Karthik Raman



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/RamanLab

Born: 1981—Chennai, INDIA
Nationality: Indian

Current Positions

2024– *Professor*, Department of Data Science and AI, Wadhwani School of Data Science and AI, IIT Madras
2025– *Core Leadership*, India's Centre of Excellence in AI for Education—IITM Bodhan AI Foundation
2015– *Co-ordinator*, Centre for Integrative Biology and Systems mEdicine (IBSE), IIT Madras
2020– *Advisor*, International Secretariat, Office of Global Engagement, IIT Madras
2018– *Co-founder & Director*, qBiome Research Private Limited, Chennai

Research Interests

Computational modelling and simulation of biological systems and networks • Microbiome systems biology • Algorithm development for systems biology • *In silico* Metabolic engineering • Design Principles of Biological Networks • Integrated analysis of massive biological datasets • High-performance computing for systems biology • Computational synthetic biology • Network biology • Machine learning for biological big data • Data-driven discovery in biology • AI in Education

Research Skills

Formal education in bio-informatics and computational/systems biology, high-performance computing, data structures and algorithms, computational methods, pattern recognition.
Number of publications: 95, plus posters/talks at scientific meetings.
Fluent in MATLAB, Python, scripting languages such as awk, sed. Working knowledge of C/C++.

Past Positions

2022–24 *Professor*, Department of Biotechnology, Bhupat and Jyoti Mehta School of Biosciences, Indian Institute of Technology (IIT) Madras
2018–22 *Associate Professor*, Department of Biotechnology, Bhupat and Jyoti Mehta School of Biosciences, Indian Institute of Technology (IIT) Madras
2017–24 *Core Faculty*, Robert Bosch Centre for Data Sciences and Artificial Intelligence (RBCDSAI), IIT Madras
2011–18 *Assistant Professor*, Department of Biotechnology, Bhupat and Jyoti Mehta School of Biosciences, Indian Institute of Technology (IIT) Madras
2016 Visiting Research Scientist, Vantage Research, Chennai
Jun–Jul Visiting Research Scientist, Samsung Advanced Institute of Technology (SAIT), Bangalore
2012 Post-doctoral researcher, Andreas Wagner Lab, Department of Biochemistry/Department of Evolution-
Jun–Jul ary Biology and Environmental Studies, University of Zürich, Switzerland
2008–11

Professional Affiliations

2026– International Society for Microbial Ecology, The Netherlands
2026– American Society for Microbiology, USA
2022– Society for Applied Microbiology, UK
2021– The Society of Biological Chemists (SBC), India
2021– Sigma Xi, The Scientific Research Honor Society
2018– Biological Engineering Society of India
2011– International Society for Computational Biology (ISCB), USA
2018 American Institute of Chemical Engineers (AIChE)
2018 Society for Biological Engineering (SBE)

Education

2009 PhD in *Systems Biology*, Supercomputer Education and Research Centre/Bioinformatics Centre, Indian Institute of Science, Bangalore, India
Thesis: Systems-level Modelling and Simulation of *Mycobacterium tuberculosis*: Insights for Drug Discovery PDF
Advisers: Nagasuma Chandra and Saraswathi Vishveshwara
Awarded the *Sir Vithal N. Chandavarkar Memorial Medal* for the best Ph. D. thesis of the year in the Supercomputer Education and Research Centre, Indian Institute of Science
2005 Awarded a transfer to the PhD programme, from an MTech in *Computational Science*, at the Supercomputer Education and Research Centre, Indian Institute of Science, Bangalore, India. Graduate courses GPA: 7.3/8.0.
2003 BTech in Chemical Technology (First class with distinction), Institute of Chemical Technology, University of Mumbai, India

Peer-reviewed Publications

Pre-prints of manuscripts under review

2026 Krithika Subramanian, Chandrika Bhattacharyya, ..., Manikandan Narayanan, **Karthik Raman**, ..., GenomeIndia Consortium, ..., Himanshu Sinha, ..., Divya Tej Sowpati*, Mohammed Faruq*, Bratati Kahali*, Analabha Basu* "An Atlas of Indian Genetic Diversity" *medRxiv* Manuscript preprint: Nature India
2025 Pratyay Sengupta, Vijay Suryakant Kapse, **Karthik Raman*** "Microbial Communities Facilitate Pathogen Persistence in Hospital Environments" *medRxiv* Manuscript preprint:
2025 R Sapna, Harikeshav Karthik, **Karthik Raman*** "Extensive Benchmarking of Community Detection Algorithms" *bioRxiv* Manuscript preprint:
2025 Prem Jagadeesan, **Karthik Raman*** and Arun K. Tangirala* "An improved framework for grey-box identification of biological processes" *bioRxiv* Manuscript preprint:
2024 **Karthik Raman**, Miroslav Kratochvíl, Brett G. Olivier, Matthias König, Pratyay Sengupta, ..., Andreas Dräger, Rahuman S Malik-Sheriff* "FROG Analysis Ensures the Reproducibility of Genome Scale Metabolic Models" *bioRxiv* Manuscript preprint:
2023 Divyang Deep Tiwari, Nils Hoffmann, Kieran Didi, Sumukh Deshpande, Sucheta Ghosh, Tung V. N. Nguyen, **Karthik Raman**, Henning Hermjakob*, Rahuman Sheriff* "BioModelsML: Building a FAIR and reproducible collection of machine learning models in life sciences and medicine for easy reuse" *bioRxiv* Manuscript preprint:

Articles in international journals (95)

2026 Vijaya Yuvaram Singh†, Veerendra P. Gadekar†, Srijith Sasikumar, R. M. Rajeeva Lokshanan, Bharath

Prithiviraj, Himanshu Sinha*, **Karthik Raman*** "Microbial communities on station and train surfaces in Chennai Metro: insights into urban transit microbiome" *mSphere* M42847700 doi The Print

2026 Vijaya Raghavan Rangamaran†, T. J. Sushmitha†, Shradha Sharma, Gajendra Joshi, Raja Subramaniyan, Anna Tumeo, Harini V., Debarata Raul, Subbaiah Priya, Anandi Muruganantham, Georgios Miliotis, Dilip Kumar Jha, Balaji Ramakrishnan, **Karthik Raman**, Dharani Gopal*, and Kasthuri Venkateswaran*. "Integrative metagenomics and cultivation reveal host- and environment-driven structuring of coral microbiomes in the Andaman Sea" *Environmental Microbiome* doi

