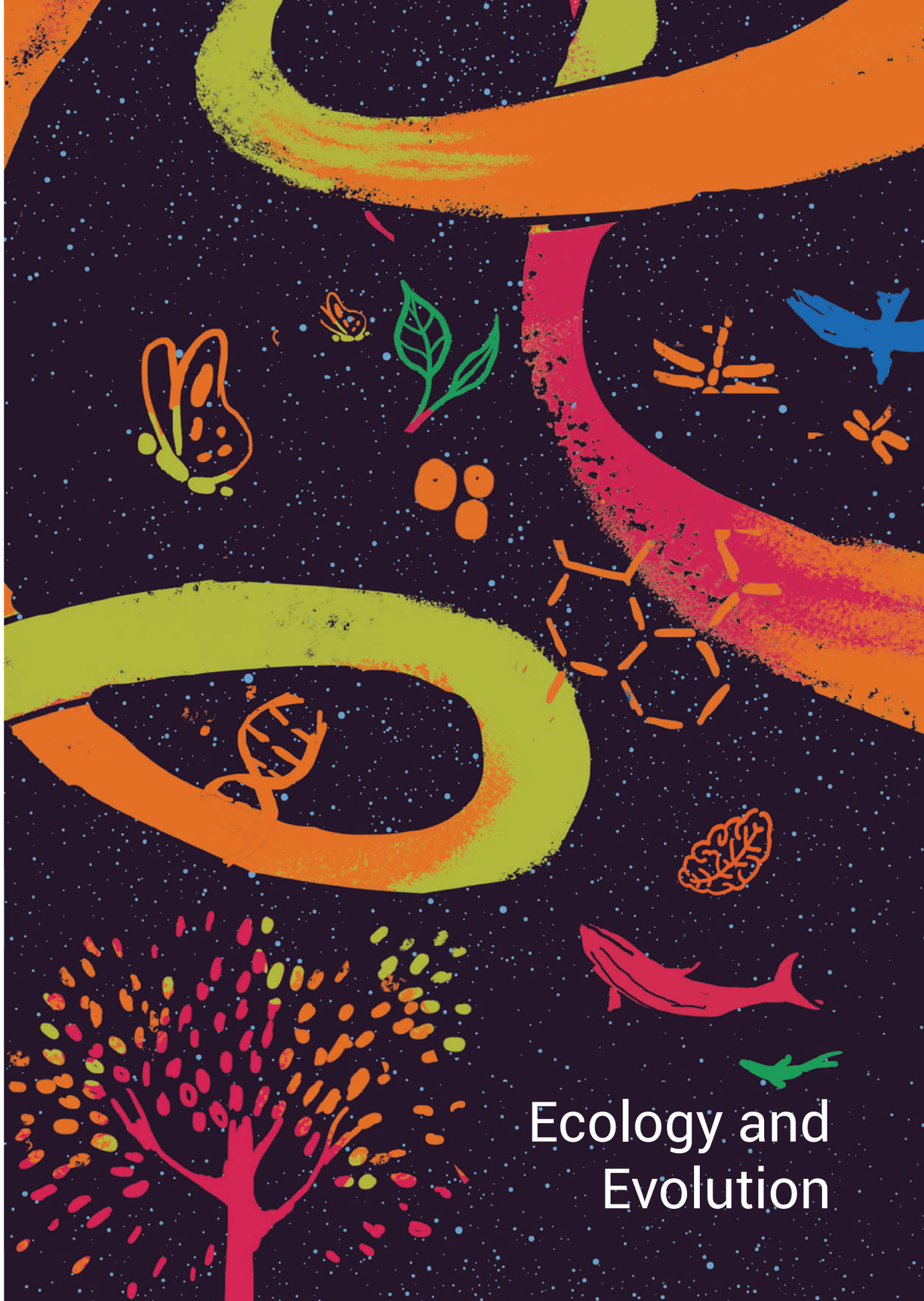
First behavior-ephys rig



Optogenetic disruption of neural activity in the hippocampus

PUBLICATIONS

1. Abhilasha Joshi, Alison E. Comrie, Samuel Bray, Abhijith Mankili, Jennifer A. Guidera, Rhino Nevers, Xulu Sun, Emily Monroe, Viktor Kharazia, Ryan Ly, Daniela Astudillo Maya, Denisse Morales-Rodriguez, Jai Yu, Anna Kiseleva, Victor Perez, Loren M. Frank, bioRxiv 2025.09.15.675587; doi: https://doi.org/10.1101/2025.09.15.675587.
2. Comrie AE, Monroe EJ, Kahn AE, Denovellis EL, Joshi A, Guidera JA, Krausz TA, Berke JD, Daw ND, Frank LM. Hippocampal representations of alternative possibilities are flexibly generated to meet cognitive demands. bioRxiv [Preprint]. 2024 Sep 23:2024.09.23.613567. doi: 10.1101/2024.09.23.613567. PMID: 39386651; PMCID: PMC11463554.
3. Jennifer A. Guidera, Daniel P. Gramling, Alison E. Comrie, Abhilasha Joshi, Eric L. Denovellis, Kyu Hyun Lee, Jenny Zhou, Paige Thompson, Jose Hernandez, Allison Yorita, Razi Haque, Christoph Kirst, Loren M. Frank. Regional specialization manifests in the reliability of neural population codes, bioRxiv 2024.01.25.576941; doi: https://doi.org/10.1101/2024.01.25.576941.
4. Ding SS*, Fox JL*, Gordus A*, Joshi A*, Liao JC*, Scholz M*. Fantastic beasts and how to study them: rethinking experimental animal behavior. J Exp Biol. 2024 Feb 15;227(4):jeb247003. doi: 10.1242/jeb.247003. Epub 2024 Feb 19. PMID: 38372042; PMCID: PMC10911175. *equal contribution.



Ecology and Evolution

Terrestrial Ecosystems and Community Ecology

Mahesh Sankaran

Can our ecosystems cope with the challenges of ever-expanding human activities? We work on understanding the dynamics of mixed tree-grass ecosystems, their responses to changes in climate, and what this means for their future distribution and functioning.

Current research in the lab is grouped around the following broad themes that examine:

(a) how interactions and feedbacks between climate, biogeochemistry, fires, and herbivory influence the structure, composition, and stability of ecosystems, and the cycling and sequestration of nutrients.

(b) how projected changes in climate, such as increasing variability of rainfall, frequency of droughts, aridity in the tropics, nitrogen and phosphorus deposition, and rising CO_2 levels impact ecosystem function, stability, and services.

Most of our research is carried out across a range of systems, from savannas and grasslands to tropical forests, in India, and Africa. Our current and planned future work will employ both long and short-term experiments, as well as targeted field surveys to address the above questions across the gamut of natural ecosystem types of the Indian subcontinent, with the goal of bringing a comprehensive understanding of biome-scale vegetation and nutrient dynamics in the Indian subcontinent.

HONORS AND AWARDS

R.M. Tulpule Chair Professorship for Global Change.

Field work in the trans-Himalaya.

PUBLICATIONS

1. Benitez, L. M., Parr, C. L., Sankaran, M., & Ryan, C. M. Fragmentation in patchy ecosystems: a call for a functional approach. Trends in ecology & evolution, 40(1), 27-36, 2025.
2. Chakravarthy, D., Raghavendra, H. V., Ratnam, J., & Sankaran, M. Soil respiration is correlated with rainfall and soil moisture at multiple temporal scales in a seasonal wet tropical forest. Journal of Tropical Ecology, 41, e20, 2025.

Understanding Human Impacts on Biodiversity and Facilitating Future Survival through a Genetic Lens

Uma Ramakrishnan

India has over a billion people, yet harbours incredible biodiversity. How are we impacting this diversity, and can we facilitate its survival? My research attempts to address this question.

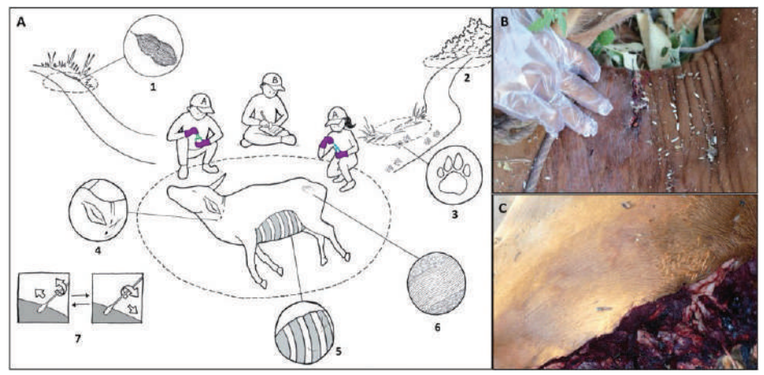
Indian biodiversity: tracking its history, conserving its future.
In my group, we use genetic information to better understand wild populations. We aim to use these insights to suggest strategies for the conservation of threatened species, or to minimize zoonotic spillover in the Indian subcontinent.

How isolated are populations of endangered species today? What determines connectivity? Are individuals in isolated populations inbred? How has human-induced fragmentation impacted the probability of zoonoses? We use field-collected samples (invasive at times, but mostly non-invasive), generate genomic (or genome-wide) data, and use computational tools to analyze this data to answer these questions.

HONORS AND AWARDS

Elected associate member, EMBO, June, 2025.

This last year, we showed how trace DNA from kill sites can be used to identify individual predators involved in cattle kills. Individual tigers were identified at 85 % of all kill sites. Individuals were classified as a true predator (high confidence as predator) at 72 sites, circumstantial predator at 34 sites (medium confidence), and predator uncertain (low confidence) at 49 sites. such methods can be effectively used to understand predation ecology better and facilitate evidence-based conflict management.



A) Field sampling scheme illustrating various types of genetic samples of potential predators collected at a kill site, B) Photograph of predation wound in neck region with visible saliva deposit around the puncture region (darker colour) and C) Photograph of carnivore lick areas with saliva deposit.

PUBLICATIONS

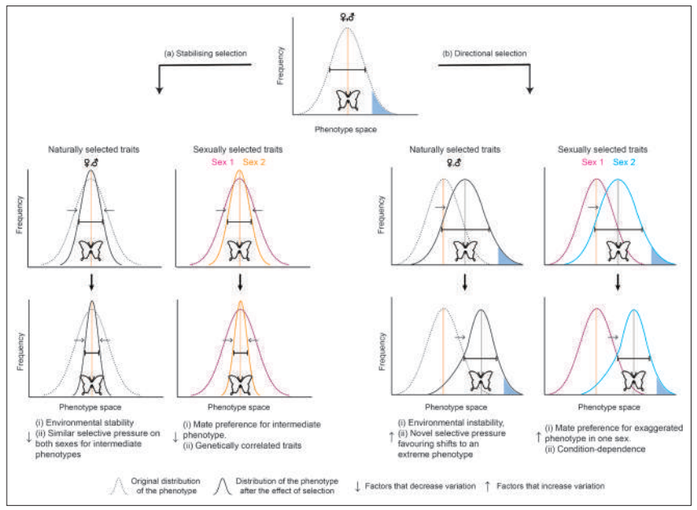
1. Chhattani, H, Harihar, A, Dean, R, Yadav, A, Patel, K, Rana, D, Pandit, A, Shukla, SK, Rahim, V and Ramakrishnan, U. Trace DNA from kill sites identifies predating tigers. Biological Conservation. Volume 307, July 2025, 111117.
2. Ansil, BR, Vishwanathan, A, Ramachandran, V, Yeshwanth, HM, Sanyal, A and Ramakrishnan. Host-pathogen-vector continuum in a changing landscape: potential transmission pathways for Bartonella in a small mammal community. Ecology and Evolution. Apr 2, 2025;15(4):e71085. doi: 10.1002/ece3.71085.

Speciation, Adaptation, and Morphological Diversification in the Tropics

Krushnamegh Kunte

Diversity is the cornerstone of life on Earth. We are evolutionary biologists who study the origins and mechanisms that underlie the proliferation of biodiversity in tropical regions such as India.

I have a broad interest in evolutionary biology, ecology, and genetics, encompassing the fields of natural selection theory, evolutionary genetics, population, and community ecology, and conservation biology. Specifically, we study ecological, sexual, and population genetic underpinnings of why populations and traits diverge, and why they often result in new species or sexually dimorphic and polymorphic adaptations. This provides a larger perspective on the evolution of biodiversity.



A graphic summary of hypotheses regarding how functional roles and selection pressures may influence trait variation. Thin arrows represent direction of selection and thick arrows represent direction of evolution for each column. Flat-headed lines indicate the relative spread of trait variation. The orange line in (a) represents trait optimum. The blue-shaded area in (b) represents the direction in which selection shifts the trait distribution. Stabilising selection on naturally or sexually selected traits (a) acting on one or both sexes may decrease trait variation while directional selection on naturally or sexually selected traits (b) may increase trait variation. In the panels for sexually selected traits, the effect of selection on trait variation has been shown separately to highlight how variation between the sexes may respond differentially. Additionally, natural selection can also affect sexes differently, potentially resulting in distinct patterns of variation between males and females, similar to what is shown for sexually selected traits. However, even in such cases, the variation in naturally selected traits is generally expected to be less pronounced than in sexually selected traits or traits not under selection.

Our main study system is Batesian mimicry, which is a phenomenon in which unprotected prey species (called 'mimics') gain protection from predators by mimicking toxic or otherwise protected species (called 'models'). Predators learn to avoid models based on prior experience, and subsequently avoid eating mimics due to misidentification. Hundreds of mimetic insects (especially butterflies) are known from tropical forests. There is tremendous variation in Batesian mimicry: mimicry can be sexually monomorphic, polymorphic, or sex-limited within and across species. Our research aims to understand the selective pressures that favour such variations in mimetic colour patterns, and uncover their genetic basis.

PUBLICATIONS

1. Dharmaraaj, B., and K. Kunte. 2025. Natural and sexual selection and functional roles influence colouration but not the amount of variation in butterfly wing colour patterns. BMC Ecology and Evolution, 25:11.
2. Todisco, V.⋆, D. N. Basu⋆, S. W. J. Prosser, S. Russell, M. Mutanen, A. Zilli, B. Huertas†, K. Kunte†, and R. Vane-Wright†. 2024. DNA barcodes from over-a-century-old type specimens shed light on the taxonomy of a group of rare butterflies (Lepidoptera: Nymphalidae: Calinaginae). PLoS ONE, 305825. ⋆equal first authors, †equal senior authors.

Genetic and Ecological Factors Underlying Adaptive Evolution

Deepa Agashe

We aim to understand evolutionary processes, focusing on the genetic and ecological drivers and consequences of adaptation to new niches.

The role of selection in sifting through available genetic variation has been textbook material for many years, but the impact of biases in the production of genetic variation has received relatively little attention.

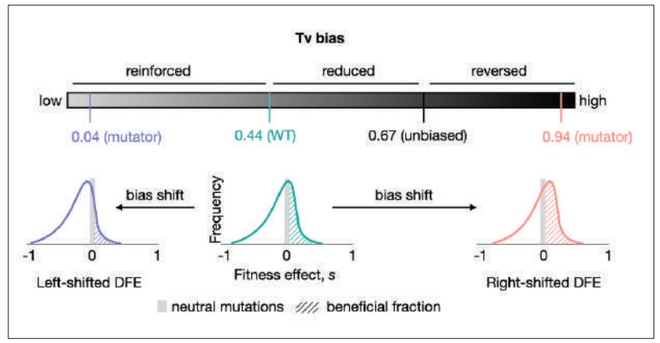
We showed experimentally that altering mutation biases (via deletion of DNA repair genes) has large and largely predictable impacts on the distribution of fitness effects (DFE), which directly influences adaptation. Using hundreds of random, genome-wide single mutations in seven *Escherichia coli* strains, we demonstrate that a strong bias favouring transversion mutations consistently leads to a right-shifted DFE with a higher fraction of beneficial mutations. Conversely, transition-biased strains have left-shifted DFEs with fewer beneficial mutations (see summary schematic, Fig 1).

Our results support our previous prediction (Sane et al. 2023, PNAS): given the transition-biased evolutionary history of *E. coli*, bias reversal (towards more transversions) should increase access to beneficial mutations, which were previously poorly sampled. This work has important implications for predicting the genetic basis of adaptation and understanding the relative roles of selection vs. mutation in evolution.

HONORS AND AWARDS

Elected Vice President of the European Society for Evolutionary Biology.

Elected Fellow of the Indian Academy of Sciences.



Schematic showing the key prediction and results (Sane et al. 2025, PLoS Biology). As the transversion (Tv) mutation bias of WT *E. coli* is shifted away from the ancestral bias, the resulting distribution of fitness effects (DFE) is predicted to change depending on the direction of the bias shift.

PUBLICATIONS

1. Sane M, Parveen S and Agashe D (2025). Mutation bias alters the distribution of fitness effects of mutations. PLoS Biology 23(7): e3003282.
2. Adamala KP, Agashe D, Zuber MT [total 38 authors] (2024). Confronting the risks of mirror life. Science 386:1351-1353.

The Community and Functional Ecology (CaFE) Lab: From Individuals to Ecosystems

Meghna Krishnadas

We seek to understand the processes that allow species to coexist, and thus maintain diversity in ecological communities.

