Structural Biochemistry for Applications in Food Science.

Dr. Balaji Prakash

Senior Principal Scientist
Head, Department of Molecular Nutrition.
CSIR-CFTRI, Mysore

Research areas: Combining 'Structural Biology, Bioinformatics and Mechanistic Enzymology' for the Rational Design of Preservatives and other applications in food science.

Profile:

Balaji Prakash, was a Professor, at Indian Institute of Technology, Kanpur for 14 years. He then joined CSIR-CFTRI.

He is fascinated by the way **Enzymes** work: Using a combination of biochemistry, structural Biology and bioinformatics, his work addressed catalytic mechanisms of important family of enzymes of bacterial origin like GTPases, kinases and sugar nucleotidylyltransferases.

An understanding of the basic mechanisms for catalysis and regulation in these enzymes allows the development of novel peptides/molecules to inhibit their action and these would find applications in food science.

Awards & Recognitions:

2013 - Fellow of the National Academy of Sciences, Allahabad, India.

2011 - Elected Member, Guha Research Conference (GRC), India.

2010 - DBT National Bioscience Award for the year 2009.

2004 - International Senior Research Fellow, Wellcome Trust, U.K.

2016 - Editorial Board Member, Nature Scientific Reports.

Previous Positions:

Nov 2002 – Dec 2014: Professor, Department of Biological Sciences and Bio-Engineering, Indian Institute of Technology, Kanpur 208 016, India.

March 2002 – Oct 2002: Assistant Professor, Special Center for Molecular Medicine, Jawaharlal Nehru University, New Delhi.

March, 1997- Feb 2002 : Post Doctoral Fellow, Max Planck Institute for Molecular Physiology, Dortmund, Germany.

Activities in Brief

Ph.D Students graduated: *9* ***M.Tech students graduated :*** *16*

Funds generated (from DBT, DST, CSIR, ICMR and Wellcome Trust, UK): *865 Lakhs.*

Publications : *42* ***Patents :*** *2.*

Professional Activities

- Member, Editorial Board, *Nature Scientific Reports*.
- Member, Protein Society.
- Member, International Union of Crystallography.
- Reviewed manuscripts for reputed international Journals – Proteins, PloS ONE, FEBS Letters, GENE, Marine Biotechnology, Biopolymers etc.
- Reviewed Ph.D. thesis from various institutions in the country.
- Reviewed Project proposals from DST and DBT and Research Grants Council (RGC) of Hong Kong.
- Delivered popular science lectures in several schools and colleges.

Students & Post-docs

Following are the details of the students graduated from my lab.

- **Ph.D. :** So far, 9 students have defended their Ph.D. thesis; 2 more will submit their PhD thesis. (see table at the end).

- At CFTRI, three students have joined for a Ph.D and one will be submitting his thesis soon.

- **M.Tech** – So far, 16 students have graduated at IIT-K and several of them are into R&D in academia or in the industry. Several have also pursued Ph.D. abroad.

- **Prospective <u>PhD students</u>** - Kindly apply as per the institute guidelines via ACSIR or contact me directly for admission via University of Mysore. Typically admissions are open twice a year (Jul and Dec).
- **Prospective <u>post doctoral fellows</u>** - Please write directly to me with a CV (including a brief statement describing research experience and scientific interests, and the contact information of at least 2-3 references). There are possibilities for external fellowship(s) which can be explored, after due discussion and ensuring that your expertise matches our requirements.

A brief on teaching and research philosophy.

I have taught for 14 years at IIT Kanpur and am fascinated with the process of teaching-learning. As an enthusiastic teacher, I try to integrate research methodologies with my class room teaching. In today's world, with internet at fingertips, as the need for a teacher appears to vanish, I believe it is even more important to keep the student engaged in the process of learning. I have experimented with a methodology 'objective-oriented-learning' in the class room and seen it do wonders. I wish to share and contribute this philosophy to the temples of learning in order to build a new generation of student innovators that care for the common man.

I enjoy interdisciplinary research that 'answers' <u>the question</u> using diverse approaches. At BSBE, IIT-K, as a founder member of the department, I have contributed to its growth right from its inception. Working with engineers from Material Science division, IIT-K, we have used <u>Microbes</u> for printing and fabrication of electronic circuits, micro lenses for organic light emitting diodes and for Braille printing on ordinary paper.