2026 Pranathi Ravikumar, Aarti Ravindran, **Karthik Raman*** "Deciphering Global Patterns of Marine Microbial Community Assembly and Network Stability" *mSystems* doi The Print NDTV Education DT Next

2026 Shayantan Banerjee, Vijay K. Tiwari, **Karthik Raman***, Mohammad Inayatullah* "Tumor-Infiltrating Lymphocytes Display Prognostic Signatures Associated with Chemotherapy Response in TNBC Patients" *iScience* M42291245 doi

2026 Debomita Chakraborty, Raghunathan Rengaswamy* and **Karthik Raman*** "UNFOLDing Robustness, Plasticity, Evolvability and Canalisation of Biological Function" *PLoS Computational Biology* **22**:e1014289 M42207798 doi

2026 Divya Dharshini Uma Shankar, Sarayu Murali, Shagun Shagun, Shyam Kumar Masakapalli, **Karthik Raman**, Smita Srivastava* "Genome-scale metabolic model guided metabolic flux analysis in the endophyte *Alternaria burnsii* NCIM1409" *Bioprocess and Biosystems Engineering* Manuscript preprint: Rχ M42118261 doi

2026 Moirangthem Sailash Singh*, Priyan Bhattacharya and **Karthik Raman** "Network hypermotifs in biological systems: structure, dynamics, and functional implications" *npj Systems Biology and Applications* M41986385 doi

2026 Samyuktha Srinivasan, **Karthik Raman***, Smita Srivastava* "Investigating the impact of carbamazepine on tomato plant metabolism using genome-scale metabolic modelling" *Scientific Reports* **16**:12801 M41803292 doi

2026 Anna Tumeo, Georgios Miliotis*, Andy O'Connor, Varsha Vijayakumar, Pratyay Sengupta, Francesca McDonagh, Aneta Kovarova, Christina Clarke, Brigid Hooban, Nitin Kumar Singh, Alexandre Soares Rosado, **Karthik Raman***, Kasthuri Venkateswaran* "Plasmidome, resistome, and virulence-associated genes characterization of Acinetobacter johnsonii in NASA cleanrooms and a clinical setting" *Microbiology Spectrum* M41869816 doi

2026 Prem Jagadeesan, **Karthik Raman*** and Arun K. Tangirala* "A generalized Bayesian framework for maximizing information gain and model selection" *PLoS Complex Systems* **3**:e0000082 doi

2025 Julia M. Kelliher*, Chloe Mirzayi, ..., **STREAMS Consortium** and Emiley A. Eloe-Fadrosh* "STREAMS guidelines: standards for technical reporting in environmental and host-associated microbiome studies" *Nature Microbiology* **10**:3059–3068 M41326814 doi phys.org

2025 Vikas Kumar†, Shradha Sharma†, Kaomud Tyagi, Barathi Lenin, Aarti Ravindran, **Karthik Raman***, Inderjeet Tyagi* "Metagenomic Profiling of Municipal Drinking Water Microbiomes in an Indian City: Insights into Diversity, Water Quality, and AMR Potential" *Journal of Environmental Chemical Engineering* **13**:119959 Manuscript preprint: Rχ doi Millennium Post The Times of India The Print The Economic Times Nature India

2025 Abhor Gupta*, Barathi Lenin, Sean Current, Rohit Batra, Balaraman Ravindran, **Karthik Raman***, Srinivasan Parthasarthy* "PURE: Policy-guided Unbiased REpresentations for structure-constrained molecular generation" *Journal of Cheminformatics* **17**:156 M41088416 doi PTI The Economic Times NDTV The Week BioSpectrum BW Healthcare World Gene Online Dinamalar The Times of India New Indian Express The Hindu DT Next News 18 The Economic Times - Pharma Digital Health News MSN The New Indian Express - EdexLive WSAI, IIT Madras

2025 Shradha Sharma, Hari Priya Narahari, **Karthik Raman*** "Harnessing machine learning for metagenomic data analysis: trends and applications" *mSystems* **10**:e01642-24 M41055333 doi

2025 Sharifah Altalhi, Júnia Schultz, Tahira Jamil, Isabel Diercks, Shradha Sharma, Jörg Follmann, Intikhab Alam, **Karthik Raman**, Nico Augustin, Froukje M. van der Zwan and Alexandre Soares Rosado* "Decoding microbial diversity, biogeochemical functions, and interaction potentials in red sea hydrothermal vents" *Environmental Microbiome* **20**:118 M41024198 doi phys.org

2025 Venkatesh Kamaraj, Ayam Gupta, **Karthik Raman***, Manikandan Narayanan*, Himanshu Sinha* "GViNC:

an innovative framework for genome graph comparison reveals hidden patterns in the genetic diversity of human populations" *Nucleic Acids Research: Genomics and Bioinformatics* **7**:lqaf121 M40918067 doi

2025 Shuvechha Chakraborty, Indumathi Palanikumar, Yash Gune, K.V. Venkatesh, **Karthik Raman***, Susan Idicula-Thomas* "An integrated systems biology approach establishes arginine biosynthesis as a metabolic weakness in *Candida albicans* during host infection" *Cell Communication and Signaling* **23**:362 M40759957 doi The Hindu BusinessLine The Indian Express News Arena India India Today Dinamalar

2025 Lavanya Raajaraam and **Karthik Raman*** "COSMOS: COmmunity and Single Microbe Optimisation System" *npj Systems Biology and Applications* **11**:51 M40399328 doi The Hindu BusinessLine

2025 Júnia Schultz, Tahira Jamil, Pratyay Sengupta, Shobhan Karthick Muthamilselvi Sivabalan, Anamika Rawat, Niketan Patel, Srinivasan Krishnamurthy, Intikhab Alam, Nitin Kumar Singh, **Karthik Raman**, Alexandre Soares Rosado*, Kasthuri Venkateswaran* "Functional Insights into Novel Extremophilic Bacteria Isolated from the NASA Phoenix Mission Spacecraft Assembly Cleanrooms" *Microbiome* **13**:117 M40350519 doi The Microbiologist phys.org MSN Nature India

