**Ajit Prakash**

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**Personal Statement**

**I gained extensive research experience in the field of structural biology and biochemistry during my Ph.D. dissertation work. After obtaining my Ph.D. I was interested in applying biophysical techniques to medically relevant problems, and with that intention, I went to the University of Cambridge for postdoctoral training. To conduct independent research, I moved to India and joined Lovely Professional University as an assistant professor. Being a private university there was very limited research opportunity, so I decided to obtain more training in biophysics and gain expertise in cell biology. With that motivation, I joined Sharon Campbell’s lab at UNC Chapel Hill. Two projects which had direct applications to human health interested me the most. The first project was to characterize the function of G**αi **protein in intracellular pH sensing, which might be highly relevant to ischemic heart diseases. Using several biophysical techniques and cell-based assay, I identified a novel mechanism of pH sensing by Gai and now desire to expand these studies disease relevant system. The second project is cancer drug discovery by targeting KRAS protein and I identified a novel small molecule that inhibits KRAS protein. My future research involved further characterization of this molecule to treat cancer.**

**Education**

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| **Degree** |  **School / University**  | **Date of Award** |
| Postdoc Fellow | **University of North Carolina,** USA | From 2018 to date |
| Postdoc Fellow | **University of Cambridge**, UK | July 2016 – 2017 |
| Ph.D. Biological Sciences | **Nanyang Technological University**, Singapore | Completed in July 2016 |
| M.Sc. Genomics | Madurai Kamaraj University, Madurai, India | Completed in July 2011 |
| B.Sc. Biotechnology | Jamia Millia Islamia, New Delhi, India  | Completed in July 2009 |

**Positions and Honors:
Professional Positions**

2018 – **Postdoctoral Researcher**; Dept. of Biochemistry and Biophysics, School of Medicine, University of North Carolina at Chapel Hill, NC, USA (Advisor: Dr. Sharon Campbell)

2017 – 2018 **Assistant Professor**; Department of Biotechnology, Lovely Professional University, Jalandhar,

 Punjab, India

2016 – 2017 **Postdoctoral Researcher**; Dept. of Pathology, **University of Cambridge**, Cambridge, United Kingdom (Advisor: Dr. Louise Boyle)

2016 – 2016 **Research Assistant**, Advanced Environmental Biotechnology Centre (AEBC), **Nanyang Technological University**, Singapore (Advisor**:** Dr. Sze Chun Chau)

**Professional Memberships**

2019 – Member, American Heart Association

2022 – Member, International Natural Product Sciences Taskforce

**Reviewer and editor roles**

Currently, I am serving as an **editor** in the following journals

1. Journal of Cancer Metastasis and Treatment
2. American Journal of Biomedical Science and Research

Currently, I am serving as a **reviewer** in reputed journals like-

1) Scientific reports (Nature)

2) Frontiers in Endocrinology

3) BMC cancer

4) Advances in Biochemistry

5) Infection, Genetics and Evolution

6) International Journal of Clinical Biochemistry and Research.

7) Food Science and Human Wellness

I have reviewed more than 25 manuscripts so far.

**Awards and Honors**

2021 Best postdoctoral oral presentation award at UNC-Chapel Hill Biochemistry and Biophysics Departmental Research Retreat

2021 Young achiever award by KKM, India

2011 Graduate research scholarship for Ph.D. studies, awarded by MOE (Ministry of Education), Singapore government.

2010 Qualified CSIR-NET (Council of Scientific & Industrial Research – National Eligibility Test) India exam and got selected for JRF (Junior Research Fellowship) with an all-India 66th rank among 65000 students.

2010 Ranked all India 113th in IIT GATE (Graduate Aptitude Test in Engineering) 2010 conducted by India Institute of Technology and scored 99.28 percentile.

2010 Participated in the prestigious Biotechnology Entrepreneurship Student Teams (BEST 2010) competition sponsored by the DBT (Department of Biotechnology), Govt. of India and executed by Association of Biotechnology Led Enterprises (ABLE India). This competition is similar to Biotechnology Young Entrepreneurs Scheme (YES), in the UK. Our proposed model of “Biokit for rapid detection of tetanus toxin” based on FRET was selected as the 2nd best innovative idea among 400 participants in this prestigious national-level competition. As a winner, we got awarded INR 300,000 (approx. USD 6000) as prize money from the Department of Biotechnology, Government of India. We are in the process of patenting our idea and prototype of the kit. The details of the competition and the 2010 winning team were featured in Biotech News (a leading Biotech magazine in India published by the Department of Biotechnology, Government of India) Volume 5, No.5, October 2010.