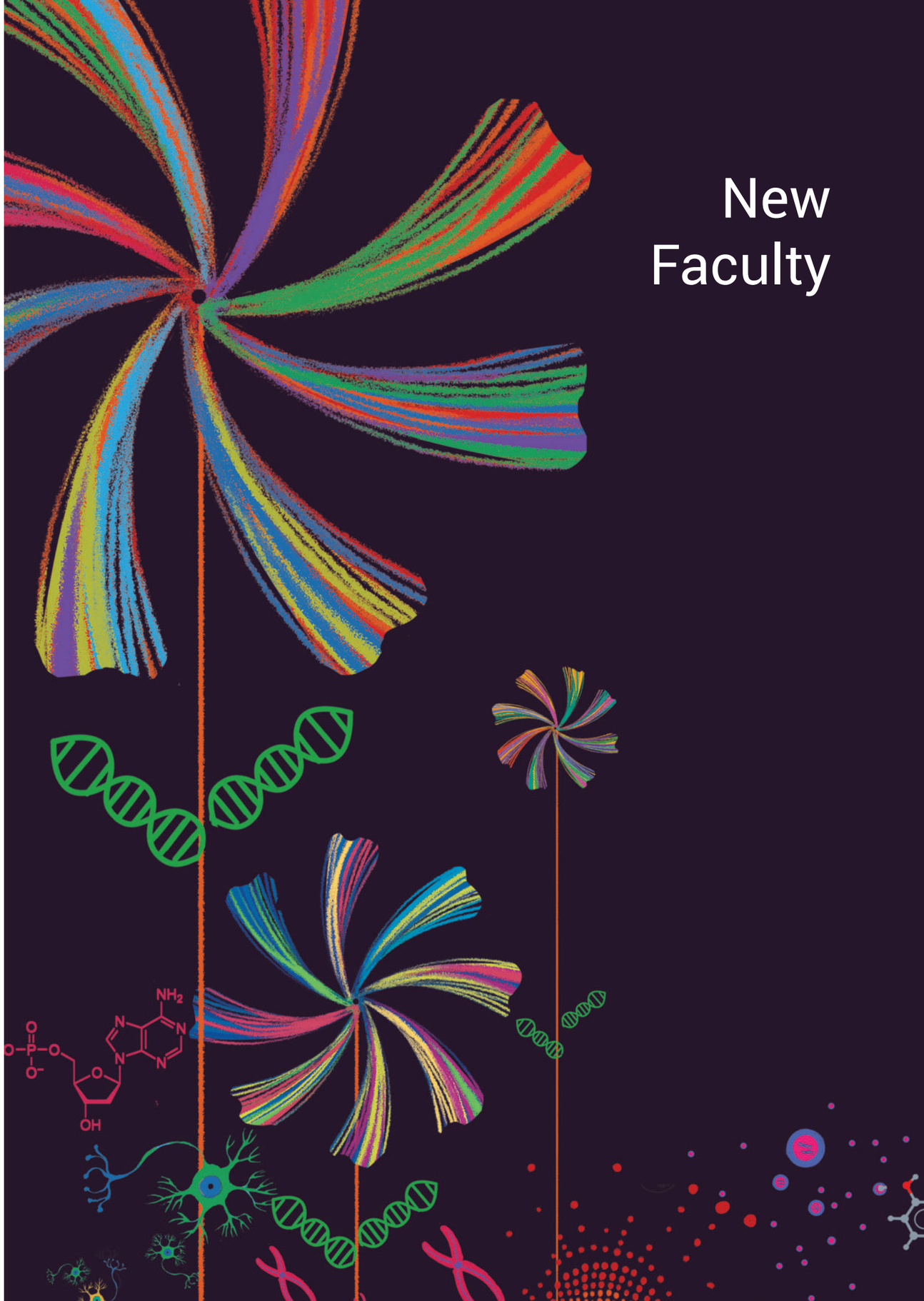
We are driven by a curiosity to understand biodiversity. Why are some species common but most species rare? What makes rare species persist? Further, in a world overwhelmingly shaped by humans today, we want to know how human influence impacts the mechanisms that maintain diversity. To this end, we combine ecological theory, experiments, and observational field research with advanced statistical models. In particular, we use functional traits—heritable characteristics that mediate species' response to different conditions—to understand patterns and processes that shape biodiversity in different ecosystems. We use plant communities as model systems, but the concepts apply across ecological communities. Ultimately, our lab is driven by theory and curiosity.

Our work broadly focuses on the following cross-cutting themes:

1. The role of biotic interactions in shaping and maintaining diversity across multiple scales.
2. How intra- and inter-specific trait variation mediate species distributions and performance.
3. How climate and disturbance shape assembly of communities and biomes.

PUBLICATIONS

1. Ke PJ, Kandlikar G, Ou S, Hsu GC, Wan J, Krishnadas M. 2025. Placing plant-soil microbe interactions into a natural demographic context. Ecological Monographs 95: e70032.
2. Ahmad M, Rathee S, Krishnadas M*. 2025. From low to high elevations, flowers adapt traits and phenology to climate, but phenology-trait relationships weak. Functional Ecology. Early view online: https://doi.org/10.1111/1365-2435.14748.



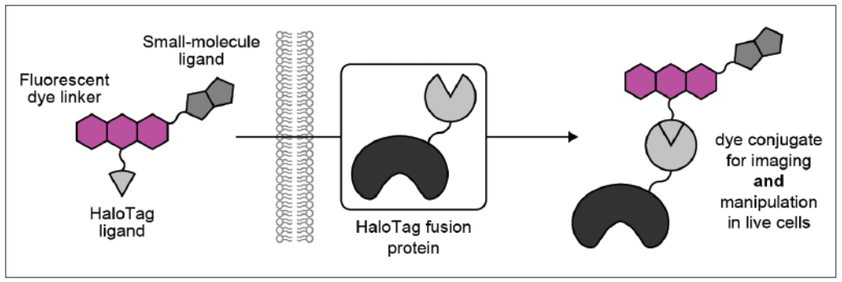
New Faculty

Molecular Tools for Biology

Pratik Kumar

We build modern tools for imaging and manipulating biological processes by integrating dye chemistry, click chemistry, and biomolecular labeling strategies. Our work generates novel reagents for probing complex biological questions.

We develop small-molecule chemical probes for biology. Using a mix of organic synthesis, photochemistry, and chemical biology, the lab designs fluorescent dyes and chemical tags for imaging and manipulating biological processes. These reagents work with widely used protein tags and are optimized for high-resolution microscopy, intracellular targeting, and biochemical labeling. Current projects include developing rhodamine-based dyes for specific cellular environments, sensors for ions and reactive molecules, and ligands that report both molecular location and activity. Our approach is highly collaborative and interdisciplinary—blending chemistry, imaging, and cell biology—to create probes that are easy to use and widely applicable.



Design of multifunctional fluorophores for self-labeling tags.

PUBLICATIONS

1. Antonio Fiore, Guoqiang Yu, Jason J. Northey, Ronak Patel, Thomas A. Ravenscroft, Richard Ikegami, Wiert Kolkman, Pratik Kumar, Tanya L. Dilan, Virginia M.S. Ruetten, Misha B. Ahrens, Hari Shroff, Shaohe Wang, Valerie M. Weaver, & Kayvon Pedram. Live imaging of the extracellular matrix with a glycan-binding fluorophore. Nature Methods, 2025, 22:1070-1080.
2. Pratik Kumar, Jason D. Vevea, Ariana N. Tkachuk, Kirby Campbell, Emma T. Watson, Anthony X. Ayala Jonathan B. Grimm, Edwin R. Chapman, David J. Solecki, & Luke D. Lavis. Optimizing multifunctional fluorescent ligands for intracellular labeling. PNAS, 122 (44), e2510046122, 2025.
3. Motokazu Uchigashima, Risa Iguchi, Kazuma Fujii, Pratik Kumar, Manabu Abe, Motohiro Nozumi, Michihiro Igarashi, Kenji Sakimura, Ryoma Bise, Luke D Lavis, & Takayasu Mikuni. Single-cell synaptome mapping of endogenous protein subpopulations in mammalian brain. Nature Communications, 16, 9705, 2025.

Understanding the Role of Biomechanics in Organ Morphogenesis and Homeostasis

Priti Agarwal

We investigate how biochemical and mechanical cues integrate across cellular and tissue scales to build functional organs. For this, we use an interdisciplinary toolkit that spans genetics, cell biology, biophysics, and theoretical modelling.

"I am fearfully and wonderfully made." The mysteries of morphogenesis remain among the most fascinating in developmental biology.

– Scott F. Gilbert

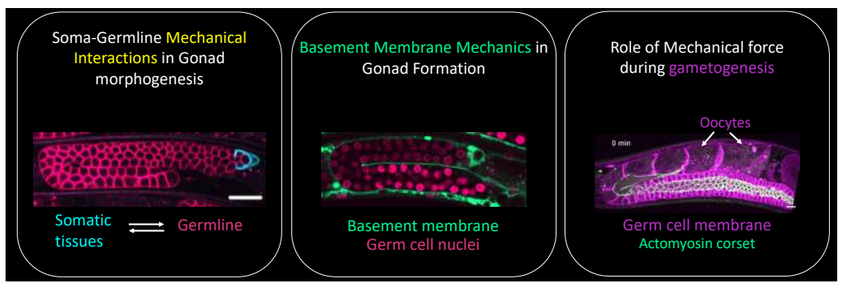
HONORS AND AWARDS

Selected as an Early Career PI Fellow in Development journal's "Pathway to Independence" programme 2023. Interview published in Development journal.

As Gilbert eloquently quoted, organ morphogenesis is one of biology's most remarkable phenomena: transforming a single cell into complex, functional structures. How these structures form and maintain themselves across a lifetime remains ambiguous. When disrupted, the consequences are severe, leading to congenital disorders, organ dysfunction, or cancer metastasis.

Traditionally, genetic regulators were viewed as the main drivers of organ formation, but mechanical signals are now recognized as equally critical. Actomyosin contractility, matrix stiffness, intercellular tension, and shear forces act alongside molecular pathways to direct cellular behaviours that sculpt organ architecture. Yet, how these signals converge in three dimensions to generate functional organs remains poorly understood.

The C. elegans gonad provides an excellent model to address this challenge. It offers unparalleled accessibility for live imaging, biophysical manipulation, and high-throughput screening. Moreover, gonad development mirrors the morphogenesis of tubular organs, including mammary glands, kidneys, and lungs. Leveraging this system, we explore how biomechanics regulate gonad architecture, germ cell fate, and extracellular matrix–guided morphogenesis.



Our work probes how mechanical forces regulate gonad development and function in C. elegans, focusing on three themes: (Left) Soma–germline mechanical interactions in coordinating tissue architecture during gonad morphogenesis, (Middle) Influence of basement membrane mechanics on germline organization and gonad formation, and (Right) Actomyosin-driven forces in oocyte development during gametogenesis.

PUBLICATIONS

1. Agarwal Priti*, Simon Berger, Tom Shemesh, Ronen Zaidel-Bar. Active nuclear positioning and actomyosin contractility maintain leader cell integrity during gonadogenesis. Current Biology, 2024. June 3; 34(11): 2373-2386. *Co-Corresponding author.
2. Ronen Zaidel-Bar and Agarwal Priti*. Outside influences: The impact of extracellular matrix mechanics on cell migration. Current topics in developmental biology. 2025;164:29-65. *Co-corresponding author.

Distinguished and Emeritus Faculty

The quest for knowledge is never ending. In this annual report, we feature this continuum: we showcase four faculty who continue this pursuit even after they have left NCBS.

Integration of Neuromodulatory Inputs by Intracellular Ca2+ Signaling for Systemic Growth and Behaviour

Gaiti Hasan

My group studies intracellular Ca2+ signaling, through the inositol 1,4,5-trisphosphate receptor (IP3R) and the store-operated Ca2+ channel (STIM/Orai) in Drosophila and human neurons. Ca2+ release through the intracellular endoplasmic reticulum (ER) - membrane localised IP3R activates STIM and leads to extracellular Ca2+ entry through Orai referred to as Store operated Ca2+ entry or SOCE. Work from our group in Drosophila neurons and more recently in human neuronal cells demonstrates a new role for the IP3R in regulating neuronal SOCE. IP3-bound IP3Rs enhance association of STIM1 and Orai1 in neuronal cells even in the absence of Ca2+ release from the ER. Convergent regulation of SOCE by IP3Rs through IP3-binding and ER-store Ca2+ release may tune neuronal SOCE to respond selectively to neuromodulatory membrane receptors that generate IP3. This finding answers a long standing question on the functional significance of neuronal SOCE. Given the multitude of Ca2+ entry channels in neurons our work has shown how IP3-mediated Ca2+ release and SOCE can affect neuronal function. Other studies from our group have identified how IP3-mediated intracellular Ca2+ release and SOCE impacts neuronal function through changes in gene expression in Drosophila dopaminergic neurons, mouse Purkinje cells and human ES cell derived neurons. My groups transition from Drosophila to human neurons happened over a period of several years. Our discovery in 2009 that Drosophila IP3R mutant neurons show reduced SOCE even after pharmacological depletion of store Ca2+ led us to pose the same question in human neurons. For this work we were aided by a 5 year outstanding scientist grant from the Department of Biotechnology awarded in 2013.

My independent research career began as a post-doctoral fellow and then an independent scientist at the Molecular Biology Unit of the Tata Institute of Fundamental Research (TIFR) in Mumbai, with a short stint of two years at Prof. Michael Rosbash's lab at Brandeis University in USA. The transition from TIFR, Mumbai to the National Centre for Biological Sciences (NCBS) in Bengaluru occurred when NCBS was founded as a TIFR centre by Prof. Obaid Siddiqi in 1989. During my post-doc at Prof. Rosbash's lab I identified neuronal intracellular Ca2+ signaling through the Inositol 1,4,5 receptor trisphosphate receptor (IP3R) as a novel scientific problem. My groups interest was to identify how Ca2+ release through the

Our discovery in 2009 that Drosophila IP3R mutant neurons show reduced SOCE even after pharmacological depletion of store Ca2+ led us to pose the same question in human neurons.

IP3R impacts cellular and systemic function in Drosophila with the broader interest of understanding how changes in cellular neuronal function impact systemic physiology and behaviour. The presence of one gene for the IP3R in Drosophila as opposed to three in mammalian genomes made it feasible to generate Drosophila IP3R mutants with complete and partial loss of function. This was followed up over the years by understanding IP3R and SOCE function in Drosophila larval neurons in the context of viability and in a set of central dopaminergic neurons in the context of adult flight behaviour. We stayed as a small group of ~5 lab members for many years (till 2010) with 2-3 graduate students and occasional junior research fellows. Our focused progress was largely due to the dedication of these young people. After 2010 the group expanded to 10-12 members with many more graduate students and JRFs and a few postdocs, allowing the expansion to human neurons. Currently, I run a small group of 4 people and our interest, in collaboration with Prof. Sumantara Chattarji at CHINTA, Kolkata, is to understand how Ca2+ signaling through IP3Rs and SOCE impacts neuronal health in the context of Parkinson's Disease and Spinocerebellar Ataxias.

Gaiti with her lab members.

Frogs and the Rat Race

K. VijayRaghavan

What interested me as a graduate student and continues to fascinate me today is the process by which the capacity for movement is established during development. To the biologist, nothing is more critical than the experimental preparation chosen for the question being asked. For the questions we asked, the adult fly Drosophila melanogaster, was ideal. The fly exhibits a range of complex and fascinating behaviour, similar to that of adolescent humans: Constantly in search of food, drink, mates, and an ability to escape from responsibility. Unlike humans, flies are amenable to rapid laboratory breeding, genetics, and dissection, allowing for the examination of how the capacity for such behaviours develops. Over time, as the tools of genetics, molecular biology, and microscopy evolved dramatically, what the fly delivered surpassed all predictions. Over the past forty years, our efforts have had a modest impact on advancing our understanding of how nerves and muscles develop. These include work that shows how stem cell lineages pattern neuronal identity in the brain and the motor system, how segmental identity and the action of Hox genes pattern muscles, and how muscle stem cells contribute to repair and regeneration.

Satyajit Mayor, KS Krishnan, Jayant Udgaonkar, Veronica Rodrigues.

Quality science can emerge in three distinct ways. The first, and very rare, is through the work of a brilliant mind. This was certainly not us, not even close. The second is by a fearless leader putting in place, by inspiration and example, a team that can climb any barrier and solve any problem. This was certainly not us, either. The third is by being in the company of the brightest and the best, in a conducive institutional environment and lucking out. A great institution, Homi Bhabha supposedly said, is where, rather than ordinary people, can do extraordinary things. TIFR, in general, and NCBS, in particular, were, and continue to be, very special. It is possible to seek out and enjoy the company of very bright people while also managing to get some work done. Much of the afternoon, now, and from when I was a graduate student, was most gainfully spent not trying to do anything useful, but just chatting with colleagues, many of whom became collaborators. Most people are better than you at most things, and you may be reasonably good at something. So there are benefits all around. Getting things done in the lab is essential, of course. But that can be done through the night when few are around. This routine can take a toll on the circadian rhythm and sleep. That is addressed by attending seminars judiciously. When the audience is large, carbon dioxide levels build up after the introduction and induce a state of deep sleep. The applause at the end will wake you up, and you can ask a question or two to mitigate guilt.