2025 Chandrika Bhattacharya, ..., Himanshu Sinha, Manikandan Narayanan, **Karthik Raman**, Raghu Padinjat, Radhakrishnan Sabarinathan, GenomeIndia Consortium, Yadati Narahari, Vijayalakshmi Ravindranath, Kumarasamy Thangaraj, Divya Tej Sowpati, Mohammed Faruq, Analabha Basu, Bratati Kahali "Mapping genetic diversity with the GenomeIndia project" *Nature Genetics* **57**:767–773 M40200122 doi The Hindu Deccan Herald

2025 **Karthik Raman*** , Rukmini Kumar , Cynthia J. Musante , Subha Madhavan "Integrating Model-Informed Drug Development With AI: A Synergistic Approach to Accelerating Pharmaceutical Innovation" *Clinical and Translational Science* **18**:e70124 M39797502 doi

2025 Asif Hameed, Francesca McDonagh, Pratyay Sengupta, Georgios Miliotis, Shobhan Karthick Muthamilselvi Sivabalan, Lukasz Szydlowski, Anna Simpson, Nitin Kumar Singh, Punchappady Devasya Rekha, **Karthik Raman***, Kasthuri Venkateswaran* "*Neobacillus driksii* sp. nov. isolated from a Mars 2020 spacecraft assembly facility and genomic potential for lasso peptide production in *Neobacillus*" *Microbiology Spectrum* **13**:e01376-24 M39611829 doi Nature India

2024 Sowmya Manojna Narasimha†, Tanisha Malpani†, Omkar S. Mohite, J. Saketha Nath, **Karthik Raman*** "Understanding flux switching in metabolic networks through an analysis of synthetic lethals" *npj Systems Biology and Applications* **10**:104 M39289347 doi

2024 Lavanya Raajaraam and **Karthik Raman*** "Modeling Microbial Communities: Perspective and Challenges" *ACS Synthetic Biology* **13**:2260–2270 M39148432 doi

2024 Indumathi Palanikumar, Himanshu Sinha, **Karthik Raman*** "Panera: A novel framework for surmounting uncertainty in microbial community modelling using Pan-genera metabolic models" *iScience* **27**:110358 M39092173 doi

2024 Priyan Bhattacharya, **Karthik Raman*** and Arun K. Tangirala* "Design Principles for Perfect Adaptation in Biological Networks with Nonlinear Dynamics" *Bulletin of Mathematical Biology* **86**:100 Manuscript preprint: Rχ M38958824 doi

2024 Aswathy Raghu, Indumathi Palanikumar and **Karthik Raman*** "Designing function-specific minimal microbiomes from large microbial communities" *npj Systems Biology and Applications* **10**:46 M38702322 doi Nature India

2024 Pratyay Sengupta†, Shobhan Karthick Muthamilselvi Sivabalan†, Nitin Kumar Singh, **Karthik Raman*** and Kasthuri Venkateswaran* "Genomic, Functional, and Metabolic Enhancements in Multidrug-Resistant *Enterobacter bugandensis* Facilitating its Persistence and Succession in the International Space Station" *Microbiome* **12**:62 M38521963 doi Research Square Business Standard The Hindu The Indian Express Mashable The Print Business World Happiest Health The Times of India Puthiya Thalaimurai

2024 Georgios Miliotis, Pratyay Sengupta, Asif Hameed, Maria Chuvochina, Francesca McDonagh, Anna Simpson, Ceth Parker, Nitin Singh, Punchappady Rekha, Dearbháile Morris, **Karthik Raman**, Nikos Kyrpides, Philip Hugenholz, and Kasthuri Venkateswaran "Novel spore-forming species exhibiting intrinsic resistance to third- and fourth-generation cephalosporins and description of *Tigheibacillus jepli* gen. nov., sp. nov." *mBio* **15**:e00181-24 M38477597 doi

2023 Anna C. Simpson†, Pratyay Sengupta†, Flora Zhang, Asif Hameed, Ceth W. Parker, Nitin K. Singh, Georgios Miliotis, Punchappady D. Rekha, **Karthik Raman**, Christopher E. Mason* and Kasthuri Venkateswaran* "Phylogenomics, phenotypic, and functional traits of five novel (Earth-derived) bacterial

species isolated from the International Space Station and their prevalence in metagenomes" *Scientific Reports* **13**:19207 M37932283 doi

2023 Ludwig Geistlinger, Chloe Mirzayi, Fatima Zohra, Rimsha Azhar, Shaimaa Elsafoury, Clare Grieve, Jennifer Wokaty, Samuel David Gamboa-Tuz, Pratyay Sengupta, Issac Hecht, Aarthi Ravikrishnan, Rafael S. Gonçalves, Eric Franzosa, **Karthik Raman**, Vincent Carey, Jennifer B. Dowd, Heidi E. Jones, Sean Davis, Nicola Segata, Curtis Huttenhower and Levi Waldron* "BugSigDB captures patterns of differential abundance across a broad range of host-associated microbial signatures" *Nature Biotechnology* **42**:709–804 Manuscript preprint: Rx M37697152 doi

2023 Sarayu Murali, Maziya Ibrahim, Hemalatha Rajendran, Shagun Shagun, Shyam Kumar Masakapalli, **Karthik Raman** and Smita Srivastava* "Genome-scale metabolic model led engineering of *Nothapodytes nimmoniana* plant cells for high camptothecin production" *Frontiers in Plant Science* **14**:1207218 M37600193 doi Edex Live Express Healthcare BioSpectrum India ETV Bharat Economic Times Healthworld.com The Telegraph The Times of India The Hindu

2023 Dinesh Kumar Kuppa Baskaran, Shreyansh Umale, Zhichao Zhou, **Karthik Raman***, Karthik Anantharaman* "Metagenome-based metabolic modelling predicts unique microbial interactions in deep-sea hydrothermal plume microbiomes" *ISME Communications* **3**:42 M37120693 doi

2023 Pratyay Sengupta, Shobhan Karthick Muthamilselvi Sivabalan, Amrita Mahesh, Indumathi Palanikumar, Dinesh Kumar Kuppa Baskaran and **Karthik Raman*** "Big Data for a Small World: A Review on Databases and Resources for Studying Microbiomes" *Journal of the Indian Institute of Science* **103**:891–907 M37362854 doi