2010 Invited talk in ABLE’s flagship event, BIOENVEST at Ahmedabad, India in December 2010.

2006 Got selected for National Talent Scholarship (NTS) in 2006 of ICAR (Indian Council of Agricultural Research) Delhi, India.

**Research Experience**

**Postdoctoral research:** Right after my Ph.D., I joined **Dr. Louise Boyle's lab** as a postdoctoral fellow in the Department of Pathology, at the **University of Cambridge** in July 2016. During my postdoctoral studies, I studied the regulation of peptide loading on major histocompatibility complex (MHC I) by TAPBPR protein to understand the nonclassical peptide presentation pathway. MHC I is a very difficult protein to purify and I optimized the refolding of MHC protein and also the expression and purification of TAPBPR protein from HEK-293F mammalian cells. I tried to make a complex of MHC and TAPBPR by several strategies to get the crystal for structural studies. I also modified the Piggy Expression vector by molecular cloning technique and used that modified vector to make a stable cell line for TAPBPR expression in HEK293 cells.

In 2018 I moved to **Sharon Campbell’s Lab at UNC-CH** for my second postdoctoral training. When I joined Sharon’s Lab, we discussed several unanswered research questions and I became particularly interested in investigating the potential role of G-protein in pH sensing and regulation. Answering this question would help us understand the basic mechanism of pH sensing in several diseases where cellular pH gets altered. To characterize the pH sensing ability of Gαi, **I optimized the high yield of Gαi purification** from E.Coli. Later I learned Circular dichroism and performed CD for Gαi at different pH to show that pH indeed affects the stability of Gαi. Later I performed **NMR to show that pH affects the dynamic property of Gαi**. Later **to identify the pH sensing residues in Gαi**, I generated more than **15 mutants proteins and tested their pH sensing ability**. This extensive screening helped me **to discover the key residues of Gαi involved in pH sensing**. Furthermore, to understand the mechanism of pH sensing by these residues **I learned molecular dynamics (MD)** and performed MD for Gαi at different pH to show that lower pH results in protonation of the identified charged resides which breaks the electrostatic interaction of charged residues and leads to order to disorder transition of protein. To understand the biological significance of the pH sensing ability of Gαi, **I trained in multiple cell biology techniques**. I was then able to optimize several methods **to alter and monitor the intracellular pH**. I showed a good correlation in the change in intracellular pH by changing extracellular pH or treating the cell with FCCP drug or changing the percentage supply of CO2 to the cell. I also perform a **HEK293 cell-based BRET assay** to show that the interaction of Gαi with Gβγ and their respective activation might be pH-dependent. We further expanded this study in another isoform of Gαi and showed a potentially conserved mechanism of pH sensing by different isoforms of Gαi. My work to characterize a novel function of G-protein as a pH sensor and modulator is incorporated in a manuscript currently in preparation. I am also involved in two other projects one in collaboration with **Dr. Aube Jeff, UNC-CH**, and the other with **Mirati Therapeutics**. In these projects, we are trying to identify novel KRAS inhibitors to treat cancer and also understating the mechanism of action of MRTX849 (discovered by Mirati Therapeutics) which is in phase II clinical trial. I have now identified a novel small molecule (UNC6126) that binds to KRAS with micromolar affinity. I used HADDOCK docking to uncover the binding mode UNC6126 with KRAS and the manuscript for this work is under preparation.

**As an assistant professor**: Right after my first postdoc at the University of Cambridge, UK, I moved to my home country India and joined Lovely Professional University (the largest private university in India) and taught undergraduate and master's students there. I also guided four students in their master’s dissertation research. Due to a lack of research infrastructure there, I moved to the USA for another postdoctoral study at Sharon Campbell Lab. I still collaborate with my students from Lovely professional university and recently published multiple papers (also as a corresponding author).

