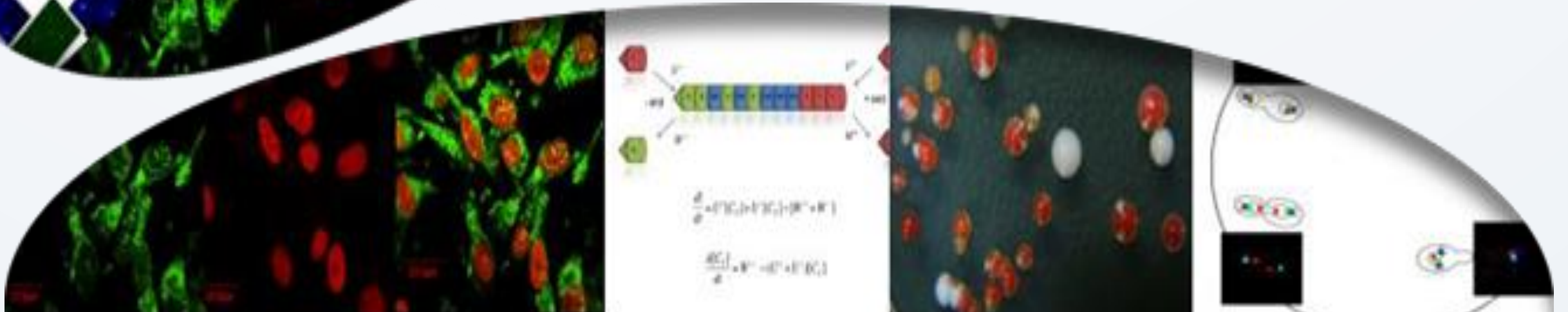


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“A strong research and teaching program in Biosciences and Bioengineering nurtured by active collaboration between biologists, medical scientists, physical scientists and engineers”





Dr. Balaji, Petety V. Head & Professor

Department of Biosciences and Bioengineering
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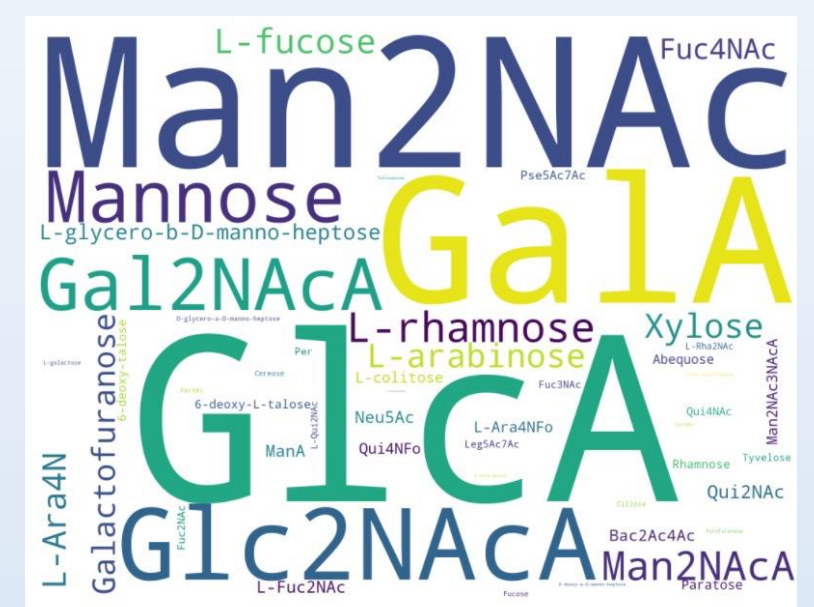
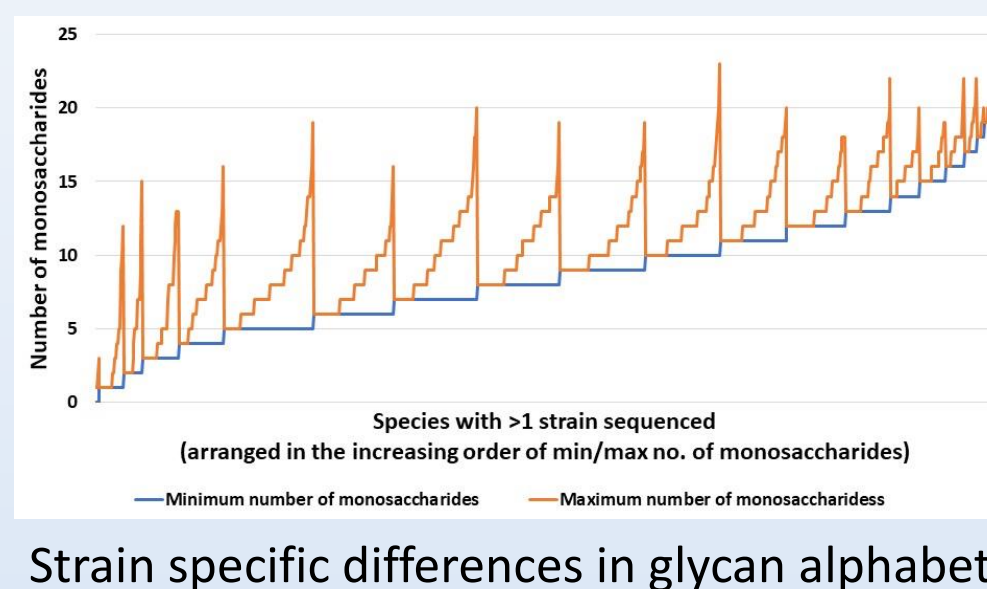
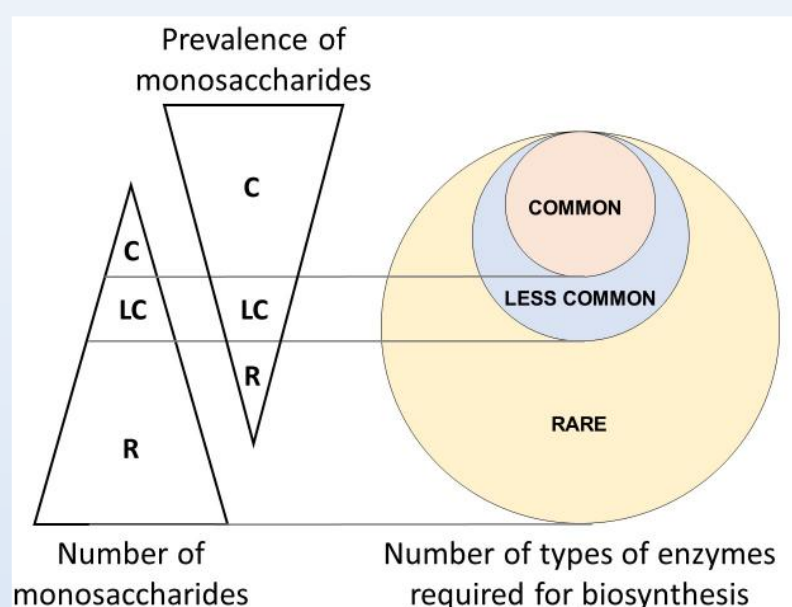
E-mail: balaji@iitb.ac.in

Broad research areas: Glycobiology and Bioinformatics

Ongoing research work: Our understanding of the varied functions of glycans has traditionally lagged behind those of proteins and nucleic acids. This is primarily because of the nuanced differences in the structures of glycan building blocks (e.g., configurational isomers) and consequent complexity in primary structure of glycans (e.g., regio- and stereo-specific differences in linkages). Microheterogeneity, branching, possibility of two hemiacetals (pyranose and furanose) and extensive modifications of building blocks (e.g., aminoacetylation) are the other contributing factors. Our research group's contribution to the worldwide efforts in decoding the role of glycans in living systems is in terms of the functional annotation of proteins involved in glycan biosynthesis and degradation. We primarily employ sequence-based methods (e.g., BLAST, HMM and PWM) to develop pipelines for large scale annotations and analyze the outcomes of such annotations. Annotation and analysis of ~13,000 prokaryotic genomes led to the hypothesis that the glycan alphabet is not universal; this is unlike those of proteins and nucleic acids. Only 10-11 monosaccharides are most prevalent whereas nearly 40 have highly restricted distribution. Not surprisingly, as part of extracellular polymeric substances, variations in glycans contribute strain-specific phenotypic characteristics (e.g., serotypes). Currently, we are developing annotation pipelines focused on domain demarcation in glycosylhydrolases and glycosyltransferases as the first step in functional annotation, and trying to find clues to neofunctionalization in monosaccharide biosynthesis enzymes.

Teaching activities: Enjoy teaching Biology to BTech students who dislike Biology, Biochemistry to Masters students who have already completed a course in Biochemistry and Molecular Biophysics to any student who is interested! I continue to find teaching of Bioinformatics a challenge. I cherish the multiple Excellence in Teaching Awards that the Institute has bestowed on me solely based on students' feedback.

Administrative responsibilities: Have contributed to the Institute by discharging key administrative responsibilities in the last 10+ years.



RECENT PUBLICATIONS

1. Srivastava, J., Sunthar, P. and Balaji, P.V. (2021) Monosaccharide biosynthesis pathways database. *Glycobiology*, **31**, 1636-1644. doi.org/10.1093/glycob/cwab030
2. Anu Prabha and Balaji, P.V. (2021) Characterization of left-handed beta helix-domains, and identification and functional annotation of proteins containing such domains. *Proteins*, **89**, 6-20.
3. Srivastava, J., Sunthar, P. and Balaji, P.V. (2020) The glycan alphabet is not universal: a hypothesis. *Microbial Genomics*, **6**, [mgen000452](https://doi.org/10.1093/mgen/mgaa0452).
4. Kaundinya, C.R., Savithri, H.S., Rao, K.K. and Balaji, P.V. (2018) EpsM from *Bacillus subtilis* 168 has UDP-2,4,6-trideoxy 2-acetamido 4-amino glucose acetyltransferase activity in vitro. *Biochem. Biophys. Res. Comm.*, **505**, 1057-1062.
5. Kaundinya, C.R., Savithri, H.S., Rao, K.K. and Balaji, P.V. (2018) In vitro characterization of N-terminal truncated EpsC from *Bacillus subtilis* 168, a UDP-N-acetyl 4,6-dehydratase. *Arch. Biochem. Biophys.*, **657**, 78-88.
6. Kaundinya, C.R., Savithri, H.S., Rao, K.K. and Balaji, P.V. (2018) EpsN from *Bacillus subtilis* 168 has UDP 2,6-dideoxy 2-acetamido 4-keto aminotransferase activity in vitro. *Glycobiology*, **28**, 802-812.



Dr. Banerjee, Anirban Professor

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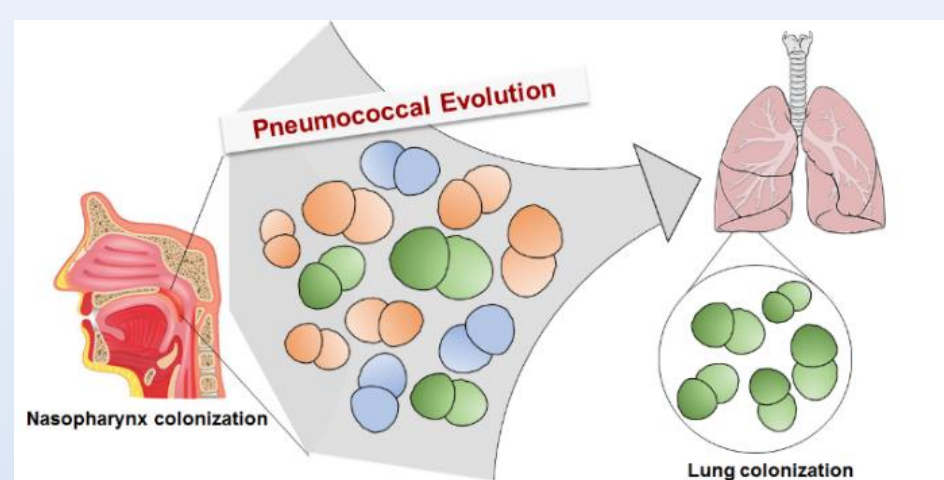
Areas of Expertise: Bacterial Pathogenesis, Host-Pathogen Interaction, Cellular Immunity

Research Description: *Crossing barriers: Uncovering the smart tactics to sneak into the host*

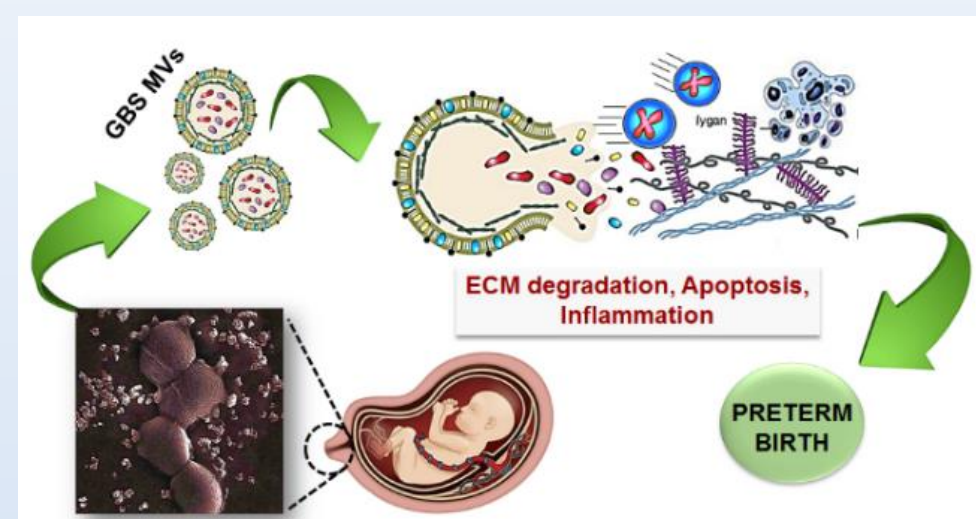
The human body is bordered by several cellular barriers that define the frontier between the internal milieu and the external non-sterile environment. In addition to their physiological roles, these host barriers provide both physical and immune defense against microbial infection. Employing Group B *Streptococcus* and *Streptococcus pneumoniae* as model pathogens, we strive to decipher novel mechanisms adopted by pathogens to breach host barriers and cause invasive disease.

Streptococcus pneumoniae is an asymptomatic colonizer in the upper respiratory tract but due to unknown reason, this bacterium switches to a pathogenic state and can cause a wide range of invasive diseases following successful invasion through host barriers. Our research encompasses these multivariate issues where we intend to decipher competing quorum sensing pathways for generation of heterogeneous pneumococcal subpopulations that are adept at crossing host barriers as well as transmit to other individuals for efficient propagation. We also intend to decode the selection pressures that are possibly governs adaptive evolution in pneumococcus due to which the bug is able to lower its virulence traits and possibly home in an alternate host niche such as the human lungs. These will enable us to predict emergence of novel pneumococcal strains as well as develop novel therapeutic strategies.

Group B *Streptococcus* (GBS), which resides in the genito-urinary tract of nearly 20-30% women is associated with increased risks chorio-amnionitis and preterm birth. We discovered that GBS produces small membrane bound vesicles (MVs) loaded with proteases and other virulence factors while colonizing female genital tract. These vesicles can travel up the birth canal and reach the uterus where they can degrade collagen lowering the strength of feto-maternal membrane and cause extensive inflammation and cell death. The culminating effect of such adverse events leads to rupture of fetal membrane and premature delivery. We hypothesize that such preterm born babies may suffer from neuro-degenerative disorders and cognitive deficits establishing a link between maternal GBS colonization and development of autism spectrum disorder like symptoms in offspring



Pneumococcal evolution



GBS produced membrane vesicles (MVs) cause preterm birth

Achievements:

Early Research Achiever Award (IIT Bombay)
Excellence in Teaching Award (IIT Bombay)
DAAD Fellowship

Selected Publications:

- Surve MV, Bhutda S, Datey A, Anil A, Rawat S, Pushpakaran A, Singh D, Kim KS, Charavotty D, Banerjee A (2018) Heterogeneity in pneumolysin expression governs the fate of *Streptococcus pneumoniae* during blood-brain barrier trafficking. *PLoS Pathogens*. 14(7): e1007168.
- Surve MV, Anil A, Kamath KG, Bhutda S, Sthanam KL, Pradhan A, Srivastava R, Basu B, Dutta S, Sen S, Modi D, Banerjee A (2016) Membrane vesicles of Group B *Streptococcus* disrupt feto-maternal barrier leading to preterm birth. *PLoS Pathogens*. 12: e1005816.
- Sangabathuni S, Vasudeva MR, Chaudhary PM, Surve M, Banerjee A, Kikkeri R (2016) Glyco-gold nanoparticle shapes enhance carbohydrate-protein interactions in mammalian cells. *Nanoscale*. 8:12729-12735.



Dr. Bhaumik, Prasenjit Professor

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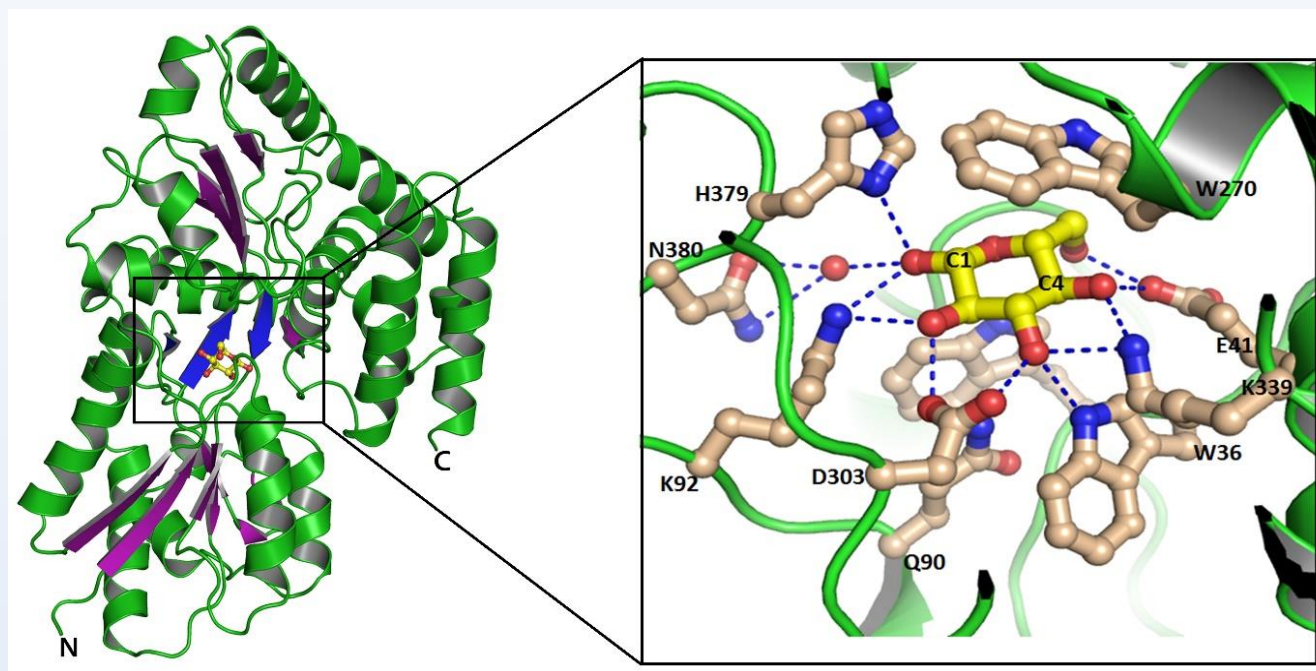
Areas of Expertise: Understanding the structure function relationship of enzymes and biological macromolecules. Protein crystallography, Structure based antimalarial drug development, Structural enzymology

Research Description- Plasmepsin V: a novel antimalarial drug target- Malaria is responsible for infecting 300-500 million people annually and the death of 1-3 million, mostly pregnant women and children. The causative agents responsible for human malaria are four Plasmodium species (*P. vivax*, *P. ovale*, *P. malariae*, and the most lethal *P. falciparum*). The current findings showing that an aspartic protease plasmepsin V (PMV) of plasmodium parasite is essential for its viability make this enzyme a novel and important target to develop antimalarial drugs. In order to understand the structural details of PMV of we have created a homology model of *P. falciparum* plasmepsin V (PfPMV). The modeled structure was used to dock a model PEXEL substrate and docking based virtual screening of inhibitors. Among the screened inhibitors saquinavir, a potent HIV-I protease inhibitor show the best affinity for PfPMV. Molecular dynamics simulations of PfPMV as apo enzyme and complexed with inhibitors have revealed important structural features of this enzyme.