2023 Prem Jagadeesan, **Karthik Raman*** and Arun K. Tangirala* "Sloppiness: fundamental study, new formalism and its application in model assessment" *PLoS ONE* **18**:e0282609–108984 M37490468 doi

2023 Priyan Bhattacharya, **Karthik Raman*** and Arun K. Tangirala* "On biological networks capable of robust adaptation in the presence of uncertainties: A linear systems-theoretic approach" *Mathematical Biosciences* **358**:108984 Manuscript preprint: Rx M36804384 doi

2022 Prem Jagadeesan, **Karthik Raman*** and Arun K. Tangirala* "Bayesian Optimal Experiment Design for Sloppy Systems" *IFAC-PapersOnLine* **55**:121–126 doi

2022 Sankalpa Venkatraghavan†, Sathvik Anantakrishnan† and **Karthik Raman*** "Probing patterning in microbial consortia with a cellular automaton for spatial organisation" *Scientific Reports* **12**:17159 M36229548 doi

2022 Anjana Anilkumar Sithara, Devi Priyanka Maripuri, Keerthika Moorthy, Sai Sruthi Amirtha Ganesh, Philge Philip, Shayantan Banerjee, Malvika Sudhakar and **Karthik Raman*** "iCOMIC: a graphical interface-driven bioinformatics pipeline for analyzing cancer omics data" *Nucleic Acids Research: Genomics and Bioinformatics* **3**:lqac053 M35899080 doi

2022 Priyan Bhattacharya, **Karthik Raman*** and Arun K. Tangirala* "Discovering design principles for biological functionalities: perspectives from systems biology" *Journal of Biosciences* **47**:56 M36222149 doi

2022 Sai Saranga Das and **Karthik Raman** "Effect of Dormant Spare Capacity on the Attack Tolerance of Complex Networks" *Physica A* **598**:127419 Manuscript preprint: doi Live Mint The Hindu BusinessLine Hindustan Times The Print Deccan Herald

2022 Rachita K Kumar, Nitin Singh, Sanjaay Balakrishnan, Ceth W. Parker, **Karthik Raman*** and Kasthuri Venkateswaran* "Metabolic modeling of the International Space Station microbiome reveals key microbial interactions" *Microbiome* **10**:102 M35791019 doi IIT Madras Shaastra Magazine The Hindu BusinessLine The Print Telegraph India Press Information Bureau, Government of India 18 Press Information Bureau, Government of India NDTV Education Gadgets 360 Edex Live New Indian Express Amar Ujala Dina Malar The Times of India The Hindu Dinakaran Hindustan Times BioSpectrum India Express Healthcare Prasar Bharati News Services

2022 Malvika Sudhakar, Raghunathan Rengaswamy* and **Karthik Raman*** "Multi-Omic Data Improve Prediction of Personalized Tumor Suppressors and Oncogenes" *Frontiers in Genetics* **13**:854190 M35620468 doi Analytics India Magazine The Hindu The Print Analytics India Magazine The Indian Express Financial Express Prasar Bharati News Services Nature India

2022 Debomita Chakraborty, Raghunathan Rengaswamy and **Karthik Raman*** "Designing biological circuits: from principles to applications" *ACS Synthetic Biology* **11**:1377–1388 Manuscript preprint: M35320676 doi

2022 Priyan Bhattacharya, **Karthik Raman*** and Arun K. Tangirala* "Discovering adaptation-capable biological network structures using control-theoretic approaches" *PLoS Computational Biology* **18**:e1009769 35061660 doi

2022 Malvika Sudhakar, Raghunathan Rengaswamy* and **Karthik Raman*** "Novel ratio-metric features enable the identification of new driver genes across cancer types" *Scientific Reports* **12**:5 34997044 doi

2022 Lavanya Raajaraam and **Karthik Raman*** "A computational framework to identify metabolic engineering strategies for the co-production of metabolites" *Frontiers in Bioengineering and Biotechnology* **9**:779405 35071202 doi

2021 Maziya Ibrahim and **Karthik Raman*** "Two-species community design of Lactic Acid Bacteria for optimal production of Lactate" *Computational and Structural Biotechnology Journal* **19**:6039–6049 34849207 doi
The Hindu BusinessLine

2021 Attila Gabor†, Marco Tognetti†, Alice Driessen, Jovan Tanevski, Baosen Guo, Wencai Cao, He Shen, Thomas Yu, Verena Chung, **Single Cell Signaling in Breast Cancer DREAM Consortium members**, Bernd Bodenmiller* and Julio Saez-Rodriguez* "Cell-to-cell and type-to-type heterogeneity of signaling networks: insights from the crowd" *Molecular Systems Biology* **17**:e10402 34661974 doi

2021 Vimaladhasan Senthamizhan, Balaraman Ravindran and **Karthik Raman*** "NetGenes: A database of essential genes predicted using features from interaction networks" *Frontiers in Genetics* **12**:722198 34630517 doi

2021 Maziya Ibrahim†, Lavanya Raajaraam† and **Karthik Raman*** "Modelling microbial communities: harnessing consortia for biotechnological applications" *Computational and Structural Biotechnology Journal* **19**:3892–3907 34584635 doi

2021 Sahana Gangadharan and **Karthik Raman*** "The art of molecular computing: whence and whither" *BioEssays* **43**:202100051 Manuscript preprint: 34101866 doi

2021 Shayantan Banerjee, **Karthik Raman*** and Balaraman Ravindran* "Sequence neighborhoods enable reliable prediction of pathogenic mutations in cancer genomes" *Cancers* **13**:2366 34068918 doi Times Now Deccan Herald Business Standard Economic Times The Daily Guardian The Hindu IIT Madras Shaastra Magazine The Hindu

2020 Sarah M. Keating*, Dagmar Waltemath*, …, **Karthik Raman**, …, Henning Hermjakob, John C. Doyle, Michael Hucka*, and SBML Community members "SBML Level 3: an extensible format for the exchange and reuse of biological models" *Molecular Systems Biology* **16**:e91110 32845085 doi

2020 Prem Jagadeesan, **Karthik Raman** and Arun K. Tangirala* "A new index for information gain in the Bayesian framework" *IFAC-PapersOnLine* **53**:634–639 doi

2020 Ulf Liebal*, Thuy An Phan Nguyen, Malvika Sudhakar, **Karthik Raman** and Lars M. Blank "Machine learning applications for mass spectrometry-based metabolomics" *Metabolites* **10**:243 32545768 doi