At CSIR-CFTRI – a food technology institute, I have built a young interdisciplinary department called "Molecular Nutrition' that researches at the cross roads of modern molecular science and the traditional food science. Using molecular approaches, our research at CFTRI, has led to the design of novel peptides as a new technology for food preservation.

- ***Research and Development***
- *Molecular approach for the design of new Preservatives.*

A mechanistic understanding of enzyme catalysis at structural and biochemical level is critical to attempt structure-based drug design. Here, I intend to integrate my experience in structural biology and bioinformatics towards the rational design of new preservatives - a hitherto unexplored area in food science.

Towards this, our group aims to inhibit (a) Rel proteins that are responsible for bacterial survival under stress and (b) GTPases involved in ribosome biogenesis in the bacteria responsible for food spoilage and (c) Sugar Nucleotidyl transferases that are responsible for the cell wall formation.

- *Molecular Nutrition and Nutraceuticals.*

While on one hand, we wish to exploit the 'low side-effect' property of natural molecules from food sources for better health; on the other hand, there is a huge potential to fortify food if (anti)nutritional properties of bio-molecules in these food are thoroughly understood. An attempt to understand structure-function relationships of such molecules is another of our interest.

Simultaneously, we discovered that it is also possible to tailor the specificity of naturally occurring peptide inhibitors against food spoilage bacteria for designing new preservatives. Based on the work in the last couple of years, a patent ensued (see below).

Technology developed:

1. Title of the Invention: Microbes based printing for fabrication of electronic circuits.
   Invention: IN-843732 (Open); United States Patent USWO2014/184687 A1. 2014.
   Inventors: Deepak Gupta; Sunita Mehta; Saravanan Murugeson; Balaji Prakash. D. Gupta, B. Prakash, S. Mehta, S. Murugeson.

2. Title of the Invention: ANTIMICROBIAL PEPTIDE AND ITS USE THEREOF.
   Inventors: Balaji Prakash, Yashwanth L.V. & Abhishek Acharya .
   Indian Patent Application No. 201711027060 dated July 31, 2017
   International: PCT/IN2017/050419.

Awards and Honours

- 2013 – Elected, **Fellow of the National Academy of Sciences**, Allahabad, India
- 2011 – Elected Member, **Guha Research Conference** (GRC), India
- 2010 - **DBT National Bioscience Award** for the year 2009.
- 2006 - Invited participant at 2nd Indo-American Frontiers of Science Symposium in Irvine, California.
- 2004 - **International Senior Research Fellow** for Biomedical Science award by the **Wellcome Trust, U.K**. in 2004.

Publications:

Manuscripts published.

Total publications – 42 [in International Journals : 39; in National Journals: 2, Book Chapters: 1.]

From India as independent PI: Published 33 [as Corresponding author – 25].

1. Yashavanth L.V*, Abhishek Acharya*, Balaji Prakash[$]. Structural basis of non-canonical polyphenol oxidase activity in DLL-II - a lectin from *Dolichos lablab. Biotech and Appl. Biochem. (2018) in press.* [International Peer reviewed – IUBMB press, **IF – 1.5**].

2. Neha Vithani, Pravin Kumar Ankush Jagtap, Sunil Kumar Verma, Ravi Tripathi, Shalini Awasthi, Nisanth N. Nair[$] and **Balaji Prakash**[$]. Mechanism of Mg^{2+}-accompanied product release in sugar nucleotidyltransferases. **Structure (**2018). 26, 459-66.e3. [International Peer reviewed – Cell press, **IF – 5.0**].

3. Yashavanth L. Vishweshwaraiah, **Balaji Prakash** and Lalitha R. Gowda[$]. Expression profiling of the *Dolichos lablab* lectin during germination and development of the seed. **Plant Physiology and Biochemistry. (2018).** 124, 10-19. [International Peer reviewed – Elsevier, **IF – 3.1**].