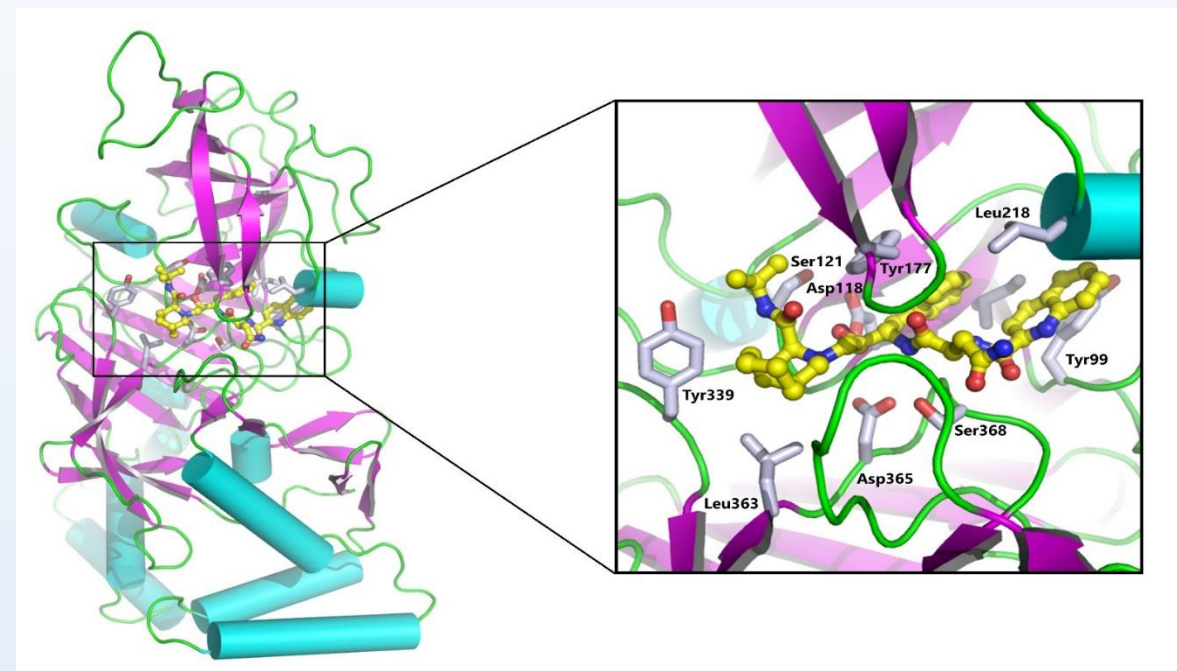
Honors and Awards:

Fellows Award for Research Excellence (FARE) award from the NIH, 2009

Travel award from American Society of Biochemistry and Molecular Biology (ASBMB), 2009



Overall structural fold of ppGBP represented as cartoon. The β -sheets are shown in purple color to highlight their arrangements. Glucose is shown as ball and stick. Inset shows interactions of glucose with ppGBP. Carbon atoms of glucose and amino acid residues are shown as yellow and light-brown color, respectively. Hydrogen bonds are presented as dotted lines.



Overall structural fold of *P. falciparum* PMV complexed with a HIV-I protease inhibitor saquinavir. Inset shows the zoomed in view of the binding pocket

Selected publications:

- Yarramala, D. S., Prakash, P., Ranade, D. S., Doshi, S., Kulkarni, P. P., **Bhaumik P.**, & Rao, C. P. (2019). Cytotoxicity of apo bovine α -lactalbumin complexed with La³⁺ on cancer cells supported by its high resolution crystal structure. **Sci Rep.** 9, 1780.
- Pandey, S., Phale, P. S. & **Bhaumik, P.** (2018). Structural modulation of a periplasmic sugar-binding protein probes into its evolutionary ancestry. **J. Struct. Biol.** 204(3):498-506
- Mishra, V., Rathore, I., Arekar, A., Sthanam, L. K., Xiao, H., Kiso, Y., Sen, S., Patankar, S., Gustchina, A., Hidaka, K., Wlodawer, A., Yada, R. Y., & **Bhaumik, P.** (2018). Deciphering the mechanism of potent peptidomimetic inhibitors targeting Plasmepsins - Biochemical and structural insights. **FEBS J.** 285, 3077-3096.
- Prakash, P., Puneekar, N. S. & **Bhaumik, P.** (2018). Structural basis for the catalytic mechanism and α -ketoglutarate cooperativity of glutamate dehydrogenase. **J. Biol. Chem.** 293, 6241-6258. (Selected for cover page)
- Wangchuk, J., Prakash, P., **Bhaumik, P.** & Kondabagil, K. (2018). Bacteriophage N4 large terminase: expression, purification and X-ray crystallographic analysis. **Acta Cryst.** F74, 198-204.



Dr. Ghosh, Santanu K. Professor

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Areas of Expertise:

Understanding mechanism of faithful chromosome segregation during meiotic cell division.

Functional studies of different regulatory factors involved in vegetative cell division.

Exploring micron plasmid biology to study fundamental biological processes like chromatin organization and post translational protein modifications.

Epigenetic and genetic factors that influence Candida life cycle.

Research Description:

The molecular mechanisms ensuring accurate chromosome segregation during meiosis and mitosis are critical to the conservation of euploidy. Errors in these processes lead to dire consequences like cancer, infertility and congenital disorders. My group is interested in elucidating the factors responsible for successful execution of these two cell division processes.

Achievements/Recognition

Jun 2002-Aug 2003: Postdoctoral Fellow, Bose Institute, Kolkata, WB, India

Sept 2003-Aug 2006: Postdoctoral Fellow, University of Texas at Austin, USA

Sept 2006- Jan 2009: Research Associate, University of Texas at Austin, USA

Feb 2009 – till date: Assistant Professor, IIT Bombay, India

Council of Scientific and Industrial Research (CSIR- NET) Fellowship (JRF and SRF), Govt. Of India, 1996 to 2001

Dept of Biotechnology Fellowship, Govt. of India, 1994 to 1996

Selected Publications:

- Mittal P, Ghule K, Trakroo D, Prajapati P and Ghosh SK. Meiosis-specific functions of kinesin motors in cohesin removal and maintenance of chromosome integrity in budding yeast. *Molecular and Cellular Biology* (in press).
- Prasad P, Sanyal K and Ghosh SK. Sth1, the key subunit of the RSC chromatin remodeling complex, is essential in maintaining chromosomal integrity and mediating high fidelity chromosome segregation in the human fungal pathogen *Candida albicans*. *Frontiers in Microbiology* 2019 Jun 12;10:1303. doi: 10.3389/fmicb.2019.01303.
- Rizvi, S.M., H.K. Prajapati, P. Nag & Ghosh S.K. The 2 micron plasmid encoded protein Raf1 regulates both stability and copy number of the plasmid by blocking the formation of the Rep1-Rep2 repressor complex. *Nucleic Acids Research*, 2017 Jul 7;45(12):7167-7179.
- Prajapati H, Azhar RSM, Rathode I, Ghosh SK. Microtubule-associated proteins, Bik1 and Bim1 are required for faithful partitioning of the endogenous 2 micron plasmids in budding yeast. *Molecular Microbiology* 2017, 103: 1046-1064.
- Mehta GD, Agarwal M, Ghosh SK. Functional characterization of kinetochore protein, Ctf19 in meiosis I: an implication of differential impact of Ctf19 on the assembly of mitotic and meiotic kinetochores in *Saccharomyces cerevisiae*. *Molecular Microbiology*. 2014; 91(6):1179-99.



Dr. Kaledhonkar, Sandip

Assistant Professor

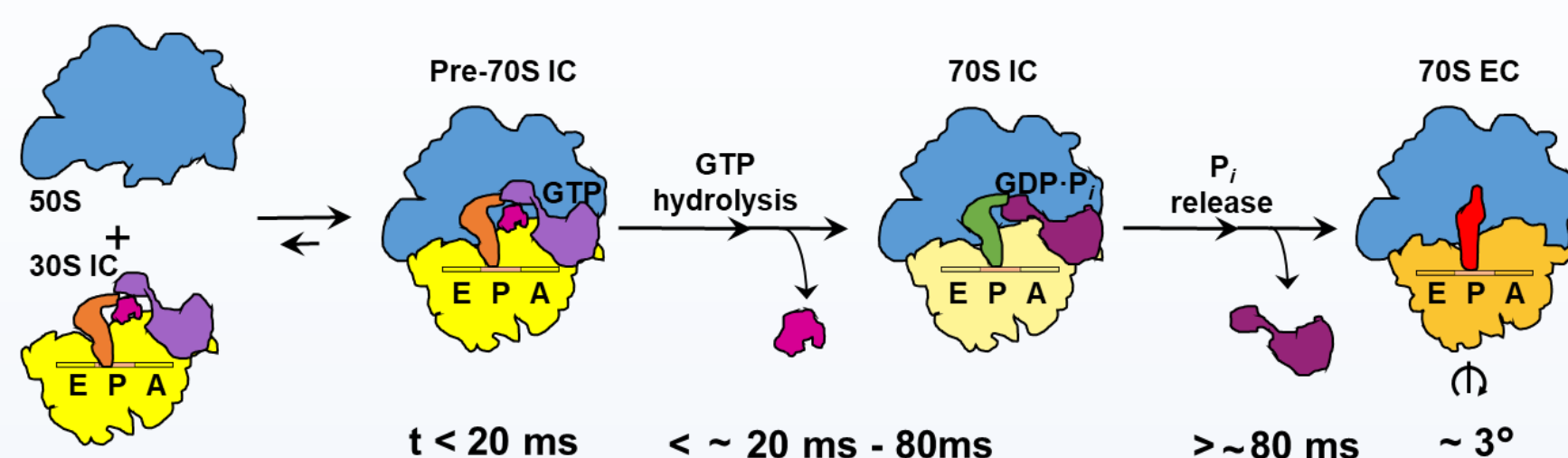
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Areas of Expertise: cryo-EM, single particle-cryo-EM, Structural Biology, single particle cryo-EM, cryo-Electron Tomography, Time-resolved techniques, Hydrogen-bonding in biomolecules

Research Description:

Structural biology provides a mechanistic understanding of biological macromolecules and their interactions inside the cell during key processes of life. We are employing single-particle cryo-EM, cryo-ET, and time-resolved studies to understand structure-function aspects of biomolecule along with computational methods. Our long-term goal is to use these methods to understand structural-function relation of biomolecules along with its dynamics



Cartoon diagram depicting transient molecular events of bacterial translation initiation process captured with time-resolved cryo-EM technique. The 30S initiation complex (30S IC) and the large subunit (50S) associate to form 70S IC intermediate complex. Initiation Factor 2 (IF2), a GTPase protein, undergoes GTP hydrolysis within 20-80 ms to form GDP-P_i , followed by P_i release after 80 ms. IF2 dissociates from 70S IC complex and forms 70S Elongation competent ribosome which is ready to go into elongation cycle of the translation process.

Honors and Awards:

- 2012: Outstanding Research Assistant, Department of Physics, Oklahoma State University, USA
- 2010: Outstanding Teaching Assistant, Department of Physics, Oklahoma State University, USA
- 2019: Invited Speaker at 3DEM Gordon Research Conference Hong Kong
- 2019: Young Faculty Award, IIT Bombay, Mumbai

Selected Publications:

- **Kaledhonkar, S.**, Fu, Z., Caban, K., Li, W., Chen, B., Sun, M., Gonzales, R.L., and Frank, J. (2019). Late steps in bacterial translation initiation visualized using time-resolved cryo-EM. **Nature** 570, 400-404.
- Fu, Z., Indrisiunaite, G., **Kaledhonkar, S.**, Shah, B., Sun, M., Chen, B., Grassucci, R.A., Ehrenberg, M., and Frank, J. (2019). The structural basis for release factor activation during translation termination revealed by time-resolved cryogenic electron microscopy. **Nature Communications** 10, 2579.
- Fu, Z., **Kaledhonkar, S.**, Borg, A., Sun, M., Chen, B., Grassucci, R.A., Ehrenberg, M., and Frank, J. (2016). Key Intermediates in Ribosome Recycling Visualized by Time-Resolved Cryoelectron Microscopy. **Structure** 24, 2092–2101.
- Chen, B., **Kaledhonkar, S.**, Sun, M., Shen, B., Lu, Z., Barnard, D., Lu, T., Gonzalez, R.L., and Frank, J. (2015). Structural dynamics of ribosome subunit association studied by mixing-spraying time-resolved cryo-EM. **Structure** 23, 1097–1105.
- **Kaledhonkar, S.**, Miwa Hara, T. Page Stalcup, Aihua Xie, Wouter D. Hoff. (2013)., Strong ionic hydrogen bond causes spectral isotope effect in *p*-coumaric acid chromophore of photoactive yellow protein from *Salinibacter rubber*, **Biophys. J.**, 110: 2577-2585



Dr. Kanekar, Neeta

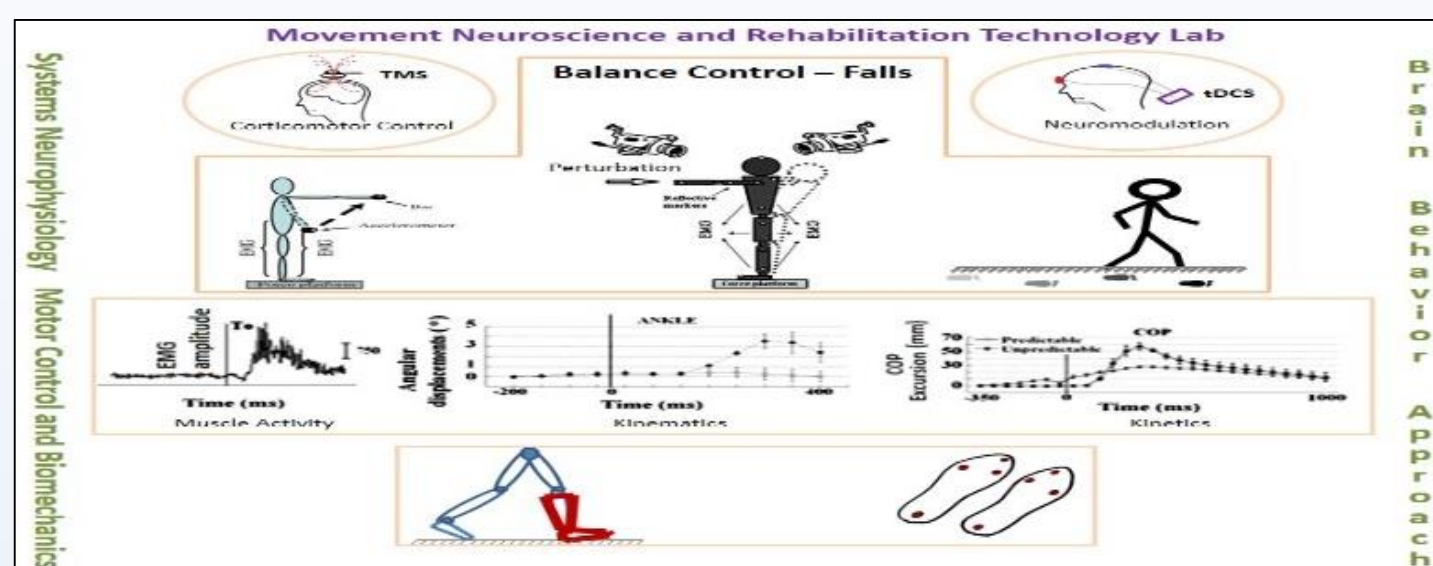
Assistant Professor

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Areas of Expertise: Human Motor Control and Learning; Neurophysiology and Biomechanics of Balance, Gait, and Falls; Neural Plasticity and Non-Invasive Brain Stimulation; Neurological and Geriatric Rehabilitation Technology

Research Description: Biped stance and gait, while setting our hands free to explore the world around us, has come at a significant cost of stability. The human body can be thought of as an inverted pendulum with a high centre of mass and a narrow base of support; an inherently unstable system whose balance needs to be finely controlled. Falls are a severely disabling consequence of impaired balance control in older adults and people with neurological disorders such as stroke and Parkinson's disease. A nuanced understanding of the neural control of standing balance and gait is essential for the development of novel movement rehabilitation technologies. At the Movement Neuroscience and Rehabilitation Technology Lab, we are an interdisciplinary team of clinicians and engineers conducting translational research that is bidirectional in its approach. One arm of our research is focused on studying aging and neurological conditions to understand the sensory-motor and cognitive mechanisms of balance control and gait, while the other arm focuses on utilizing this basic knowledge to serve clinical analysis and early identification of individuals at high risk of falls and to develop new rehabilitation interventions and technologies for people with impaired mobility.



We use non-invasive brain stimulation methods such as transcranial magnetic stimulation (TMS) along with surface electromyography (EMG) to investigate excitability of lower limb corticomotor pathways and neuromodulatory approaches such as transcranial direct current stimulation (tDCS) to understand the role of different cortical areas in movement control. These electrophysiological recordings are carried out in conjunction with three-dimensional kinetic (force platform) and kinematic measurements (spatiotemporal gait analysis), thereby presenting a brain-behavior approach to the study of human balance control. In the area of rehabilitation technologies, our work focuses on the design and development of pressure sensor-based insoles for balance and gait monitoring and low-cost wearable assistive devices for improving mobility in older adults and people with neurological disorders.

Achievements/Recognition:

- Applied Health Sciences New Alum Award, University of Illinois at Chicago
- American Heart Association/American Stroke Association's Pre-doctoral Fellowship Award

Selected Publications/Patents:

- Indian Patent Filed: A controlled unpowered device for assisting gait. Inventors: Rishi Chauhan, Rajbeer Singh Anand, Anirban Guha, Neeta Kanekar (2021).
- Anand R.S, Kanekar N, Guha A. Modeling the effects of linear and torsional spring based passive assistance on human gait. In: Sen D., Mohan S., Ananthasuresh G. (eds) Mechanism and Machine Science. Lecture Notes in Mechanical Engineering. Springer, Singapore, 2021.
- Madhavan S, Stinear JW, Kanekar N. Effects of a single session of high intensity interval treadmill training on corticomotor excitability following stroke: implications for therapy. *Neural Plasticity*, 2016; 2016:1686414.
- Kanekar N, Aruin AS. Improvement of anticipatory postural adjustments for balance control: effect of a single training session. *Journal of Electromyography and Kinesiology*, 2015; 25(2):400-405.
- Kanekar N, Aruin AS. The effect of aging on anticipatory postural control. *Experimental Brain Research*, 2014; 232(4):1127-1136.
- Kanekar N, Lee YJ, Aruin AS. Frequency analysis approach to study balance control in individuals with multiple sclerosis. *Journal of Neuroscience Methods*, 2014; 222:91-96.



Dr. Kondabagil, Kiran Professor

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Areas of Expertise:

Evolutionary biology of large DNA viruses, molecular mechanisms of DNA replication, repair and packaging in Mimivirus, vaccinia virus, and bacteriophage N4. Environmental genomics, isolation of novel viruses

Research Description:

Our group works on understanding the environmental ecology and evolutionary genomics of viruses, how their functional interactions dynamically alter the microbial diversity, and molecular mechanisms of their assembly. We employ a range of tools from comparative genomics to metagenomics to structural biology and biochemistry for understanding the diversity and biology of giant viruses. Recently, we showed that the viral genome packaging machinery is remarkably similar to prokaryotes machinery implying cellular origin of large DNA viruses. We have isolated and sequenced several giant viruses for the first time from India.

Achievements/Recognition

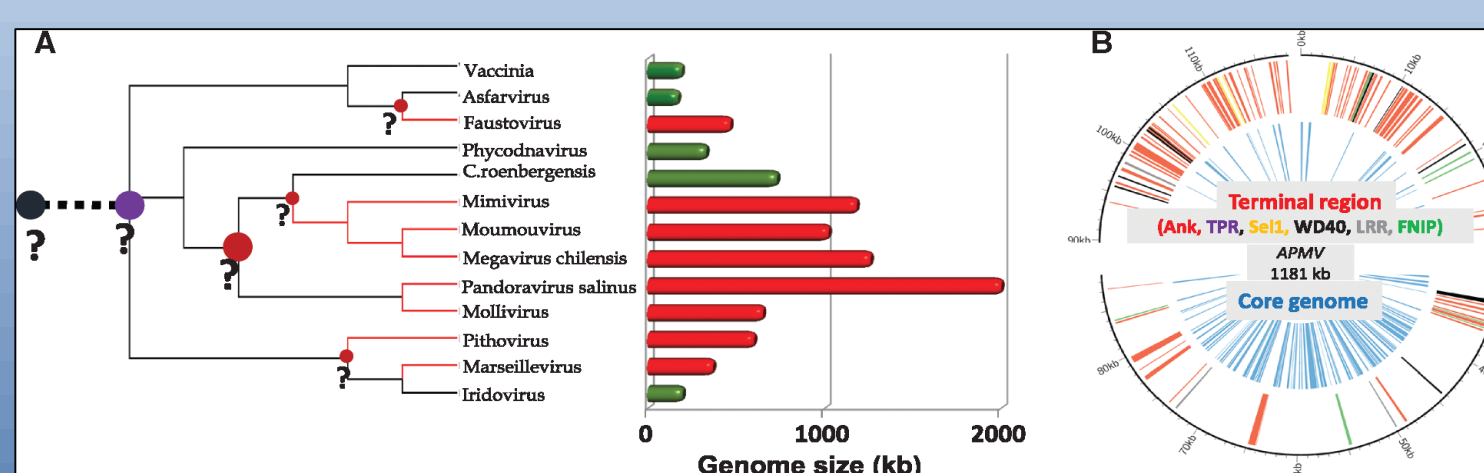
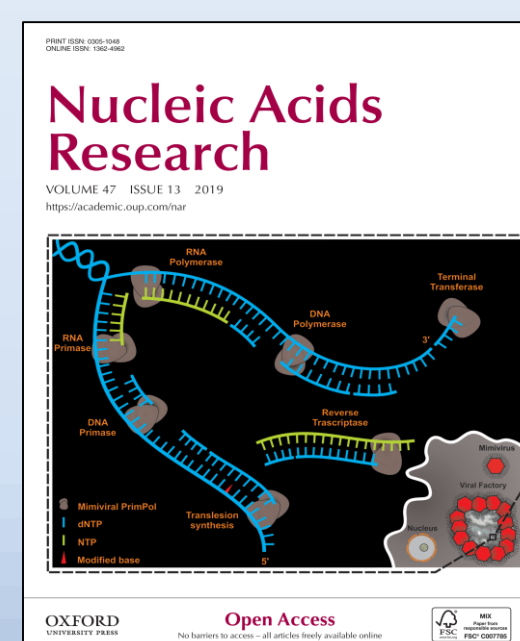
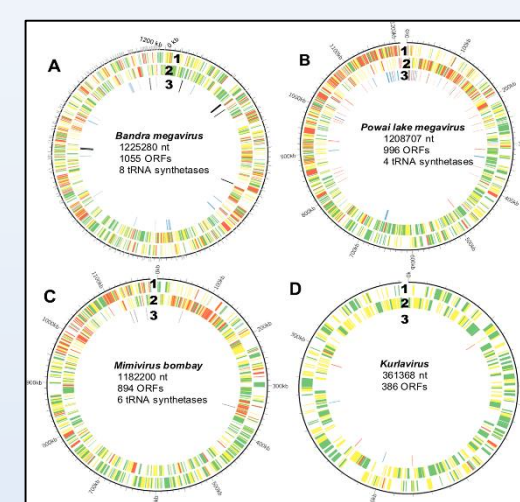
Excellence in Teaching, IIT Bombay, **2015**.