Institutions of this kind that have a culture of collegiality and interaction do not appear magically. The story of how a ragtag team led by Obaid managed to build NCBS is a long one for another time. We were frogs in a pan of water being slowly heated, taking on many more things than our science at a stage in life when good sense exhorted us to focus. And being frigs in a well, we had no idea about what we were not supposed to do.

Entropy needs to be kept at bay to create order when building an institution; it must also be kept at bay today to prevent decline. Most groups of frogs can make an institution with an open culture. Building something from scratch is always easier than reshaping old structures. Today, it takes a special kind of frog—and the water in the pan is hotter today—to continue growing, prevent decline, and maintain institutional culture despite our size and age.

All visitors think that the campus, with inStem, C-CAMP, TIGS and NCBS, is a magical place. As frogs in a well, we need to appreciate that collective strength too, and spend half of each day engaging with people from diverse backgrounds in science and life. Otherwise, there is a danger that we frogs will fall victim to the rat race—for which we are not built—and the distinctiveness of the campus will be lost.

TIFR, in general, and NCBS, in particular, were, and continue to be, very special. It is possible to seek out and enjoy the company of very bright people while also managing to get some work done.

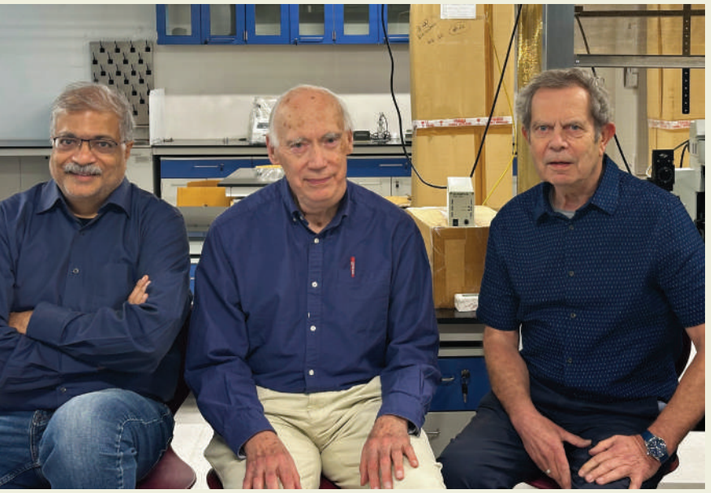
Left: NCBS main gate in 1997.
Right: Animal house in 1998.

From NCBS to CHINTA: Back to the Future

Sumantra "Shona" Chattarji

In early 2023, after more than two decades at NCBS, I embarked on a new journey in Kolkata. I founded the Center for High Impact Neuroscience and Translational Applications (CHINTA), which is funded by The Chatterjee Group (TCG) Centres for Research and Education in Science and Technology (CREST). The word "chinta", in Bengali, means a thought or idea. There are several thoughts that motivated the creation of this research center focused on translational neuroscience. Foremost among these is the challenge that we are all aware of. Brain disorders represent a growing public health threat, underscoring the need for new interdisciplinary approaches in discovery neuroscience that can be translated into effective therapeutic interventions. While western societies have developed frameworks for meeting these challenges, there remain gaps between basic neuroscience research and clinical practice in India. Another key issue has to do with the inherently interdisciplinary nature of this kind of research. The best and the brightest in the physical, computational and engineering sciences are have a growing impact on neuroscience research. But, there are still significant structural barriers between these disciplines in India – and this makes such transitions and interactions between disciplines more difficult. So, there is a pressing need to overcome these barriers with new models for research and training in neuroscience that empower cross-disciplinary mobility. Our hope is that CHINTA can contribute to this paradigm shift in the Indian context.

Beyond these bigger picture issues, there are more personal reasons behind this transition from NCBS to CHINTA. Kolkata is renowned for its scientific and academic achievements, world famous literary icons, and an amazingly rich tapestry of art and culture. But, various socio- political and economic factors, have led to stagnation over the past several decades. And this in turn has contributed to a prolonged exodus of talent out of Bengal. Yet, look at any prestigious research institute around India – and a significant proportion of the students and faculty will be from this state. So, despite all the turmoil, there is a deeply ingrained respect and admiration for scholarship and knowledge – and this is reflected in a constant supply of talented and motivated young Bengalis who want to learn and do good science. And this is another key reason for setting up an example of how good science can be done – closer to the source of this talent pool.



Prof. Tim Bliss (center) and Richard Morris at CHINTA.

I grew up in Bengal. But, like many others in my generation, I had to leave home to faraway places seeking opportunities to do exciting science. Where I enjoyed doing my science and where my heart yearned to be – have been far apart – with little hope of uniting the two! Hence, my return to NCBS from the USA more than 25 years ago was an important step in resolving this disconnect. The NCBS experience was truly amazing! But it was not quite "home". This is what makes the CHINTA experiment so close to my heart. As we build CHINTA, I constantly draw upon the valuable lessons I learned from my NCBS colleagues, and the amazingly gifted graduate students and post-docs in my former lab. NCBS showed me how a relatively small place with a tightly knit and collegial scientific family could punch above its weight. Our talented and committed colleagues really made NCBS such a unique scientific ecosystem. Hence, though I have "left" NCBS, NCBS will never leave me – it will continue to shape and inform my scientific journey.

CHINTA reception area.

As we build CHINTA, I constantly draw upon the valuable lessons I learned from my NCBS colleagues, and the amazingly gifted graduate students and post-docs in my former lab.

"I left NCBS, yet it is always a part of me."

You can check out anytime you like, but you can never leave.

Yamuna Krishnan | Department of Chemistry, The University of Chicago, Chicago, IL 60637

Ten years after leaving NCBS, I'm asked to describe my 8-year metamorphosis there, plus a decade of its impact on my lab, in 600 words. Before I came to NCBS, I freely confess my heart was set on IISc. But my discussions with NCBS Faculty were so fantastic, that by the end of that fateful day, I could not picture myself anywhere else. I wanted to work there so badly, I accepted the first low-ball offer I received and ended up with the second smallest lab.

Yet I was thrilled to bits in my shoebox-sized office, because I had these minds (YK gestures to The Old Guard) as my daily intellectual sandpaper. As critical as they were in shaping how I thought about biology, they also gave me the space I needed while my marriage ended. Yet throughout, they were friends, they were fun, always supportive, never gossipy. I thought deeply about whether to say this, finally deciding to do so, because though we are scientists, we are human first. It was this personal cocoon, yet professional furnace, that forged the foundation of my research.

I started developing small DNA assemblies that adopted unusual shapes via non-canonical base-pairing. This was different from mainstream structural DNA nanotechnology, yet my colleagues' incessant so-what-never-mind-if-it's-cool troubled me no end. Finally, my coolest project, a pH triggered DNA switch, ended up sensing pH only from 5 to 6.5. Since chemists are taught that physiological pH is 7.4, I thought my lab was finished. Sensing my doom, a PhD student in Jitu's lab told me that many organelles had acidic lumens. Perhaps, I reasoned, I could use it in organelles.

With nothing left to lose, I persuaded Souvik Modi my first PhD student to "chuck it on cells, see what happens". I figured either the cells would die or our nanodevice would be obliterated, and either way, so would my precious lab. But the cells stayed healthy, the nanodevice ended up acting like an endocytic tracer and we mapped pH as a function of endosomal maturation. Jitu, my collaborator, warned me in advance that there was nothing new to be found by mapping endosomal pH. He was right. We did not learn anything new about endosomes. But we learnt something new about DNA: it could report on organelle chemistry without being interfered with, or interfering with, the cell's own mechanisms of DNA control.

Meanwhile, I fell in love with *C. elegans* peering at them through a microscope in Sandhya Koushika's lab and together we mapped the pH of the endolysosomal pathway in worms. Suddenly, I had the awesome power of worm genetics to validate DNA reporters for ions other than protons. For this technology to reach its fullest potential, it needed an environment where I could harness all the tools of chemistry yet also access clinical samples. I flew the nest.

I fell in love with *C. elegans* peering at them through a microscope in Sandhya Koushika's lab and together we mapped the pH of the endolysosomal pathway in worms.

A decade later in Chicago, we have mapped all the major physiological ions, illuminated the hidden chemistry of organelles, and showed that organelles have electrical behaviour. This has upended our long-standing view of organelles as inert fat bubbles, revealing them instead as electrical compartments. Our technology also yielded new ways to diagnose diseases and deliver drugs with organelle-level precision. Today in medicine, the most successfully drugged proteins transport ions across the plasma membrane, which comprises just 2-5% of the total cellular membrane. Organelles comprise the remainder and harbor many more ion-transporting proteins, none of which could previously be probed in their native environments. By creating the means to do so, we have now made accessible, a vast and untapped landscape for biology and medicine.

Our Alumni

Sristi Batra
Co-founder,
Qzense Labs

I am Dr Srishti Batra, founder of Qzense Labs, a deep-tech, National Technology Award-winning startup. I am proud to share that this award recognised our work on digitising olfaction—a direct continuum of my PhD research at NCBS.

As a PhD student at NCBS, I studied olfactory sensory systems in the lab of Dr Shannon Olsson. She always encouraged bridging fundamental biology with real-world impact. This encouraged me to look for unconventional careers. My PhD work inspired me to explore how the science of smell could be translated into technology. This idea ultimately became the foundation of Qzense Labs, which digitises olfaction to assess food freshness and shelf life—reducing post-harvest losses and promoting sustainability.

My journey at NCBS was a defining chapter in shaping both my scientific thinking and entrepreneurial path. The scientific rigour, access to world-class facilities, and, most importantly, the openness of the NCBS community fostered a deep sense of independence and innovation in my approach to science. I led a team of interns for my project, and that experience equipped me with the managerial skills required while building my team at Qzense. I also value the continued support of C-CAMP, the technology incubator on the BLiSC campus, which played a crucial role in helping us secure the prestigious BIRAC Biotechnology Ignition Grant.

The continuum between my academic training at NCBS and my current work in applied olfactory technology reflects the power of empowering scientists to think beyond the lab and create tangible impact.

Prasenjeet Yadav
National Geographic Photographer

I am a National Geographic photographer, filmmaker, and writer, focusing on telling science, ecology, and environmental stories from India and Central Asia. I also mentor others and run science communication courses in India and internationally, helping people share their science stories with the world. NCBS has shaped me professionally by giving me a rigorous scientific foundation. I learned to think, design experiments, understand and respect data, and value collaboration and feedback. The critical thinking skills I gained there continue to form the backbone of my work. Personally, NCBS gave me confidence and introduced me to a supportive community of critical thinkers. I found mentors and made close friends—people who are ambitious, curious, and passionate about ecology and India's natural history. This environment helped me grow and feel comfortable navigating both the scientific and storytelling worlds.

Pritha Ghosh
Senior Clinical Scientist at ConcertAI, Bangalore

My years at NCBS were a defining part of my scientific journey. Working with Prof. Sowdhamini and the vibrant research community taught me to think independently, ask meaningful questions, and enjoy the rollercoaster journey of scientific discoveries. The collaborative environment, where ideas flowed freely across disciplines, helped me see scientific research through diverse perspectives. An excellent supervisor, supportive mentors and colleagues, and access to world-class facilities made NCBS a place where curiosity could truly thrive.

Today, I work as an oncology researcher, focusing on real-world healthcare data. My research explores how clinico-genomic information can be integrated to advance precision oncology and improve patient outcomes. Many of the skills and values I rely on daily — from rigorous data analysis to scientific communication and teamwork — have their roots in my time at NCBS.

What I carry forward most from NCBS is its spirit of openness and exploration. It continues to guide how I approach scientific problems, collaborate with others, and translate research into meaningful impact. That sense of continuity — from academic discovery to applied science — keeps the NCBS legacy alive in my work today.

Aathira Perinchery
Environment Journalist,
The Wire

Aathira Perinchery currently works as an environment journalist, reporting on wildlife, conservation, climate change and the environment in India for *The Wire*, a national digital media house.

Her professional backgrounds in both wildlife research and journalism began at NCBS. Between 2006 and 2008, she trained as a wildlife biologist as part of the second batch of the NCBS master's programme. After transitioning away from academia in 2011, it was a chance encounter with science writing while working as part of the NCBS news team – in the form of Anil Ananthaswamy's science writing course – that made her delve into the world of writing about science and later, wildlife. After a diploma in print journalism, Aathira worked as a wildlife reporter for *The Hindu*. She has also freelanced for numerous media houses including *Mongabay-India*. Having a background in wildlife biology and conservation has helped her better understand the issues that she covers.

In 2021, she received the AAAS Kavli Gold Award for “Science Reporting Small Outlet” for her story titled “Succession” for the online publication *Fifty-Two*. The story looked at how scientists keep discovering species in the Western Ghats. Aathira is also the recipient of several reporting grants for her work, including from the Earth Journalism Network.

Akshit Goyal
Faculty at International Centre for Theoretical Sciences (ICTS-TIFR)

I am a biological physicist whose academic path has been shaped by several outstanding institutions. I completed my PhD at the National Centre for Biological Sciences (NCBS) under the guidance of Sandeep Krishna, During the five years I spent at NCBS, I lived away from home for the first time, formed lasting friendships, and built an international network of collaborators, thanks in large part to the vibrant community and frequent international visitors. A significant aspect of my journey was collaborating with Dr. Sergei Maslov from University of Illinois, who became an informal second mentor and a long-term scientific partner after we met at a conference organised at NCBS.

Following my PhD, I worked as an independent postdoctoral fellow in the Department of Physics at MIT. In October 2023, I joined the International Centre for Theoretical Sciences (ICTS) in Bangalore, where I now lead a group of biological physicists. My research focuses on understanding diversity and stability in ecosystems using tools from statistical physics, with recent interest in integrating evolution into ecological models. Through the joint “Physics of Life” graduate program, I remain closely connected to NCBS, collaborating with colleagues across both institutions.

Sudha Kumari
Assistant Professor, Department of Microbiology and Cell Biology, Indian Institute of Science

When I think back to my days at NCBS, no single emotion can capture the whole experience. It was a transformative phase in my journey—a coming of age as a scientist—filled with exciting challenges, exhilarating victories, and educational misadventures. I can't imagine a better experience. Only a few institutes so vibrantly embody a dynamic training environment or cultivate curiosity in their students the way NCBS does. From the many different model systems to the versatile infrastructure to the sheer diversity of thought, it truly felt like a holistic microcosm of scientific exploration- one that opened an entire universe of science to me.

These days, I only get to visit occasionally to NCBS occasionally, but each time I do, I feel great satisfaction in seeing the next generation of thinkers, investigators, and tinkerers at various stages of their growth. It's always a deeply emotional experience for me.

Administration, Academics and Facilities

Administration, Procurement, Finance, Stores & Catering Services

G. Ravi Shankar
Head, Administration and Finance

The National Centre for Biological Sciences (NCBS-TIFR), established in 1991 as a Centre of the Tata Institute of Fundamental Research (TIFR), has, over the past three decades, grown into a premier Centre of Excellence in the biological sciences.

In a research environment like NCBS, the Administrative framework serves as the backbone-enabling faculty and researchers to pursue their scientific aspirations while safeguarding the Institute's interests amid increasing complexities, shifting economic landscapes, and evolving societal expectations.

The Administration at NCBS plays a pivotal role in translating institutional policies into practice, ensuring their effective dissemination and seamless coordination within and across departments. It functions through five core divisions - Establishment, Procurement, Finance, Stores, and Canteen – each entrusted with specific operational mandates. Together, these divisions are supported by 24 dedicated permanent staff members, whose collective efforts drive the objectives of their respective units and contribute to the smooth functioning of the Centre.

The true strength of the NCBS-TIFR Administration lies in its unwavering commitment to efficiency, teamwork, and timely service delivery. Throughout the past year, the Division has exemplified collaboration, service-mindedness, and adaptability, continually enhancing administrative systems while nurturing a supportive and engaging environment for students, faculty, and staff alike.

As of September 2025, the personnel strength at NCBS is as follows:

Particulars	Sanctioned Positions	Filled in Positions	No of Vacancies	Deputation	Pachmarhi Field Station
Academics	42	38	04	1	0
Scientific	28	26	02	0	1
Technical	21	19	02	0	1
Administrative	32	24	08	0	1
Auxiliary	05	02	03	0	5
TOTAL	**128**	**109**	**19**	**1**	**8***

*These are positions sanctioned for TIFR and loaned to NCBS. Their salaries are being paid by NCBS.

PROCUREMENT

The Procurement Division at NCBS stands as a model of collaborative efficiency, supporting the diverse scientific and infrastructural needs of the Institute. Its responsibilities encompass the procurement of laboratory consumables, equipment, furniture, and high-end sophisticated instruments, as well as the management of service and labour contracts—including canteen, security, laboratory kitchen, animal house, and building maintenance. The Division also oversees Annual Maintenance Contracts (AMC), import and export logistics, live shipments, disposal processes, and the finalization of agreements.