4. Soneya Majumdar, Abhishek Acharya and **Balaji Prakash**[$]. Structural Plasticity mediates distinct GAP-dependent GTP hydrolysis mechanisms in Rab33 and Rab5. **Febs. J. (2017)** 284, 4358-4375. *[International Peer reviewed – FEBs Press, **IF – 4.3**].*

5. Vaibhav Singh Bais, Balaram Mohapatra, Nadim Ahamad, Sanjana Boggaram, Sandeep Verma[$] and **Balaji Prakash[$]**. Investigating the Inhibitory Potential of 2-Aminopurine Metal Complexes Against Serine/Threonine Protein Kinases from *Mycobacterium Tuberculosis.* **Tuberculosis (2017)** 108, 47-55. *[International Peer reviewed – Elsevier, **IF – 2.93**].*

6. Neha Vithani, Sahil Batra, **Balaji Prakash**[$] and Nisanth Nair[$]. Elucidating the GTP Hydrolysis Mechanism in FeoB – a Hydrophobic Amino Acid substituted GTPase. ***ACS Catalysis* (2017)**, 7, 902−906. *[International Peer reviewed – American Chemical Society, **IF – 9.30**].*

7. Soneya Majumdar, Abhishek Acharya, Sushil Kumar Tomar and **Balaji Prakash[$]**. Disrupting domain-domain interactions is indispensable for EngA-ribosome interactions. ***Biochimica et Biophysica Acta* -** (Proteins and Proteomics) **(2017)** 1865, 289–303**.** *[International Peer reviewed – Elsevier, **IF – 3.28**].*
8. Sunita Mehta, Saravanan Murugeson, **Balaji Prakash**, Deepak[$]. Microbes based printing for fabrication of microlenses for organic light emitting diodes. **Organic Electronics (2016)** 35: 199-207. *[International Peer reviewed – Elsevier, **IF – 3.5**].*

9. Sunita Mehta, Saravanan Murugeson, **Balaji Prakash**, Deepak[$]. Development of process for generating three dimensional microbial patterns amenable for engineering use. ***RSC Advances*** **(2016),** 6: 22586-22593. *[International Peer reviewed – Royal Soc. Chemistry,* ***IF – 3.28****]*.

10. Sunita Mehta, Saravanan Murugeson, **Balaji Prakash**, Deepak[$]. Fabrication of three dimensional patterns of wide dimensional range using microbes and their applications. ***Scientific Reports. (2015).*** 5:15416. doi: 10.1038/srep15416. *[International Peer reviewed – Nature press,* ***IF – 5.23****]*.

11. Vinod Kumar, Saravanan Murugeson, Neha Vithani, **Balaji Prakash** and Lalitha R Gowda[$]. A salt-bridge stabilized C-terminal hook is critical for the dimerization of a Bowman Birk inhibitor. ***Archives of Biochemistry and Biophysics.*** **(2015)** 566:15-25. *[International Peer reviewed – Elsevier,* ***IF – 3.02****]*.

12. Neha Vithani, Vaibhav Bais and **Balaji Prakash**[$]. GlmU (N-acetylglucosamine-1-phosphate uridyltransferase) bound to three magnesium ions and ATP at the active site. ***Acta Cryst. F (2014)*** 70, doi:10.1107/S2053230X14008279. *[International Peer reviewed – International Union of Crystallography,* ***IF – 0.65****]*.

13. Shiv Singh, Vaibhav Bais, **Balaji Prakash** and Nishith Verma[$]**.** Multi-scale carbon micro/nanofibers-based adsorbents for protein-immobilization. ***Materials Science and Engineering C*** **(2014***) 38, 46-54. [International Peer reviewed – Elsevier,* ***IF – 3.33****]*.

14. Nikhil Jain, Neha Vithani, Abu Rafay and **Balaji Prakash**[$]. Identification and characterization of a hitherto unknown nucleotide binding domain and an intricate inter-domain regulation in HflX, a ribosome binding GTPase. ***Nucleic Acids Research*** **(2013)** 41, 9557-69**.** *[International Peer reviewed – Oxford University Press,* ***IF – 9.2****]*.

15. Pravin Kumar Ankush Jagtap, Sunil Kumar Verma, Neha Vithani, Vaibhav Bais and **Balaji Prakash**[$]. Crystal structures identify an atypical two-metal ion mechanism for uridyl transfer in GlmU: Its significance to sugar nucleotidyltransferases. ***Journal of Molecular Biology.*** **(2013),** 425, 1745 -1759.*[International Peer reviewed – Elsevier,* ***IF – 4.33****]*.

16. Anand Baskaran, Soneya Majumdar and **Balaji Prakash[$]**. The Structural Basis Unifying Diverse GTP Hydrolysis Mechanisms. ***Biochemistry*** **(2013)** 52,1122-30**.** *[International Peer reviewed – American Chemical Society,* ***IF – 3.01****]*.