ASMCUE — **Leadership Grant for International Educators**. Awarded by the American Society of Microbiology, **2016**.

Novozymes and the Holck–Larsen Foundation Visiting Professor. Department of Systems Biology, Technical University of Denmark (DTU) Denmark, Sept-Dec **2016**.

Selected Publications:

- Chatterjee A, **Kondabagil K**. Giant viral genomic signatures in the previously reported gut metagenomes of pre-school children in rural India. *Arch Virol*. 164(11):2819-2822, **2019**.
- Chatterjee, A, Sicheritz-Ponten T, Yadav R, **Kondabagil K**. Ubiquitous genomic and metagenomic signatures of giant viruses in water samples from sewage, inland lake, waste water treatment plant and municipal water supply in Mumbai. *Scientific Reports*, 9(1):3690. **2019**.
- Gupta A*, Lad S*, Ghodke P, Pradeepkumar P, **Kondabagil K**. Mimivirus encodes a multifunctional primase with DNA/RNA polymerase, terminal transferase and tranlesion synthesis activities. *Nucleic Acids Res*. 47:6932-6945, **2019**. [Cover page article](#).
- Halkare P, Punjabi N, Wangchuk J, Nair A, **Kondabagil K**. Mukherji S. Bacteria functionalized gold nanoparticle matrix fibre-optic sensor for monitoring heavy metal pollution in water. *Sensors & Actuators: B Chemical* 281: 643-651, **2019**.
- Shukla A, Chatterjee A, **Kondabagil K**. Repeat domain containing proteins drive the genome size evolution in amoebal giant viruses. *Virus Evolution*, 4(1): vex039, **2018**.





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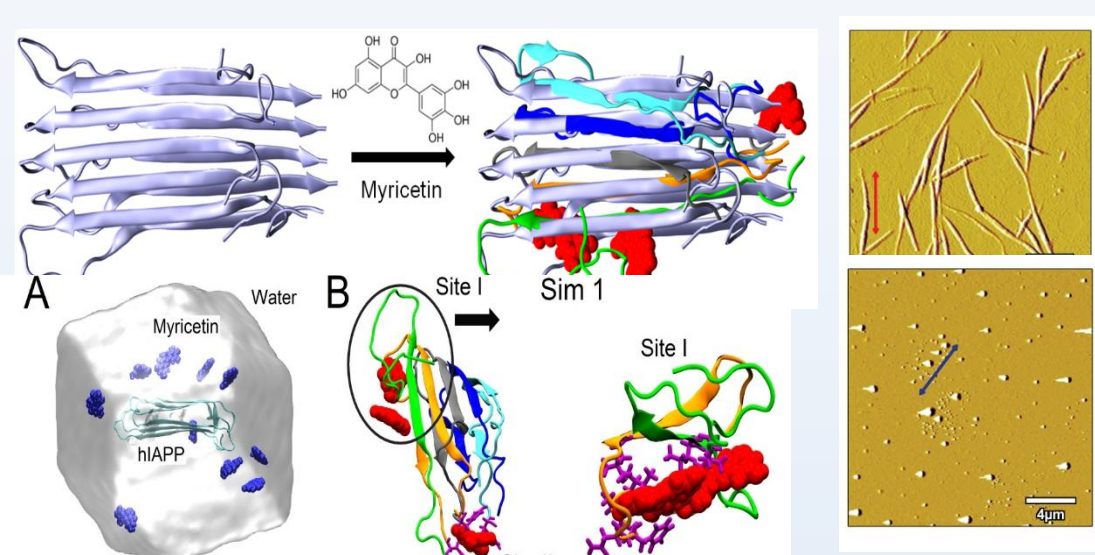
E-mail: ashutoshk@iitb.ac.in

Areas of Expertise: Biomolecular NMR spectroscopy, Structural Biology

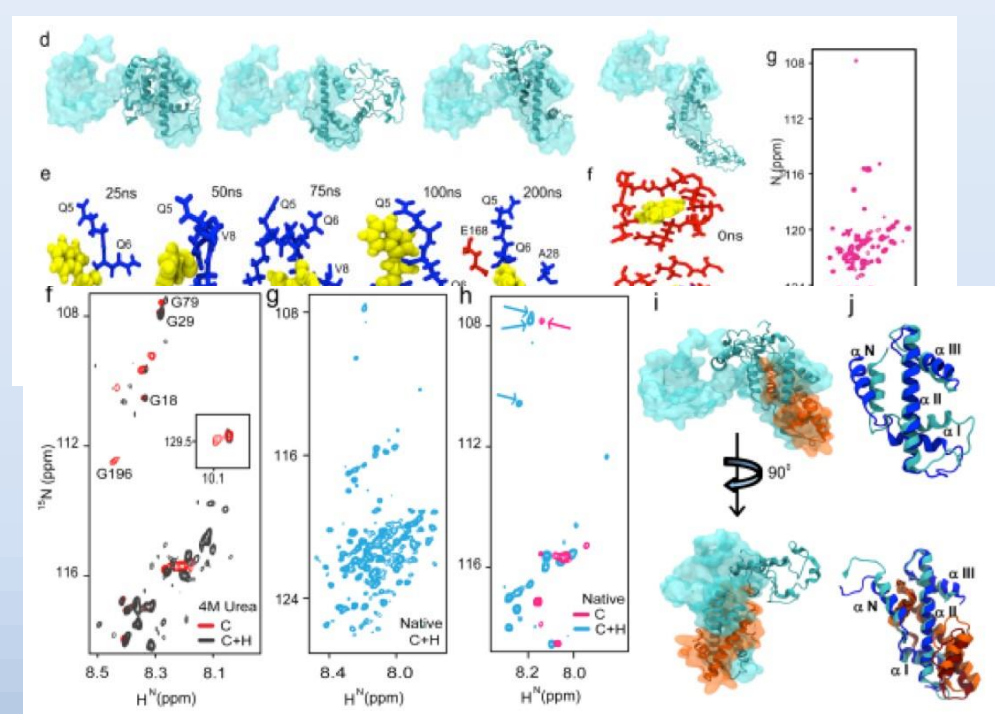
Research Description- Amyloids: We work on Amyloid forming proteins: α -Synuclein and hIAPP, Implicated in Parkinson's Diseases and Type II Diabetes Mellitus respectively. We showed that a perturbation in long-range interactions in α -synuclein modulates the aggregation kinetics of α -synuclein and its familial mutants at different pH to understand disease mechanism. For hIAPP, we have established, for the first time, a bacterial-expression based protocol for high yield of hIAPP fibrils as well as hIAPP monomer. We have also demonstrated that hIAPP oligomers and fibrils disrupt pancreatic β -cell membrane by pore formation and also studied compounds, which may inhibit fibril formation.

Specialized nucleosome: Studies in the lab have shown that Cse4 (CenH3), a H3 variant in budding yeast may exist in a closed conformation wherein the N- terminus and C-terminus are involved in self-interaction which is unique to Cse4 and not found in other histones. On addition of H4, the conformation opens up releasing the N-terminal tail. This conformation switch caused by H4 maybe an important mechanism for the regulation of Cse4.

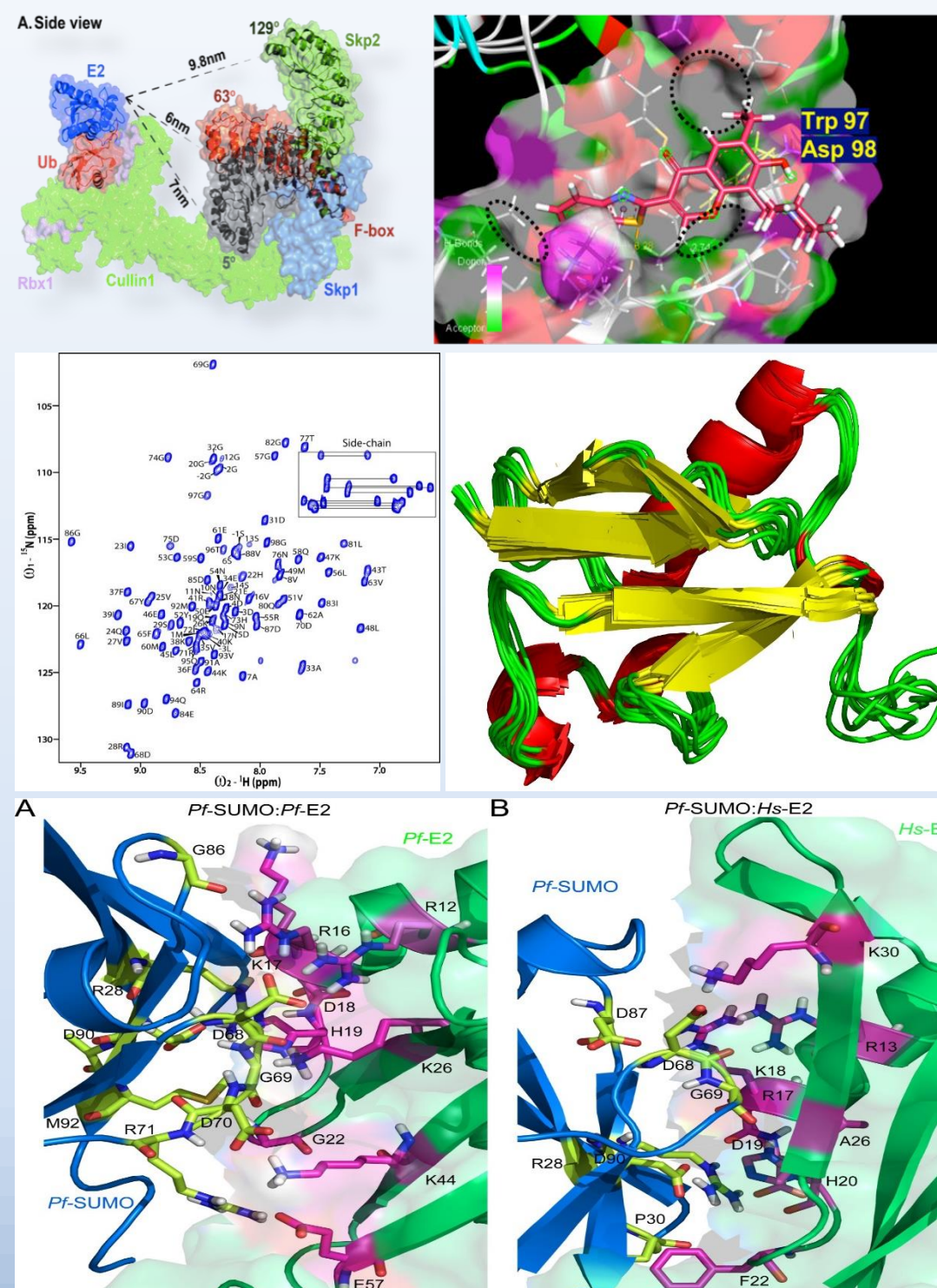
Cell-cycle regulation: Another project involves the study of Structure and dynamics of a cell cycle associated protein, S-phase kinase-associated protein 1 (Skp1). The structure of Skp1 has been solved in the lab using NMR spectroscopy (PDB ID 5XYL) By using NMR spectroscopy; we are investigating the mechanism by which Skp1 is capable of recognizing multiple F-box substrates using a single interface.



This figure demonstrates hIAPP fibril formation inhibition by Polyphenolic compounds



Cse4 N-terminus and C-terminus interact as shown by MD simulations and H4 stabilizes Cse4



Selected Publications:

- Dubey R, Patil K, Dantu SC, Sardesai DM, Bhatia P, Malik N, Acharya JD, Sarkar S, Ghosh S, Chakrabarti R, Sharma S, **Kumar A.** Biochem J. 476(5):889-907.
- Malik, N., Dantu, S. C., Shukla, S., Kombrabail, M., Ghosh, S. K., Krishnamoorthy, G., & **Kumar, A.** (2018). Journal of Biological Chemistry, 293(52), 20273-20284.
- Ranjan P., **Kumar A.**, (2017) ACS Chem. Neurosci. 18: 2235-2246.



Dr. Kumar, Sushil

Assistant Professor

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Areas of Expertise: Cancer Biology, Cell signaling, Cancer Biomarkers, Big data analysis

Research Description:

The mutations that make cancer cells grow also confer vulnerabilities if cancer cells lack them. Some of these acquired variations represent fascinating therapeutic targets. We are interested in understanding cancer's essential signaling and utilizing that knowledge for translational purposes. To achieve our goals, we use cell lines, drug-resistant cell lines, organoids, xenograft models and computational analysis. Besides basic research, we will collaborate with clinicians to get fresh patient samples to appreciate their complexity and heterogeneity.

Teaching Activities: Teaching is the best way to know and interact with fresh minds. I teach an MSc course “Genetics” in the autumn semester and another course “Immunology” in the spring semester.

Awards and Fellowships:

Research grant from Basser Center, Uni. of Pennsylvania in 2020 worth \$250K for two years
International travel awards from DBT Govt of India, DST Govt of India, and The American Association of Immunologists USA in year 2015
NET-JRF from CSIR in 2010
ICAR-ASRB NET in 2010

Editor/Reviewer responsibilities:

Review Editor for “Frontier in Molecular Biosciences” journal
Reviewer for Lancet EBioMedicine, STAR Protocols by Cell Press, International Reviews of Immunology, OncoTargets and Therapy, and Cancer Management and Research.

Selected Publications:

- Sushil Kumar, Ajeya Nandi, Snahlata Singh, Rohan Regulapati, Ning Li, John W. Tobias, Christian W. Siebel, Mario Andres Blanco, Andres J. Klein-Szanto, Christopher Lengner, Alana L. Welm, Yibin Kang, and Rumela Chakrabarti. Dll1+ quiescent tumor stem cells drive chemoresistance in breast cancer through NF- κ B survival pathway. **Nature Communications** (2021).
- Sushil Kumar, Ratnesh Kumar Srivastav, David W. Wilkes, Taylor Ross, Sabrina Kim, Jules Kowalski, Srinivas Chatla, Qing Zhang, Anupma Nayak, Manti Guha, Serge Y. Fuchs, Christoforos Thomas & Rumela Chakrabarti. Estrogen-dependent DLL1-mediated Notch signaling promotes luminal breast cancer. **Oncogene**, 38, pages2092–2107 (2019). doi: 10.1038/s41388-018-0562-z.
- Sushil Kumar, David W. Wilkes, Nina Samuel, Mario Andres Blanco, Anupma Nayak, Kevin Alicea-Torres, Christian Gluck, Satrajit Sinha, Dmitry Gabrilovich, and Rumela Chakrabarti. DeltaNp63-driven recruitment of myeloid-derived suppressor cells promotes metastasis in triple-negative breast cancer. **The Journal of clinical investigation** 2018; 128(11):5095-5109.
- Rumela Chakrabarti, Toni Celià-Terrassa*, Sushil Kumar*, Xiang Hang, Yong Wei, Abrar Choudhury, Julie Hwang, Jia Peng, Briana Nixon, John J. Grady, Christina DeCoste, Jie Gao, Johan H. van Es, Ming O. Li, Iannis Aifantis, Hans Clevers and Yibin Kang. Notch ligand Dll1 mediates cross-talk between mammary stem cells and the macrophageal niche. **Science** 360:4153. *Equally contributing authors. **Science** (New York, N.Y.). 2018; 360(6396).



Dr. Kunwar, Ambarish Professor

Department of Biosciences and Bioengineering
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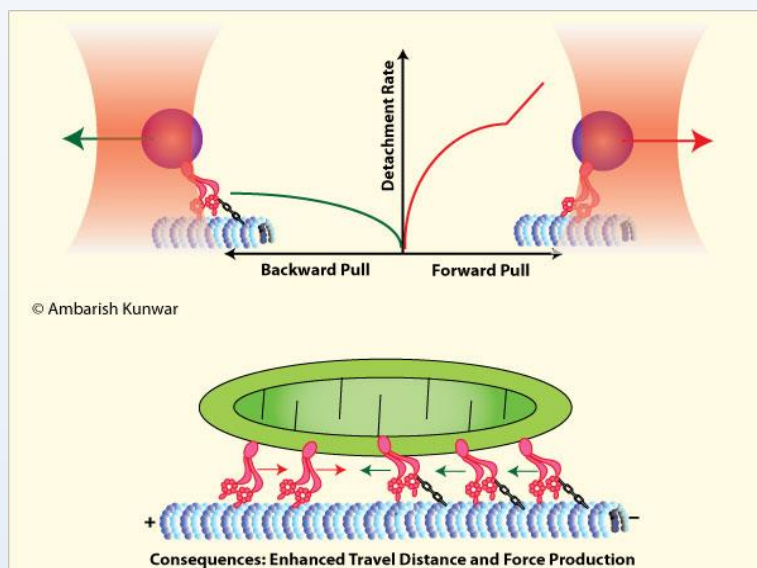
Areas of Expertise: Biophysics and Computational Biology

Research Description: Our lab works in the area of biophysics and computational biology.

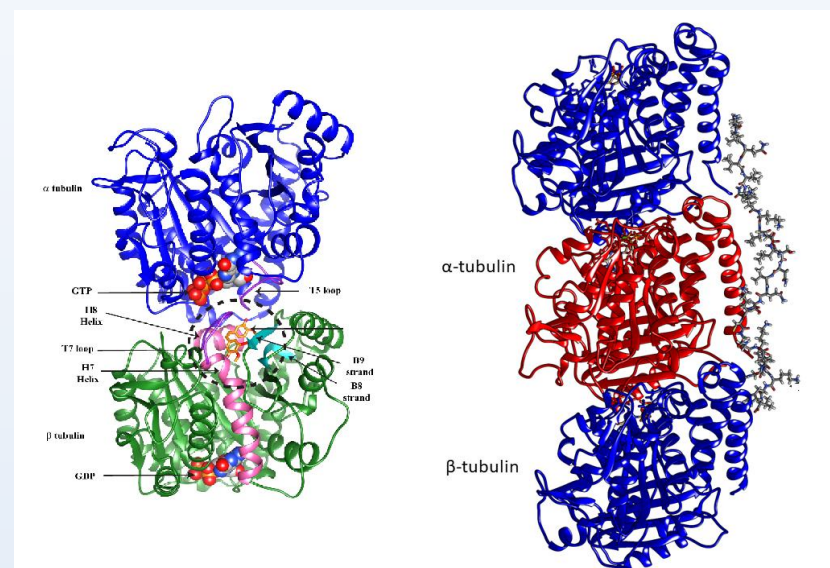
- We use Monte-Carlo Simulations to study
Transport and force generation by motor Proteins
Microtubule dynamics
- We use Molecular Dynamics simulations to study
Interaction of potential anti-cancer drugs with microtubules
Interaction of microtubule associated proteins (MAPs) with microtubules
Effect of pathogenic variation on proteins involved in Endocrine diseases
- We also work on development of various robotic and non-robotic disinfection /sterilization devices based on
Germicidal UVC radiation
Far-UVC radiation
Ozone

HONORS AND AWARDS

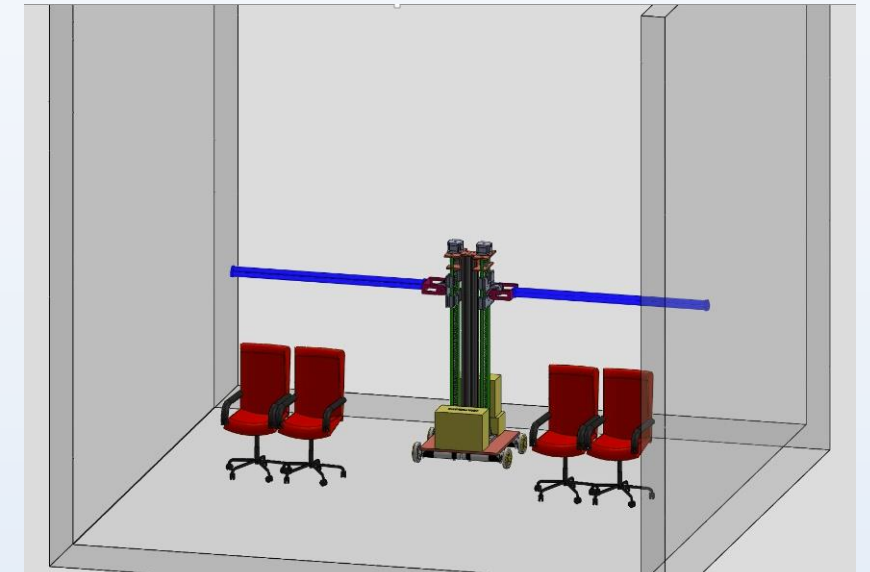
Innovative Young Biotechnologist Award for the year 2012 (IYBA 2012), DBT
Young Faculty Award, IIT Bombay
Excellence-in-Research Fellowship, IIT Gandhinagar



