SANKALPA VENKATRAGHAVAN

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EDUCATION

Indian Institute of Technology Madras *June 2022*
Integrated B.Tech and M.Tech in Biological Engineering *CGPA:* ***9.64/10***
Specialization in Computational Biology *CGPA:* ***10/10***

HONOURS AND AWARDS

- Ranked 1st in the Department of Biotechnology (batch size of 70) for 4 consecutive years *2021*
- International Max Planck Research School Student Fellowship Awardee *2021*
- Shortlisted to interview for the Rhodes Scholarship at the University of Oxford *2021*
- Runner-Up (out of 500) in Science Communication Competition at the Indian Institute of Science *2021*
- Dr. Anita Mehta Damani Institute Merit Prize for highest CGPA in the department in 2nd year *2020*
- Awarded Gold, Silver, and Best Education Award (nominee) at International Genetically Engineered Machine (iGEM - the largest synthetic biology competition) in Boston, USA *2019* *2018*
- 1 of 40 students (out of 500) selected to attend Simons – NCBS Monsoon School 'Physics of Life' *2018*
- Awarded INSPIRE scholarship by Department of Science and Technology, Govt. of India *2017*

RESEARCH EXPERIENCE

Max Planck Institute of Molecular Cell Biology and Genetics *Dresden, Germany*
Advisor: Prof. Jan Brugues *Jun 2021 - Ongoing*
Master's Thesis: Dresden International Ph.D. Program and IMPRS Student Research Fellowship
Project: Investigating the physical principles of nuclear scaling

- Utilised confocal spinning disc microscopy to characterize import and chromatin state in *Xenopus* cytoplasmic extract
- Formulated and tested 3 frameworks to model the mechanics of nuclear scaling
- Established analysis pipeline for *Xenopus* oocyte cytoplasmic extract to compare model findings with data

Harvard Medical School *Boston, USA*
Advisor: Prof. Angela DePace *Aug – Nov 2020*
Project: Development of an automated Python-Fiji image analysis tool for *Drosophila* reporter systems

- Established a modular, open-source, AI-driven pipeline to analyze fluorescence reporters from live-cell imaging
- Reduced processing time from the order of months to hours by automating cell segmentation using deep learning tools
- Analyzed 10,000+ fixed cells from two cell lines to identify the efficacy of transfection and effects of heterogeneity

Indian Institute of Technology Madras *Chennai, India*
Advisor: Prof. Karthik Raman *Jan 2020 – Ongoing*
Project: Analysis of the spatial organization of microbial communities (Venkatraghavan et al., 2020)

- Conceptualized agent-based, cellular automaton models (MATLAB package available) to study spatial patterning
- Implemented novel quorum-sensing communication strategy, benchmarked against established auxotrophic coupling
- Facilitated design of synthetic microbial communities, identified parameters to best tune spatial organization

Indian Institute of Technology Madras *Chennai, India*
Advisor: Prof. K. Subramaniam *Dec 2019 – Ongoing*
Project: Identification of genetic interaction partners of puf-8 and their role in germ cell development in *C. elegans*

- Shortlisted 800 candidate genes with bioinformatics using a putative motif targeted by *puf-8*
- Performed an RNAi Screen to identify the interaction partners of *puf-8* and *glp-1*, identified 50 non-target genes

Project: Investigation of the role of *plp-1* in transcriptional regulation

- Examined RNA-sequencing data, identified 68 sperm-related genes upregulated in *plp-1* mutants
- Analyzed upstream sequences, 5'UTR and 3'UTR of target genes, identified consensus sequence (100bp) across 33%

Indian Institute of Science (Biosystems Science and Engineering) *Bengaluru, India*
Advisor: Prof. Sandhya S. Visveswariah *May – July 2019*
Project: Characterisation of the effect of copy-number variation of initiator genes on the fitness of *C. rodentium*

- Performed growth studies of copy number variants (CNVs) to determine the CFU/ml used in infection studies
- Monitored fecal CFUs in a 28-day study in 6 mice infected with WT and CNVs to characterize the clearance rate
- Sacrificed mice in 9- day study, mucosa-associated CFU, serum ELISA, histopathology revealed no *in vivo* effects