17. Megha Gulati, Nikhil Jain, Baskaran Anand, **Balaji Prakash** and Robert Britton. Mutational analysis of the ribosome assembly GTPaseRbgA provides insight into ribosome interaction and ribosome stimulated GTPase activation. ***Nucleic Acids Research*** **(2013),** 41, 3217–3227.*[International Peer reviewed – Oxford University Press,* ***IF – 9.2****]*.

18. Pravin Kumar Ankush Jagtap, Vijay Soni, Neha Vithani, Gagan Deep Jhingan, Vaibhav Singh Bais, Vinay Kumar Nandicoori[$], and **Balaji Prakash[$]**. Substrate bound crystal structures reveal features unique to Mycobacterium tuberculosis N-acetyl-glucosamine-1-phosphate uridyltransferase and a catalytic mechanism for acetyltransfer**. *Journal of Biological chemistry*** (2012) 287, 39524-37.*[International Peer reviewed – American Society for Biochemistry and Molecular Biology, **IF – 4.57**]*.

19. Abu Rafay, Soneya Majumdar, and **Balaji Prakash[$]**. Exploring potassium-dependent GTP hydrolysis in TEES family GTPases. ***FEBS Open Bio*** (2012) 2, 173-177.*[International Peer reviewed – Elsevier, **IF – 2.10**]*.

20. Sushil Kumar Tomar, Prashant Kumar, Soneya Majumdar, Varun Bhaskar, Prasun Dutta and **Balaji Prakash[$]**. Extended C-terminus and length of the linker connecting the G-domains arespecies-specific variations in the EngA family of GTPases. ***FEBS Open Bio*** (2012) 2, 191–195.*[International Peer reviewed – Elsevier, **IF – 2.10**]*.

21. Sushil Kumar Tomar, Prashant Kumar, **Balaji Prakash[$]**. Deciphering the catalytic machinery in a universally conserved ribosome binding ATPase YchF, ***Biochem. Biophys. Res. Commun.*** **(2011)**, 408, 459–464. *[International Peer reviewed – Elsevier, **IF – 2.39**]*.

22. Ashish Arora ,Nagasuma R. Chandra , Amit Das , Balasubramanian Gopal , Shekhar C. Mande, **Balaji Prakash**, Ravishankar Ramachandran, Rajan Sankaranarayanan, K. Sekar, Kaza Suguna, Anil K. Tyagi, Mamannamana Vijayan. Structural biology of Mycobacterium tuberculosis proteins: The Indian efforts, ***Tuberculosis*** **(2011)**, 91, 456-68.*[International Peer reviewed – Elsevier, **IF – 3.39**]*.

23. Baskaran Anand, Parag Surana and **Balaji Prakash[$]**. Deciphering the Catalytic Machinery in 30S Ribosome Assembly GTPase YqeH. ***PloS ONE*** **(2010),** 5(4): e9944. doi:10.1371/journal.pone.0009944. *[International Peer reviewed – Public Library of Science, **IF – 4.41**]*.

24. Divya Tiwari, Rajnish Kumar Singh, Kasturi Goswami, Sunil Kumar Verma, **Balaji Prakash** and Vinay Kumar Nandicoori[$]. The N-terminal region of protein kinase G from *Mycobacterium tuberculosis* plays a regulatory role in modulating kinase activity and survival in the host macrophages. ***Journal of Biological Chemistry*** **(2009)** 284**,** 27467-79.*[International Peer reviewed – American Society for Biochemistry and Molecular Biology, **IF – 4.57**]*.

25. Baskaran Anand, Parag Surana, Sagar Bhogaraju, Sushmita Pahari and **Balaji Prakash[$]**. Circularly permuted GTPaseYqeH binds 30S ribosomal subunit: Implications for its role in

ribosome assembly. ***Biochem. Biophys. Res. Commun*. (2009**), 386, 602–606. *[International Peer reviewed – Elsevier, **IF – 2.39**]*.

26. Sunil Kumar Verma, Mamta Jaiswal, Neeraj Kumar, Amit Parikh, Vinay Kumar Nandicoori, **Balaji Prakash[$].** Crystal structure of N-acetylglucosamine-1-phosphate uridyltransferase (GlmU) from *Mycobacterium tuberculosis* in a cubic space group. ***Acta Cryst. F.* (2009)**, 65: 435–439. *[International Peer reviewed – International Union of Crystallography, **IF – 0.65**]*.