Transport and Force Generation by Motor Proteins



Interaction of microtubule with potential anti-cancer drugs and MAPs



Robotic and non-robotic devices based on germicidal UV radiation

Selected Publications

- Saumya Yadav and **Ambarish Kunwar**, Temperature-Dependent Activity of Motor Proteins: Energetics and Their Implications for Collective Behavior, *Frontiers in cell and developmental biology* vol. 9 610899 (2021)
- Vishwambhar Bhandare, Bajarang Vasant Kumbhar and **Ambarish Kunwar**, Differential binding affinity of tau repeat region R2 with neuronal specific β -tubulin isotypes, **Scientific Reports** 9, 10795 (2019)
- Carlos M. Guardia, Raffaella De Pace, Aritra Sen, Amra Saric, Michal Jarnik, David A. Kolin, **Ambarish Kunwar**, Juan S. Bonifacio, Reversible association with motor proteins (RAMP): A streptavidin-based method to manipulate organelle positioning, **PLoS Biology** 17(5): e3000279 (2019)
- Weili Hong, Anjneya Takshak, Olaolu Osunbayo, **Ambarish Kunwar** and Michael Vershinin, The Effect of Temperature on Microtubule-Based Transport by Cytoplasmic Dynein and Kinesin-1 Motors, **Biophysical Journal**, Vol. 111, 1287 (2016)
- Bajarang Vasant Kumbhar, Anubhaw Borogaon, Dulal Panda and **Ambarish Kunwar**, Exploring the Origin of Differential Binding Affinities of Human Tubulin Isotypes $\alpha\beta$ II, $\alpha\beta$ III and $\alpha\beta$ IV for DAMA-colchicine using Homology Modelling, Molecular Docking and Molecular Dynamics Simulation, **PLoS ONE** 11(5): e0156048 (2016)

Patents

- A ROBOTIC DISINFECTION SYSTEM, Indian patent application No. 202121050239 (Filed)
- MULTIFUNCTIONAL ULTRAVIOLET DISINFECTION ROBOT, Indian patent application No. 202121049152 (Filed)



Dr. Maji, Samir K. Professor

Department of Biosciences and Bioengineering
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E-mail: samirmaji@iitb.ac.in

Areas of Expertise: Amyloid, neurodegenerative disease, cancer biology, secretory granule biogenesis, drug delivery, tissue engineering

Research Description:

We are a multidisciplinary group exploring various aspects of amyloid. Amyloids are protein/peptides aggregates that are associated with various human diseases and normal functions of host organism. We investigate mechanisms of protein mis-folding, aggregation and amyloid formation associated with human neurodegenerative diseases such as Alzheimer's, Parkinson's and Prions. We are also investigating the possibility of p53 amyloid formation associated with human cancers. Apart from disease associated amyloids, we are also elucidating functional amyloid formation by various protein/peptide hormones for their storage in secretory granules in mammalian organs. We are actively engaged in designing amyloid based biomaterials for drug delivery and tissue engineering applications. We are also developing 3D *in vitro* tumor model for high throughput drug screening.

Honors and Awards

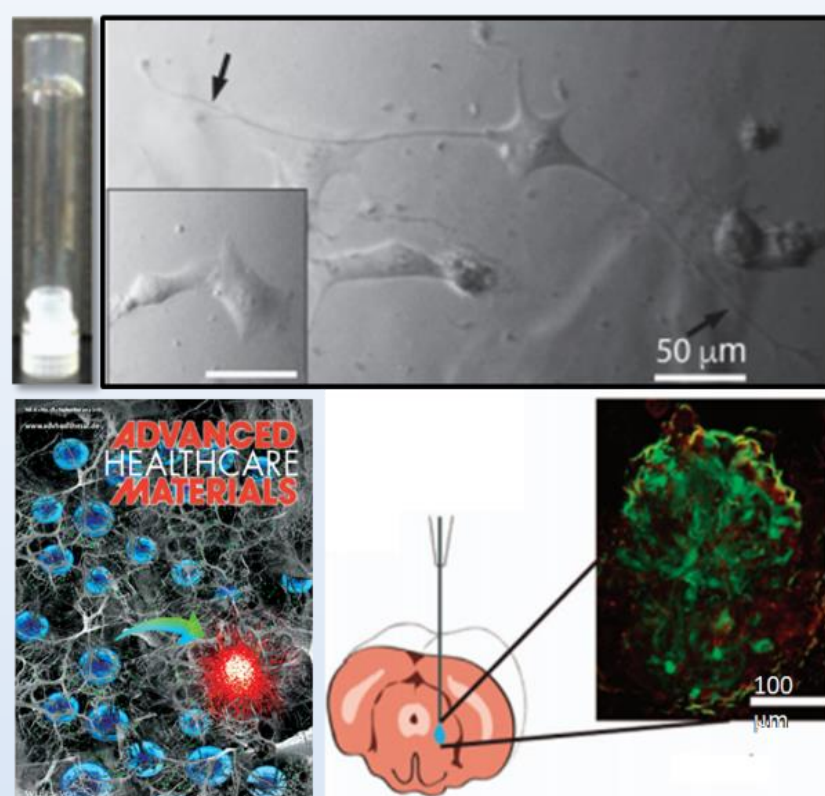
Selected as an **Editorial Board Member** of **The Journal of Biological Chemistry** (2018).

National Bioscience Award for Career Development 2016, by the Department of Biotechnology, Ministry of Science and Technology, Government of India.

IIT Bombay Research Publication Award for the year 2016, for his work on "Understanding α -Synuclein aggregation associated with Parkinson's disease: a therapeutic approach against the disease."

Young researcher award (2013), Lady Tata memorial Trust.

Received **International short visit fellowship from Swiss National Science Foundation (SNF)** (2013)



Selected Publications:

- Hydrogel for neural tissue engineering. Inventors: Subhadeep Das, Dr. Samir K. Maji, Dr. John S Forsythe, Dr. David Finkelstein. Patent file no. 3712/MUM/2015 (Status: Filed, National)
- Jacob, R.S., Ghosh, D., Singh, P.K., Basu, S.K., Jha, N.N., Das, S., Sukul, P.K., Patil, S., Sathaye, S., Kumar, A., Chowdhury, A., Malik S., Sen S., and Maji S.K. (2015) Self-healing hydrogels composed of amyloid nano-fibrils for cell culture and stem cell differentiation. **Biomaterials**, 54, 97-105.
- Das, S., Zhou, K., Ghosh, D., Jha, N. N., Singh, P. K., Jacob, R. S., Bernard C.C., Finkelstein D.I., Forsythe J.S., and Maji, S. K. (2016) Implantable amyloid hydrogels for promoting stem cell differentiation to neurons. **NPG Asia Materials**, 8(9), e304
- Das, S., Kumar, R., Jha, N.N. and Maji, S.K. (2017) Controlled Exposure of Bioactive Growth Factor in 3D Amyloid Hydrogel for Stem Cells Differentiation. **Advanced Healthcare Materials**, 6(18)
- Ghosh, S., Salot, S., Sengupta, S., Navalkar, A., Ghosh, D., Jacob, R.S., Das, S., Kumar, R., Jha, N.N., Sahay, S., Mehra, S., Mohite, G.M., Ghosh, S.K., Kombrabail, M., Krishnamoorthy, G., Chaudhari, P., Maji, S.K (2017), p53 amyloid formation leading to its loss of function: Implications in cancer pathogenesis. **Cell Death and Differentiation**, 24, 1784–1798.



Dr. Mallik, Roop Professor

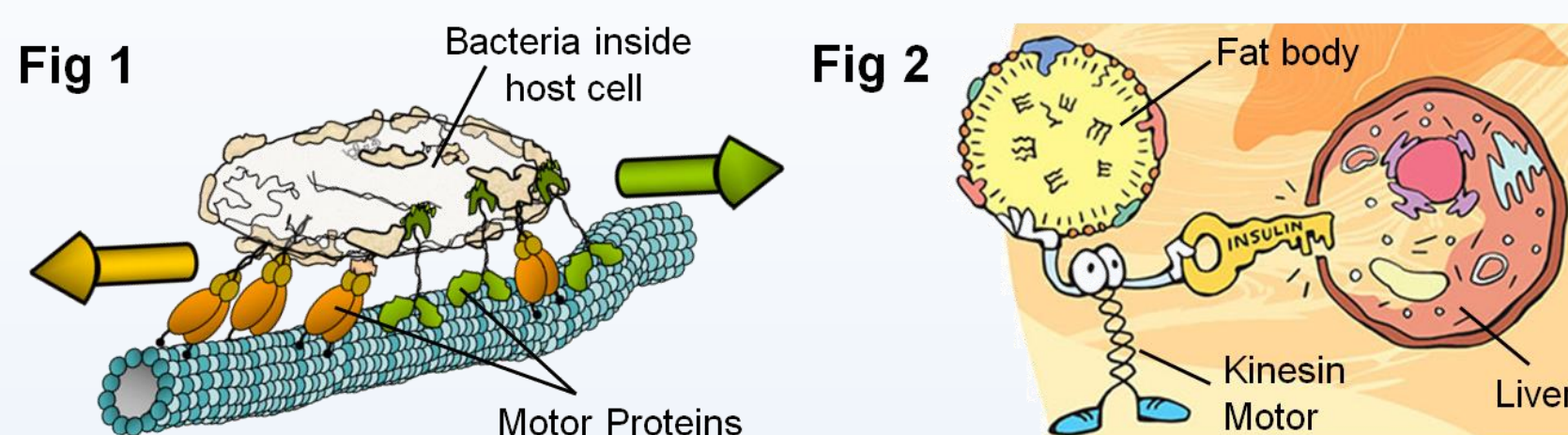
Department of Biosciences and Bioengineering
IIT Bombay, Mumbai 400 076 Phone: 022 2576 7769/4789

E-mail: rmallik@iitb.ac.in

Areas of Expertise: Motor Proteins, Pathogen degradation, Liver function, Triglyceride secretion, Lipid homeostasis.

Research Description:

Pathogens are usually transported by “Motor” proteins to lysosomes inside the host cell for degradation (Fig 1). We study the mechanisms by which such transport happens in a normal situation allowing the pathogen to be degraded, and also how pathogens might subvert this transport to survive and cause disease. We showed the importance of these processes to immune evasion by *Leishmania*. Building on this finding, we hope to address how lipids and proteins secreted by pathogens result in immune evasion. In another line of study we investigate how the liver controls amounts of circulating fat (serum triglycerides or VLDL). We showed that insulin recruits the motor protein kinesin to fat bodies inside the cells of the liver (Fig 2). Kinesin then propels fat bodies to the periphery of liver cells, from where the fat is secreted out into blood. Excess VLDL means diabetes, obesity, metabolic and heart diseases. We are therefore developing peptides and peptide-mimetic drugs to control fat secretion in a manner that can help patients with fatty liver or high VLDL.



HONORS AND AWARDS

Associate Membership of EMBO (European Molecular Biology Organization)
DBT – Wellcome Trust India Alliance Senior Research Fellowship
G.D. Birla Award for Scientific Research, 2019
Infosys Prize in Life Sciences 2018
Shanti Swarup Bhatnagar award in Biological Sciences
Fellowship of the Indian Academy of Sciences Bengaluru
Wellcome Trust – DBT India alliance Senior Research Fellowship (2013 -2018)
Wellcome Trust (UK) International Senior Research Fellowship (2006-2012)

TOP FIVE PUBLICATIONS

- *On and Off Controls within Dynein-Dynactin on Native Cargoes*. Paulomi Sanghavi, Pankaj Kumar, Ankit Roy, M.S.Madhusudhan and Roop Mallik. **Proceedings of the National Academy of Sciences USA**, June 8, 118 (2021).
- *Insulin activates Intracellular transport of Lipid Droplets to release Triglycerides from the Liver*. Mukesh Kumar, Srikant Ojha, Priyanka Rai, Alaumy Joshi, Siddhesh S. Kamat and Roop Mallik. **The Journal of Cell Biology** Nov 2019, 218 (11) 3697-3713
- *Coin-tossing explains the Activity of Opposing Microtubule Motors on Phagosomes*. Paulomi Sanghavi, Ashwin D’Souza, Ashim Rai, Arpan Rai, Ranjith Padinhathoori and Roop Mallik. **Current Biology**, 28, 1460–1466 (2018)
- *Kinesin dependent Mechanism for Controlling Triglyceride Secretion from the Liver*. Priyanka Rai, Mukesh Kumar, Geetika Sharma, Pradeep Barak, Saumitra Das, Siddhesh S. Kamat and Roop Mallik. **Proceedings of the National Academy of Sciences USA**, 114, 12958–12963 (2017)
- *Dynein clusters into Lipid Microdomains on Phagosomes to drive Rapid Transport towards Lysosomes*. Ashim Rai, Divya Pathak, Shreyasi Thakur, Shampa Singh, Alok Kumar Dubey and Roop Mallik. **Cell** 164, 722–734 (2016)



Dr. Manchanda, Rohit

Professor

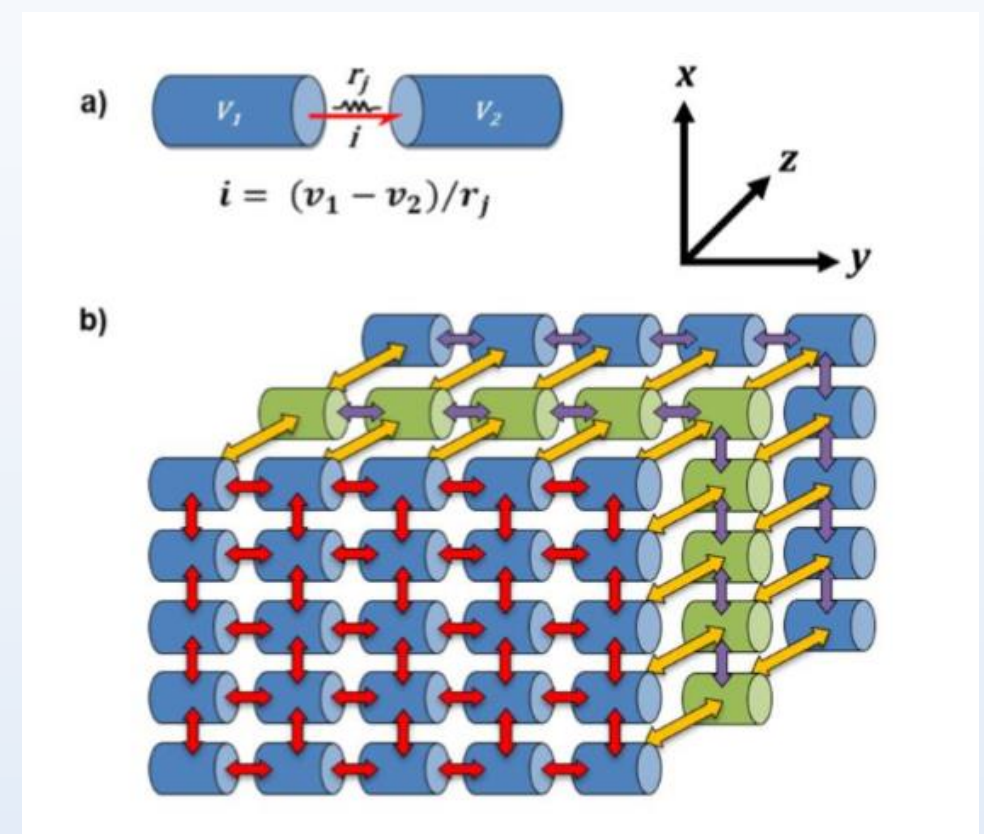
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E-mail : rmanch@iitb.ac.in

Areas of Expertise: Computational neurophysiology, Electrophysiology, Smooth muscle, Neuromuscular transmission, Urinary bladder biophysics.

Research Description: Smooth muscle tissues, owing to their complexity and diversity, are one of the least explored so far. Thanks to the development of the tools in instrumentation and imaging, many mysteries in the smooth muscle systems are now revealed. Along with the experimental techniques, there has been much development in the computational techniques as well. The Computational Neurophysiology Lab (CNPL) headed by Dr. Manchanda develops detailed computational models for the various elements of a particularly ill-understood smooth muscle organ, the urinary bladder. We are engaged in modelling detrusor smooth muscle cells, urothelium, interstitial cells, and the afferent and efferent neurons that constitute the reflex pathway of the urinary bladder. The focus is on the modelling of (i) the electrical activity, both passive and active (spiking) in the smooth muscle and ICC syncytia, and (ii) on individual ion channels and Ca signaling. Cellular mechanisms that modify ionic concentrations, especially calcium, are of prime importance and hence addressed in detail. In addition to the computational models, techniques for analyzing the electrical signals recorded from the detrusor smooth muscle cells have also been developed. The insights derived from the computational models and signal-processing techniques shed light on the intricate and hitherto unelucidated biophysical mechanisms underlying urinary bladder function and malfunction.

Simplified representations of (a) gap junction between two cells. The gap junctional current is determined by the potential gradient between the cells and the resistance offered by the gap junction. (b) arrangement of cells in a 3D syncytium (Appukuttan et al., 2015)



Honors and Awards:

Award for Excellence in Teaching, IIT-Bombay, 2006, 2011, and 2016.

Recognition:

Betty Trask Award, 1995.

AICTE Career Award for Young Teachers, 1997.

Tibor Jones South Asia Award, 2012.

Indian National Science Academy Teaching Award, 2019.

Selected Publications:

- Gupta, S., & **Manchanda, R.** (2019). A computational model of large conductance voltage and calcium activated potassium channels: implications for calcium dynamics and electrophysiology in detrusor smooth muscle cells. *Journal of computational neuroscience*, 1-24.
- Mandge, D., & **Manchanda, R.** (2018). A biophysically detailed computational model of bladder small DRG neuron soma. *PLoS computational biology*, 14(7), e1006293.
- Mahapatra, C., Brain, K. L., & **Manchanda, R.** (2018). A biophysically constrained computational model of the action potential of mouse urinary bladder smooth muscle. *PloS one*, 13(7), e0200712.
- Padmakumar, M., Brain, K. L., Young, J. S., & **Manchanda, R.** (2018). A four-component model of the action potential in mouse detrusor smooth muscle cell. *PloS one*, 13(1), e0190016.



Dr. Mukherji, Soumyo (FNAE) Professor

Department of Biosciences and Bioengineering
IIT Bombay, Mumbai 400 076 Phone: 022 2576 7767

E-mail: mukherji@iitb.ac.in

Areas of Expertise: Biosensors and Bioinstrumentation for health, environment and security

Research Description:

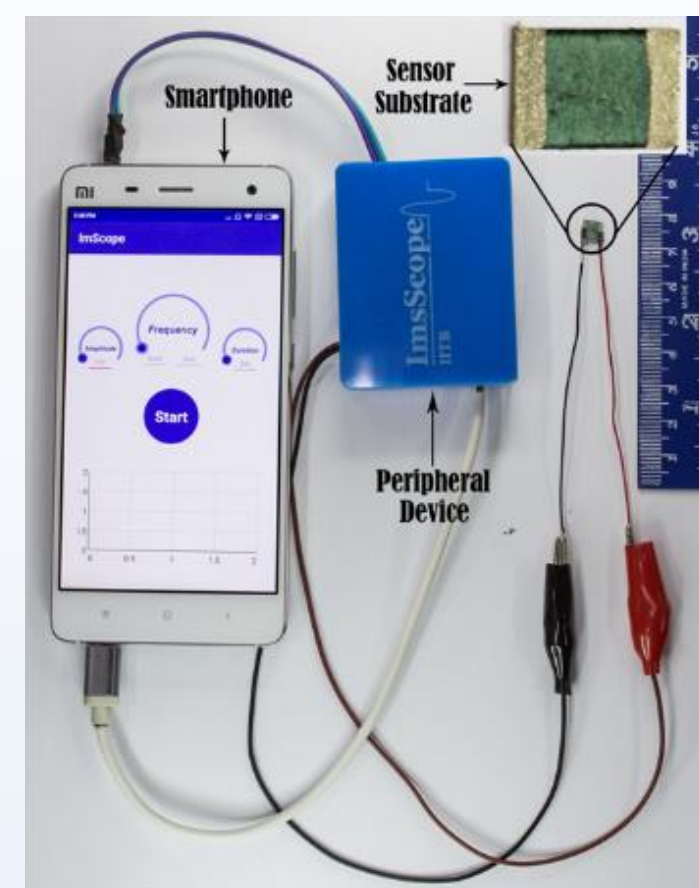
My lab works primarily in the area of biosensors and associated instrumentation required for widescale deployment of monitoring and diagnostic systems. As such the primary objective is to explore novel sensors, emphasizing on optical and electrochemical methods, to create systems for detection of hard-to-detect analytes at the point of care or point of sampling. We have developed highly sensitive optical detectors for heavy metals and bacteria in field samples. These sensors, once deployed can reduce the requirement of lab-based protocols and instruments such as ICP-MS or ICP-AES. We are also developing systems for differentiation for bacterial and viral infections, monitoring of diabetes using breath analysis, etc.