PUBLICATIONS

1. **Venkatraghavan S*,** Anantakrishnan S*, and Raman K. "PicCASO: A Cellular Automaton for Spatial Organisation." 2020. BioRxiv, https://doi.org/10.1101/2021.02.14.431138.
2. Beal, J,…**Venkatraghavan S** *et al.*, 2021. Comparative analysis of three studies measuring fluorescence from engineered bacterial genetic constructs. PLOS ONE 16, e0252263. https://doi.org/10.1371/journal.pone.0252263
3. Beal, J.,…**Venkatraghavan S** , *et al.,* 2020. Robust estimation of bacterial cell count from optical density. Commun Biol 3, 1–29. https://doi.org/10.1038/s42003-020-01127-5

NOTABLE PROJECTS

International Genetically Engineered Machine (Undergraduate Team) *Jan – Nov 2018*

Project: Engineering a promoter library and codon-optimized reporters validated in *A. Baylyi*

- Characterized library and identified promoter with 80x strength of T5 promoter in GFP reporter studies
- Implemented codon-optimization algorithms, efficacy of codon-optimised reporters was significantly higher than WT
- Headed Interlab Study to standardize GFP fluorescent measurements, co-authored two studies with collaborators

International Genetically Engineered Machine (Team Leader, Undergraduate Team) *Jan – Nov 2019*

Project: Establishing a microbial production platform for the synthesis of camptothecin

- Standardized growth and media conditions, developed transformation protocols for endophytic fungus *F. solani*
- Created a new BioBrick consisting of CaMV-35s promoter-driven GFP and strictosidine synthase
- Designed hygromycin sensitivity assay to characterize the activity of CaMV-35s promoter in our cassette

Analysis of influencers in social media using diffusion as an analogy *Jul – Nov 2019*

- Modeled the spread of information from social media influencers using Fick's law of diffusion
- Proposed effective marketing strategies on frequency of posting, follower size, and influence from model insights

IITM – EBI Modelling Workshop *Jan 2020*

- Selected to participate (1/40) in a national workshop conducted by the EBI BioModels team at IIT Madras
- Manually curated and annotated 6 ODE models (highest in the workshop) using COPASI, uploaded to BioModels

Molecular dynamics simulations of MERS CoV and SARS CoV 2 S2 fusion peptides *Jul – Nov 2020*

- Reproduced RMSD, RMSF & CAD scores from Kandeel et al. (2018) for MERS CoV monomers of 4NJL and 4MOD
- Compared with SARS CoV S2 fusion peptides RMSD and RMSF, this indicated a mechanism for differing transmissivity

Design of DNA nanostructures for the controlled delivery of growth factors for angiogenesis *Jul – Nov 2020*

- Drafted a grant proposal to enable the usage of DNA origami for the controlled delivery of VEGF and PDGF
- Explored DNA origami designs, proposed modifications to existing DNA boxes to enable spatiotemporal control

CONFERENCE POSTERS AND PRESENTATIONS

1. **Venkatraghavan S*,** Anantakrishnan S*, Raman K, 'picCASO: A Cellular Automaton for Spatial Organisation' – *Centre for Integrative Biology and Systems Medicine Symposium (2020)*
2. **Venkatraghavan S*,** Gangadharan S*, Prakash G*, Swaminathan N*, *et al.,* 'Development of Microbial Production Platform for the Synthesis of Campthothecin' – *India-EMBO Symposium (2020)*
3. **Venkatraghavan S*,** Gangadharan S*, Prakash G*, Swaminathan N*, *et al.,* 'Development of Microbial Production Platform for the Synthesis of Campthothecin' – *Bio Wissen SYN-POSIUM (2020)*
4. **Venkatraghavan S*,** Gangadharan S*, Prakash G*, Swaminathan N*, *et al.,* 'Development of Microbial Production Platform for the Synthesis of Campthothecin' – *Giant Jamboree iGEM, Boston, USA (2019)*