27. Sushil Kumar Tomar, Neha Dhimole, Moon Chatterji and **Balaji Prakash[$]**. Distinct GTP/GDP bound states of the tandem G-domains of *Escherichia Coli* EngA regulate ribosome binding. **Nucleic Acids Research *(2009)*** 37(7):2359-70**.** *[International Peer reviewed – Oxford University Press, **IF – 9.2**]*.

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28. Mathew Sajish, Sissy Kalayil, Sunil Kumar Verma, Vinay Kumar Nandicoori[$] and **Balaji Prakash[$]**. The Significance of ExDD and RxKD Motifs Conservation in Rel Proteins. ***Journal of Biological Chemistry* (2009),** 284, 9115-9123. *[International Peer reviewed – American Society for Biochemistry and Molecular Biology, **IF – 4.57**]*.

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29. Nikhil Jain, Neha Dhimole, Abu Rafay Khan, Debojyoti De, Sushil Kumar, Tomar, Mathew Sajish, DipakDutta, PradeepParrack and **Balaji Prakash[$]**. *E.coli*HflX interacts with 50S ribosomal subunits in presence of nucleotides. **Biochem. Biophys. Res. Commun. (2009**), 379, 201-5. *[International Peer reviewed – Elsevier, **IF – 2.39**]*.

30. Amit Parikh[*], Sunil Kumar Verma[*], Shazia Khan, **Balaji Prakash[$]** & Vinay Kumar Nandicoori[$]. PknB mediated phosphorylation of a novel substrate, N-acetylglucosamine-1-phosphate uridyltransferase (GlmU), modulates its acetyltransferase activity. ***Journal of Molecular Biology.* (2009)**, 386, 451-64. *[International Peer reviewed – Elsevier, **IF – 4.33**]*.

31. Mathew Sajish, DivyaTiwari, Dimple Rananaware, Vinay Kumar Nandicoori[$] and **Balaji Prakash[$]**. A Charge Reversal Differentiates (p)ppGpp Synthesis by Monofunctional and BifunctionalRel Proteins. ***Journal of Biological Chemistry.* (2007)**282, 34977-34983. *[International Peer reviewed – American Society for Biochemistry and Molecular Biology, **IF – 4.57**]*.

32. Baskaran Anand, Sunil Kumar Verma, **Balaji Prakash[$]**. Structural stabilization of GTP-binding domains incircularly permuted GTPases: Implications forRNA binding. ***Nucleic Acids Research.* (2006)**34, 2196-2205. *[International Peer reviewed – Oxford University Press, **IF – 9.2**]*.

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33. Rajeev Mishra, Sudheer Kumar Gara, ShambhaviMishra, **Balaji Prakash[$]**. Analysis of GTPases carrying hydrophobic amino acid substitutions in lieu of the catalytic glutamine:

Implications for GTP hydrolysis. ***Proteins: Structure, Function, and Bioinformatics*** (**2005**) 59, 332-338. *[International Peer reviewed – Wiley,* ***IF – 2.5****]*.

From Post-Doctoral and Doctoral Work: 8.

34. Gerrit.J.K.Praefcke, Stephen Kloep, UtzBenscheid, HankeLilie, **Balaji Prakash** and Christian Herrmann. Identification of Residues in the Human Guanylate-binding Protein 1 Critical for Nucleotide Binding and Cooperative GTP Hydrolysis. ***J. Mol. Biol.*** (**2004**) **344**, 257-269. *[International Peer reviewed – Elsevier,* ***IF – 4.33****]*.

35. **Balaji Prakash**[*], HolgerRehmann[*], Eva Wolf[*], Alma Rueppel, Johan de Rooij, Johannes. L. Bos& Alfred Wittinghofer. Structure and Regulation of the cAMP binding domains of Epac2. ***Nature. Struct. Biol.***(**2003**)10, 26-32. *Cover Article* (* refers to equal contributors) *[International Peer reviewed – Nature press,* ***IF – 13.38****]*.

36. **Balaji Prakash*,** Louis Renault*, Gerrit.J.K.Praefcke, Christian Herrmann & Alfred Wittinghofer.Triphosphate structure of guanylate-binding protein 1 and implications for nucleotide binding and GTPase mechanism. ***EMBO Journal*** (**2000**), 19, 4555-4564. *[International Peer reviewed – EMBO press,* ***IF – 9.6*** *]*.

37. **Balaji Prakash,** GerritJ.K.Praefcke, Louis Renault, Alfred Wittinghofer& Christian Herrmann. Structure of human Guanylate-binding protein-1 representing a class of GTP-binding proteins with unique properties. ***Nature*** (**2000**), 403, 567-571. *[International Peer reviewed – Nature press,* ***IF – 38.14****]*.