Optical Fiber Based Sensing System



Standalone Electrochemical Impedance Spectroscopy based system for health and environment.



Electrochemical Impedance Spectroscopy based system using Mobile Phone

Achievements/Recognition:

BIRAC-GYTI awards in 2017 and 2018.

Selected publications:

- Kapil Sadani, Pooja Nag, Soumyo Mukherji*, "LSPR based optical fiber sensor with chitosan capped gold nanoparticles on BSA for trace detection of Hg (II) in water, soil and food samples." Biosensors and Bioelectronics, 134, 90-96.
- B Karunakaran, J Tharion, AR Dhawangale, D Paul, S. Mukherji*, "Fabrication of miniature elastomer lenses with programmable liquid mold for smartphone microscopy: curing polydimethylsiloxane with in situ curvature control," Journal of biomedical optics, 2018.
- S Chandra, A Dhawangale, S Mukherji*, "Hand-held optical sensor using denatured antibody coated electro-active polymer for ultra-trace detection of copper in blood serum and environmental samples". Biosensors and Bioelectronics 110, 38-43, 2018.
- Mondal, Debasmita; Paul, Debjani; Mukherji, Soumyo* "Impedance Spectroscopy-Based Detection of Cardiac Biomarkers on Polyaniline Coated Filter Paper," IEEE Sensors Journal, Vol. 17 16:, 2017, pp. 5021-5029.
- Reshma Bharadwaj, V.V.R. Sai, Kamini Thakare, Arvind Dhawangale, Tapanendu Kundu, Susan Titus, Pradeep Kumar Verma, and Soumyo Mukherji*, "Evanescent wave absorbance based fiber optic biosensor for label-free detection of E. coli at 280 nm wavelength". Biosensors and Bioelectronics 26 (2011), pp. 3367-3370



Dr. Nair, Sreelaja

Associate Professor

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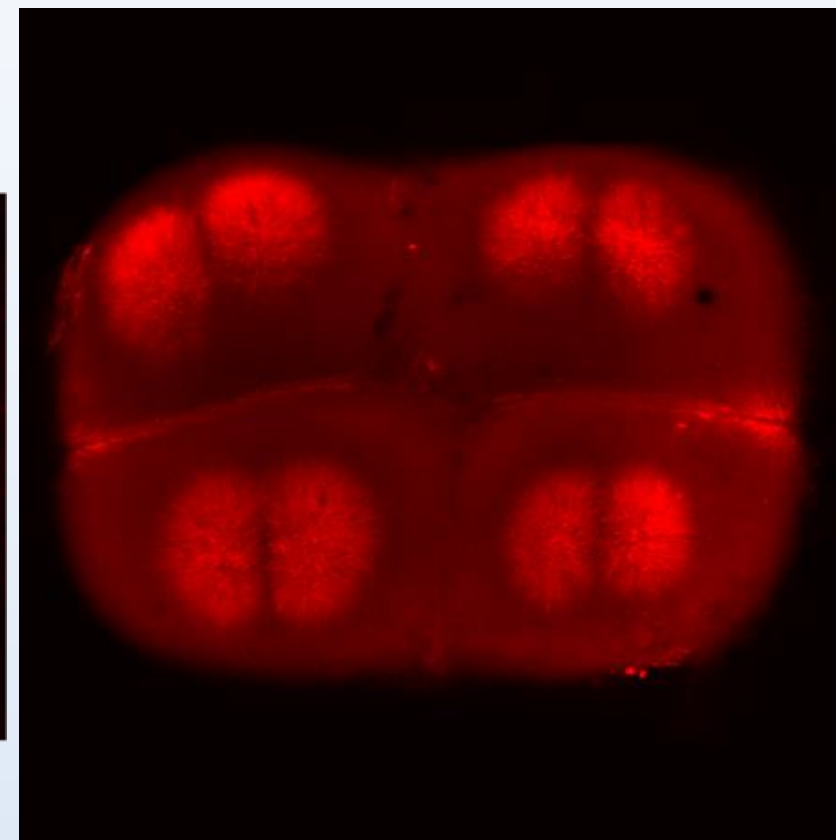
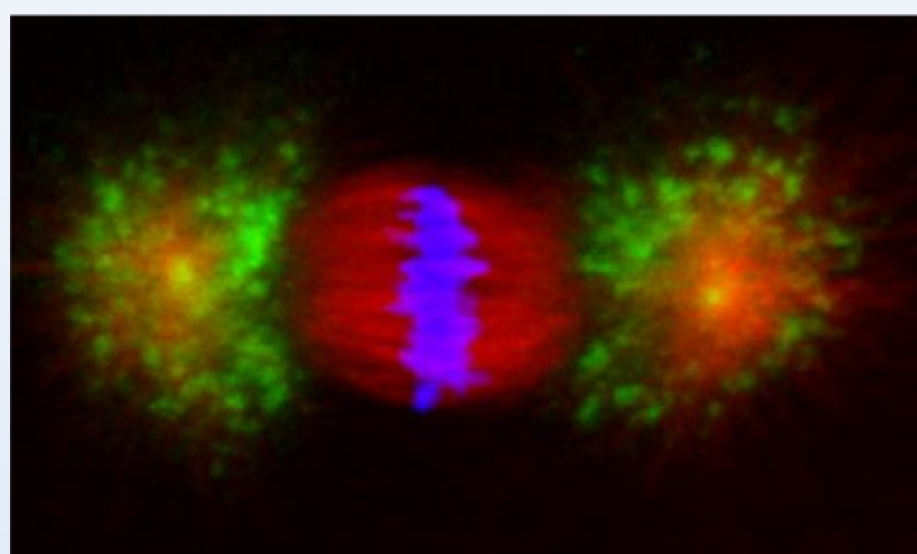
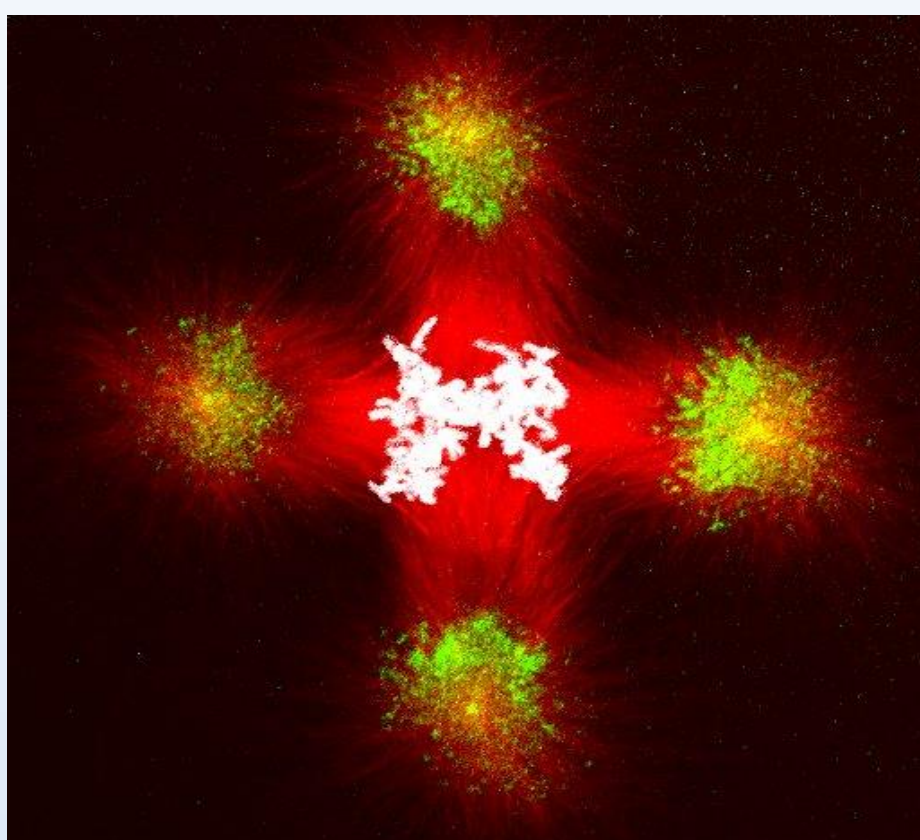
Areas of Expertise: Developmental Biology, Cell Biology, Embryology, Transcription regulation, RNA localization, Cerebellum development and function

Research Description:

Our group is interested in understanding the development of animal embryos using the vertebrate *Danio rerio* (zebrafish) as our model organism. In the early phases of development, we study how fertilized embryos modulate the sizes of mitotic spindles, nuclei and cells as it undergoes repeated cell divisions. When cells begin to undergo migration in the embryo, we study how the process of gastrulation, the master program which rearranges the amorphous mass of cells into the shape of an embryo, sculpts an embryo in three dimensions with organs and tissues in the correct positions. We are especially keen to understand the development of the heart, liver and pancreas, which have an inherent left-right asymmetry in all animals. We have recently begun efforts to understand how the cerebellum neural circuit develops, with the aim to understand how the cerebellum neural circuit controls motor and cognitive function in an animal. Since zebrafish share ~70 percent of genes with humans, insights obtained from our work would aid in understanding human development and disease conditions. More broadly, we are keen to understand how the physical shape of the vertebrate embryo and its organs emerge during embryonic development.

HONORS AND AWARDS

India Alliance Wellcome Trust – DBT Intermediate Fellow



TOP FIVE PUBLICATIONS

- Menon T, Borbora A S, Kumar R and Nair S. Dynamic optima in cell sizes during early development enable normal gastrulation in zebrafish embryos. *Developmental Biology* Dec 1;468(1-2):26-40 (2020).
- Menon T and Nair S. A transient window of resilience during early development minimizes teratogenic effects of heat in zebrafish embryos. *Developmental Dynamics*. Aug;247(8):992-1004 (2018).
- Nair S., Marlow F., Abrams E., Kapp L., Mullins MC and Pelegri F. The chromosomal passenger protein birc5b organizes microfilaments and germ plasm in the zebrafish embryo. *PLoS Genetics* (2013) Apr;9(4):e1003448.
- Nair S and Schilling TF. Chemokine signaling controls endodermal migration during zebrafish gastrulation. *Science* (2008) Oct 3;322(5898):89-92.
- Nair S., Li W., Cornell R and Schilling TF. Requirements for Endothelin type-A receptors and Endothelin-1 signaling in the facial ectoderm for the patterning of skeletogenic neural crest cells in zebrafish. *Development* (2007) Jan;134(2):335-45.



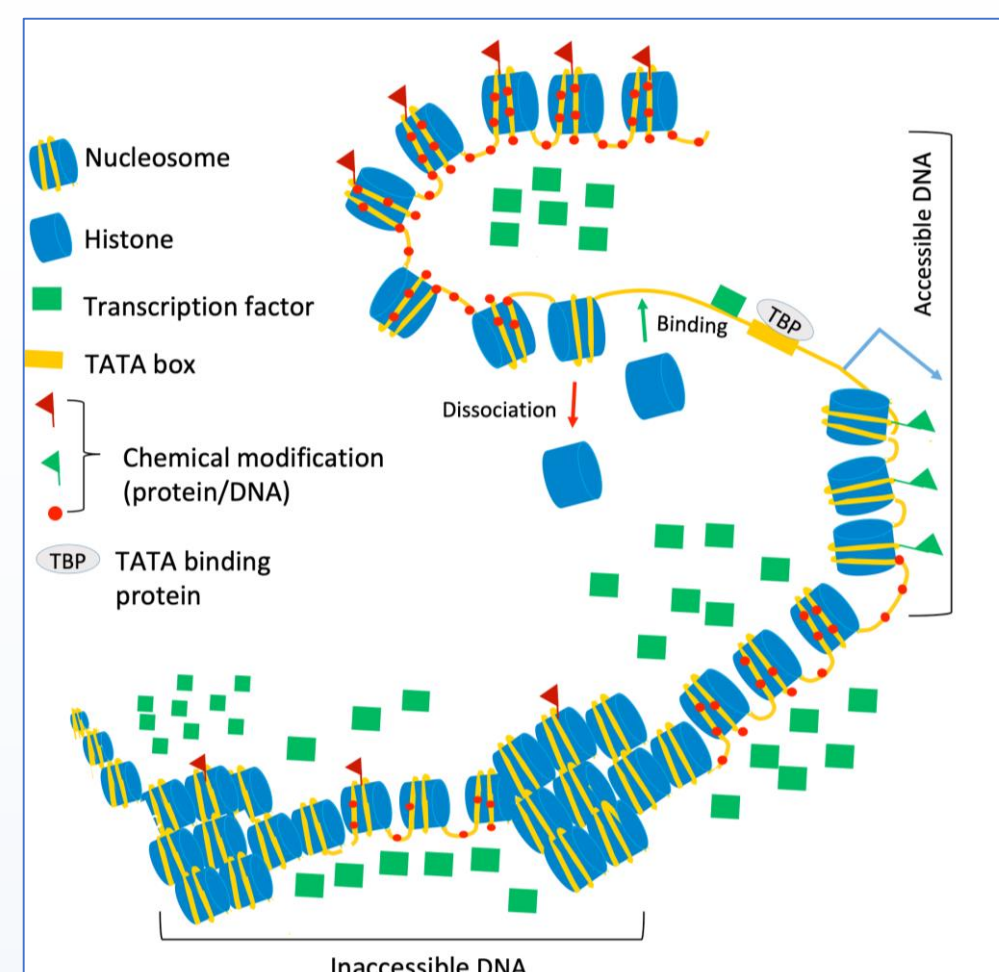
Dr. Padinhateeri, Ranjith Professor

Department of Biosciences and Bioengineering
IIT Bombay, Mumbai 400 076 Phone: 022 2576 7761

E-mail: ranjithp@iitb.ac.in

Areas of Expertise: Computational Biology, Physical Biology, Chromatin organization, Self-assembly in biology

Research Description: We do theoretical/computational studies to understand various biological phenomena using a variety of tools from physics and engineering, including statistical mechanics, soft-matter physics, and information theory. Broad questions we address in the lab are: How do cells make decisions? How is chromatin organization linked to information-storage and decision-making in cells? How is the active self-assembly and dynamics of proteins and chromatin help in processing the information necessary for the decision-making?



Honors and Awards:

National Bioscience Award, DBT India, 2017-2020

Excellence in Teaching Award, IIT Bombay, 2014

Senior Innovative Young Investigator Award, Department of Biotechnology (DBT), India, 2013-2014

Innovative Young Investigator Award, Department of Biotechnology (DBT), India, 2009-2010

Experience/Earlier affiliations: IIT Madras, University of Illinois at Chicago, North-western University, Institute Curie, Paris.

Selected Publications:

- High fidelity epigenetic inheritance: Information theoretic model predicts threshold filling of histone modifications post replication. Nithya Ramakrishnan, Sibi Raj B. Pillai and **Ranjith Padinhateeri**, *PLoS Comput. Biol.* 18(2) e1009861 (2022)
- Continuous variable responses and signal gating form kinetic bases for pulsatile insulin signaling and emergence of resistance. Namrata Shukla, Shantanu Kadam, **Ranjith Padinhateeri**, and Ullas Kolthur-Seetharam, *Proc. Natl. Acad. Sci. (USA)*, 118, e2102560118 (2021)
- Nucleosome positioning and chromatin organization. Jyotsana Parmar and **Ranjith Padinhateeri**, *Current Opinion in Structural Biology*, 64, 111-118 (2020)
- Coupling of replisome movement with nucleosome dynamics can contribute to parent-daughter information transfer, Tripti Bameta, Dibyendu Das & **Ranjith Padinhateeri**, *Nucleic Acids Research*, 46, 4991-5000 (2018)
- Binding of DNA-bending non-histone proteins destabilizes regular 30-nm chromatin structure, Gaurav Bajpai, Ishutesh Jain, Mandar Inamdar, Dibyendu Das & **Ranjith Padinhateeri**, *PLoS Computational Biology*, 13, e1005365 (2017)
- Defining a physical basis for diversity in protein self-assemblies using a minimal model Srivastav Ranganathan, Samir Maji and **Ranjith Padinhateeri**, *J. Am. Chem. Soc.* 138, 13911-13922 (2016)
- Theoretical estimates of exposure timescales of protein binding sites on DNA regulated by nucleosome kinetics, Jyotsana Parmar, Dibyendu Das, and **Ranjith Padinhateeri**, *Nucleic Acids Research*, 44, (2016)
- Nucleosome positioning and kinetics near transcription-start-site barriers are controlled by interplay between active remodeling and DNA sequence. Jyotsana Parmar, John F Marko, and **Ranjith Padinhateeri** *Nucleic Acids Research*, 42, 128-146, (2014)



Dr. Panda, Dulal

Professor

Department of Biosciences and Bioengineering
IIT Bombay, Mumbai 400 076 Phone: 022 2576 7838

E-mail: panda@iitb.ac.in

Areas of Expertise: Cell biology, biophysics, protein structure-function, anticancer and antibacterial drugs

Research Description: Eukaryotic and prokaryotic cell division, microtubule dynamics, mitosis, cancer chemotherapy, FtsZ assembly dynamics, and FtsZ targeted antibacterial drugs and biomolecular spectroscopy

Positions Occupied:

June 2011 - to date: Chair Professor, Department of Biosciences and Bioengineering, IIT Bombay
2008 March to 2011 May: Head, Biosciences and Bioengineering, IIT Bombay
2007- till date: Professor, Department of Bioscience and Bioengineering, IIT Bombay
2003: Associate Professor, School of Bioscience and Bioengineering, IIT Bombay
2000 - 2003: Assistant Professor, School of Bioscience and Bioengineering, IIT Bombay
1998 - 2000: Assistant Research Biologist, Department of Molecular, Cellular and Developmental Biology, University of California, Santa Barbara, USA.

Awards and Recognitions:

JC Bose National Fellowship
TATA Innovation Fellowship – DBT India
G. N. Ramachandran Gold Medal (CSIR INDIA)
DAE-SRC outstanding research investigator award
National Biosciences Award, DBT, Govt of India
Swarnajayanti Fellowship, DST, New Delhi
CDRI excellence in drug research
S. C. Bhattacharya award excellence in basic sciences IIT Bombay
P. S. Sharma Memorial Award, Society of Biological Chemists
Member of the Guha Research Conference
Fogarty International Research Award, National Institute of Health, USA

Academy Fellowships:

Fellow of Indian National Science Academy
Fellow of Indian Academy of Sciences
Fellow of National Academy of Sciences, India

Editorial board member: Associate Editor - BMC Molecular Cell Biology

Selected Publications:

- Rane, J. S., Kumari, A., and **Panda, D.** (2019) An acetylation mimicking mutation, K274Q, in tau imparts neurotoxicity by enhancing tau aggregation and inhibiting tubulin polymerization. *Biochem. J*, 476:1401-1417.
- Naaz, A., Ahad, S., Rai, A., Surolia, A., and **Panda, D.** (2019). BubR1 depletion delays apoptosis in the microtubule-depolymerized cells. *Biochem. pharmacol.*, 162:177-190.
- Prassanawar, S. S., and **Panda, D** (2019). Tubulin heterogeneity regulates functions and dynamics of microtubules and plays a role in the development of drug resistance in cancer. *Biochem. J*, 476:1359-1376.
- Dhaked, H.P.S., Ray, S., Battaje, R.R., Banerjee, A., and **Panda, D** (2019). Regulation of *Streptococcus pneumoniae* FtsZ assembly by divalent cations: Paradoxical effects of Ca^{2+} on the nucleation and bundling of FtsZ polymers. *FEBS J*, 286:3629-3646.
- Mundhara, N., Majumder, A., and **Panda, D** (2019). Methyl- β -cyclodextrin, an actin depolymerizer augments the antiproliferative potential of microtubule-targeting agents. *Scientific reports*, 9(1):7638.