CONFERENCE PARTICIPATION

- SDB 79th and 80th Annual Meeting
- SMB Virtual Annual Meeting (2020)
- The Allied Genetics Conference (2020)

SOCIETY MEMBERSHIP

- Society for Developmental Biology (2020,2021)
- Genetics Society of America (2021,2022)

SKILLS

Wetlab	Programming	Software
Molbio techniques, Genetic screens, Immunohistochemistry, Microbiology techniques, Mouse handling, RNAi, Tissue processing, Worm picking, Zebrafish handling	Python, MATLAB, Markdown, HTML, UNIX, C	BLAST, CD-HIT, Clustal W, GROMACS, StarDist, Ilastik, Cellpose, ImageJ/Fiji, Phylip, MegaX, PyMol, VMD

* Denotes equal contribution

TEACHING EXPERIENCE

Indian Institute of Technology Madras
Teaching Assistant for Data Structures and Algorithms (HTTA-funded) *Jul - Nov 2021*
- Designed and graded 6 assignments for 70 students
- Managed an active discussion forum on Piazza

NPTEL Swayam India (Massive Online Open Course)
Teaching Assistant for Biochemistry *Jan - May 2021*
- Designed weekly assignments for 2600+ enrolled students.
- Managed an active discussion forum for students, facilitated doubt clarification.

Teaching Assistant for Introduction to Developmental Biology *Jul – Nov 2020*
- Designed weekly assignments for 2000+ enrolled graduate students
- Managed an active discussion forum for students, facilitated doubt clarification.

SCIENCE OUTREACH

The Language Project *Jan '18 – Nov' 20*
Project by iGEM IITM to develop science material in regional languages
- Created 105 videos, translated to over 30 languages with 50,000+ views and 850+ subscribers.
- Nominated for the 'Best Public Engagement and Education Award' at MIT, Boston, USA (2019).
- Received national media coverage in The Times of India, The New Indian Express, IEEE newsletter
- Conducted well-received gamified synthetic biology sessions for 1000+ high school students

Indian Scientists Respond to COVID-19 *May - Jul 2020*
- Worked with a volunteer run action group to develop science popularisation material for COVID-19.
- Developed 5 guides on best practices for household hygiene and safety, reaching 5000+.
- Set up the Tamil Webpage for all available guides, improving site traffic by 3x**.**

The Fifth Estate *Jan '18 – Nov' 20*
Editor of the Official Media Body of IIT Madras
- Pioneered a popular science column 'Science Deconstructed' with 9 articles, 2500+ average views
- Authored 4 investigative pieces on the experiences of women in STEM (3x average views)
- Demystified the credit system in a review article, garnering the highest ever readership (4400+ views)

Biotech Research Club *Jul '19 - Nov' 20*
- Established the first platform for UG research with biweekly meetings, conducted 12 showcases
- Launched 'Alumni Talk Series' with 15 talks from the industry/academia reaching 750+ students
- Programmed website, curated a blog (8 articles), and authored an essay on diagnostics (500+ views)

DIVERSITY AND INCLUSION

Black Tulip – Women's Forum of IIT Madras *Jul '20 - May' 21*
- Suggested policy reforms to the head of the sexual harassment committee as a panel member
- Organized flagship webinar for aspiring engineers (300+ students), inaugurated by the Director
- Created pan-IIT platforms (500+ members) for incoming students to seek mentorship and guidance
- Spearheaded a social media campaign #ILookLikeAnEngineer to break stereotypes, reached 5000+

Vannam – LGBTQIA+ Alliance of IIT Madras *May - Jul 2021*
- Instituted the first resource group for the LGBTQIA+ community and allies, drafted vision statement.
- Planned events to improve mental health, raise awareness based on a survey of 7 college collectives

Biotech Mentor Programme *Oct – Jul 2021*
- Guided 10 first-year students in a remote semester with course work in mathemathics, chemistry and physics.
- Assisted cohort on time-management, adapting to college life and exploring opportunities in college.