**Ph.D. thesis work:** During the first semester of my Ph.D., I worked with Prof. Ravi Kambadur and I tried to elucidate the mechanism of **insulin sensitivity in myostatin knockout mice fed on a high-fat diet**. During this period, I extensively performed RT-PCR, cell culture work, western blotting and mouse work. I also completed an **animal handling course in Singapore**. Then I joined **Prof. Yoon Ho Sup's lab** and finished my Ph.D. under his supervision. During my Ph.D., I cloned, expressed, and purified the human FKBP25 protein in *E.coli.* Purified protein was further used to determine the NMR solution structure of FKBP25. **I also solved the crystal structure of FKBD25** in complex with the immunosuppressive drug FK506 at a resolution of 1.8 Å. Later using NMR, ITC and EMSA, **I showed that FKBP25 binds with dsDNA in a sequence-independent manner.** We generated several mutants of FKBP25 to abolish FKBP25-DNA interaction. Further, we could map the DNA binding site of FKBP25. We performed HADDOCK docking to get the FKBP25-DNA complex model. Later we also showed that **FKBP25 forms a ternary complex with DNA and YY1** (a transcription factor) and this ternary complex formation enhance the transcriptional repression activity of YY1. We also tried to crystallize the FKBP25-DNA complex to solve the crystal structure of the complex**. In collaboration with Dr. Phan, we showed that FKBP25 had the potential to bind to G-quadruplex DNA.** I published three high-impact first-author papers during my Ph.D. research.

**Pre-PhD research:** I have done **six months** M.Sc. dissertations under the supervision of Prof. Hussain Muanavar, MKU, India. I was employed in **cloning** a **nonsense suppressor tRNA** named *SupE44.* I cloned this suppressor tRNA and reported its multi-copy effect in *E.coli.* During my first year of my Master, I did **three months summer internship** at the Indian Institute of Science Education and Research (IISER) Bhopal, India under Prof. Vikas Jain. During the project, we isolated 8 different **metal-resistant bacteria** from the Bhopal gas tragedy site. I identified and characterized all the bacteria and also determined MIC (minimal inhibitory concentration) under different metal stress conditions using Co, Mg, Cu, Ag, Hg, Cr etc.

**Teaching and mentoring experience**

**Teaching Assistant.** I completed a course on “university teaching for teaching assistants” during my Ph.D. I have done more than 80 hours of teaching assistantship which included teaching, preparing exam papers, conducting exams, and evaluating the papers.

**Teaching as an assistant professor.** After my Ph.D. I worked at Lovely Professional University (the largest private university in India) as an assistant professor and taught Biochemistry to both undergraduate and master's students there for one semester (six months). I helped in designing the course curriculum for our department. I also guided four students in their master’s dissertation research.

**Undergraduate Research Mentor.** I mentored three undergrad students during my Ph.D. study. During my postdoctoral research at UNC, I have guided two Ph.D. rotation students as well as four undergrad students. I recruited all my students through an interview conducted by me. I provided them with recommendations and career advice as needed which helped them to fetch prestigious fellowships for further research.

**Grants:**

I have assisted my Ph.D. guide as well as my postdoc guide in writing three successful grants.

**Services:**

**I have been serving as an associate editor of “The Journal of Cancer Metastasis and Treatment” and the “American Journal of Biomedical Science and Research. I am also serving as a journal reviewer in several prestigious journals like “scientific reports”. I am also serving as our department vice chair of the postdoctoral association, department of biochemistry of biophysics, UNC. I am also serving as a board member of AABAJ which is a non-government organization that hosts cultural and educational events in North Carolina.** I also teach science experiments through my YouTube channel “**Science beyond books**” where I also host a research talk show called “**Science and research simplified**”. During covid-19, I started a campaign on Facebook by creating a Facebook group “Covid Patient Helping group” with more than 5000 active members and this group helped more than 500 covid patients.

* Conference on STRUCTURAL DYNAMICS IN CELLULAR COMMUNICATION, conducted by VIB Belgium

from 9-10 February.

* EMBO workshop on TELOMERIC CHROMATIN AND TELOMERE FRAGILITY, conducted by NISB, NTU

Singapore from 7-10 December.

**Publications**

**Research and review articles:**

* **Prakash A.**, Shin J. and Yoon H.S. (2015). H, C and N resonance assignments of human FK506 binding protein 25.*Biomol NMR Assign*, 9, 43-46.
* **Prakash A,** Shin J, Rajan S, Yoon HS. (2016). Structural basis of nucleic acid recognition by FK506-binding protein 25 (FKBP25), a nuclear immunophilin. *Nucleic Acids Research*. 2016;44(6):2909-2925. doi:10.1093/nar/gkw001**.**