Dr. Patankar, Swati

Professor

Department of Biosciences and Bioengineering
IIT Bombay, Mumbai 400 076 Phone: 022 2576 7773

E-mail: patankar@iitb.ac.in

Areas of Expertise: Malaria, toxoplasmosis, organellar trafficking, protein synthesis, genomics and proteomics, diagnostic antigens

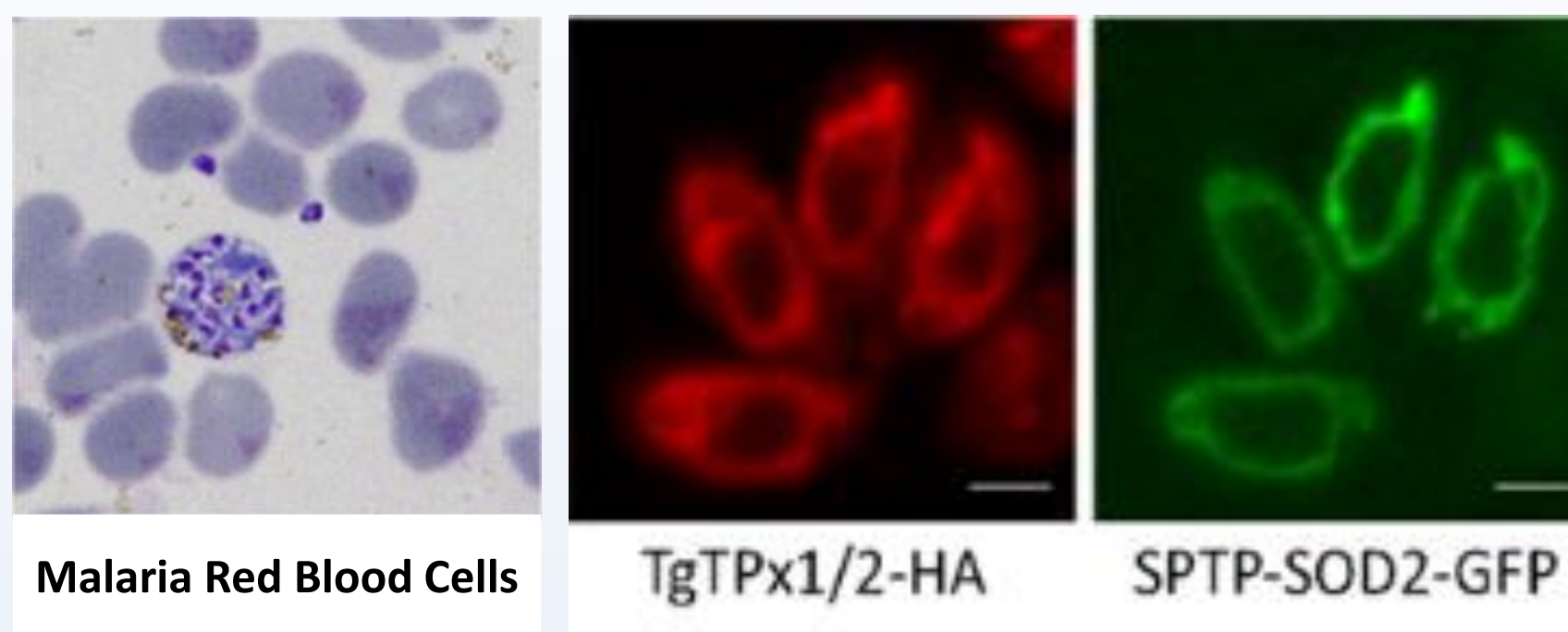
Research Description:

Regulation of gene expression in *Plasmodium falciparum* and *Toxoplasma gondii*: translation initiation and its role in differentiation

Protein trafficking: routes for the localization of proteins in the apicoplast and mitochondria

Protein trafficking: nuclear import pathways as targets for drug discovery

Genomics and proteomics of malaria in clinical samples, focusing on analysis of existing diagnostic markers and discovery of new diagnostic markers: *P. falciparum* and *P. vivax*



Honors and Awards:

- Invited member, World Health Organization (WHO) Working Group on Genomes to Drugs and WHO Steering Committee on Pathogenesis and Applied Genomics
- Award for Excellence in Teaching (2012), conferred by the Indian Institute of Technology Bombay
- Prof. S. P. Sukhatme Award for Excellence in Teaching (2016), conferred by the Indian Institute of Technology Bombay

Selected Publications:

- Walunj, S. B., Dias, M. M., Kaur, C., Wagstaff, K. M., Dey, V., Hick, C., Patankar, S.* and Jans, D. A.* (2022). High-throughput screening to identify inhibitors of *Plasmodium falciparum* importin α . *Cells*. 11(7), 1201. * Equal contribution.
- Venkatesh, A., Jain, A., Davies, H., Rathod, P. K., Patankar S. and Srivastava S. (2021). Protein arrays for the identification of seroreactive protein markers for infectious diseases. *Methods in Molecular Biology*. 2344, 139-150.
- Kaur, C. and Patankar, S. (2021). The role of upstream open reading frames in translation regulation in the Apicomplexan parasites *Plasmodium falciparum* and *Toxoplasma gondii*. Preprints doi: 10.20944/preprints202104.0680.v1. *Parasitology*. 148(11), 1277-1287.
- Prasad, A., Mastud, P. and Patankar, S. (2021). Dually localized proteins found in both the apicoplast and mitochondrion utilize the Golgi-dependent pathway for apicoplast targeting in *Toxoplasma gondii*. bioRxiv doi:10.1101/2020.03.25.007476. *Biology of the Cell*. 113 (1), 58-78.
- Chakrabarti, R., Chery-Karschney, L., White, J., Mascarenhas, A., Skillman, K. M., Kanjee, U., Babar, P. H., Patrapuvich, R., Mohapatra, P. K., Patankar, S., Smith, J. D., Anvikar, A., Valecha, N., Rahi, M., Duraisingh, M. T. and Rathod, P. K. (2022). Diverse malaria presentation across NIH South Asia ICEMR sites in India. Accepted in *American Journal of Tropical Medicine & Hygiene*.

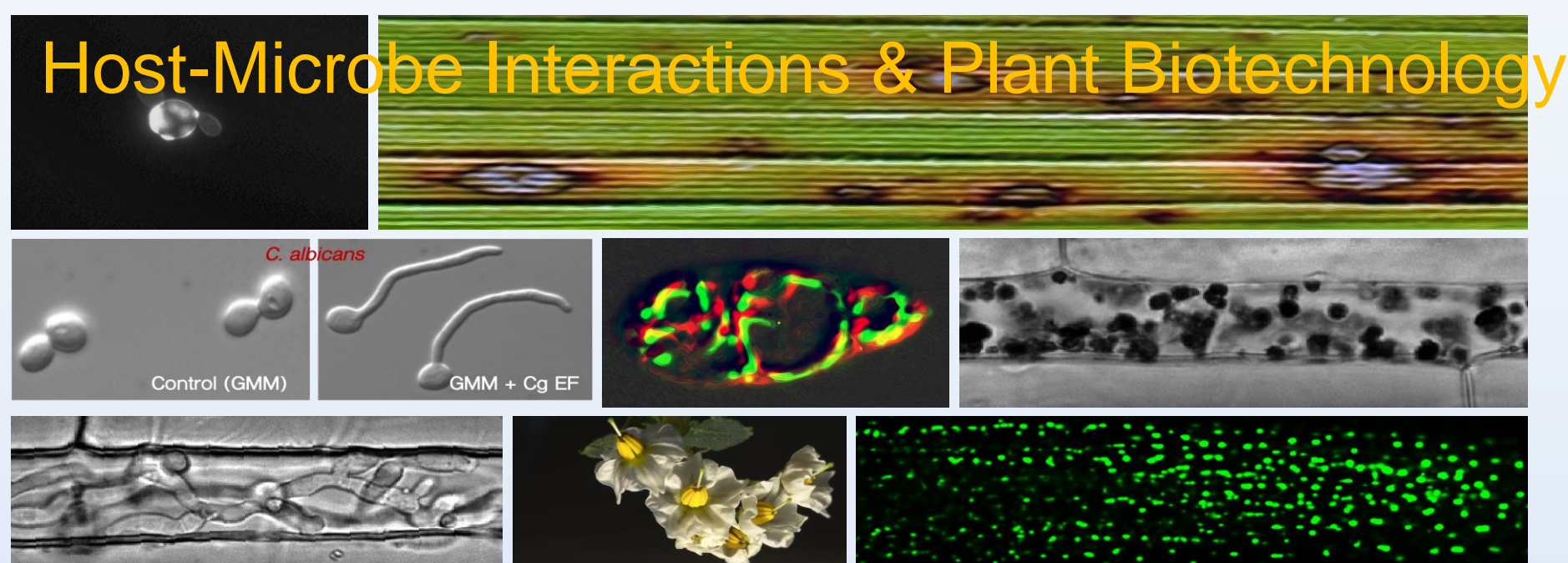


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RESEARCH DESCRIPTION:

The major focus is to study the chemical/molecular language used by these fungal pathogens, using innovative cell-based assays, in conjunction with the functional genomics, imaging and analytical chemistry tools, to understand the molecular mechanisms at the interface. We use the model patho-system of Rice-Blast disease caused by *Magnaporthe oryzae* for the plant-fungus interaction studies. Similarly, for the studies on the opportunistic fungal pathogens of human host, we use candidiasis caused by *Candida glabrata* & *C. albicans* as the model system. The broad research interest is to understand the kind of relationship the usually co-isolated two fungal commensals establish, through their interactions with each other, while living in the host, especially during pathogenesis.

DBT-Ramalingaswami Fellow (2016-2020)



- Thaker, A., Mehta, K. & Patkar, R.* 2021. Feruloyl esterase Fae1 is required specifically for host colonisation by the rice-blast fungus *Magnaporthe oryzae*. *Current Genetics*.
- Reza M.H. *, Patkar R.N.* and Sanyal K.*. 2021. Vacuolar transporter Mnr2 safeguards mitochondrial integrity in aged cells. *Molecular Microbiology*. 116(3):861-876.
- Shah H., Rawat K., Ashar H., Patkar R.N.*, Manjrekar J.*. 2019. Dual role for fungal-specific outer kinetochore proteins during cell cycle and development in *Magnaporthe oryzae*. *Journal of Cell Science*. 132: jcs224147.
- Patkar R.N.* and Naqvi N.I.* 2017. Fungal Manipulation of Hormone-Regulated Plant Defense. *PLoS Pathogens*. 13(6): e1006334.
- Patkar R.N.*, Benke P., Qu Z., Constance C.Y., Fan Y., Swarup S. and Naqvi N.I.* 2015. A Fungal Monooxygenase-Derived Jasmonate Attenuates Host Innate Immunity. *Nature Chemical Biology* 11: 733-40.

- Enhanced Crop Yield and Nutritional Value using an Innovative Approach



Dr. Paul, Debjani

Professor

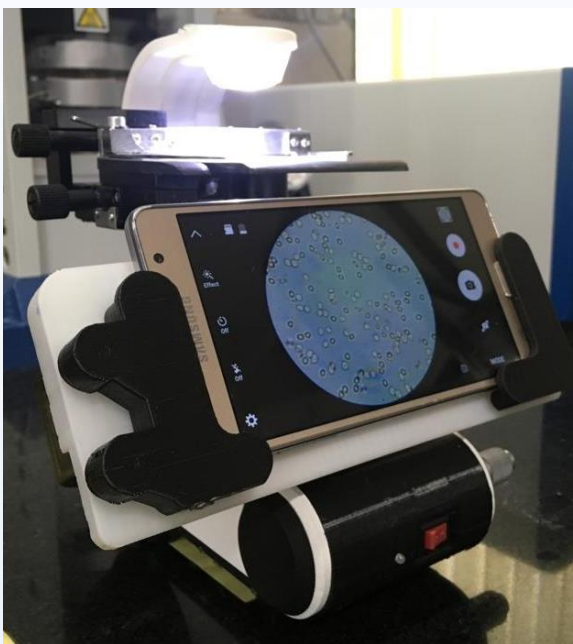
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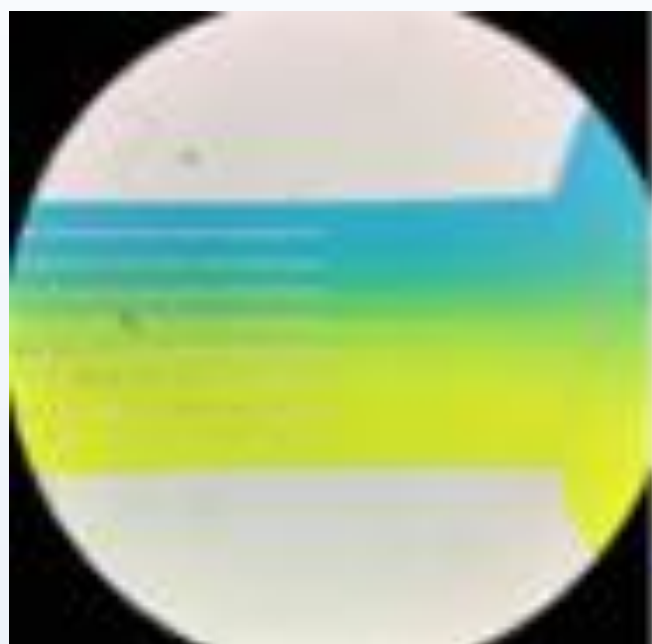
Areas of Expertise: Microfluidics, diagnostics, cell separation, paper fluidics, mobile microscopy, biosensors

Research Description: We have an interdisciplinary research group that develops microfluidic devices for healthcare applications, with a strong focus on translation and testing of these devices in the field. Some of our ongoing projects include measuring deformability of single red blood cells to probe biophysical markers of disease, droplet microfluidic platforms for diagnostics and drug delivery, centrifugal and inertial microfluidic platforms for cell separation, and isolation of exosomes to identify biomarkers of targeted cancer therapy. We also combine microfluidics, imaging and image processing tools to understand the biophysical properties of single cells and under confinement.

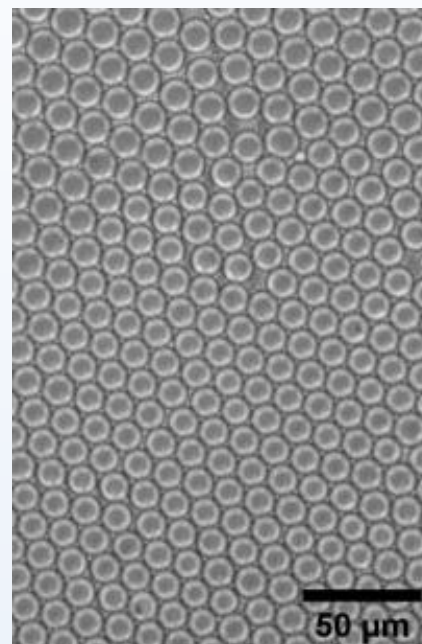
Honors and Awards: Innovative Young Biotechnologist Award, Department of Biotechnology (2013)



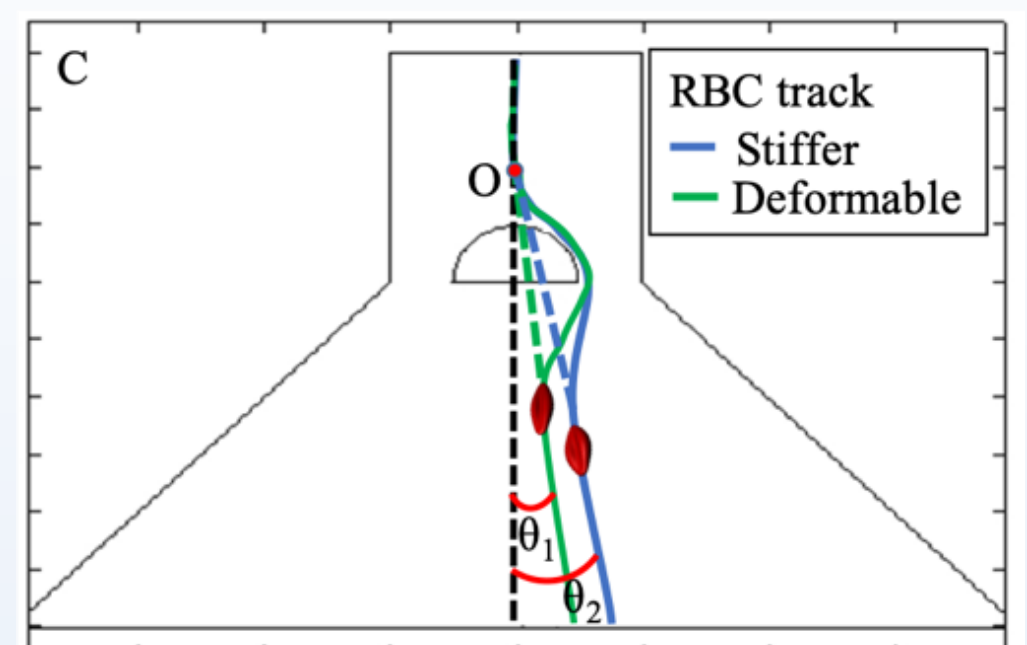
Affordable diagnostics



Universal gradient generator



Droplet microfluidics



Cell sorting

Selected Publications/Preprints:

- Differential sensitivity to hypoxia enables shape-based classification of sickle cell disease and trait blood, C. D'Costa, O. Sharma, R. Manna, M. Singh, Samrat, S. Singh, A. Mahto, P. Govil, S. Satti, N. Mehendale and **D. Paul**. MedRxiv (<https://doi.org/10.1101/2020.10.28.20221358>)
- Dynamic generation of power function gradient profiles in a universal microfluidic gradient generator by controlling the inlet flow rates, G. Paduthol, T. S. Korma, A. Agrawal and **D. Paul**. Lab on a Chip (2022), Vol. 22, p. 592.
- An integrated one-step assay combining thermal lysis and loop-mediated isothermal DNA amplification (LAMP) in 30 min from E. coli and M. smegmatis cells on a paper substrate, P. Naik, S. Jaitpal, P. Shetty and **D. Paul**, Sensors and Actuators B (2019), Vol. 291, p. 74.
- A RADial Pillar Device (RAPID) for continuous and high-throughput separation of multi-sized particles, N. Mehendale, O. Sharma, C. D'Costa and **D. Paul**, Biomedical Microdevices (2018), Vol. 20, p. 6.
- Clogging-free continuous operation with whole blood in a radial pillar device (RAPID), N. Mehendale, O. Sharma, S. Pandey and **D. Paul**, Biomedical Microdevices (2018), Vol. 20, p. 75.



Dr. Phale, Prashant S

Associate Professor

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Areas of Expertise: Environmental Microbiology, Microbial degradation of aromatic pollutant using microbes

Research Description: Elucidation of metabolic pathways for degradation of aromatic compounds, Purification and characterization of oxygenases, Preferential utilization of aromatics compounds by *Pseudomonas*, Metabolic engineering of aromatic degradation pathways.

Achievements/Recognition

Associate Professor: School of Biosciences & Bioengineering, IIT Bombay

Assistant Professor: School of Biosciences & Bioengineering, IIT Bombay

Post-Doctoral Research Fellow: Harvard Medical School, Boston, USA

Post-Doctoral Fellow: Biozentrum, University of Basel, Switzerland

Memberships

Life member of:

National Academy of Sciences, India

Society of Biological Chemists, India

Association of Microbiologist of India

Biotechnology Research Society of India

Selected Publications:

- Trivedi VD, Jangir PK, Sharma R, & Phale PS (2016) Insights into functional and evolutionary analysis of carbaryl metabolic pathway from *Pseudomonas* sp. strain C5pp. Sci. Rep. 6, 38430; doi: 10.1038/srep38430.
- Pandey S, Modak A, Phale PS* & Bhaumik P* (2016) High resolution structures of periplasmic glucose binding protein of *Pseudomonas putida* CSV86 reveal structural basis of its substrate specificity. J Biol Chem 291:7844–7857; *Corresponding authors
- Paliwal V, Raju SC, Modak A, Phale PS & Purohit HJ (2014) *Pseudomonas putida* CSV86: A candidate genome for genetic bioaugmentation. PLoS One 9(1):e84000. doi: 10.1371/journal.pone.0084000.
- Modak A, Bhaumik P & Phale PS (2014) Periplasmic glucose binding protein from *Pseudomonas putida* CSV86: Identification of the glucose binding pocket by homology-model-guided site-specific mutagenesis. FFEBS J 281:365-375.
- Singh R, Trivedi VD & Phale PS (2013) Metabolic regulation and chromosomal localization of carbaryl degradation pathway in *Pseudomonas* sp. strains C4, C5 and C6. Arch Microbiol 195:521-535.



Dr. Purwar, Rahul

Associate Professor

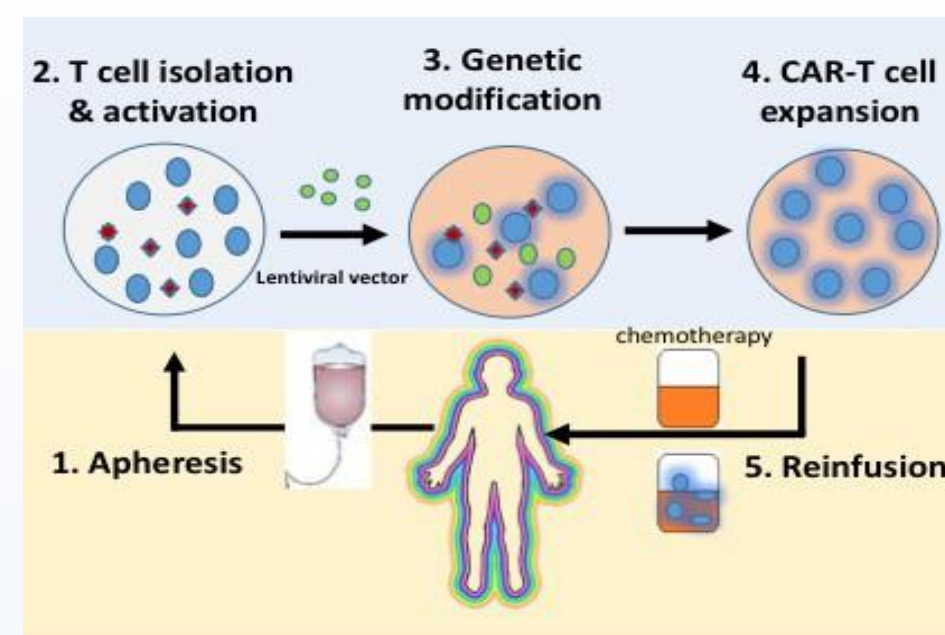
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Areas of Expertise: CAR T cells therapy, Biomarker, Inflammation, Immunology

Research Description: CAR-T cell therapy, a combination of cell and gene therapy, has demonstrated remarkable success in long-term remission of certain hematological malignancies. However, this technology is not yet available in India. Considering socioeconomic conditions of patients in our country, CAR-T-cell therapy is unaffordable to majority of them due to high cost. To harness this technology and bringing it to the clinic in India at affordable-cost, there is a clear need of developing indigenous CAR-T cell technology platform. Our laboratory is attempting to develop the novel products and process of CAR T cell therapy for blood cancer as well as solid tumors. Besides CAR T cell therapy platform development, we are working in the area of biomarker discovery and inflammation.