2020 Kern Rei Chng, Tarini Shankar Ghosh, Yi Han Tan, Tannistha Nandi, Ivor Russel Lee, Amanda Hui Qi Ng, Chenhao Li, Aarthi Ravikrishnan, Kar Mun Lim, David Lye, Timothy Barkham, **Karthik Raman**, Swaine Chen, Louis Chai, Barnaby Young*, Yunn-Hwen Gan* and Niranjan Nagarajan* "Metagenome-wide association analysis identifies microbial determinants of post-antibiotic ecological recovery in the gut" *Nature Ecology and Evolution* **4**:1256–1267 32632261 doi The Hindu BusinessLine

2020 Kuldeep Sachdeva, Manisha Goel, Malvika Sudhakar, Mansi Mehta, Rajmani Raju, **Karthik Raman**, Amit Singh and Varadharajan Sundaramurthy* "*Mycobacterium tuberculosis* (*Mtb*) lipid–mediated lysosomal rewiring in infected macrophages modulates intracellular *Mtb* trafficking and survival" *Journal of Biological Chemistry* **295**:9192–9210 32424041 doi

2020 Gayathri Sambamoorthy and **Karthik Raman*** "MinReact: a systematic approach for identifying minimal metabolic networks" *Bioinformatics* **36**:4309–4315 32407533 doi

2020 Aarthi Ravikrishnan, Lars M. Blank, Smita Srivastava and **Karthik Raman** "Investigating metabolic interactions in a microbial co-culture through integrated modelling and experiments" *Computational and Structural Biotechnology Journal* **18**:1249–1258 32551031 doi Vigyan Prasar

2019 Devika N T and **Karthik Raman*** "Deciphering the metabolic capabilities of Bifidobacteria using genome-scale metabolic models" *Scientific Reports* **9**:18222 31796826 doi The Scientist The Hindu

2019 Sarvenaz Choobdar, …, **The DREAM Module Identification Challenge Consortium**, …, Sven Bergmann*, Daniel Marbach* "Open Community Challenge Reveals Molecular Network Modules with Key Roles in Diseases" *Nature Methods* **16**:843 31471613 doi

2019 Aparajitha Srinivasan, Vijayakumar S, **Karthik Raman** and Smita Srivastava* "Rational engineering of vitamin E metabolism for enhanced alpha-tocopherol production in *Helianthus annuus* cell culture" *Biochemical Engineering Journal* **151**:107256 Hindustan Times Indian Express

2019 Abinaya Badri, **Karthik Raman*** and Guhan Jayaraman* "Uncovering Novel Pathways for Enhancing Hyaluronan Synthesis in Recombinant *Lactococcus lactis*: Genome-Scale Metabolic Modeling and Experimental Validation" *Processes* **7**:343

2019 Beethika Tripathi, Srinivasan Parthasarathy, Himanshu Sinha, **Karthik Raman** and Balaraman Ravindran* "Adapting Community Detection Algorithms for Disease Module Identification in Heterogeneous Biological Networks" *Frontiers in Genetics* **10**:164 30918511 Business World Education The Times of India: Education Times BioSpectrum India

2019 Gayathri Sambamoorthy, Himanshu Sinha* and **Karthik Raman*** "Evolutionary Design Principles in Metabolism" *Proc Biol Sci* **286**:20190098 30836874

2019 Swagatika Sahoo*, Ranjith Kumar R, Brandon Nicolay, Omkar Mohite, Karthikeyan Sivaraman, Vikas Khetan, Pukhraj Rishi, Suganeswari Ganesan, Subramanian Krishnakumar, **Karthik Raman**, Wayne Miles and Sailaja V Elchuri* "Metabolite systems profiling identifies exploitable weaknesses in retinoblastoma" *FEBS Letters* **593**:23–41 30417337 The Hindu India Education Diary

2018 Karthik Azhagesan, Balaraman Ravindran* and **Karthik Raman*** "Network-based Features Enable Prediction of Essential Genes Across Diverse Organisms" *PLoS ONE* **13**:e0208722 30543651

2018 Gayathri Sambamoorthy and **Karthik Raman*** "Understanding the evolution of functional redundancy in metabolic networks" *Bioinformatics* **34**:i981–i987 30423058

2018 Aarthi Ravikrishnan, Meghana Nasre and **Karthik Raman*** "Enumerating all possible biosynthetic pathways in metabolic networks" *Scientific Reports* **8**:9932 29967471

2018 Priyan Bhattacharya, **Karthik Raman** and Arun K. Tangirala* "A systems-theoretic approach towards designing biological networks for perfect adaptation" *IFAC-PapersOnLine* **51**:307–312

2017 Aravind Sankar, Sayan Ranu* and **Karthik Raman*** "Predicting Novel Metabolic Pathways through Subgraph Mining" *Bioinformatics* **33**:3955–3963 28961716 The Hindu BusinessLine

2017 Purva Bhatter, **Karthik Raman***, and Vani Janakiraman* "Elucidating the biosynthetic pathways of volatile organic compounds in *Mycobacterium tuberculosis* through a computational approach" *Molecular BioSystems* **13**:750–755 28225105

2017 Nandakumar Rajasekaran, Swaathiratna Suresh, Soundhararajan Gopi, **Karthik Raman**, and Athi N. Naganathan* "A General Mechanism for the Propagation of Mutational Effects in Proteins" *Biochemistry* **56**:294–305 27958720

2015 Aditya Pratapa, Shankar Balachandran and **Karthik Raman*** "FAST-SL: An efficient algorithm to identify synthetic lethal sets in metabolic networks" *Bioinformatics* **31**:3299–3305 26085504

2015 Aarthi Ravikrishnan and **Karthik Raman*** "Critical Assessment of Genome-Scale Metabolic Networks: The Need for a Unified Standard" *Briefings in Bioinformatics* **16**:1057–1068 25725218

2014 Raghavendran Partha and **Karthik Raman*** "Revisiting robustness and evolvability: evolution in weighted genotype spaces" *PLoS ONE* **9**:e112792 25390641

2014 **Karthik Raman***, Nandita Damaraju and Govind Krishna Joshi "The organisational structure of protein networks: revisiting the centrality–lethality hypothesis" *Systems and Synthetic Biology* **8**:73–81 24592293