Despite operating with a small team, the Procurement Division manages nearly 40% to 50% of NCBS's total annual expenditure. The continued growth of campus infrastructure and research facilities has introduced new challenges, requiring strategic planning, multitasking, and effective resource alignment—particularly in human resource management. The Division has responded to these demands with foresight, adopting a strategic growth model that ensures sustainability, compliance, and responsiveness to the Institute's evolving needs.

The Division's work extends beyond routine acquisitions to include specialized procurement of advanced scientific equipment and high-value capital assets, alongside the formulation and finalization of contracts and agreements. In executing these multifaceted responsibilities, the team consistently demonstrates deep institutional knowledge, procedural expertise, and proactive problem-solving, while maintaining an unwavering commitment to service excellence—empowering NCBS researchers to achieve their scientific goals with efficiency and integrity.

FINANCE

During the financial year 2024-25, NCBS received a Core Grant of ₹94.42 crore from the Department of Atomic Energy (DAE). This core funding serves as the financial backbone of the Institute, supporting its regular operations, research programs, and institutional development activities.

In addition to the core support, the year witnessed the addition of 27 new research grants from various national and international funding agencies, further strengthening NCBS's extramural funding portfolio. These grants continue to play a pivotal role in

Particulars	2020-21	2021-22	2022-23	2023-24	2024-25
Research & Development	183.40	328.10	393.86	301.97	288.08
Extra Mural Grants	374.62	445.93	447.88	549.64	663.78
Salaries & Fellowships	268.43	292.92	352.91	385.37	398.50
Operational Expenditure	261.86	253.84	305.01	317.54	323.54
Construction	0.19	0.01	6.53	6.07	6.52
Total	**1088.50**	**1320.80**	**1506.19**	**1560.59**	**1680.42**

Expenditure (Amount in Millions)

advancing a diverse range of scientific projects. Notably, Indian corporates such as the Rohini Nilekani Philanthropies Foundation (RNPF) and the Murty Trust, along with global organizations including the Bill & Melinda Gates Foundation (BMGF), the Kavli Foundation, the International Bank for Reconstruction and Development (IBRD), and the Wellcome Trust, have extended substantial financial support to NCBS's research and testing initiatives.

The financial year concluded successfully with full utilization of allocated funds, ensuring no lapses or underutilization. The introduction of the Treasury Single Account (TSA) system during the period has notably improved fund flow management and operational efficiency. Through careful financial planning and prudent resource allocation, the Institute ensured timely expenditure and accountability. The prompt signing and finalization of financial statements further underscored NCBS's commitment to transparency, compliance, and fiscal discipline.

The Finance Team continues to work proactively with all departments, ensuring seamless fund management and financial support for research activities. Their efficiency enables researchers to focus entirely on their scientific pursuits, while financial operations are managed with precision and reliability in the background.

We extend our sincere appreciation to all faculty members, students, technical, and administrative staff for their continued cooperation and support, which collectively contribute to the Institute's sound financial governance and operational excellence.

STORES

The Stores Division at NCBS plays a vital role in ensuring the seamless availability and efficient management of materials essential for the Institute's scientific and administrative operations. It serves as the central node for the receipt, inspection, safe custody, and distribution of consumables, chemicals, glassware, laboratory items, instruments, and general supplies required across departments and research laboratories.

The Division meticulously maintains inventory records and ensures accurate stock accounting through systematic verification and timely documentation, in accordance with prescribed procedures and audit norms. A digital inventory system helps track material availability and supports the timely replenishment of stock to meet departmental requirements. The Division also works in close coordination with the Procurement and Finance Divisions to facilitate seamless workflows related to purchase orders, material receipt, invoice processing, and vendor payments. By adhering to the principles of transparency, accountability, and cost efficiency, the Stores Division contributes significantly to effective material management and institutional governance. Regular monitoring of stock levels, timely disposal of non-moving items, and compliance with statutory audit requirements have further strengthened the operational integrity of the Division. The Stores Section also helps manage the return of materials, disposal of scrap items, and recycling of packing materials in compliance with safety and environmental guidelines.The team's proactive and service-oriented approach has ensured uninterrupted supply chains, supporting the research community in meeting project timelines and institutional objectives. The Stores Division remains committed to continual process

improvement, digital record-keeping, and sustainable resource management practices that align with NCBS's long-term operational goals.

CATERING SERVICE

The Catering Services Division at NCBS provides an essential welfare and hospitality function, ensuring the availability of wholesome, hygienic, and affordable food for faculty, students, staff, and visitors across the campus. The facility operates under a managed service contract, with oversight from the Administration to maintain consistent standards of quality, cleanliness, and operational efficiency.

In addition to overseeing campus dining facilities, the Catering Services Division is also responsible for the maintenance and operation of the NCBS Guest House, which accommodates national and international visitors, including scientists, collaborators, and participants attending meetings, workshops, and conferences. The same dedicated team ensures courteous service, comfortable lodging, and well-maintained amenities. Coordination for bookings, housekeeping, and catering arrangements is handled efficiently to meet the diverse requirements of guests and institutional events.

The Division ensures that daily food services function smoothly, catering to diverse dietary preferences while adhering to food safety regulations and best practices in hygiene. Regular inspections and quality audits are conducted to ensure compliance with contractual obligations, and user feedback is continuously reviewed to improve menu variety and service standards.

Beyond routine operations, the Catering Services Division also supports institutional programs, workshops, and conferences by coordinating special catering arrangements in line with NCBS standards. The Division works closely with the service contractor to ensure fair pricing, menu planning, infrastructure maintenance, and ongoing service enhancement.

Through its commitment to quality, accessibility, and user satisfaction, the Catering Services Division continues to play a vital role in sustaining a positive and inclusive campus environment—one that supports the well-being, comfort, and productivity of the NCBS community while upholding the Institute's hospitality standards for both national and international visitors.

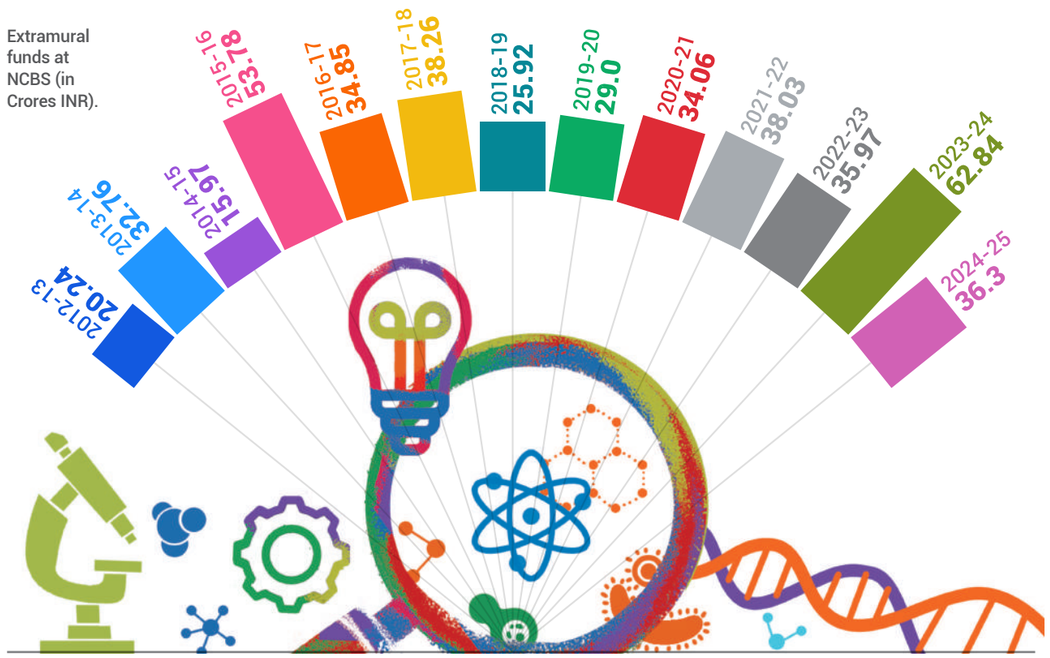
Research Development Office

Malini SP

The Research Development Office (RDO) facilitates research and training on campus via research funding and collaborations. The office provides comprehensive support to campus researchers with securing funding, management of grants and awards, and facilitating research collaborations.

A few key highlights of research funding at NCBS include the receipt of the prestigious DBT-SAHAJ Infrastructure Grant for the National CryoEM Facility. During this period, NCBS faculty member, Dr. Abhilasha Joshi also received the "Transition to Independence Faculty Award" from the Simons Foundation, USA for her research program on cognitive-motor flexibility across the organismal lifespan.

Private and philanthropic funding supports specific initiatives at NCBS. NCBS successfully secured funding from the Murty Trust to support a program in field ecology and conservation- "The Indica School of Field Ecology and Conservation". Despite the growing number of graduate programs in ecology and conservation across India, many students lack the opportunity to immerse themselves in the critical field-based pedagogy that is essential



The RDO continues to support establishment of national and international collaborations to facilitate and promote collaboration in life sciences and biotechnology.

to the training of effective ecologists and wildlife biologists. At present, there is a notable gap in the availability of immersive, high-quality field courses for. The Indica School of Field Ecology and Conservation seeks to fill this gap by offering two complementary field courses annually: Community Ecology and Conservation and Ecology and Wildlife Science. Additionally, with the generous support from TTK Prestige Ltd., NCBS has undertaken several education outreach activities with a focus on mentoring high school/undergraduate students from underrepresented regions and their teachers in learning/teaching basic concepts of biological sciences and applicability of scientific methods across diverse sectors. The TNQ Foundation continues its support for the "Obaid Siddiqi Chair in the History and Culture of Science" and the establishment of a Research Fellows Programme at the Archives at NCBS.

The RDO continues to support establishment of national and international collaborations. Recent highlights include the LOI signed between NCBS-TIFR and Imperial College of Science, Technology and Medicine, UK, to facilitate and promote collaboration in life sciences and biotechnology, building on their partnership and supporting the Eric and Wendy Schmidt AI in Science Global Faculty Fellowships. During this period, NCBS has also signed MoUs with various institutions across India including IIT Dharward, Kuvempu University, KSCSTE-Kerala Forest Research Institute (KFRI), Peechi, Wildlife Institute of India- Salim Ali Centre for Ornithology and Natural History- (SACON) and Aster Hospitals.

Work at the RDO is made possible by a dynamic and professional team who are committed to offering several key services to the campus at the boundaries of science, management, resource development, planning, and outreach. We look forward to a rewarding journey further ahead for the RDO, supporting campus research funding and research collaborations.

Research Support Facilities

P.C. Gautam

The Technical Services team plays a pivotal role in supporting the institute's scientific research and mission through integrated engineering- technology development, operations and maintenance , and infrastructure development. Over the past year, the division has demonstrated strong interdisciplinary collaboration, innovation, and operational excellence through the collective efforts of the IT, Instrumentation, Electrical, HVAC, Civil, and Architecture teams.

Technology Development and Innovation

The IT and Instrumentation teams achieved significant milestones in developing in-house technological solutions tailored to the institute's research and operational needs. A major achievement was the development and deployment of the Visitor Management System (VMS), which streamlined visitor registration, tracking, and security compliance while enhancing data accuracy and operational efficiency.

Another notable innovation was the Thermomatery – Online Temperature Monitoring System, designed for real-time monitoring and logging of temperature-sensitive environments, with automated alerts via email and WhatsApp. This system has strengthened regulatory compliance, improved reliability, and significantly reduced manual intervention across critical laboratory and facility areas.

The Instrumentation team also successfully designed and developed advanced research-support equipment, including a Micro Centrifuge, Speleo Climate Data Logger, Portable CO Detector, Bead Bath, UV Transilluminator, and an indigenously developed Stage Top Incubator with gas mixer and humidity control for microscopy applications. These developments have directly enhanced experimental capabilities and supported ongoing scientific research within the institute.

The Electrical team successfully converted a petrol bike into an electric bike, and designed and installed auto-changeover and APFC panels, contributing to energy efficiency and operational reliability. The HVAC team successfully designed and fabricated a crane system for the cooling tower, improving maintenance efficiency and safety.

Research Support Facilities team.

The Civil, Electrical, Architecture, and other technical teams played a key role in strengthening the institute's physical infrastructure.

Infrastructure Development and Facility Enhancement

The Civil, Electrical, Architecture, and other technical teams played a key role in strengthening the institute's physical infrastructure. A landmark achievement during the year was the development of the Technical Services and store Building, which provides a centralized, well-equipped workspace, enhancing coordination, efficiency, and service delivery across departments.

Additionally, the division completed several critical infrastructure projects, including laboratory renovations to upgrade research areas for new faculty, construction of a Security Building to reinforce campus safety and access control, and a Conference-cum-Meeting Facility designed to host international visitors, collaborations, and high-level meetings. These facilities reflect modern design principles, functional efficiency, and sustainability considerations.

Integrated Team Effort and Institutional Impact

The success of these initiatives reflects the strong synergy among all teams within Technical Services. From concept design and system development to execution, commissioning, operations, and maintenance, the division has delivered robust solutions aligned with the institute's long-term vision of innovation, reliability, and excellence.

From Campus to Community

The Lasting Impact of NCBS Facilities

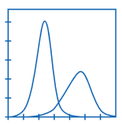
Deepti Trivedi

The research facilities at NCBS are the backbone of discovery and collaboration, linking generations of scientists through a spirit of continuum. Born from the needs of our researchers and nurtured by the energy of students, these platforms have grown into state-of-the-art resources spanning imaging, omics, model organisms, biophysics, and specialized research spaces. Their impact extends far beyond campus—shaping scientific journeys, fostering mentorship, and creating enduring connections carried forward by our alumni across the globe.

Imaging

Imaging at NCBS brings together state-of-the-art platforms to explore biology across scales. The Central Imaging and Flow Cytometry Facility enables advanced light microscopy through 21 high-end microscopes and cell analysis through 12 flow cytometers, while the Electron Microscopy Facility provides ultrastructural insights through scanning and transmission electron microscopy. High-content discovery is supported by the High Throughput Screening Facility, and cutting-edge structural biology is powered by the CryoEM Facility, a national facility. Together, these resources empower researchers to visualize life from molecules to organisms with precision and depth.

Central Imaging and Flow Cytometry
Crew: Sarvajith Manjunath, Venkatesan Iyer, Raksha K, Anil Kumar HV, Subhashini Thiyagarajan, and H. Krishnamurthy
Electron Microscopy
Crew: Angshuman Ray Chowdhuri, Sunil Prabhakar, Chandrani Samadder and Malavika Prabhakaran
CryoEM Facility
Crew: Sucharita Bose



OMICS

Omics at NCBS provides powerful platforms to decode the molecular foundations of biology. The Mass Spectrometry Facility enables in-depth proteomic, lipidomics, glycomics, and metabolomic analysis through several high end platforms, while the Next Generation Sequencing Facility delivers high-throughput genomic and transcriptomic insights. Complementing these, the Sanger Sequencing Facility supports rapid, accurate sequence validation. Together, these facilities offer comprehensive omics capabilities to drive discovery from single genes to complex transcriptome and proteome networks.

Mass Spectrometry
Crew: Ankit Jain, Selsiya B., Swikruthi T.G.
Sequencing Facility
Crew: Awadhesh Pandit, Lakshminarayanan C. P., Suresraj Y., and Vinay Kumar

Model Organisms

Multiple facilities are dedicated to maintaining model organisms at NCBS and provide versatile systems to uncover biological mechanisms and model human disease. The Animal Care Resource Centre (ACRC) supports research with mouse, rat, and zebrafish models under high standards of care including high barrier and SPF facility. The Mouse Genome Engineering Facility (MGEF) enables creation of customized transgenic, and knockout strains. The Drosophila Facility offers powerful tools for genetic manipulation including transgenesis and mutations, while the C. elegans Facility supports investigators in microinjections and worm maintenance. Together, these platforms empower researchers to address questions across genetics, development, and disease biology.

Animal Care Resource Centre (ACRC)
Crew: Mohan G H, Roopa N, Sreenivasulu T, Manjuntha A M, Dinesh Kumar, Janarthanan, Jeeva Meena, Prasad G, Jagdish P T, Padmavathi G V, Himakar T, Laxmankumar N A, Akash R, Aravind N, Mahesh M, Babu P, Gopi P, Kumar R, Amarnath, Manjunath A, Nagaraju V, Nagaraju M C, Rohina, Srikanth R, Madhu H and Mahesh M V
Mouse Genome Engineering Facility (MGEF)
Crew: Mahesh Sahare, Gamyashree, Darshan L, Mahima, Reena V, Utkarsh Nikhade, Rakshana L, Shilpa Kumari BA
Drosophila Facility
Crew: Deepti Trivedi, Anitha V A, Devika TK, Hemavathy C, Kishore V, Nataraj N, Smrithi V Yashwantha K.
C. Elegans Facility
Crew: Selvanayaki E

Specialised Spaces for Research

Multiple specialized research spaces exist at NCBS that provide tailored environments to support diverse scientific needs. The Stem Cell Facility enables cutting-edge cellular reprogramming and differentiation studies, while the Greenhouses offer controlled settings for plant research. The Radioactivity Facility and Biosafety Facility ensure safe handling of hazardous and infectious materials. Extending beyond the campus, field stations open access to natural ecosystems, and the Collection Facility preserves invaluable biological specimens. Together, these spaces create a comprehensive ecosystem for research across disciplines.