38. **Balaji Prakash**, M.R.N.Murthy, Y N Sreerama, D RajagopalRao&Lalitha R Gowda. Studies on simultaneous inhibition of trypsin and chymotrypsin by horsegram Bowman-Birk inhibitor. ***Journal of Biosciences*** (**1997**), 22(5), 545-554. *[National Peer reviewed – Indian Academy of Sciences,* ***IF – 1.41****]*.

39. **Balaji Prakash** & M.R.N.Murthy. Source and target enzyme signature in serine protease inhibitor active site sequences. ***Journal of Biosciences*** (**1997**), 22(5), 555 -556. *[National Peer reviewed – Indian Academy of Sciences,* ***IF – 1.41****]*.

40. **Balaji Prakash**, S.Selvaraj, M.R.N.Murthy, Y.N.Sreerama, D. Rajagopal Rao & L.R.Gowda. Analysis of amino acid sequences of Plant Bowman-Birk Inhibitors. ***Journal of Molecular Evolution***. (**1996**) 42, 560-569. .*[International Peer reviewed – Springer,* ***IF – 1.85****]*.

41. **Balaji Prakash**, M.R.N.Murthy, Y.N.Sreerama, P.R.Rama Sarma & D.Rajagopala Rao. Crystallization and preliminary X-ray diffraction studies on a Trypsin/Chymotrypsin double

headed inhibitor from horse gram seeds. ***Journal of Molecular Biology***. (**1994**) 235, 364-366. *[International Peer reviewed – Elsevier, **IF – 3.34**]*.

Book Chapters.

42. Neha Vithani and **Balaji Prakash**$. GlmU from Mycobacterium tuberculosis – Structure, function and the role of metal ions in catalysis. ***Encyclopedia of Inorganic and Bioinorganic Chemistry***. **(2015).** *[International Peer reviewed – Wiley]. http://onlinelibrary.wiley.com/doi/10.1002/9781119951438.eibc2327/abstract*

(Note - * refers to equal contributors, $ to co- corresponding authors).

Details of Ph.D students

	Ph.D. Degree Awarded / Thesis Defended	Name	Year in which Degree Awarded/Thesis Defended	Title of the Thesis	Present Position
1	Degree Awarded	Dr. Sajish Mathew	May, 2009	Motif Specific Regulation of (p)ppGpp Synthesis in Rel Proteins.	Post Doctoral Fellow, Scripps Research Institute, California, USA
2	Degree Awarded	Dr. Anand Baskaran	Feb 2010	Structure-Function Relationships in Circularly Permuted GTPases.	Assistant Professor, Dept of Biotechnology, Indian Institute of Technology, Guwahati.

3	Degree Awarded	Dr. Sunil Kumar Verma	Feb 2010	Structural studies on N-acetylglucosamine-1-phosphate uridyltransferase (GlmU) from Mycobacterium tuberculosis.	Post Doctoral Fellow, Baylor College of Medicine, Texas, USA
4	Degree Awarded	Dr. Sushil Kumar Tomar	Dec 2010	Elucidating a double switch mechanism and inter-domain regulation in a unique ribosome binding bacterial GTPase EngA.	Post Doctoral fellow, RNA research center, Ohio State University, USA
5	Degree Awarded	Dr. Nikhil Jain	Jan 2011	Structure based biochemical investigations on HflX - a GTPase and an ATPase likely involved in ribosome assembly.	Post doctoral Fellow, University of Michigan, USA
6	Degree Awarded (Co-supervised with Dr. Deepak Gupta, Dept of Material Science Engineering, IITK)	Dr. Sunita Mehta	Oct 2016	Development of microbes based three dimensional patterns and their use demonstrated in microlenses, braille and source-drain of thin film transistors	
7	Degree Awarded	Dr. Soneya Majumdar	May 2017	Investigating diversity in GTP hydrolysis mechanisms with special emphasis on Rab GTPases and a ribosome binding GTPase EngA.	

8	Degree Awarded	Dr. Vaibhav. S. Bias	May 2017	Characterization of sugar nucleotidylyltransferases and the design of inhibitors against Ser/Thr protein kinases.	
9	Degree Awarded	Dr. Saravanan Murugeson	May 2017	Two dimensional diffusion crystallization: a novel process to crystallize proteins	