2013 Anuja Kulkarni, Laxmi Ananthanarayanan* and **Karthik Raman** "Identification of putative and cross-reactive chickpea (*Cicer arietinum*) allergens through an *in silico* approach" *Computational Biology & Chemistry* **47**:149–155 24099701

2011 **Karthik Raman** and Andreas Wagner "Evolvability and robustness in a complex signalling circuit" *Molecular BioSystems* **7**:1081–1092 21225054

2011 **Karthik Raman** and Andreas Wagner "The evolvability of programmable hardware" *Journal of the Royal Society Interface* **8**:269–281 20534598

2010 **Karthik Raman**, Ashwini Gurudas Bhat and Nagasuma Chandra "A systems perspective of host–pathogen interactions: prediction of tuberculosis disease outcome" *Molecular BioSystems* **6**:516–530 20174680

2010 **Karthik Raman*** "Construction and analysis of protein–protein interaction networks" *Automated Experimentation* **2**:2 20334628

2010 **Karthik Raman** and Nagasuma Chandra "Systems Biology" *Resonance* **15**:131–153

2009 **Karthik Raman**, Rohit Vashisht and Nagasuma Chandra "Strategies for efficient disruption of metabolism in *Mycobacterium tuberculosis* from network analysis" *Molecular BioSystems* **5**:1740–1751 M19593474 doi

2009 **Karthik Raman** and Nagasuma Chandra "Flux balance analysis of biological systems: applications and challenges" *Briefings in Bioinformatics* **10**:435–449 M19287049 doi

2008 **Karthik Raman**, Yeturu Kalidas and Nagasuma Chandra "targetTB: A target identification pipeline for *Mycobacterium tuberculosis* through an interactome, reactome and genome-scale structural analysis" *BMC Systems Biology* **2**:109 M19099550 doi

2008 **Karthik Raman** and Nagasuma Chandra "*Mycobacterium tuberculosis* interactome analysis unravels potential pathways to drug resistance" *BMC Microbiology* **8**:234 M19105810 doi

2007 Ketki Verkhedkar, **Karthik Raman**, Nagasuma Chandra and Saraswathi Vishveshwara "Metabolome based reaction graphs of *M. tuberculosis* and *M. leprae*: A comparative network analysis" *PLoS ONE* **2**:e881 M17849010 doi

2007 **Karthik Raman**, Preethi Rajagopalan and Nagasuma Chandra "Hallmarks of Mycolic Acid Biosynthesis: A Comparative Genomics Study" *Proteins: Structure, Function and Bioinformatics* **69**:358 M17600834 doi

2005 **Karthik Raman**, Preethi Rajagopalan and Nagasuma Chandra "Flux Balance Analysis of *Mycobacterium tuberculosis*: targets for anti-tubercular drugs" *PLoS Computational Biology* **1**:e46 M16261191 doi

Books and Monographs (2)

2021 **Karthik Raman** "An Introduction to Computational Systems Biology: Systems-Level Modelling of Cellular Networks" CRC Press/Taylor & Francis, Boca Raton ISBN 978-1138597327

2018 Aarthi Ravikrishnan and **Karthik Raman** "Systems-Level Modelling of Microbial Communities: Theory and Practice" CRC Press/Taylor & Francis, Boca Raton ISBN 978-1138596719

Edited Books (3)

2026 **Karthik Raman** and Gayathri Sambamoorthy "*Modelling the Microbiome*" Springer Verlag (London) ISBN 978-1-0716-5079-0

2014 Vishwesh Kulkarni, Guy-Bart Stan and **Karthik Raman** "*A Systems Theoretic Approach to Systems and Synthetic Biology I: Models and System Characterizations*" Springer Verlag (London) ISBN 978-9401790406

2014 Vishwesh Kulkarni, Guy-Bart Stan and **Karthik Raman** "*A Systems Theoretic Approach to Systems and Synthetic Biology II: Analysis and Design of Cellular Systems*" Springer Verlag (London) ISBN 978-9401790468

Book chapters (9)

2026 Debomita Chakraborty, Raghunathan Rengaswamy* and **Karthik Raman*** "Design Space Exploration of Genetic Circuits Using the UNFOLD Framework" *Methods Mol Biol* **3083**:69–83 M42961739 doi

2026 Maziya Ibrahim and **Karthik Raman*** "Constraint-Based Modeling of Microbial Communities for Metabolite Production" *Methods Mol Biol* **3006**:221–231 M42156657 doi

2026 Pratyay Sengupta, Sandhya Vasudevan and **Karthik Raman*** "Evaluating Metabolic Support in Pairwise Microbial Communities Using MetQuest" *Methods Mol Biol* **3006**:175–190 M42156655 doi

2024 Priyan Bhattacharya, **Karthik Raman*** and Arun Tangirala "Design Principles for Biological Adaptation: A Systems and Control-Theoretic Treatment" *Methods Mol Biol* **2760**:35–56 M38468081 doi

2021 Priyan Bhattacharya, **Karthik Raman*** and Arun Tangirala "Systems-theoretic approaches to design biological networks with desired functionalities" *Methods Mol Biol* **2189**:133–135 M33180299 doi

2018 **Karthik Raman***, Aditya Pratapa, Omkar Mohite and Shankar Balachandran "Computational Prediction of Synthetic Lethals in Genome-Scale Metabolic Models Using Fast-SL" *Methods Mol Biol* **1716**:315–336 M29222760 doi

2017 Abinaya Badri, Aparajitha Srinivasan and **Karthik Raman*** "In *Silico* Approaches to Metabolic Engineering" *In*: P. Gunasekaran, S. Noronha and A. Pandey (editors), *Current Developments in Biotechnology and Bioengineering*, Elsevier ISBN 978-0444636676 doi

2011 **Karthik Raman** and Nagasuma Chandra "Systems Biology of Tuberculosis: Insights for drug discovery" *In*: W. Dubitzky, J. Southgate and H. Fuss (editors), *Understanding the Dynamics of Biological Systems:*

Lessons Learned from Integrative Systems Biology, Springer ISBN 978-1441979636

2007 **Karthik Raman**, Yeturu Kalidas and Nagasuma Chandra "Model Driven Drug Discovery: Principles and Practices", *In*: J. Chen, A. S. Sidhu (editors), *Biological Database Modeling*, Artech House ISBN 978-1596932586