Stem Cell Facility
Crew: Deepti Trivedi
Green Houses
Crew: Ranjith P P, S.K Munegowda, Narasimha Raju, and Parvathamma
Radioactive Facility
Crew: Akshay Tharali
Biosafety Facility
Crew: Akshay Tharali, Chaitra Jagannathrao
Field Stations
Crew: Savita Chib (Pachmarhi), Chengappa (Kodagu), Raghavendra (Sirsi)
Collection Facility
Crew: Pritha Dey, Tarun Karmakar

Computing Clusters

The NCBS computing cluster facility provides researchers with high-performance computing resources to support data-intensive biological research. It enables large-scale simulations, advanced data analysis, and storage, fostering cutting-edge work in genomics, structural biology, and computational modeling.

Crew: Rajshekar KS

Biophysics

NCBS offers advanced tools to probe the structure and dynamics of biological systems. The NMR Facility provides atomic-level insights into biomolecular interactions and conformations, while the X-ray Facility enables crystallographic studies of macromolecules. Complementing these, the Microfluidics and Microfabrication Facility allows precise manipulation of cells and molecules in custom-designed environments. Together, these platforms integrate structural, dynamic, and engineering approaches to illuminate biology at multiple scales.

NMR Facility

Crew: Arnab Dey

Microfluidics and Microfabrication

Crew: Ankit Jain

Facilities at a glance

Over the years, the Central Research Facilities have grown significantly in both scope and scale. A new discovery biology platform was established for generating CRISPR cell lines and determining crystal structures using X-rays. The Kodagu Research Station for Tropical Ecology was set up in Coorg, and a Biorepository Facility was operationalized. The facilities also conducted several workshops and training programs for internal and external researchers and were recognized in numerous peer-reviewed publications.

Alumni

Manoj Mathew

A Journey from NCBS to ZEISS

My career spans over 17 years, beginning at NCBS, Bangalore, where I served as the Facility In-Charge of the Light Microscopy Core Facility. There, I helped establish infrastructure, developed and organized training programs—including the Bangalore Microscopy Course—and led microscope system R&D projects while collaborating with industry. These experiences honed my expertise in microscopy, automation, and teaching. At ZEISS, I initially worked in the allied field of life science light microscopy, leveraging my NCBS foundation. Later, I transitioned to solutions for the electronics and semiconductor industries, focusing on automated microscopy that integrates digital technologies such as machine vision and AI. My NCBS experience deepened my expertise in imaging systems and automation and instilled a passion for innovation that continues to drive my work today.

Vinay Vikas

Making and keeping the connections alive

NCBS built the foundation of my career, starting in Vijay and Veronica's labs. My time as the Drosophila (fly) facility manager was crucial, providing global leadership experience by leading two international consortium projects. Today, I apply that expertise developing cutting-edge antibody therapeutics at a biotech company. Inspired by NCBS's barrier-free science culture, I co-founded a non-profit, Scienspur, along with another NCBS alumnus, Nagaraju Dhanyasi. This NCBS alumni-rich initiative (with more than 20 instructors who are NCBS alumni) is dedicated to democratizing life science education, impacting over 1,000 underprivileged students and building a community for scientific dialogue across borders. (A highlight of my time at NCBS was also meeting my life partner.)

Scientific Information Resource Centre (SIRC)

Avinash D. Chinchure

The NCBS SIRC is a well-equipped and modern academic research facility that serves the research needs of the members of the entire campus, as well as visiting scholars and researchers. It plays a very important role in supporting the academic programs of the institute.

The primary aim of the SIRC is to develop, organize, preserve, and deliver information and scholarly resources. To achieve this, the SIRC continually expands its collection, explores new resources, and develops an excellent partnership with users to provide effective information services. All SIRC holdings can be systematically searched through the online catalog.

SIRC has a large collection of books, journals, and other resources in the biological sciences, including interdisciplinary areas. It also has a collection of electronic journals and e-books that can be accessed online. In addition to its collections, the SIRC provides a range of services to support research.

SIRC actively participates in consortiums to broaden access to a wide range of resources. Through the ONOS initiative, NCBS has access to an extensive collection of journals from various participating publishers. We also explore new subscription models, such as transformative agreements, to enhance access and offer APC waivers. Currently, we have Read and Publish arrangements with the Company of Biologists journals independently and through the DAE consortia with publishers like Wiley and Springer Nature journals.

The NCBS SIRC is open to all the campus members and is available 24/7 throughout the year, so users can walk-in whenever they need the services. The facility provides a comfortable, welcoming environment and modern infrastructure, including private study carrels, wired and wireless internet, and more to its users for their academic use.

SIRC is an important resource for the entire campus research community and beyond. Its extensive collection, knowledgeable staff, and range of services make it an essential resource for every member and a core facility for the academic and research activities of the institute.

Retirement Note

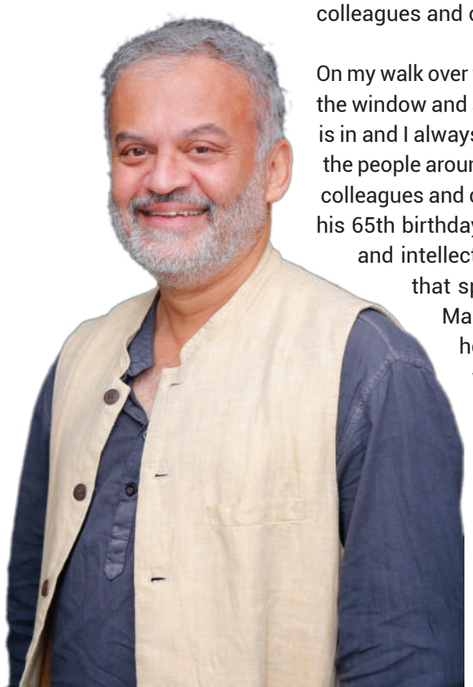
Madan Rao

Written by Shashi Thutupalli

> n a place that is built on cross-disciplinarity, Madan Rao has been one of NCBS's most enduring bridges – between physics and biology, ideas and experiments, individuals and institutions. For over three decades, Madan's science has given a language for how to think about the organization and dynamics of living matter: how membranes, the cortical actin meshwork, active stresses, curvature, and composition create mesoscale structure; how the structures organize signals; how fluctuations and dissipation can be the logic by which cells organize information. After having laid foundational ground for the field of active matter, for the last decade and a half, he has been the keystone around which the Simons Centre for the Study of Living Machines has rallied, brewing a distinctive blend of physics and computer science with biology.

At every seminar on the NCBS campus, be it the Annual Work Seminar of students or from subject-expert colleagues or at faculty chalk talks, Madan has been the colleague who asks the tough questions with warmth. He has constantly provoked us to think beyond the obvious, raise the bar and drive new directions. Madan has been exacting in his standards, cultivating a taste for problems, not only in students but in colleagues, nudging us toward questions that are simple to state, consequential if answered, and resistant to fashionable shortcuts. In a similar vein, Madan is dismissive of the proverbial "big hammer" approach to science emphasising instead a reliance on elegant analytics and reasoning or just the minimal and cleanest experiment to get insight. Over the years, that stance has helped build a unique nexus of theory and experiment that now feels inseparable from the NCBS culture and has radiated out of our campus, drawing colleagues and collaborations from across the world.

Professor Madan Rao.



On my walk over to the Acad canteen every morning, I look into the Simons Centre through the window and am always cheered up when Madan's office door is open – it means he is in and I always look forward to a discussion with him. Madan has cared deeply about the people around him – the warmth and enthusiasm with which multiple generations of colleagues and collaborators from across the world recently came together to celebrate his 65th birthday is a testament! His mentorship is a rare combination of care, rigour, and intellectual challenge. Many of the trainees who learned with him now carry that spirit into their own labs and classrooms across India and the world. Madan, and many thanks also to Jayashree, welcomed us often to their home that felt like a veritable Samarkand of the old: a generous space where students and colleagues met, celebrated, discussed and became a community, another strand in the NCBS continuum.

Madan's legacy has left a lasting imprint across many institutes in India, and it is a very happy thing that this influence will continue to shape new directions. As the 'Physics of Life' Chair Professor at NCBS, he will build bridges across timescales and generations.

Partnerships and Flagship Programmes

Archives at NCBS

Archives at NCBS team

The Archives at NCBS (*https://archives.ncbs.res.in/*) is a public collecting centre for the history of science in contemporary India. Our objectives are four-fold: to strengthen research collections and public access in our domain, push the frontiers of research in archival sciences in India, build capacity through education, and reimagine the archives as part of the commons through vibrant public engagement. Most of our work is generously supported by TNQ Foundation, Arcadia, and NCBS.

Obaid Siddiqi Chair in the History and Culture of Science 2025-26

The Obaid Siddiqi (OS) Chair in the History and Culture of Science at the Archives at NCBS was founded to bridge gaps in the practice, history, and philosophy of science and the humanities (*https://archives.ncbs.res.in/OS*). Prof. Samira Sheikh was chosen as the recipient of the fifth OS Chair, 2025-26. She will be working towards bringing a fresh perspective to India's scientific history, particularly through the history of cartography. Dr Savithri Preetha Nair, the noted historian and philosopher of science, concluded her tenure as the Chair in July 2025.

Lab18 or the archives processing room.
PHOTO: RAVI KUMAR BOYAPATI

Collections

The Archives at NCBS completed three years of its grant from Arcadia toward "Documenting the Contemporary History of Science in India". We currently house over 350,000 objects from across 50+ collections in various forms including Oral History Collections processed by Deepika S, Samyamee Sreevathsa and Mansi Dhingra and the physical materials were processed by Anjali R, Dhatri S, Parvathy V, Sanjna GY and Venkat S.

In February 2025, the Archives awarded diverse projects from across the country that were selected for the Program for the Archiving of Science and Technology (PAST) 2025-26. The program is a regrant made possible by Arcadia to enable digital access to rare, endangered and archivally relevant collections related to the history of science and technology in India, with a focus on documenting under-represented and marginalised groups in STEM.

This year, the Conservation Lab, led by Sindhu Nagaraja, Kinjal Shah, and Dhanya Shree R, successfully completed condition assessment reports for all archival collections up to 2024. They have also contributed to digitization initiatives at the archives by ensuring safe and efficient scanning of fragile objects.

Scenes from the workshop *Building a Feminist Archival Practice*, May 22-23, 2025.
PHOTO: RAVI KUMAR BOYAPATI

By November 2025, we had welcomed three Metadata Archivists, Janaky Sunil, Nisha Bhakat, and Pricilla P Rozario, who focused on modernising, contextualising, and expanding our archival description workflows for collections across three thematic areas: Ecology, Space Sciences, and Biological Sciences.

Research and Collaborations

The Archives continued to run its Research Fellowship and Scholar-in-Residence Program, supported by the TNQ Foundation, hosting researchers from across the country to develop academic outputs based on archival materials.

In May 2025, the Archives at NCBS collaborated with the Museum of Art and Photography (MAP) to organise "Archiving like a Feminist", a two-day gathering at NCBS that brought together archivists, activists, artists and scholars to reimagine archival practice using feminist methodologies. The event was organised and facilitated by Anjali R, Deepika S, Hetal Vora and Venkat S, and the 2023-24 Obaid Siddiqi Chair, Prof. Gita Chadha.

Several presentations and consultations emerged from the team's ongoing work. At the 10th Annual Conference of the Oral History Association of India in Kochi (January 26, 2025), Samyamee Sreevathsa and Deepika S introduced a sensitivity framework developed at the Archives at NCBS to assess interviews and ensure sensitive or personal content is reviewed before public access. This work was also presented along with the Archives oral history workflow at a consultation meeting in Pune organised by the Oral History Association of India, Milli Archives Foundation and FLAME University to develop an ethics framework for oral histories in India. Deepika S also presented "*Whose Science?*

(Top) Student visitors at the Archives processing lab.

(Right) Visitors at the Archives 2025 exhibition *Untitled, Undated*

PHOTOS: RAVI KUMAR BOYAPATI

Whose Archive?" at the *History and the Archive: Practices, Perspectives, and Challenges* workshop at the Centre for Studies in Social Sciences, Calcutta, analysing efforts at the Archives to include archival material from women in science.

At the International Congress of History of Science and Technology, 2025 held at University of Otago, Dunedin, Ojas Kadu presented the work of the Milli Archives Foundation, in collaboration with Tattle, Anoopa John, and the Archives at NCBS, on the development of anno.milli, a public archival annotation tool.

An essay by Anjali Ramachandran and Deepika S, "Building an Inclusive Science Archive in India", was published in "Archives of Science: Challenges and Opportunities in the 21st Century", edited by Polina Ilieva and Venkat Srinivasan. The essay was based on their presentation at the 2024 ICA-SUV conference at the University of California, San Francisco.

Team members contributed significantly across archival processing, access, outreach, and infrastructure development. Ravi Kumar Boyapati led the development of the new processing lab while coordinating digitisation of processed collections. Parvathy V, Nisha Bhakat, and Anjali R conducted a workshop titled "Natural History and Conservation in the Archives" at the Students Conference on Conservation Sciences at IISc. Parvathy V also participated in a panel discussion organised by the Science Journalists Association of India on "A Journalist Walks into a Museum: Sourcing from Archives, Exhibitions, Collections et al." at Ahmedabad University and presented "Using Archives for Ornithology" at the Wayanad Bird Festival

The Archives at NCBS also received a special mention at the Neu-Whitrow Prize 2025 awarded in Auckland, New Zealand, for making archival catalogues of collections from underrepresented groups in science available for public access, including for oral history catalogues on the Archives website.

Tape removal at the conservation lab.

PHOTO: KINJAL SHAH

Education

The Archives at NCBS continued to build capacity in archival training through archiving internships, which led to new collections processed by Abishai V, Archi Kulkarni, Kirti Nair, Rutuja Rokade, and Taksh Sangwan. The Archives-in-education programme, led by Sahamatha, also created curriculum modules and hosted multiple workshops for teachers that use archival material for critical thinking.

We also had two courses last year for the students of NCBS, one on the History and Philosophy of Science by Dr Savithri Preetha Nair, the Obaid Siddiqi Chair 2024-25, and one on the History of Modern Biology by Dr S Prashant Kumar, Honorary Fellow at the Archives at NCBS, which was also open to the public.

Public Engagement

The Archives celebrated its six-year anniversary with the launch of new digital objects on February 22, 2025 (*https://archives.ncbs.res.in/untitled-undated*), along with the sixth exhibition season, "Untitled, Undated" by Dhatri S Aradhya, Sindhu Nagaraja and Kinjal Shah. This exhibition explored the fragments of a science archive understood through the processes of a scientist, an archivist, and an artist.

This year we had an open call for a Public Engagement Officer (PEO) and the new PEO, Gokul Prabhu, joined the team in November. Gokul is working towards making public engagement at the Archives more diverse, inclusive, and accessible.

The archives also expanded its social media presence by collaborating with Flickr, making it the first in the country to join the Flickr Commons Programme, where its collections in the history of science became part of a unique repository of historical photography alongside participations from over 100 cultural institutions across the globe.

Some other efforts towards outreach include a collaboration with the India Foundation for Arts (IFA) to invite arts practitioners and researchers to engage with records at the archives and generate new, critical and creative approaches for public engagement with archives and museum collections.

2025 Team

Abishai V, Anjali Ramachandran, Archi Kulkarni, Deepika S, Dhanya Shree R, Dhatri S, Gokul Prabhu, Janaky Sunil, Kirti Nair, Kinjal Shah, Mansi Dhingra, Nisha Bhakat, Ojas Kadu, Parvathy V, S Prashant Kumar, Pricilla P Rozario, Ravi K Boyapati, Rutuja Rokade, Sahamatha, Samyamee Sreevathsa, Sanjna GY, Sindhu Nagaraja, Taksh Sangwan, Venkat Srinivasan.

(*https://archives.ncbs.res.in/team*)

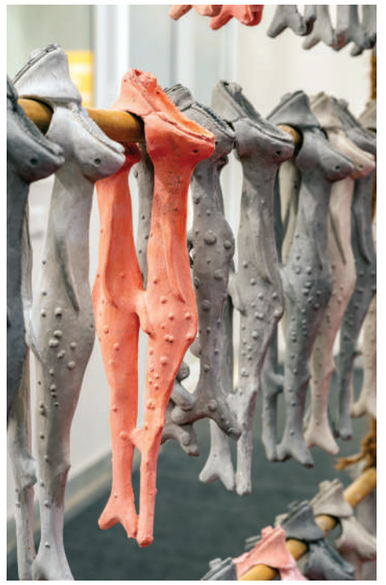
Science Gallery Bengaluru

Explores food and nutrition, politics and caste, death and decay, and more, with CALORIE

After wrapping up the 2024-2025 exhibition-season, Sci560, featuring exhibits and prototypes of Bengaluru's historic contributions to Indian science, SGB's new exhibition-season, CALORIE, launched this year in August. Featuring 35+ exhibits, the themes deal with the inception, production, and destruction of food, and human societies' complex relationships with food as cultures and individuals. Exhibits explore nutrition, caste, food fortification and food security, food waste, famine and feasts, geopolitics and violence around food, cultural effects inside and outside the home, microplastics in food, and more.