**(Impact factor : 19.16)**

* **Prakash A**., Rajan S, & Yoon H S (2016). Crystal structure of the FK506 binding domain of human FKBP25 in complex with FK506. *Protein Science: A Publication of the Protein Society*, *25*(4), 905–910. http://doi.org/10.1002/pro.2875 **(Impact factor : 6.7)**
* Natalie H. Valentin, Soumadwip Ghosh, **Ajit Prakash**, Jeffrey F. DiBerto, Reid H. J. Olsen,Bryan L. Roth, Nagarajan Vaidehi,\*, Sharon L. Campbell,\*, and Henrik G. Dohlman. “Non-catalytic functions of the catalytic glutamine in G proteins”. Science Signaling (accepted) **(Impact factor : 9.5)**
* AK Wani, NM Hashem, N Akhtar, R Singh, M Madkour, **A Prakash** (2022). “Understanding microbial networks of farm animals through genomics, metagenomics, and other meta-omic approaches for livestock wellness and sustainability”. Annals of Animal Science vol.0, no.0, 2022, pp.-. https://doi.org/10.2478/aoas-2022-0002.
* Wani AK, Akhtar N, Singh R, **Prakash A**, Raza SHA, Cavalu S, Chopra C, Madkour M, Elolimy A, Hashem NM.(2022) “Genome centric engineering using ZFNs, TALENs and CRISPR-Cas9 systems for trait improvement and disease control in Animals”. Vet Res Commun. Jul 4. doi: 10.1007/s11259-022-09967-8. PMID: 35781172.
* Tahir ul Gani Mir, Sakshi Manhas, Atif Khurshid Wani, Nahid Akhtar, Saurabh Shukla, **Ajit Prakash\***.(2022). “Alterations in Microbiome of COVID-19 Patients and its Impact on Forensic Pathology” accepted in Brazilian Journal of Microbiology.
* Sayed Haidar Abbas Raza, Dwi Wijayanti, Sameer D. Pant, Sameh A. Abdelnour, Nesrein M. Hashem, Ahmed Amin, Atif Khurshid Wani, **Ajit Prakash**, Mahmoud A.O. Dawood, Linsen Zan (2022). Exploring the physiological roles of circular RNAs in livestock animals, Research in Veterinary Science, Volume 152.
* Nahid Akhtar, Atif Khurshid Wani, Surya Kant Tripathi, **Ajit Prakash**\* M. Amin-ul Mannan\*.(**2022)**. “The role of SARS-CoV-2 immunosuppression and the therapy used to manage COVID-19 disease in the emergence of opportunistic fungal infections: A review” Curr Res Biotechnol. 2022;4:337-349. **(Impact factor : 5.2)**

**\*Corresponding authors**

* Atif Khurshid Wani, Nahid Akhtar, Tahir-ul Gani Mir, Rattandeep Singh, Prakash Kumar Jha, Shyam Kumar Mallik, Shruti Sinha, Surya Kant Tripathi, Abha Jain, Aprajita Jha, Hari Prasad Devkota\*, **Ajit Prakash\*. (2023)** “Targeting Apoptotic Pathway of Cancer Cells with Phytochem-icals and Plant-based Nanomaterials” **Biomolecules**, 13, 194. https://doi.org/10.3390/biom13020194. **(Impact factor : 6.2)**

**\*Corresponding authors**

* Nahid Akhtar, Atif Khurshid Wani, Hari Prasad Devkota, Ayaz Shahid, M. Amin-ul Mannan\*, **Ajit Prakash\*** **(2023) “**Lactoferrin and Activated Protein C: potential role in cancer progression, prevention and therapy”. Submitted to EXCLI journal **(Impact factor : 4.1)**

**\*Corresponding authors**

**Book Chapters:**

* “Karrikins: Molecular Association with Strigolactones: Role in Plant Growth Regulation, and Quorum Sensing Modulation”. Accepted in book entitled “Strigolactones, Karrikins and Alkamides in Plants" to be published by **Taylor and Francis (USA) in May 2023.**
* “Regulatory roles of strigolactones in plant growth, development, and Abiotic stress tolerance: Web networking with phytohormonal crosstalk”. Accepted in book entitled “Strigolactones, Karrikins and Alkamides in Plants" to be published by **Taylor and Francis (USA) in May 2023.**
* “Factors affecting composition and diversity of gut microbiota: A disease hallmark”. Submitted in book chapter published by **Wiley.**
* “Morphological studies for achieving mechanical tunability and application specificity in biopolymer composites” submitted for book chapter in "Handbook of Composite Materials for Advanced Biomedical Applications" **Springer Nature in 2023.**