Perspectives and Editorials (3)

2026 Rahuman S. Malik-Sheriff*, **Karthik Raman**, Maria Zimmermann-Kogadeeva, Blerta Shtylla, Henning Hermjakob, Liesbet Geris, Hiroki Asari "BioModels Model of the Year 2024" *Frontiers in Systems Biology*

2021 **Karthik Raman**, Himanshu Sinha, Claudia E Vickers and Pablo Ivan Nikel "Synthetic biology beyond borders" *Microbial Biotechnology* **14**:2254–2256 34792854

2019 **Karthik Raman**, A Kalyanaraman "Special issue on theory and application of network algorithms in biology" *Int J Adv Eng Sci Appl Math* **11**:89–90

Software Tools

2025 Debomita Chakraborty, Raghunathan Rengaswamy* and **Karthik Raman*** "UNFOLDing Robustness, Plasticity, Evolvability and Canalisation of Biological Function" Software available from /RamanLab/UNFOLD-Framework/

2024 Karthik Raman, Miroslav Kratochvíl, Brett G. Olivier, Matthias König, Pratyay Sengupta, ..., Andreas Dräger, Rahuman S Malik-Sheriff* "FROG Analysis Ensures the Reproducibility of Genome Scale Metabolic Models" Software available from /RamanLab/fbc_curation_matlab/

2025 Abhor Gupta*, Barathi Lenin, Sean Current, Rohit Batra, Balaraman Ravindran, Karthik Raman*, Srinivasan Parthasarthy* "PURE: Policy-guided Unbiased REpresentations for structure-constrained molecular generation" Software available from /WSAI-IITM/ReactionRL/

2025 Venkatesh Kamaraj, Ayam Gupta, **Karthik Raman***, Manikandan Narayanan*, Himanshu Sinha* "GViNC: an innovative framework for genome graph comparison reveals hidden patterns in the genetic diversity of human populations " Software available from /IBSE-IITM/GViNC/

2025 Lavanya Raajaraam and **Karthik Raman*** "COSMOS: COmmunity and Single Microbe Optimisation System" Software available from /RamanLab/COSMOS/

2024 Sowmya Manojna Narasimha†, Tanisha Malpani†, Omkar S. Mohite, J. Saketha Nath, **Karthik Raman*** "Understanding flux switching in metabolic networks through an analysis of synthetic lethals" Software available from /RamanLab/minRerouting/

2024 Indumathi Palanikumar, Himanshu Sinha, **Karthik Raman*** "Panera: A novel framework for surmounting uncertainty in microbial community modelling using Pan-genera metabolic models" Software available from /RamanLab/Panera/

2024 Aswathy Raghu, Indumathi Palanikumar and **Karthik Raman*** "Designing function-specific minimal microbiomes from large microbial communities" Software available from /RamanLab/minMicrobiome/

2021 Sankalpa Venkatraghavan†, Sathvik Anantakrishnan† and **Karthik Raman*** "Probing Patterning in Microbial Consortia with picCASO: a Cellular Automaton for Spatial Organisation" Software available from /RamanLab/picCASO/

2022 Malvika Sudhakar, Raghunathan Rengaswamy* and **Karthik Raman*** "Multi-omic data helps improve prediction of personalised tumor suppressors and oncogenes" Software available from /RamanLab/PIVOT/

2021 Anjana Anilkumar Sithara, Devi Priyanka Maripuri, Keerthika Moorthy, Sai Sruthi Amirtha Ganesh, Philge Philip, Shayantan Banerjee, Malvika Sudhakar and **Karthik Raman*** "iCOMIC: a graphical interface-driven bioinformatics pipeline for analyzing cancer omics data" Software available from /RamanLab/iCOMIC/

2022 Malvika Sudhakar, Raghunathan Rengaswamy* and **Karthik Raman*** "Novel ratio-metric features enable the identification of new driver genes across cancer types" Software available from /RamanLab/cTaG/

2022 Lavanya Raajaraam and **Karthik Raman*** "A computational framework to identify metabolic engineer-

ing strategies for the co-production of metabolites" Software available from /RamanLab/coFSEOF/

2021 Maziya Ibrahim and **Karthik Raman*** "Two-species community design of Lactic Acid Bacteria for optimal production of Lactate" Software available from /RamanLab/CAMP/

2020 Gayathri Sambamoorthy and **Karthik Raman*** "MinReact: an efficient algorithm for identifying minimal metabolic networks" Software available from /RamanLab/MinReact/

2018 Aarthi Ravikrishnan, Meghana Nasre and **Karthik Raman*** "MetQuest: A tool for enumerating all possible biosynthetic pathways in metabolic networks" Software available from /RamanLab/MetQuest/

2017 Aravind Sankar, Sayan Ranu* and **Karthik Raman*** "ReactionMiner: Predicting Novel Metabolic Pathways through Subgraph Mining" Software available from /RamanLab/ReactionMiner/

2015 Aditya Pratapa, Shankar Balachandran and **Karthik Raman*** "Fast-SL: An efficient algorithm to identify synthetic lethal sets in metabolic networks" Software available from /RamanLab/FastSL/

2008 **Karthik Raman** and Nagasuma Chandra "PathwayAnalyser: A systems biology tool for flux analysis of metabolic pathways" Software available from /karthikraman/PathwayAnalyser/

Conference Presentations, Invited Talks & Posters

International Conferences (selected, *denotes presenting author)

2022 Dinesh Kumar Kuppa Baskaran* and **Karthik Raman** "A protocol for studying metabolic interactions in a microbial community using graph-based approaches" at the *30th Annual International Conference on Intelligent Systems for Molecular Biology (ISMB)*, Madison, USA, (In-person)

2022 Aswathy Raghu* and **Karthik Raman** "A constraint-based method to identify function-specific minimal microbiomes from large microbial communities" at the *30th Annual International Conference on Intelligent Systems for Molecular Biology (ISMB)*, Madison, USA, (In-person)

2019 Rachita Kumar* and **Karthik Raman** "Systems Modelling of the Skin Microbiome" at the *2nd International Conference on Microbiome Engineering (ICME)*, Boston, USA, (In-person)