The exhibition is accompanied by regular, free weekend programmes pertaining to the theme in the form of lectures, workshops, film screenings, and more. Upcoming programmes can be found at *https://calorie.scigalleryblr.org/programmes*.

The exhibition will run until July 2026.



(*Left*)The Bombay Duck sculpture by Parag Tandel elaborates on Mumbai's Koli fishing community's traditions, part of CALORIE.

(*Below*) In Focus: Nobel 2025 was the first edition of an annual pop-up exhibition exploring educational material behind each year's research prizes.

PHOTOS: SCIENCE GALLERY BENGALURU

Left & above: The interactive exhibit Mapping Mapusa Market where artist Orijit Sen invites the audience to play a game, part of CALORIE.

Interactive exhibit Carbivore by Priya Mani and Vinay Venkatraman lays out visually the environmental and health impact of everyday carbohydrates, part of CALORIE.

SGB this year also launched the pilot edition of its annual Nobel pop-up exhibition called In Focus: Nobel 2025 featuring educational material from the Nobel committee about four of the six research-based prizes: Physiology, Physics, Chemistry, Economics, and also Literature. Related weekend events included public lectures and ask-me-anything sessions with speakers and experts from relevants fields, including former students of laureates.

Meanwhile, the newly launched cafe inside the campus, Café ScCuXe by Henchu, has been virally spreading on social media. Visitors are encouraged to indulge in homely Karnataka food at affordable prices!

The Gallery has announced its upcoming food festival Namma Oota in December, and also has open calls out for it, a photography workshop, and a film commission.

For more information, visit the gallery's website: *https://bengaluru.sciencegallery.com/*

Bengaluru Sustainability Forum

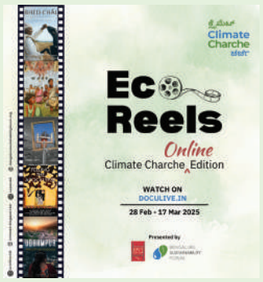
Manasi Pingle and **Vinita S**

The Bengaluru Sustainability Forum is a multi- institutional initiative, focusing on issues of urban and peri-urban sustainability in Bengaluru. Our current partner institutions include Azim Premji University, BIOME, Indian Institute for Human Settlements, NCBS, Science Gallery Bengaluru and Wipro Foundation.

- The main focus of BSF's work is to curate interdisciplinary conversations and collaborations on Bengaluru's sustainable future - bringing together diverse stakeholders, from academics, researchers, and practitioners to social advocates and citizens.
- We work with a diverse community of citizens and organisations who are working to address the pressing challenges that our city faces around sustainability.
- We collaborate with a range of organisations and institutions to initiate campaigns - both offline and online - to take conversations on sustainability to newer audiences.
- BSF's Small Grants Programme supports hyperlocal, innovative, collaborative, community-driven projects that make a tangible impact on the ground. Since its inception the SGP has supported 45+ projects in the city across thematics of water, biodiversity, waste, climate resilience and more.

This year, we focussed on…

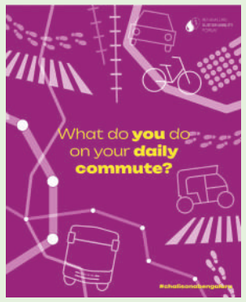
Facilitating the Eco Reels film festival the Climate Charche Edition - in both in-person and online formats - reaching out to over 2000 people. The festival featured national and international films—documentaries, fiction, shorts, and animations—on themes of Nature, People & Power, The Changing Planet, Flora, Fauna & Habitats, and Community Resilience.



Consolidating the learnings from last year's Climate Charche series of engagements - we released the report on the Focus Group Discussions (in English and Kannada) and brought together participants representing community members, CBOs, researchers, organisations, think tanks, and BCAC Fellows for a roundtable - to share and discuss learnings from the Climate Charche FGD process, and to initiate further interactions on focussed discussions that can address some of the key challenges faced by the vulnerable groups in the city.

The 2025 cohort of our Small Grants Programme (SGP) with a focus on 'Building urban resilience' where we have identified 5 interesting projects.

Strengthening **connections and shared learning** within the Small Grants community through inter-project visits and periodic meet-ups.



Growing our online community through collaborations that bring fresh perspectives and deeper insights into Bengaluru's sustainable future.

We also …

Showcased a couple of the Small Grants Programme supported projects at The Bangalore Design Week + World Design Protopolis Conclave.

Facilitated a workshop, a film screening, and a panel discussion at Mount Carmel College as part of the lead-up sessions to their international conference on Biodiversity.

Hosted a visit by UNDP-TERI team visiting us to learn more about BSF's the Small Grant Programme.

Distributed copies of the BSF supported SGP publications through NCF's Prakritiya Pettige kit on nature learning resources for panchayat libraries in Bangalore and rest of Karnataka.

Hosted our first ever in person World Environment Day Quiz, and participated in NCBS Open Day & the Parikrama Science Festival.

In the coming months we urge you to keep a look out for The Climate Charche Podcast to be released on the BSF YouTube channel.

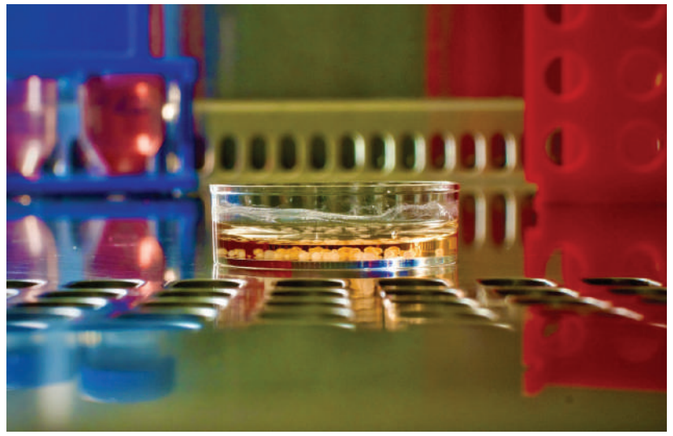
Rohini Nilekani Centre for Brain and Mind

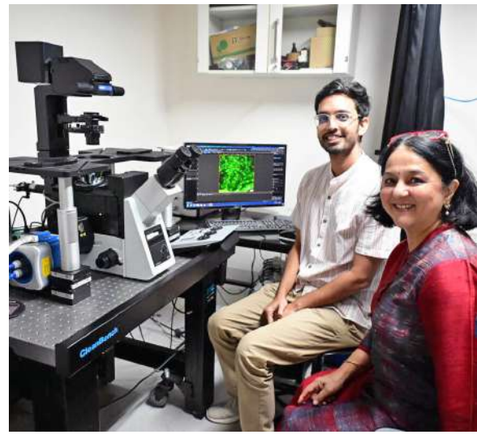
Raghu Padinjat

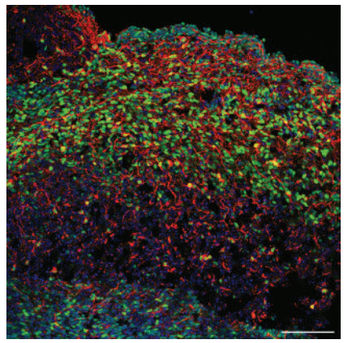
Severe mental Illnesses are a major source of disability in young adults, with about 2–3 % of the population at risk for developing these disorders both in India and across the world. These disorders are recognized as one of the major non-communicable diseases (NCD), and a significant contributor to morbidity, as articulated by the World Health Organization's New Delhi call for action on combating NCDs in India. Given this huge disease burden, the development of novel ways to diagnose and treat mental illness will have important positive social and economic benefits. To achieve this goal, there is a pressing need to understand the mechanistic basis of these disorders; such discovery could form the basis for the development of novel diagnostic and therapeutic approaches.

In 2015, NCBS led the development of a research program to understand the genetic and cellular basis of severe mental illness through harnessing the power of modern human genetics and stem cell technology. The program was set up in 2015 as a collaborative initiative of three institutions from Bengaluru, India, the National Centre for Biological Sciences (NCBS) – the Institute for Stem Cell Science and Regenerative Medicine (inStem), and the National Institute for Mental Health and Neurosciences (NIMHANS) supported between 2016-2022 by the Department of Biotechnology, Government of India, and the Pratiksha Trust. Since 2023 the program is funded through generous support from Rohini Nilekani Philanthropies as a collaborative effort between NCBS and NIMHANS as the Rohini Nilekani Centre for Brain and Mind (CBM).

CBM studies five major forms of severe mental illness (SMI): schizophrenia, bipolar disorder, obsessive-compulsive disorder, substance dependence, and dementia. All these disorders are known to have an inherited basis. However, despite their high heritability, to date, few genetic correlates that could account for this high heritability have been identified. To study these disorders, a prospective cohort of families with a strong family history of SMI is being studied. Three distinct but complementary lines of analysis are being pursued on these families: (i) The families have been clinically studied to understand changes in structure and function at multiple levels of brain organization; they will continue to be followed over twenty years at 3-year intervals to define the temporal development of disease at multiple scales of brain function through regular and detailed clinical neuroscience analysis. (ii) We have established ca. 120 induced pluripotent stem cell lines from affected individuals in these families and unaffected controls. CBM uses modern technology to create stem cells from human subjects with a strong history of severe mental illness and uses these to create “disease-in-a-dish” models of the human brain to study the mechanistic aspects of cellular neurobiology that lead to disease. (iii) Next-Generation Sequencing and neuroinformatics are being used to uncover the genetic basis of SMI.







Top: 3D brain organoids after 120 days culture in vitro (DIV).
Left: Cryosection of organoid stained to show the various cell types in the mini brain. Red: Glial Fibrillary Acidic Protein (GFAP)- marker of mature astrocytes; Green: NF1A a marker of glial precursor cells; DAPI(Blue). Glial cells are critical regulators of neuronal function in healthy brains and in disease conditions. The CBM program is using disease-in-a-dish models generated from human iPSC to discover the role of altered glial cell function in the pathogenesis of severe mental illness.

The multiple types of data generated by the program are being assembled into an integrated database (CALM-BRAIN) to facilitate the application of sophisticated methods of data analysis to uncover new disease biology. The stem cell lines, other biomaterials, and other datasets have been assembled into a biorepository that will allow the sharing and use of this resource to drive discovery biology around SMI. The program has instituted mechanisms to facilitate the sharing of data and resources generated through its activities. CBM is envisaged as a discovery platform that seeks to engage with scientists beyond the core partner institutions to leverage the most modern tools and methods of analysis and discover new biology that will lead to better solutions for the treatment of severe mental illness in humans.

SELECTED PUBLICATIONS

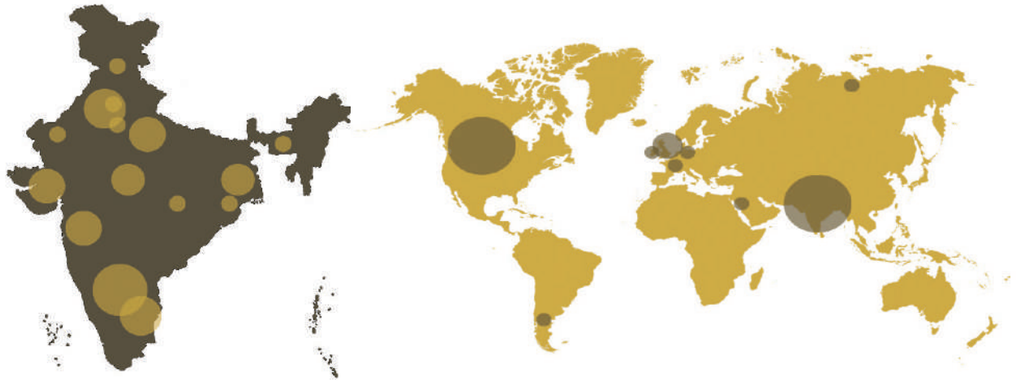
1. Enhanced Notch dependent gliogenesis and delayed physiological maturation underlie neurodevelopmental defects in Lowe syndrome. Yojet Sharma, Priyanka Bhatia, Gagana Rangappa, Sankhanil Saha, Raghu P* bioRxiv 2024.11.25.625332; doi: https://doi.org/10.1101/2024.11.25.625332.
2. Saha S, H Krishnan H, Raghu P*. IMPA1 dependent regulation of phosphatidylinositol 4,5-bisphosphate and calcium signalling by lithium. Life Sci Alliance 2023 Dec 6;7(2): e202302425. doi: 10.26508/lsa.202302425. Print 2024 Feb.
3. Raghu P*, Sharma S, Aswathy BS and Krishnan H. Challenges and opportunities for discovering the biology of rare genetic diseases of the brain. J. Biosciences. 2024. 49:26 Indian Academy of Sciences DOI: 10.1007/s12038-023-00408-5
4. Holla B, Mahadevan J, Ganesh S, Sud R, Janardhanan M, Balachander S, Strom N, Mattheisen M, Sullivan PF, Huang H, Zandi P, Benegal V, Reddy YJ, Jain S; cVEDA collaborators; ADBS-CBM consortium; iPSYCH OCD consortium; NORDiC OCD & Related Disorders Consortium; Purushottam M, Viswanath B. A cross ancestry genetic study of psychiatric disorders from India. medRxiv. 2024 Apr 27:2024.04.25.24306377. doi: 10.1101/2024.04.25.24306377.

IndiaBioscience

A catalyst to engage communities and enable change

Siuli Mitra

IndiaBioscience continued to build on its foundational efforts to strengthen life science research in India by deepening networks and relationships built through its flagship initiatives, while also launching new programmes to adapt to the evolving global research landscape. With funding support from the Department of Biotechnology, Government of India, and a base at NCBS-TIFR, Bengaluru, the programme expanded its reach to more institutions, cities, and communities across the country. This growth was also made possible by a strong and growing national network of partners. We recap the various activities undertaken in 2024-25 and their impact on the community across different verticals.



Geo-distribution of participants from India; Left: Young Investigators, Right: Postdoctoral Fellows.

Networking & Mentorship

- Our flagship, annual Young Investigators' Meeting (YIM 2025) in Agra was attended by about 150 participants, including YIs, postdocs, mentors, institutional heads, and funders, all united by the common thread of curiosity and collaboration. Nine mentor talks, lively panels, and 40 PDFs presenting their research made for an atmosphere charged with aspiration.
- Four Regional YIMs were held at Visakhapatnam, Bengaluru, Chennai, and Delhi NCR, with each meeting keeping our commitment of bringing mentoring closer to researchers everywhere.
- Geo-distribution of participants from India; Left: Young Investigators, Right: Postdoctoral Fellows.

Skill Building

- Ten "Crafting Your Career" (CYC) workshops across India reached 360+ master's, doctoral, and postdoctoral researchers, unpacking the art of networking, self-assessment, and real-world career navigation.
- We demystified international grants through four webinars (EMBO, HFSP, open access) and a vibrant "Voices of the Community" article series.
- Our mentorship program trained 13 interns in science communication, digital communications, and event management.

Few columns published in 2024-25

Science Communication

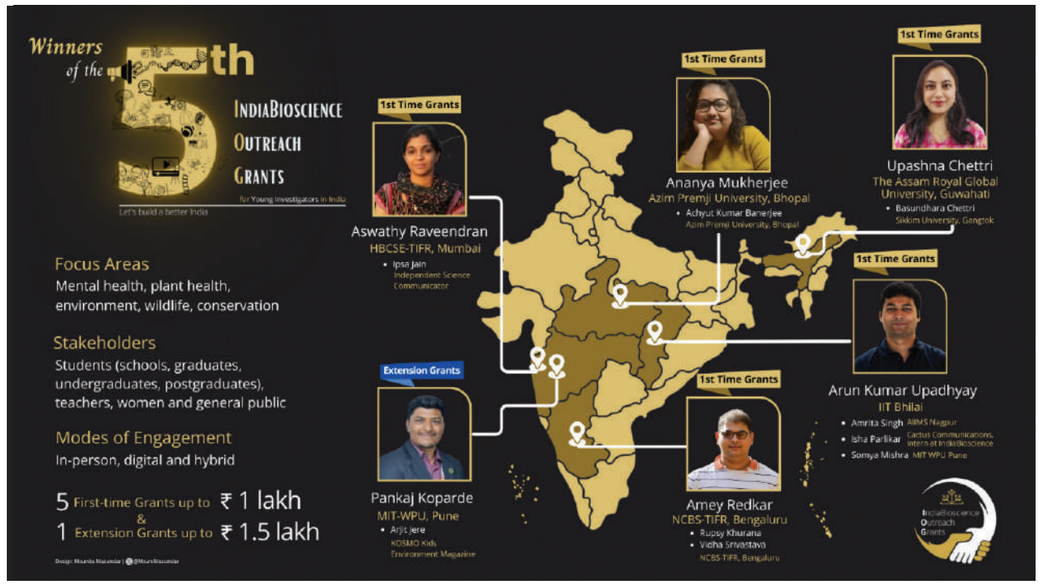
- Our website, the hub for research spotlights to personal accounts of young investigators' careers in India, sparked conversations and recognition for Indian science with more than a hundred articles and columns last year.
- Nine new e-books and compendia (including "YI 101," "Vividh," "On the Road to Excellence") were downloaded 500+ times.
- The Write On-2024 science writing competition drew 370+ student entries.

