

VIKRAM VENUGOPAL

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EDUCATION

Indian Institute of Science Education and Research (IISER), Pune, India

(August 2020 – Present)

Bachelor of Science - Master of Science (BS-MS) Dual Degree - Majors in Biology, Minors in Chemistry (Current CGPA – 9.0/10.0)

RESEARCH INTERESTS

- Host-Microbe interactions
- Evolutionary Enzymology
- Synthetic Biology
- Evolutionary and Developmental Immunology
- Immune cell signalling
- Immune-Pathogen Interactions

RESEARCH PROJECTS

Investigating the mechanism of interaction between Nodule-specific Cysteine Rich peptides and bacterial proteins and elucidating their role in plant-microbe symbiosis

Jun 2024 – Present

Supervisor: [Dr Siva Sankari](mailto:Dr.Siva.Sankari@stowers.org) (Stowers Institute for Medical Research) (ssankari@stowers.org)

Field: Protein biochemistry, Microbiology, Host-microbe interactions

- This project primarily involves verifying protein-protein interactions predicted by AlphaFold Multimer between host plant peptides called Nodule-specific Cysteine Rich (NCR) peptides and symbiotic bacterial targets using Yeast Surface Display, and investigating their role in establishing plant-bacterial symbiosis
- Development of a Y2H-based screen for all possible PPIs between plant peptides and bacterial protein targets to cover any missing interactions
- Purification of NCR peptides using different expression systems: *E. coli*, *B. subtilis*, *Pichia pastoris*, Cell-free expression systems followed by binding assays and functional assays with purified peptides

Analyzing evolutionary differences in gatekeeper helices and their effects on nucleotide specificity

Aug 2023 – Nov 2023

Supervisor: [Dr Amrita Hazra](mailto:Dr.Amrita.Hazra@iiserpune.ac.in) (IISER Pune) (amrita@iiserpune.ac.in)

Field: Evolutionary microbiology, Bioinformatics, Enzymology

- This project involved identifying patterns that exist across all organisms with respect to the presence of gatekeeper helices. The presence of certain sequences suggested the possibility that an enzyme was nucleotide-specific and certain others suggested nucleotide promiscuity.
- One of the primary goals of the project was to hypothesize how the existing patterns came to be the way they are. How do some organisms' enzymes have nucleotide specificity while others have promiscuity? Are the gatekeeper helices that we found to confer specificity, universal? (Do they confer specificity to any nucleotide-utilising enzyme?)
- The project involved a bioinformatics-based investigation of enzyme homologs across the tree of life. Patterns identified were then worked on to come up with an experimentally testable hypothesis.

Standardization of the Phosphate-binding protein fluorescence assay

Jan 2023 – Jul 2023

Supervisor: [Dr Gayathri Pananghat](mailto:Dr.Gayathri.Pananghat@iiserpune.ac.in) (IISER Pune) (gayathri@iiserpune.ac.in)

Field: Molecular Biology, Enzymology

- The project's aim was to develop a continuous assay to monitor the activity of ATPases and GTPases that were studied in the lab. It involved the genetic engineering of a phosphate-binding protein of *E. coli*, called PstS, to be able to accept fluorescent labels. The labelled enzyme would act as a continuous biosensor for phosphate released during NTPase enzyme reactions.
- I was able to construct the expression plasmid from scratch - using site-directed mutagenesis to mutate the gene, and then cloning it into a SUMO-His-tagged T7 expression vector. I then optimised the expression conditions for the protein and purified the protein.
- Technical skills learned: PCR, site-directed mutagenesis, protein expression optimization, protein purification.

Supervisor: [Prof Saikrishnan Kayarat](#) (IISER Pune) (saikrishnan@iiserpune.ac.in)

Field: Molecular Biology, Enzymology

- The project's aim was to clone the gene coding for ACC deaminase into an expression plasmid, purify the protein, and study the enzyme's activity in converting its substrate 1-aminocyclopropane-1-carboxylic acid, into alpha-ketobutyrate.
- I was able to clone the gene into the expression plasmid, and I also standardised the absorption curve for different concentrations of alpha-ketobutyrate.
- Technical skills learned: Bacterial cell culture, Restriction-free cloning, protein expression optimization.

[iGEM Competition 2022 \(International Genetically Engineered Machine\)](#)

Jan 2022 – Nov 2022

PIs: [Prof Saikrishnan Kayarat](#) (IISER Pune) & [Dr Mridula Nambiar](#) (IISER Pune)

Project: Reducing waterlogging-based stress responses in plants through hypoxia-induced breakdown of ACC

Role: Team Lead; Member of Wet Lab and Human Practices departments

- My iGEM project worked on engineering the bacteria *Azospirillum* to be able to break down ACC - the molecule which eventually ends up causing waterlogging stress in plants.
- I gained experience in projects, finance, and team management as the team lead. The handling of the work done by 13 members of my team has taught me how interpersonal dynamics, work distribution, and professionalism play into the success of any team-based project.
- I was also a member of the Wet Lab - where I learnt to use molecular biology as a tool - and the Human Practices - where I learnt to incorporate peoples' feedback into developing my project - departments.
- My team ended up **winning a Gold Medal** in the iGEM Competition 2022.
- In this project, I learnt all the basic techniques in molecular biology, including restriction digestion, restriction-free cloning, PCR, agarose gels, SDS-PAGE, transformation, and protein expression and purification.

RELEVANT COURSEWORK

- Biology (Graduate Courses): Microbial Genetics, Advanced Immunology, Developmental Biology, Human Physiology, Microbiology, Advanced Biochemistry, Introductory Immunology, Advanced Molecular Biology, Structural Biology, Disease and Discourse, Cell Biology, Physiology, Genetics, Ecology and Evolution, Systems Biology
- Chemistry (Graduate Courses): Bioorganic Chemistry and Chemical Biology, Advanced Organic Chemistry Laboratory, Analytical Chemistry, Molecular Spectroscopy, Principles of Inorganic Chemistry, Principles of Organic Chemistry, Principles of Physical Chemistry

ACHIEVEMENTS AND SCHOLARSHIPS

- I was one of 16 oral presenters at the Crossroads Research Conference 2024 organized by the Stowers Institute for Medical Research
- Gold Medal, iGEM Competition 2022 (October 2022) - As the team lead for the iGEM Team IISER-Pune-India, representing IISER Pune.
- The INSPIRE Scholarship for Higher Education (2020), awarded by the Department of Science and Technology, Government of India.
- The GEMS Scholarship (2019) for academic excellence among high school students.
- In 2019 and 2020, I held a workshop and a talk, about literary skills and leadership, respectively. The talks were held as part of my school's Learning Skills Development Programme.

LANGUAGES KNOWN

- English: Native Speaker
- Malayalam: Native Speaker
- Hindi: Native Proficiency
- Arabic: Beginner Proficiency