CAR-T cell therapy Platform



Honors and Awards:

- The Melissa K. Bambino Memorial Award by The Skin Cancer Foundation, USA
- HBRS Prize (best PhD thesis award) by Hannover Biomedical Research School, Hannover, Germany.
- Poster Prize in a meeting organized by Global Allergy and Asthma European Network (GA2LEN/EAACI), Hannover, Germany
- ECARF Award (cash & certificate) for best research abstract by European Center for Allergy Research Foundation

Selected Publications:

- Kumar S, Dhamija B, Marathe S, Ghosh S, Dwivedi A, Karulkar A, Sharma N, Sengar M, Sridhar E, Bonda A, Thorat J, Tembhare P, Shet T, Gujral S, Bagal B, Laskar S, Jain H, Purwar R*. The Th9 Axis Reduces the Oxidative Stress and Promotes the Survival of Malignant T Cells in Cutaneous T-Cell Lymphoma Patients. *Molecular Cancer Research*, 2020Apr;18(4):657-668. PubMed PMID: 31996468, *Corresponding author
- Srinivasan, S., Das, S., Surve, V., Srivastava, A., Kumar, S., Jain, N., et al. & Purwar, R. (2019). Blockade of ROCK inhibits migration of human primary keratinocytes and malignant epithelial skin cells by regulating actomyosin contractility. *Scientific Reports*, 9(1), 1-13.
- Das, S., Srinivasan, S., Srivastava, A., Kumar, S., Das, G., Das, S., et al. & Purwar, R. (2019). Differential Influence of IL-9 and IL-17 on Actin Cytoskeleton Regulates the Migration Potential of Human Keratinocytes. *The Journal of Immunology*, 202(7), 1949-1961.
- Dwivedi, A., Karulkar, A., Ghosh, S., Rafiq, A., & Purwar, R. (2019). Lymphocytes in Cellular Therapy: Functional Regulation of CAR T Cells *Frontiers in immunology*, 9, 3180. doi:10.3389/fimmu.2018.03180
- Mogha, P., Srivastava, A., Kumar, S., Das, S., Kureel, S., Dwivedi, A., et al. & Purwar, R. (2019). Hydrogel scaffold with substrate elasticity mimicking physiological-niche promotes proliferation of functional keratinocytes. *RSC advances*, 9(18), 10174-10183. This work was highlighted in "The Hindu" on April 6th 2019: Title "Now, culture more skin cells in less time"
- Dwivedi, A., Kumar, S., & Purwar, R. (2017). B16 Lung Melanoma Model to Study the Role of Th9 Cells in Cancer. In *Th9 Cells* (pp. 217-222). Humana Press, New York, NY.

Editorial

- Killugudi Jayaraman. (2019) Cut-price CAR-T cell therapies top India's biotech agenda. *Nature Biotechnology*. News Published: 03 December 2019 (link: <https://www.nature.com/articles/s41587-019-0346-1>)



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Professor

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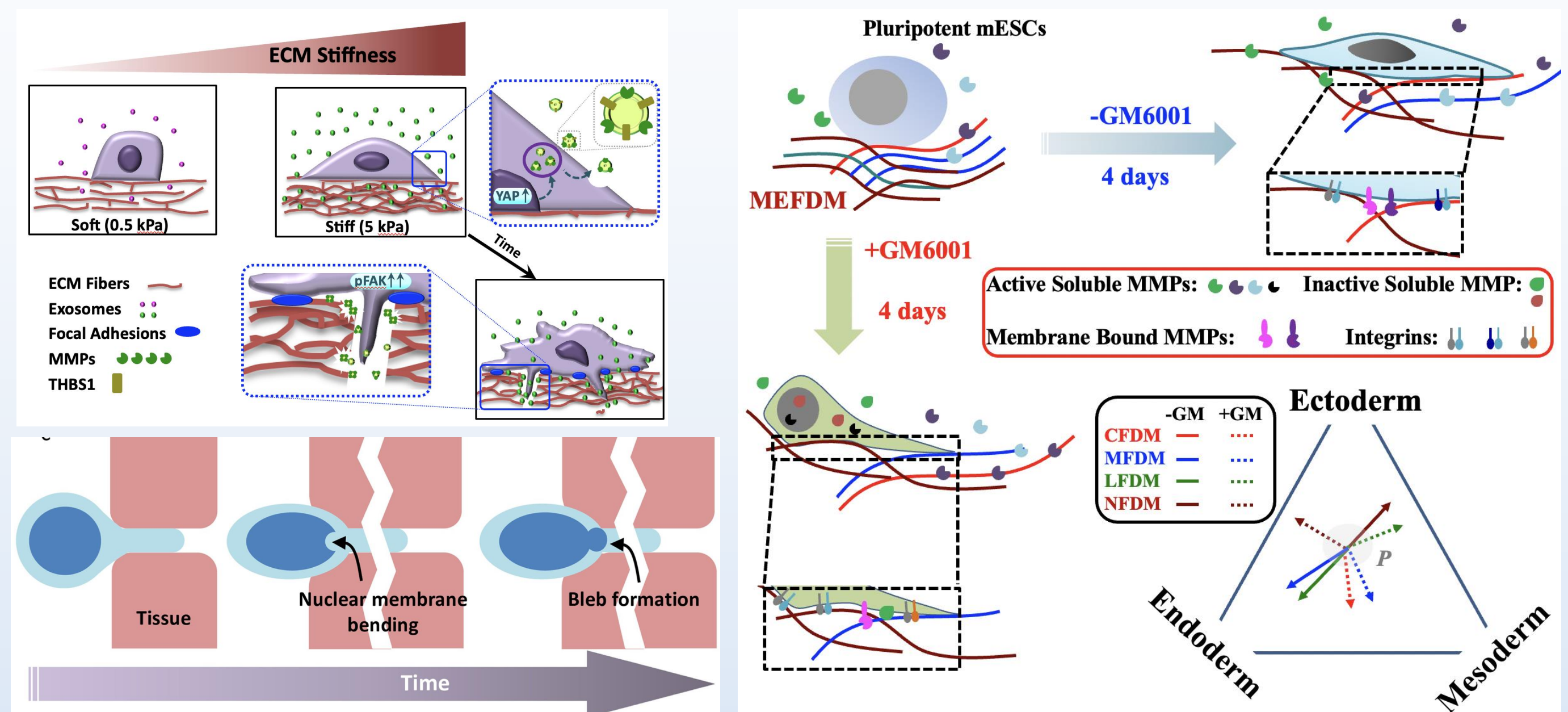
Areas of Expertise: Cancer Biology, Stem Cell Biology, Tissue Engineering, Computational Biology

Research Description: My broad interest is in the area of Mechanobiology. Specifically, I study how physicochemical cues encoded by the extracellular matrix regulates cancer invasion and stem cell fate, and how physical properties of cells are modulated in the context of these processes. For doing this, I combine traditional cell biological approaches with cell biophysics techniques and computational biology. We also aim to translate some of our basic findings in the area of tissue engineering with a focus on development of scaffolds for (i) stem cell differentiation, and (ii) wound healing applications both in normal and diabetic patients.

Honors and Awards:

2017 Swarnajayanti Fellowship (Dept. of Science & Technology)

2011 DAE Research Award for Young Scientists (BRNS, India)



Selected publications:

- Sthanam, LK, Roy T, Patwardhan S, Shukla A, Sharma S, Shinde PV, Kale HT, Shekar PC, Kondabagil K, **Sen S**, "MMP modulated differentiation of mouse embryonic stem cells on engineered cell derived matrices", *Biomaterials*, 2022, 280: 121268.
- Patwardhan S, Mahadik P, Shetty O, **Sen S**, "ECM stiffness-tuned exosomes drive breast cancer motility through thrombospondin-1", *Biomaterials*, 2021, 279: 121185
- Mukherjee A, Barai A, Singh RK, Yan W, **Sen S**, "Nuclear Plasticity Increases Susceptibility to Damage During Confined Migration", *PLoS Computational Biology*, 2020, 16(10):e1008300
- Das, A., Barai, A., Monteiro, M., Kumar, S., **Sen, S.**, Nuclear softening is essential for protease-independent migration, *Matrix Biology*, 2019.
- Sthanam S. L., Barai A., Rastogi A., Mistari V. K., Maria A., Kauthale R., Gatne M. , **Sen S.**, "Biophysical regulation of mouse embryonic stem cell fate and genomic integrity by feeder derived matrices", *Biomaterials*, 2017.



Dr. Shinde, Swapnil

Assistant Professor

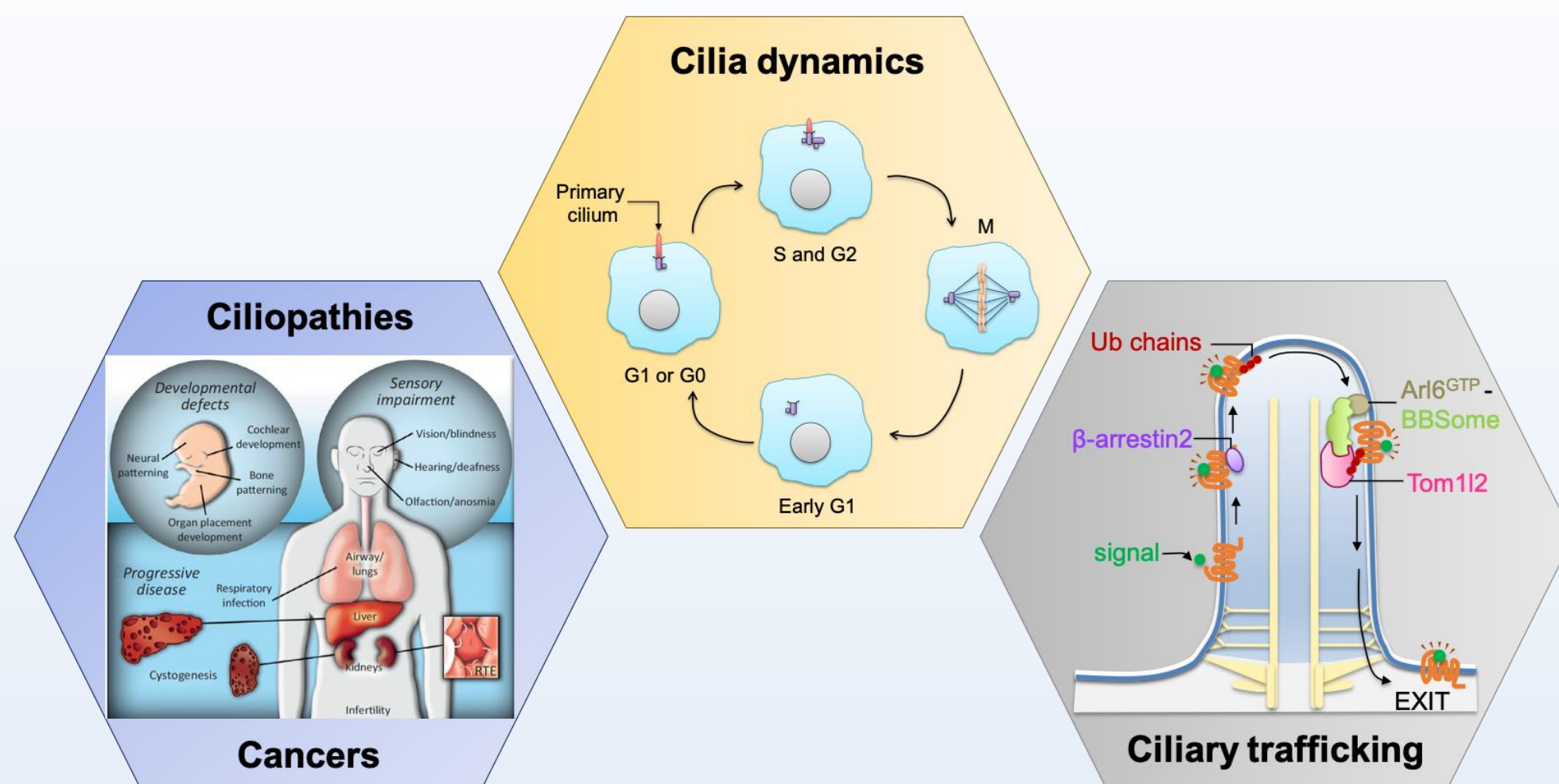
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Areas of Expertise: Assembly and disassembly of cilia/flagella, Trafficking of signaling receptors, proteins, and secondary messengers in and out of cilia, Ciliary signaling and ciliopathies, Intracellular Transport

Research Description:

Primary cilia, a microtubule-based, surface-exposed organelle, function in phototransduction, olfaction, planar cell polarity, and several signalling pathways essential for development and tissue homeostasis. We study how cilia assembly and disassembly is intimately linked to cell cycle progression. Primary cilia host several G-protein-coupled receptors (GPCRs) to orchestrate signalling pathways. Signal-dependent dynamic redistribution of GPCRs is at the core of ciliary signalling. We aim to delineate the molecular pathways and mechanisms that regulate the dynamic redistribution of ciliary proteins. Dysfunctional primary cilia causes ciliopathies which are multisystemic disorders characterized with developmental delays, retinal degeneration, obesity, polydactyly, hearing impairments, hypogonadism etc. We aim to understand molecular basis of ciliopathies.



Honors and Awards:

2022: Young Faculty Award, from IIT Bombay

2021: Sandler Program for Breakthrough Biomedical Research – Postdoctoral Independent Research Grant from UCSF.

Selected publications:

- Shinde et al., The ancestral ESCRT protein TOM1L2 selects ubiquitinated cargoes for retrieval from cilia. *Developmental Cell* (2023), <https://doi.org/10.1016/j.devcel.2023.03.003>
- Shinde SR, Nager A R, Nachury M V. Ubiquitin chains earmark GPCRs for BBSome-mediated removal from cilia. *Journal of Cell Biology*. 2020 Dec 7;219(12):e202003020. doi: 10.1083/jcb.202003020. PMID: 33185668
➤ Highlighted in Gigante ED, Caspary T. Cilia Biology: You're It! Tagging Proteins for Ciliary Removal. *Curr Biol*. 2021 PMID: 33497637.
- Shinde SR, and Maddika S. PTEN Regulates Glucose Transporter Recycling by Impairing SNX27 Retromer Assembly. *Cell Reports*. 2017 Nov 07; 21(6):1655-1666. PMID: 29117568.
- Kumar P, Munnangi P, Chowdary KR, Shah VJ, Shinde SR, Kolli NR, Halehalli RR, Nagarajaram HA, Maddika S. A Human Tyrosine Phosphatase Interactome Mapped by Proteomic Profiling. *J Proteome Res*. 2017 08 04; 16(8):2789-2801. PMID: 28675297.
- Shinde SR, and Maddika S. PTEN modulates EGFR late endocytic trafficking and degradation by dephosphorylating Rab7. *Nature Communications*. 2016 Feb 12; 7:10689. PMID: 26869029.



Dr. Srivastava, Rohit (FNASc, FNAE) Professor

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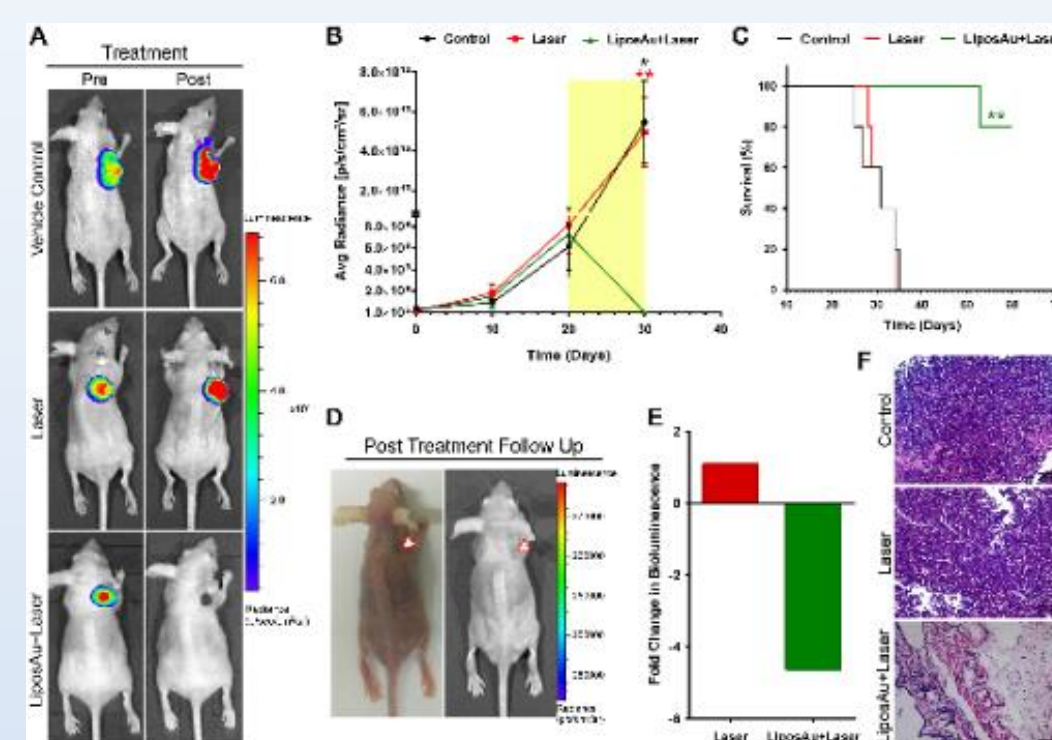
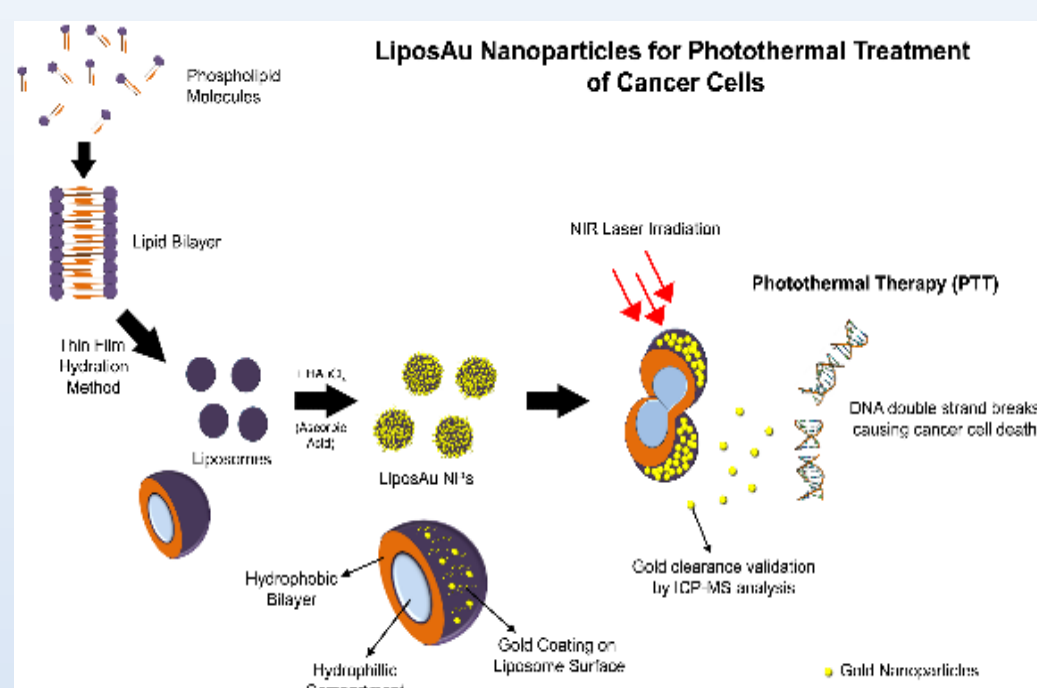
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Areas of Expertise: Point of Care Diagnostics, Cancer Nanomedicine, Diagnostics for Diabetes, Cardiac marker, Electrolyte, Tuberculosis

Research Description: NanoBios lab is working in the area of point of care diagnostic devices and their commercialization. We have developed several low-cost colorimetric, enzymatic and Lateral Flow assays along with their optical reader for various conditions such as Blood Electrolyte detection, Hemoglobin, Urine parameters, Glycemic Panel, Cardiac Panel etc. We have produced many successful entrepreneurs who have taken these products to the market. Additionally, NanoBios Lab is one of the leading research labs in the area of cancer nanomedicine and we study NIR laser-based localized photothermal therapy using engineered plasmonic nanohybrids for imaging and tumor ablation of cancerous cells.