Digital Outreach

- Sixteen webinars (education, funding, careers, and open science) and 22 podcasts reached tens of thousands of viewers on YouTube, Spotify, and other platforms.
- Social media reach soared, with over 80,000 combined followers across X, LinkedIn, Facebook, and Instagram. Our monthly newsletter, with its 20,000+ readers, is now a go-to resource for research news and updates for young researchers, educators and students.

Community Building

From the IndiaBioscience Outreach Grants (supporting seven public engagement projects) to the She Inspires! Pilot, women scientists reaching 1,000+ schoolchildren across eight cities, we aim for work that "returns value to the community".



Looking Forward

With the continued support from DBT and NCBS, IndiaBioscience remains committed to its mission to build, bridge, and celebrate the Indian life science community at every stage and scale. Our growth is measured not just in numbers, but in stories, partnerships, and the rising confidence of the next generation.

Team members in 2024-25: Ankita Rathore, Arushi Batra, Karishma Kaushik, Manjula Harikrishna, Moumita Mazumdar, Rohini Karandikar, Shwetha C.

Masters in Wildlife Biology & Conservation

Jayashree Ratnam

On the first of March, 2025, Dr Ajith Kumar, founding director of our Master's program in Wildlife Biology and Conservation, passed away suddenly while on a field trek in the Central Indian highlands with the current cohort of students. Over a career spanning forty years and multiple institutions, Ajith mentored an entire generation of wildlife ecologists across the country. The extent of this reach became clear when more than five hundred community members collectively mourned his loss on various social media platforms, obituaries in his honor flooded wildlife magazines and journals, and nearly two hundred flocked to our campus to attend his memorial. As the Director of the Wildlife Program at NCBS from 2004-2020, Ajith shaped a culture of evidence-driven conservation science and collaborative work that are signatures of our program. With his passing, we have lost a passionate voice for the conservation of wildlife and nature, but the legacy he leaves behind in the many alumni of our program will ensure that what he started will continue to impact conservation in this country for decades to come.

Learning stream related measurements in the Freshwater Ecology course at the NCBS Coorg Field Station, Western Ghats- July 2025.

Our alumni today are spread out across the country, impacting science and conservation in different ways. A number of early alumni have focused their efforts in the biodiverse north-east region of the country. Their efforts have resulted in the establishment of two conservation NGOs, *Conservation Initiatives* and *Canopy Collective*. While *Conservation Initiatives* works across Assam, Meghalaya and Nagaland, alongside local communities, to save threatened wildlife such as elephants and gibbons, *Canopy Collective* works across the north-east to empower local communities in nature-related livelihoods. Other research groups led by alumni monitor bird communities in the forests of Arunachal Pradesh to understand their ecology and responses to climate change, and multiple endangered primates in Assam and Arunachal Pradesh to understand how they are faring across the fragmented forests of this region. At the western end of Himalayas, research led by our alumni informs conservation of the enigmatic snow leopard and its ungulate prey across the remote and rugged Trans-Himalaya.

In the Central Indian landscapes, the *Wildlife Conservation Trust*, with several of our alumni in leadership and senior roles, works to conserve connectivity across habitats in this vast landscape, and to understand the ecologies of threatened flagship species such as otters, pangolins, river dolphins and gharial.

Closer to home in the Western Ghats, our alumni lead multiple efforts to conserve wildlife across the matrix of protected areas and production landscapes that define this region. Their collective research sheds light on the carbon and regeneration dynamics of fragmented forests, the wildlife and biodiversity sustained in plantation-forest mosaics, and pathways to mitigate human-wildlife conflicts and empower indigenous livelihoods in this shared landscape.

Along India's coastline, work by our alumni has contributed to policy and citizen initiatives in sustainable fisheries, while their research in the atolls of Lakshadweep and the Andaman Islands has shed light on the ecology of important marine habitats such as coral reefs and sea-grass meadows.

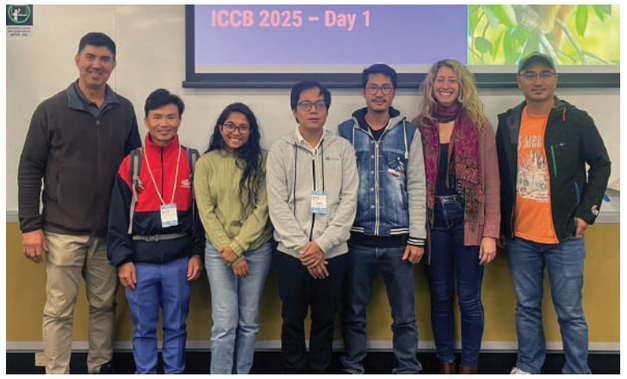
Our alumni-led efforts have led to deep conservation work in important landscapes across the country over the past decade. With these firmly established, the program has widened its scope to encompass the wider Asian geography. With a growing international initiative that admits students from developing countries in Central, South and South-east Asia into our program, our alumni and current students now engage in conservation research and action in Mongolia, Nepal, Bangladesh, Sri Lanka, Myanmar, Vietnam, Laos and the Philippines. It is our hope that in the decade to come, this growing cohort will widen the reach of our work across the Asian tropics and

Left-right: Learning about the ecology of mangrove species in the Andaman Islands as part of the Marine Ecology course- April 2026.

Learning to measure rodent morphology for identification in Central India- March 2025.

Understanding grassland ecology in Coorg region in the Western Ghats – August 2024.

Ajith Kumar and students of the working group on plant epiphytes during our field trip to Periyar Tiger Reserve in the Western Ghats- November 2024.



International students of the current cohort at the Fonseca Conservation Leadership Program at ICCB-2025 in Brisbane Australia.

eventually lead to coordinated, trans-national conservation efforts.

As always, our deepest thanks to the fantastic community of wildlife and ecology researchers and practitioners, across the country and beyond, who help us to deliver our program. Their commitment and engagement make our work possible. Our program partners, the Nature Conservation Foundation and the Wildlife Conservation Society-India, are key collaborators who bring their expertise and resources to bear on the program. Further, funding from the Global Environment Facility of the World Bank, Wildlife Conservation Society-Global, and the Habitats Trust are critical to our ability to sustain and expand the reach of our work. We are deeply grateful for this support, and for our shared commitment to save the magnificent, but increasingly threatened, wildlife and natural habitats that sustain us on this planet.

The Indica School of Field Ecology and Conservation

Sachin Sridhara and **Ankila Hiremath**

For many PhD scholars and post-PhD early career researchers pursuing ecology and allied disciplines, opportunities for immersive field-based learning often remain out of reach. Constrained by cost and geography, the right combination of experts and access to specialized resources to train researchers in a field setting is especially limited across the country. Recognizing this gap a new initiative, the Indica School of Field Ecology and Conservation, was brought to life through the generous support of the Murty Trust. Indica School, in collaboration with institutions and expert ecologists, will organize a series of 2-3 weeks-long courses as immersive journeys into field-based ecological training and research, where theory meets practice in natural settings. These courses open the door for aspiring researchers to gain hands-on experience doing field research. We are hopeful that these courses will immediately benefit upcoming ecologists in refining their research outputs.

Left: Dr Kallesh (2nd from left) explaining butterfly identification techniques to participants at IISER TVM campus (Arthropod Ecology and Taxonomy course).
PHOTO: SHUTTERBUGS, IISER TVM

Right: Dr Sandeep Pulla explaining plant identification techniques to participants at Satpuda Tiger Reserve (Foundations of Field Ecology course).
PHOTO: ANAND, INDICA SCHOOL

The first course – Arthropod Ecology and Taxonomy – will take place in partnership with the Indian Institute of Science Education & Research, Trivandrum, at its scenic, forested campus from 28th September. This course offers participants a rare opportunity to immerse themselves in the study of one of the most diverse and ecologically important groups of organisms. Taught by leading arthropod researchers from across the country this course combines intensive fieldwork with structured learning. Fifteen participants have been selected from a total of 90 applications received from across 24 states and union territories, reflecting both the widespread demand and the growing recognition of the need for specialized training in arthropod studies. The selection process was rigorous ensuring that participants admitted to the course represent a motivated and diverse cohort, united by their shared interest in ecology and taxonomy.

The Indica School of Field Ecology and Conservation, was brought to life through the generous support of the Murty Trust. Indica School, in collaboration with institutions and expert ecologists.

The course comes at a crucial time for the Indian subcontinent where formal training in arthropod identification, ecology, and taxonomy remains limited. Most academic programs focus on broader ecological principles but lack the focused taxonomic expertise necessary to document, classify, and conserve lesser-known arthropod groups. By providing structured modules that combine classroom sessions, guided field surveys, and specimen identification workshops, the course aims to fill this critical gap. Participants will gain not only technical skills but also a deeper appreciation of arthropods' ecological roles and as indicator of ecosystem health.

In parallel, preparations for two more courses are well underway. These courses – Field Techniques in Ecology and Foundations of Field Ecology will be held in NCBS's Pachmarhi Field Station, Madhya Pradesh, this December. Participants for one of the courses have been selected (15 out of 122 that applied from 20 states and union territories across the country), while a call for applications has been announced for the second.

The widespread interest in these courses from students across the country affirms the timeliness of the Indica School of Field Ecology and Conservation. Together, these initiatives mark an important stride toward strengthening field-based ecological education in India, equipping the next generation with the skills needed to study and conserve the subcontinent's extraordinary biodiversity.

Prof. Uma Ramakrishna explaining DNA extraction to participants at Pachmarhi Field Station in the presence of Dr Yadvendradev Jhala (Field Techniques in Ecology course).
PHOTO: ANAND, INDICA SCHOOL

Meetings & Workshops 2025

JANUARY

6-17
ICTP-ICTS Winter School on Quantitative Systems Biology

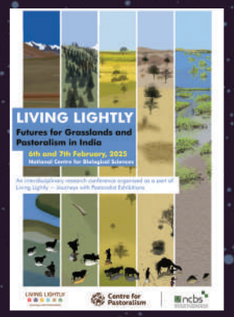
15-17
NCBS Annual Talks 2025: "Conversations on Biology"

27-31
Hands on training workshop on basic biomethodologies of laboratory mice and rats

FEBRUARY

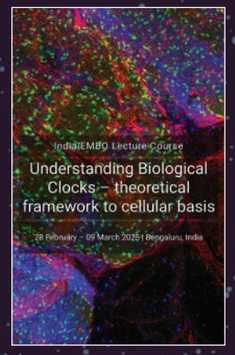
6-7
Living Lightly 2025: Futures for Grasslands and Pastoralism in India

17-21
Hands on workshop on: CRISPR Genome Editing: Generating Mouse Models for Human Therapeutics



FEBRUARY-MARCH

28 FEB-9 MAR
India | EMBO Lecture Course: Understanding Biological Clocks – theoretical framework to cellular basis (in partnership with JNCASR)

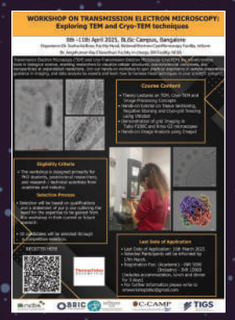


APRIL

17-18
The Vascular Biology Symposium

23-25
Workshop On Transmission Electron Microscopy (Tem): Exploring Tem And Cryo-Tem Techniques

23-25
Genome Informatics Across Scales



MAY

2
Technology Platforms for Advancing Biological Research

JUNE

18-19
Workshop On Mass Spectrometry Data Analysis Using Open-Source Tools

26-27
BMGF-WES consortium

JULY

4-5
Ignite - Orkla Spice SpARC meeting

14-18
8th Hands on Workshop on "Integrated OMICS" (Genomics, Proteomics and Bioinformatics)

AUGUST

21-22
AMR Conference

SEPTEMBER

2-3
Drosophila genetics for human disease biology

14-21
15th Bangalore Microscopy Course

OCTOBER

6-10
Hands on Workshop on basic Bio-methodologies of Laboratory Mice and Rats

15-16
MechBio: Indian Mechanobiolgy Annual Meeting

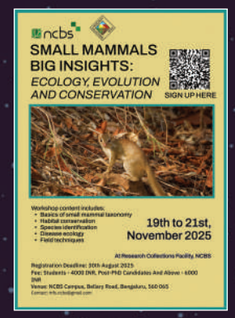
OCTOBER-NOVEMBER

9 OCT-11 NOV
Conservation Practitioners' Course, 2025 | Bootcamp

NOVEMBER

10-11
Manotsava: Neuroscience Research Symposium

19-21
Small Mammals, Big Insights: Ecology, Evolution and conservation



DECEMBER

8-13
3rd Statistical Genomics workshop

Office of Science Communication & Outreach

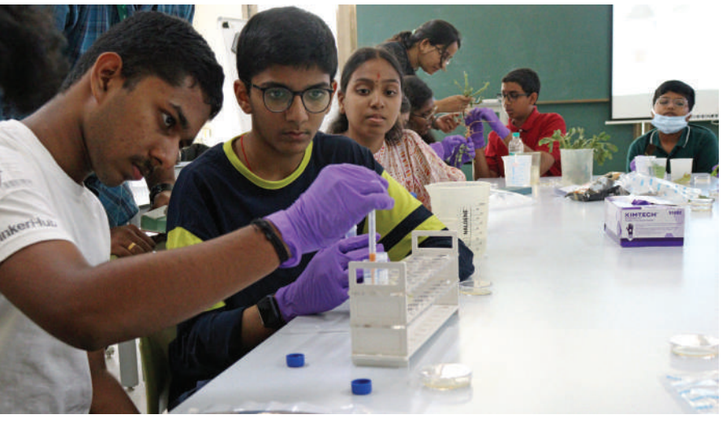
Rupsy Khurana

This year at the Office of Science Communication and Outreach felt like a beautiful expansion — bigger audiences, deeper conversations, and bolder experiments in how we tell science stories. One of our biggest highlights was Open Day, which saw the largest footfall ever at NCBS science outreach events! The campus was buzzing with curiosity as young kids, students, and science enthusiasts poured in. From hands-on activities to conversations with researchers, it was incredibly heartening to see so many people engaging with science up close.

We also took a giant leap into gamifying science with an Escape Room we designed around zoonoses and pandemics. Designed to make people think, collaborate, and question, this experience challenged participants to solve problems rooted in real-world science. Presenting it at the India Science Festival in January 2025 was an exciting milestone — seeing people learn science while racing against the clock was immensely rewarding.

This year was also about building stronger connections within and beyond NCBS. We launched a new quarterly newsletter – *Transcript* – that sits at the intersection of art and science, sharing stories and updates from NCBS with our partner institutions and the BLiSC community. Alongside this, we started a monthly internal newsletter for the NCBS community, celebrating achievements big and small — from research milestones to the incredible, often unseen work of our staff who keep NCBS running every single day. Shining a light behind the science has been especially meaningful.

On the digital front, we introduced Student Highlight videos on social media — short, engaging pieces where PhD students talk about their research in their own words. These videos have been an interesting way to bring young scientists and their work to a wider audience, making complex ideas personal, accessible, and inspiring.



Summer Camp: World of Microbes, May 2025.

And of course, we returned to one of our favourite spaces — working with young minds. Our summer camp was back this year, filled with curiosity, questions, experiments, and plenty of joy. The energy students bring into these spaces continues to remind us why science communication matters so deeply.

This year's Annual Report theme — *Continuum* reflects the idea that NCBS is not a static institution but a living, evolving ecosystem. It celebrates the people who have shaped NCBS over the years and those who continue to carry its legacy forward — far beyond the campus, across disciplines, institutions, and generations.

Open Day, September 2025.

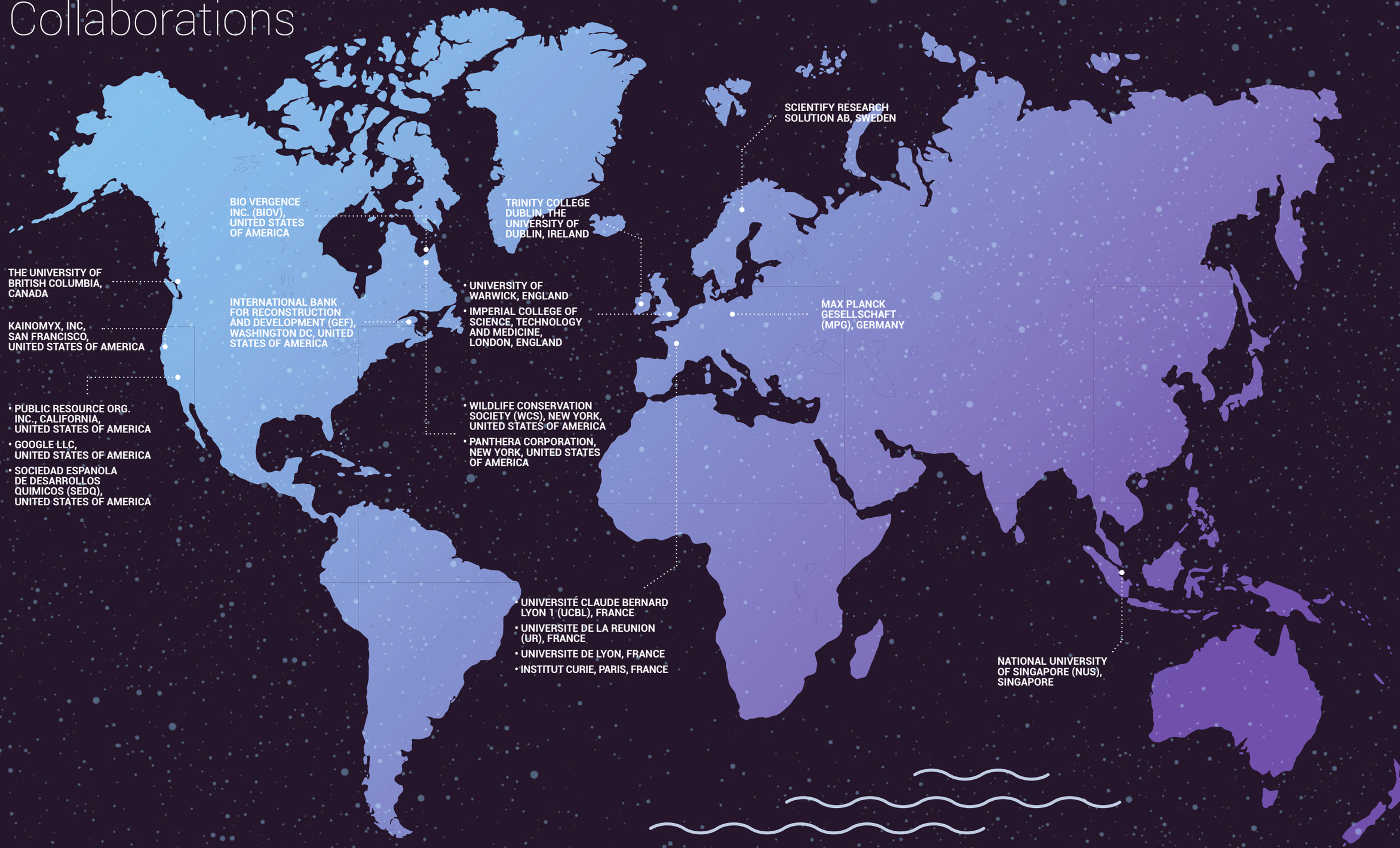
Quarterly Newsletter: *Transcript*.

Translating *Continuum* into design was an exciting challenge. We wanted the visual language to speak of flow rather than fragments — of ideas moving seamlessly across time and fields. The design draws on the notion of continuity: of science in conversation with art. Forms, colours, and layouts were imagined to feel dynamic and interconnected, reflecting how ideas at NCBS are constantly evolving, intersecting, and building upon one another.

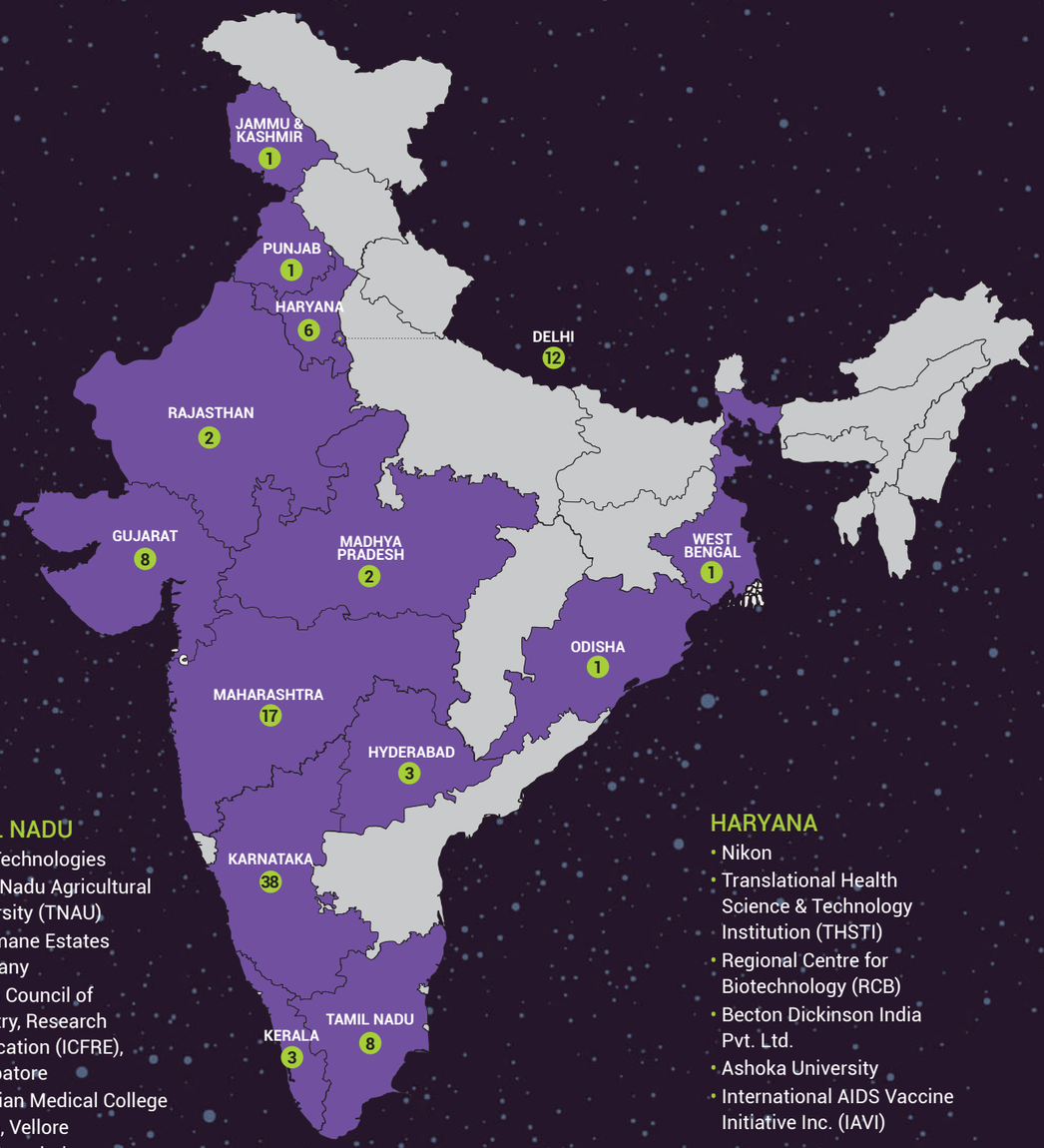
Looking back, this year was about scale and depth — reaching more people while also nurturing our own community. It was a year of collaboration, creativity, and learning, and we're incredibly grateful for the trust, support, and freedom to experiment that makes all of this possible.

As always, none of this would happen without the enthusiasm of NCBS students, staff, and faculty, who continue to be our biggest collaborators and inspiration. We're excited to keep building, experimenting, and finding new ways to make science resonate on campus, beyond it, and everywhere curiosity lives. Here's to the continuum, and to many more stories yet to unfold.

International Collaborations



National Collaborations



TAMIL NADU

- TNQ Technologies
- Tamil Nadu Agricultural University (TNAU)
- Kadamane Estates Company
- Indian Council of Forestry, Research & Education (ICFRE), Coimbatore
- Christian Medical College (CMC), Vellore
- TNQ Foundation
- NationalInstitute of Ocean Technology (NIOT)
- Wildlife Institute of India-Salim Ali Centre for Ornithology and Natural History (SACON)

HARYANA

- Nikon
- Translational Health Science & Technology Institution (THSTI)
- Regional Centre for Biotechnology (RCB)
- Becton Dickinson India Pvt. Ltd.
- Ashoka University
- International AIDS Vaccine Initiative Inc. (IAVI)

HYDERABAD

- CSIR-CCMB, Hyderabad
- Cellular and Molecular Biology (CCMB)
- National Institute of Animal Biotechnology (NIAB)

GUJARAT

- Sun Pharma Advanced Research Company (SPARC)
- Sahajeevan/ Centre for Pastorilism
- Conversation Indica
- Zydus Life Sciences Ltd.
- Gujarat Biotechnology Research Council (GBRC)
- SynLyfe Research Laboratory
- O_2h Discovery Pvt. Ltd.
- Feather Library

KARNATAKA

- Nature Conservation Foundation (NCF)
- Wildlife Conservation Soceity-India (WCS)
- CBCI Society for Medical Edu. St. John's
- Sankara Academy of Vision (SAV)
- Tata Institute for Genetics and Society (TIGS)
- Cytecare Hosptials Pvt. Ltd.
- Wipro Foundation
- Indian Institute of Science
- Nature Conservation Foundation (NCF)
- Institute for Stem Cell Biology & Regenerative Medicine (inStem)
- Kodo Lifescience Pvt. Ltd.
- IQVIA RDS (India) Pvt. Ltd.
- NationalInstitute of Mental Health & Neuro Sciences (NIMHANS)
- Infosys Foundation
- Saythu
- Nature Conservation Foundation (NCF)
- Dakshin Foundation, Bangalore
- Lobhopping Science Media Forum (LSMF)
- BIOCON Foundation
- Indian Institute for Human Settlements
- Foundation for Bengaluru Science and Technology (BeST)
- India Foundation for the Arts (IFA)
- Bangalore Baptist Hospital (BBH)
- I-Hub for Robotics and Autonomous Systems Innovation Foundation (ARTPARK)
- Sri Shankara Cancer Hospital and Research Centre
- Bat Conservation India Trust
- Indian Council of Forestry Research and Education-Institute of Wood Science and Technology (ICFRE-IWST)
- Ashok Trust for Research in Ecology and Environment (ATREE)
- ICAR-NationalInstitute of Veterinary Epidemiology & Disease Informatics (NIVEDI)
- Kuvempu University
- University of Agricultural Sciences-Gandhi Krishi Vigyana Kendra, UAS (GKVK)
- Foundation for Bengaluru Science and Technology (BeST)
- Subbaiah Research Institute (SRI)
- Indian Institute of Technology, Dharward (IIT-DH)
- Institute of Bioinformatics and Applied Biotechnology (IBAB)
- Microbeworks Scientific Private Limited
- The Avestagenome Project
- Aster Hospitals

MADHYA PRADESH

- Nanaji Deshmukh Veterinary Science University (NDVSU)
- ICAR-NationalInstitute of High Security Animal Diseases (NIHSAD)

MAHARASHTRA

- Thackeray Wildlife Foundation (TWF)
- Tadoba Andhari Tiger Reserve Conservation Foundation (TATRCF)
- Amar Chitra Katha Pvt. Ltd. (ACK)
- Indian Institute of Technology Bombay (IITB)
- MassTech Life and Analytical Sciences
- Maharashtra Prabodhan Deva Mandal (MPSM)
- Advance Centre for Treatment Research & Education in Cancer (ACTREC)
- Hindustan Unilever Limited (HUL)
- Pune Knowledge Cluster (PKC)
- Max Healthcare Institute Limited (MHIL)
- PopVax Private Limited
- ICGA Foundation (ICGA)
- Unilever
- Gennova Biopharmaceuticals Ltd
- Pranshanti Cancer Care Mission (PCCM)
- Wildlife Research and Conservation Society (WRCS)
- Indian Institute of Science Education and Research (IISER) Pune

DELHI

- Punjab National Bank (PNB)
- Springer Nature India Private Limited (SNIPL)
- Central Zoo Authority (CZA)
- Ministry of Environment, Forest and Climate Change
- Partners for law in Development
- Chase Avian Communications Pvt. Ltd. (CI)
- World Wide Fund for Nature-India (WWF-India)
- Indira Gandhi National Forest Academy (IGNFA) and Central Academy of State Forest Services (CASFOS), Dehradun, Coimbatore and Burnihat
- The Habitats Trust (THT)
- Housing and Urban Development Corporation Limited (HUDCO)
- InterNationalFoundation of Research & Education (IFRE)
- Advanced Media Production-AMP

RAJASTHAN

- Government of Rajasthan (GoR)
- PI Health Sciences Limited (PIHS)

PUNJAB

- Indian Institute of Science Education and Research (IISER), Mohali

JAMMU & KASHMIR

- University of Jammu

KERALA

- VPS Lakeshore Hospital
- Kerala Agricultural University
- Polus Solutions

WEST BENGAL

- TCG Centres for Research & Education in Science & Technology (CREST)

ODISHA

- Field Director Simplipal Tiger Reserve

Scientific and Management Board

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- **Head, Admin & Finance**, NCBS, (ex-officio) - Non-Member Secretary

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- **Prof. Rajan Sankaranarayanan**, Centre for Cellular and Molecular Biology, Hyderabad, India
- **Prof. Sarah Teichmann**, Cambridge Stem Cell Institute, UK
- **Prof. Yadvinder Malhi**, Environmental Change Institute, Oxford University, UK

Funders

NATIONAL

- Anusandhan National Research Foundation (ANRF)
- Biocon Foundation
- Centre Franco-Indien pour la Promotion de la Recherche Avancée (CEFIPRA)/Indo-French Centre for the Promotion of Advanced Research (IFCPAR)
- Council of Scientific & Industrial Research (CSIR)
- Department of Biotechnology (DBT)
- Hindustan Unilever Limited (HUL)
- Housing and Urban Development Corporation Limited (HUDCO)
- DBT/Welcome Trust India Allliance
- Indian Council for Medical Research (ICMR)
- Infosys Foundation
- Indian National Science Academy (INSA)
- International Foundation Ashoka University
- Kiran Mazumdar Shaw
- Ministry of Environment, Forest and Climate Change (MOEFCC)
- Murty Trust
- Nalluru C Murthy
- Narayana Murty
- Prof. Mani Ramaswamy
- Rohini Nilekani Philanthropies
- Sahjeevan/Centre for Pastoralism
- Science and Engineering Research Board (SERB)
- Similipal Tiger Reserve-cum-Regional CCF
- Srikanta and Radhika Gopalakrishnan
- Sun Pharma
- Tadoba Andhari Tiger Reserve Conservation Foundation
- The Habitat Trust
- Tata Institute for Fundamental Research (TIFR)
- TNQ Foundation
- TNQ Technologies
- TTK Prestige Ltd.
- Wildlife Conservation Trust
- Wipro Foundation
- Wildlife Conservation Society

INTERNATIONAL

- Arcadia Philanthropic Trust, UK
- Bill and Melinda Gates Foundation (BMGF), USA
- British Ecological Society, UK
- Conservation Food and Health Foundation, USA
- European Molocular Biology Organization (EMBO), Germany
- Global Partnerships, UK
- Human Frontier Science Program (HFSP), France
- International Association for Bear Research and Management (IBA), USA
- International Bank for Reconstruction and Development (World Bank)
- Kavli Foundation
- Max-Planck-Gesellschaft zur Förderung der Wissenschaften, Germany
- New Castle Univeristy, UK
- On the Edge Conservation (OTEC), UK
- Rockfeller Foundation, USA
- Simons Foundation, USA
- Wellcome Trust, UK
- Wildlife Research and Conservation Society (WRCS), USA

Designer's Note

Peali Dutta Gupta
www.pealidezine.com

Continuum is conceived as a visual metaphor for movement, connection, and enduring influence. The design reflects the journeys of NCBS alumni as an unbroken flow—one that begins at the institution and extends outward across disciplines, geographies, and generations. Rather than depicting linear progress or fixed destinations, the artwork embraces fluidity, suggesting that learning, inquiry, and impact are always in motion.

The sweeping, ribbon-like forms symbolise pathways taken by alumni—intertwining, diverging, and rejoining—echoing careers that span academia, industry, policy, and science communication. Their continuous motion reflects how ideas cultivated at NCBS evolve and adapt, yet remain rooted in the same core values of rigour, curiosity, and excellence. The absence of hard edges reinforces the idea that boundaries between disciplines are porous, encouraging cross-pollination of thought.

A vibrant, layered colour palette draws from both scientific imagery and creative expression. Subtle references to DNA strands, molecular structures, ecological forms, and data patterns are embedded within the flow, acknowledging the scientific foundation of NCBS while celebrating the diversity of directions its alumni pursue. The dark backdrop provides contrast, allowing each trajectory to stand out—much like individual stories emerging from a shared origin.

The composition avoids a single focal point, inviting the viewer's eye to travel freely across the surface. This openness mirrors the evolving nature of the NCBS legacy—one that does not conclude but continues to grow through the achievements of its alumni worldwide.

Ultimately, Continuum is a tribute to sustained inquiry and collective progress: a living visual narrative of how the spirit of NCBS travels forward, carried by its people, shaping science and society in ever-expanding ways.

We extend our sincere gratitude to the NCBS Communications Office for their invaluable efforts, guidance, and thoughtful suggestions in bringing this report together. It was truly a pleasure collaborating with the team, and we deeply appreciate their support throughout the process.

Notes

Design: **PealiDezine**, *www.pealidezine.com*

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