Honors and Awards:

- 2021 Dr Shanti Swarup Bhatnagar Award
- 2021 Himanshu Patel Chair Professor
- 2020 INAE Abdul Kalam Technology Innovation National Fellowship
- 2019 Elected Fellow of NASI, INDIA, FRSC, London and FRSB, London
- 2019 Shri Om Prakash Bhasin Award for Excellence in Health and Medical Sciences
- 2018 NASI Reliance Industries Platinum Jubilee Award
- 2017 Best research Award by Cancer Research Society of India
- 2016 DBT National Bioscience Award
- 2016 DBT Biotech Product and Process Development and Commercialization Award
- 2015 DBT Tata Innovation Fellowship Award



Selected Publications:

- Rengan, A. K., Bukhari, A. B., Pradhan, A., Malhotra, R., Banerjee, De, A, **Srivastava, R.**, "In Vivo Analysis of Biodegradable Liposome Gold Nanoparticles as Efficient Agents for Photothermal Therapy of Cancer", *Nano Lett.* 2015.
- Chauhan, D. S., Bukhari, A. B., Ravichandran, G., Gupta, R., George, L., Poojari, R., Ingle, A., Rengan, A. K., Shanavas, A., **Srivastava, R.**, et al., "Enhanced EPR Directed and Imaging Guided Photothermal Therapy Using Vitamin E Modified Toco-Photoxil", *Sci. Rep.* 2018.
- Kumawat, M. K., Thakur, M., Gurung, R. B., **Srivastava, R.**, "Graphene Quantum Dots for Cell Proliferation, Nucleus Imaging, and Photoluminescent Sensing Applications", *Sci. Rep.* 2017.
- Borse, V., **Srivastava, R.**, "Fluorescence Lateral Flow Immunoassay Based Point-of-Care Nanodiagnostics for Orthopedic Implant-Associated Infection", *Sensors Actuators B Chem.* 2019.
- Keshav, K., Torawane, P., Kumar Kumawat, M., Tayade, K., Sahoo, S. K., **Srivastava, R.**, Kuwar, A., "Highly Selective Optical and Reversible Dual-Path Chemosensor for Cyanide Detection and Its Application in Live Cells Imaging", *Biosens. Bioelectron.* 2017.



Dr. Srivastava, Sanjeeva

Professor

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Areas of Expertise: Clinical Proteomics & Proteogenomics

Research Description: Current research focus of my group is on biomarker and drug target discovery and deciphering the protein interaction networks in complex human diseases (e.g., gliomas) as well as infectious diseases (e.g., malaria) using high throughput proteomics and proteo-genomics technologies. In brain tumor projects we investigated inter- and intra-tumoral heterogeneity; protein biomarkers for different grades of gliomas, meningiomas and medulloblastomas; and provided mechanistic insights of disease pathogenesis. We are in process of developing selected reaction monitoring (SRM) assays with industry partners for translation and therapeutic interventions. Additionally, we are trying to cultivate an ecosystem for clinical proteomics and proteogenomics research in India and enable disruptive innovation for biotechnology and global life sciences R&D.

Honors and Awards:

Received **Scholarly Awards:** Young Scientist Footstep Award Canada, Apple Research Technology Support Award UK, IITB Young Investigator Award, DST & DAE-BRNS young scientist award.

Initiated cancer proteogenomics research & facilitated partnership between IIT Bombay, Tata Memorial and National Cancer Institute USA for Cancer Proteogenomics research. India became 12th country to join **International Cancer Proteogenomics Consortium (ICPC)** in May 2018.

Human Proteome Organization (HUPO) Council member; HUPO-Biology/Disease driven project EC member; EC member of Proteomics Society, India.

Published 5 thematic special issues as **Editor:** Journal of Protein and Proteomics (2014), Nature India (2015), Journal of Proteomics (2015), Proteomics (2016), Proteomics Clinical Applications (2018)

Conducted 3 **International Conferences** & several successful hands-on workshops.

Task force member & reviewer of National (Department of Biotechnology) & International grants (IUSSTF; Israel Science Foundation; Agency Nationale Dela Recherche, France; National Science Centre, Poland; German Federal Ministry of Education and Research; Proteomics Network Canada; Netherlands Organisation for Scientific Research; PHRT-ETH Zürich).

Selected publications:

(105, h-index 29); Patents 11 (filed); Book – 1; Book chapter – 4

Selected Research Articles:

- Syed et al. Autoantibody profiling of glioma serum to identify. **Scientific Reports**, 2015, 5, 13895-13908.
- Gupta et al. Evaluation of autoantibody signatures in meningioma., **Oncotarget**, 2017, 8, 58443-58456.
- Gollapalli et al. Subventricular zone involvement in., **Scientific Reports**, 2017, 7, 1449-1462.
- Atak et al Quantitative MS analysis reveals a panel of nine., **Oncotarget**, 2018, 9, 13530-13544.
- Patel et al. Rapid discrimination of malaria. using Raman Spectroscopy, **Anal. Chem**, 2019, 91, 11 ,7054-7062.

Selected Reviews/ Perspective:

- Moiyadi A. et al. "Fluorescence-guided surgery of gliomas.", **Nature Reviews Cancer**, 2014, 14, 146.
- Ray S. et al. "Biorepositories in promoting cancer.", **Nature Reviews Clinical Oncology**, 2013, 10, 434-436.



Dr. Tayalia, Prakriti

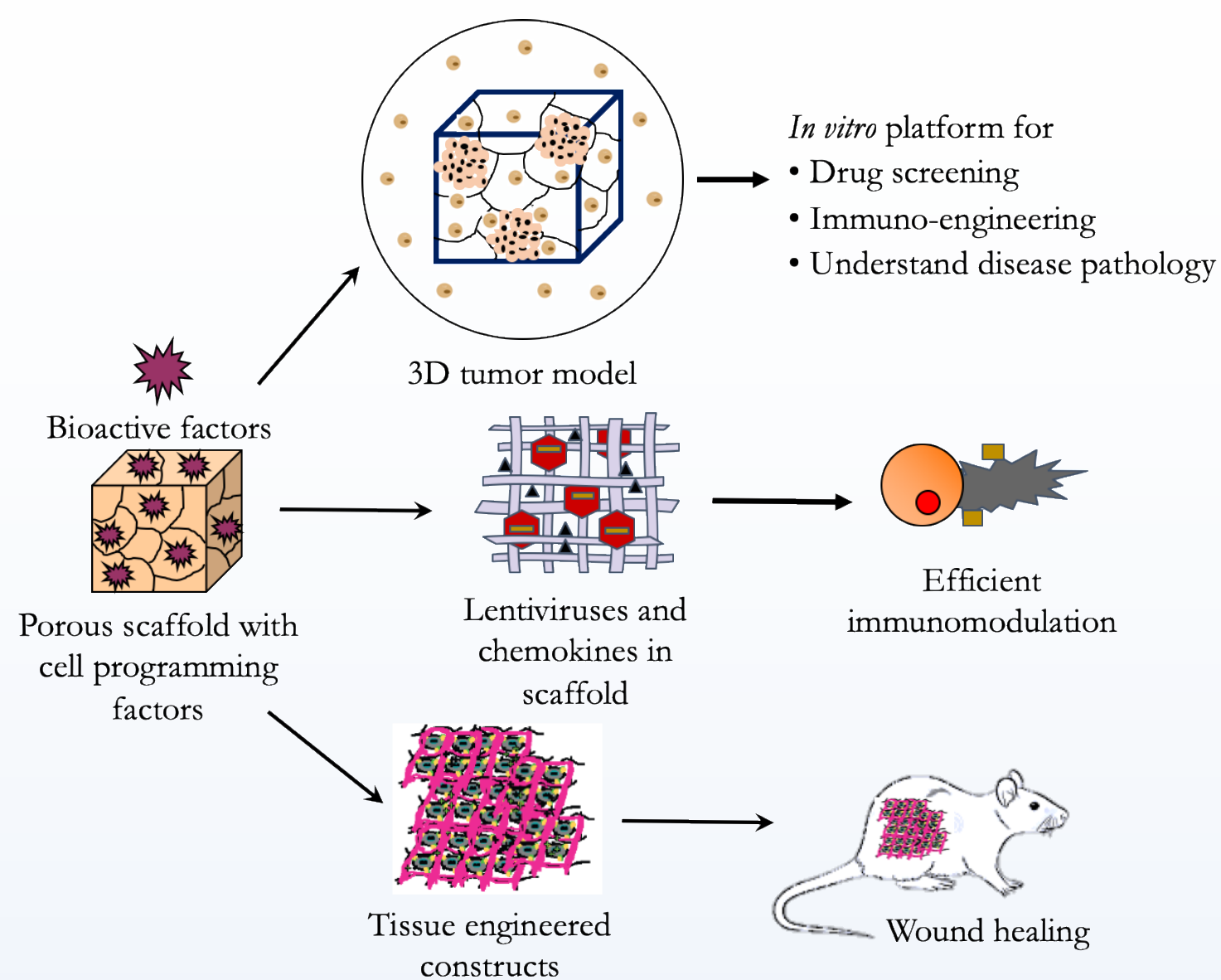
Associate Professor

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Areas of Expertise: Biomaterials, Immunotherapy, Tissue Engineering, 3D cell culture platforms, Micro and Nanofabrication.

Research Description: My lab has been developing various kinds of material based systems for replicating and understanding in vivo physiological phenomena. In this pursuit, we have developed three-dimensional (3D) cell culture platforms both for delivery of bioactive molecules as well as recruitment or culture of cells. We have been working on material-based gene delivery to deliver vectors and allow in situ (or in vivo) genetic modification of cells for applications in immunotherapy and tissue regeneration. We have also developed porous cryogel scaffolds for 3D cell culture and have demonstrated their utility for immunotherapy and for spheroid formation. These scaffolds enable us to recreate systems to understand underlying cellular mechanisms in normal and pathological conditions and for drug screening applications. Specifically, these platforms can be used to study co-cultures, cell-cell and cell-ECM interactions, influence of immune cells on tumor cells and vice versa.



Honors and Awards:

- 2022 Outstanding Immunologist Award - Female Category (Indian Immunology Society).
- 2021 Merck Young Scientist Award for Life Sciences (Merck India).
- 2013 Innovative Young Biotechnologist (DBT-IYBA) Award (Dept. of Biotechnology).
- 2011 Young Faculty Award (IIT Bombay).

Selected Publications:

- Pillai MM, Dandia H, Checker R, Rokade S, Sharma D, **Tayalia P***. Novel combination of bioactive agents in bilayered dermal patches provides superior wound healing. **Nanomedicine: NBM.** **2022**, 40, 102495.
- Singh A, Mirgule J, Pillai MM, Dalal N, **Tayalia P***. Particulate leaching improves spheroid formation in PEG and gelatin-based matrices for 3D tumour model. **Materials Today Communications.** **2022**, 31, 103494.
- Saha R, Patkar S, Maniar D, Pillai MM, **Tayalia P***. A bilayered skin substitute developed using an eggshell membrane crosslinked gelatin–chitosan cryogel. **Biomaterials Science.** **2021**, 9, 7921-7933.
- Dandia H, **Tayalia P***. Immunomodulation via macrophages to fight solid tumor malignancies. **FEBS J.** **2021**, 288(3), 799-802.
- Singh A, **Tayalia P***. Three-dimensional cryogel matrix for spheroid formation and anti-cancer drug screening. **J Biomed Mater Res.** **2020**, 108(2), 365-376.
- Dandia H, Makkad K, **Tayalia P***. Glycated collagen – a 3D matrix system to study pathological cell behavior. **Biomater. Sci.** **2019**, 7(8), 3480-3488.
- Shrimali P, Peter M, Singh A, Dalal N, Dakave S, Chiplunkar SV, **Tayalia P***. Efficient in situ gene delivery via PEG diacrylate matrices. **Biomater. Sci.** **2018**, 6, 3241-3250.

Patents:

- Tayalia, P. et al. (2022) Indian patent application no. **202221036495, 202221036082, 202121018106**
- Tayalia, P. et al. (2021) Indian patent application no. **202121010325, 202121008638**
- Tayalia, P. et al. (2019) Indian patent application no. **201921011783, 201921038250**



Dr. Thirugnanasambandam, Nivethida

Assistant Professor

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Areas of Expertise: Human motor neurophysiology, Noninvasive neuromodulation, Neural signal processing

Research Description:

The Human Motor Neurophysiology and Neuromodulation Lab focuses on understanding the physiology of human motor control and the pathophysiology of movement disorders using a combination of non-invasive brain stimulation and recording methods.

Our primary aim is to elucidate the neurophysiological basis of certain clinical phenomena observed in patients with movement disorders. For example, we are currently studying the phenomena of ‘motor surround inhibition’ and ‘sense of agency’ that are abnormal in patients with dystonia and functional movement disorders respectively. Another project probes into the pathophysiology of dyskinesias in patients with Parkinson’s disease. Lately, we are also expanding our focus on the use of data-driven approaches on human neurophysiological and neuroimaging data to understand these mechanisms.

Methods: We employ a multimodal approach integrating transcranial magnetic stimulation (TMS) and/or low-intensity transcranial electrical stimulation (tES including transcranial direct/alternating current stimulation – tDCS/tACS) in combination with electromyography (EMG), electroencephalography (EEG) and magnetic resonance imaging (MRI), supplemented by clinical assessments, cognitive/behavioural tasks or pharmacological interventions as needed.

We envisage that a deeper understanding of the neurophysiology will steer the development of novel and effective technological solutions to alleviate the motor and non-motor disabilities caused by various neuropsychiatric disorders.

Achievements/Recognition:

- Young Faculty Award, from IIT Bombay, 2022
- Member of the Indian National Young Academy of Sciences (INYAS) 2021-25
- Har Gobind Khorana Innovative Young Biotechnologist Award, from DBT, 2020
- DBT/Wellcome Trust India Alliance Clinical Research Fellowship (Intermediate), 2017-2023
- Ramalingaswami Re-entry Fellowship, from DBT, 2016 – did not avail
- Ruth L.Kirschstein National Research Service Award, from National Institute of Neurological Disorders and Stroke (NINDS), NIH, USA, 2013-2016

Selected Publications:

- Das A, Mandel A, Shitara H, Popa T, Horovitz SG, Hallett M, Thirugnanasambandam N. Evaluating interhemispheric connectivity during midline object recognition using EEG. (accepted in PLoS One).
- Shukla S, Thirugnanasambandam N. Deriving mechanistic insights from machine learning and its possible implications in non-invasive brain stimulation research. *Brain Stimul.* 14(4): 1035-1037. doi: 10.1016/j.brs.2021.06.013.
- Shukla S, Thirugnanasambandam N. Tapping the potential of multimodal non-invasive brain stimulation to elucidate the pathophysiology of movement disorders. *Front Hum Neurosci.* 15:661396. doi: 10.3389/fnhum.2021.661396.
- Thirugnanasambandam N, Zimmerman T, Pillai AS, Shields J, Horovitz SG, Hallett M. Task-specific interhemispheric hypoconnectivity in writer’s cramp – an EEG study. *Clin Neurophysiol.* 2020. 131(5):985-993. doi: 10.1016/j.clinph.2020.01.011.
- Thirugnanasambandam N, Leodori L, Popa T, Kassavetis P, Mandel A, Shaft A, Kee J, Kashyap S, Khodorov G, Hallett M. Parietal conditioning enhances motor surround inhibition. *Brain Stimul.* 2020. 13(2):447-449. doi: 10.1016/j.brs.2019.12.011.



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Associate Professor

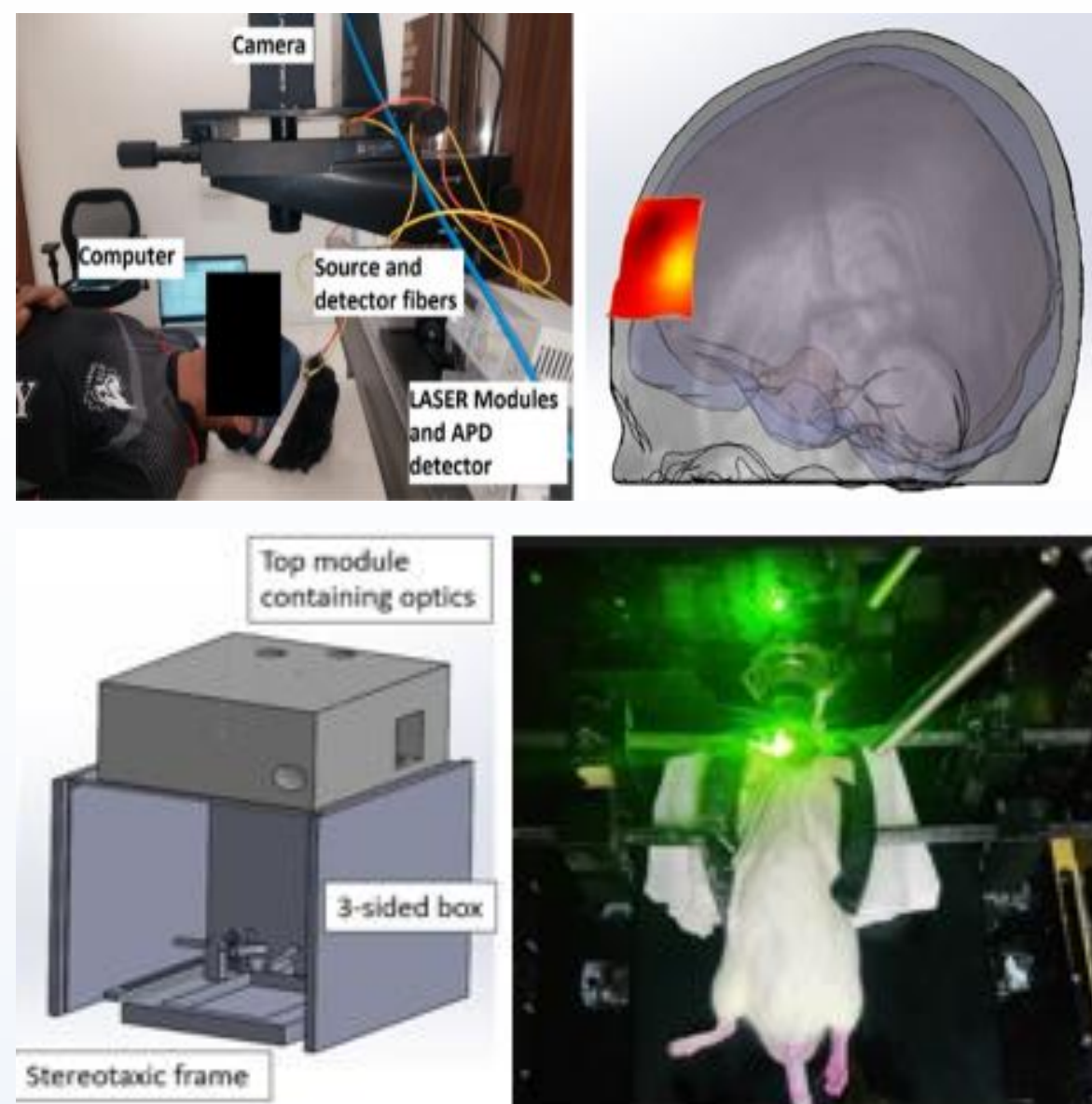
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Areas of Expertise: Biomedical Optics, Cerebral blood flow imaging, Microscopy, Optical tomography, Inverse Problems in imaging

Research Description:

Broad area: Developing optical tools for medical imaging applications. We work on developing imaging systems for in vivo and in vitro applications for both pre-clinical and clinical studies. Specific modality: Laser speckle contrast imaging, Near Infrared spectroscopy/diffuse optical tomography and diffuse correlation spectroscopy/tomography for in vivo imaging of human tissue. Specific applications: Imaging of cerebral blood flow changes associated with stroke, other neurological disorders and functional activation of human brain. The developed systems are first tested using tissue mimicking phantoms followed by healthy human subjects and animals. Join us: Desired background: Engineering degree in ECE, BME, IN, EE and ME; Masters in Physics, Photonics or applied mathematics.



Achievements/Recognition

- Ramalingaswamy Re-entry Fellowship 2016-2021, DBT, India
- Early Career Research Award (ECRA) 2017-2020, DST, India

Selected Publications/Patents:

- Paul, Ria, K. Murali, Sumana Chetia, and Hari M. Varma. "A simple algorithm for diffuse optical tomography (DOT) without matrix inversion." Biomedical Physics & Engineering Express 8 (2022) 045001
- Murali, K. and Hari M. Varma "Multi-speckle diffuse correlation spectroscopy to measure cerebral blood flow." Biomedical optics express 11 (2020): 6699–6709.
- Murali, K., A. K. Nandakumaran, and Hari M. Varma. "On the equivalence of speckle contrast-based and diffuse correlation spectroscopy methods in measuring in vivo blood flow." Optics Letters 45 (2020): 3993-3996.
- Indian Patent Filed: "Systems and methods for high density diffusing wave spectroscopy: Murali K and Hari M Varma (2019).
- K. Murali, A. K. Nandakumaran, Turgut Durduran, and Hari M. Varma, "Recovery of the diffuse correlation spectroscopy data-type from speckle contrast measurements: towards low-cost, deep-tissue blood flow measurements," Biomed. Opt. Express 10, 5395-5413 (2019).
- T.Dragojevic, D.Bronzi, H.M.Varma, C.P.Valdes, C.Castellvi, F. Villa, A.Tosi, C.Justicia, F.Zappa, T.Durduran, "High-speed multi-exposure laser speckle contrast imaging with a single-photon counting camera," Biomedical Optics Express 6, 2865-2876 (2015).
- H. M. Varma, C. P. Valdes, A. K. Kristoffersen, J. P. Culver, and T. Durduran, "Speckle contrast optical tomography: A new method for deep tissue three-dimensional tomography of blood flow," Biomedical Optics Express 5, 1275-1289 (2014).
- C. P. Valdes, H. M. Varma, A. K. Kristoffersen, J. P. Culver, and T. Durduran, "Speckle contrast optical spectroscopy for measuring blood flow in deep tissues," Biomedical Optics Express 5, 2769-2784 (2014).
- N. Hyvonen, A. K. Nandakumaran, H. M. Varma, and R. M. Vasu, "Generalized eigenvalue decomposition of the field autocorrelation in correlation diffusion of photons in turbid media," Mathematical Methods in the Applied Sciences 36, 1447-1458 (2013).

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