2017 Aravind Sankar, Sayan Ranu and **Karthik Raman*** "Predicting Novel Metabolic Pathways through Subgraph Mining" at the *NetBIO COSI, 25th Annual International Conference on Intelligent Systems for Molecular Biology (ISMB)/16th European Conference on Computational Biology (ECCB)*, Prague, Czech Republic

2014 Aditya Pratapa, Shankar Balachandran and **Karthik Raman*** "Fast-SL: An efficient algorithm to identify synthetic lethal reaction sets in metabolic networks" at the *2014 RECOMB/ISCB Conference on Regulatory and Systems Genomics*, San Diego, USA

2009 **Karthik Raman*** "Systems–level modelling of pathogenic organisms for drug target identification", *Emerging Modelling Methodologies in Medicine and Biology*, Edinburgh, United Kingdom

Seminars & Invited talks (selected)

2026 "Computational approaches to decoding cancer genomes: from pan-cancer to personalised predictions", *EMBO Workshop on Cancer in young adults: from correlation to causation*, Chennai

2025 "AI, Networks & Models: A Trifecta Reshaping Early-Stage Drug Discovery", *74th Indian Pharmaceutical Congress*, Bengaluru

2025 "Metabolic Models, Network Biology & AI: A Synergy for Omics Data Analysis", invited talk at *Workshop on Harnessing Artificial Intelligence for Multi-Omics Data Integration and Analysis*, organised by Sir Ganga Ram Hospital, New Delhi

2025 "AI as Catalyst for National Research Excellence", invited talk at *Academic Allies in India: A Library Leaders' Summit*, organised by Taylor & Francis, Chennai

2025 "AI, Networks & Models: A trifecta reshaping early-stage drug discovery", *2025 Symposium on Artificial Intelligence and Pharmaceutical Medicine (AIPM-India)*, IIT Madras

2025 "Models, Networks & AI: A Trifecta Empowering Big Data Analytics in (Meta)Genomics", invited talk at *Genomics India Conference (GIC) 2025*, IISc Bengaluru

2025 "Computational approaches to understanding Microbial Ecosystems: Disentangling Complexities with Metabolic Modelling", invited talk at *31st Annual Meeting of the IERG (ARVO-India Chapter)*, Sankara Nethralaya

2025 "Algorithmic Adventures in Microbial Ecosystems: Disentangling Complexities with Metabolic Modelling", invited talk at *Webinar series on: "Connecting Experts, Advancing Knowledge in Bioinformatics and Computational Biology"*, organised by SASTRA University, Webinar

2025 "Decoding driver genes in cancer genomes: from pan-cancer to personalised predictions", invited talk at *ICMR Two-Day Workshop on "Research Methods in Big Data Analytics for Healthcare: From Basics to Applications"*, organised by ICMR, New Delhi (via videoconferencing)

2025 "UNFOLDing Biological Paradoxes: Insights into Robustness, Plasticity, and Multifunctionality of Gene Regulatory Networks", invited talk at *NetSciX 2025*, Indore, India

2024 "Algorithmic Adventures in Microbial Ecosystems: Disentangling Complexities with Metabolic Modelling", invited talk at *Contemporary Perspectives in Computational Biology*, held at the Institute of Mathematical Sciences, Chennai

2024 "Panera: A novel framework for surmounting uncertainty in microbial community modelling using pan-genera metabolic models", invited talk at *ICBGDEES: International Conference on Biodiversity and Geochemistry of Deep and Extreme Earth Systems*, held at IIT Kharagpur (online)

2023 "Surmounting uncertainty in microbial community modelling using Pan-genera metabolic models", invited talk at *Modelling and Tackling Complex Biological Systems*, held at the Institute of Mathematical Sciences, Chennai

2023 "Social networking in microbes: from deep sea to outer space", at CSI-IITM Symposium, IIT Madras (October 4, 2023)

2023 Led a session on "Utilizing Data Science to Transform Medicine, Drug Discovery and Development", at the inaugural *Chennai AI/ML symposium* co-organised by IITM and Pfizer R&D, Chennai

2023 "Learning on, using and from networks in Biology", invited talk at *Network Biology Day*, held at the Institute of Mathematical Sciences, Chennai

2023 "Computational approaches for metabolic engineering", at the *Workshop on Fermentation assisted Biomanufacturing*, IIT Madras

2023 "Computational approaches to decoding microbial interactions in microbiomes", Institute of Mathematical Sciences, Chennai

2023 "Decoding driver genes in cancer genomes: from pan-cancer to personalised predictions", at *International Online CME on Awareness on Genetic Diseases in Paediatrics & Cancer Genetics* held at AIIMS, Madurai (online)

2023 "Decoding driver genes in cancer genomes: from pan-cancer to personalised predictions", at *Symposium on Big Data Algorithms for Biology 2023* held at the Indian Institute of Science (IISc), Bengaluru

2023 "Decoding driver genes in cancer genomes: from pan-cancer to personalised predictions", at *Workshop on Data Science in Drug Discovery* held at NCCS, Pune (online)

2023 "Decoding driver genes in cancer genomes: from pan-cancer to personalised predictions", at the International Institute of Information Technology (IIITH), Hyderabad

2021 "Unravelling microbial interactions in the gut microbiome through computational approaches", at the *90th annual meeting of The Society of Biological Chemists (SBC), India*

2021 "Computational insights into biological networks", at the *Health Informatics Summit 2021*, organized by The Department of Computational Biology at Indraprastha Institute of Information Technology Delhi (IIIT-D), alongside the Asia Pacific Bioinformatics Interaction & Networking Society (APbians)

2021 "Introduction and application of synthetic biology in everyday life", at iGEM Community Experts Talk (via video-conferencing)

2021 "Learning on, using and from networks in biology", at *International Workshop on Networks & Dynamical Systems*, Centre for Complex Systems and Dynamics at the Indian Institute of Technology Madras, Chennai (virtual)

2021 "Unravelling microbial interactions in the gut microbiome through computational approaches", at *7th BSSE Annual Research Symposium*, Centre for BioSystems Science and Engineering (BSSE) at the Indian Institute of Science (IISc), Bengaluru

2020 "Computational Approaches to Understand Biological Networks", at *The Centre for Predictive Human Model Systems (CPHMS), Atal Incubation Centre - Centre for Cellular and Molecular Biology (AIC - CCMB)* (via video-conferencing)

2020 "Learning on, using and from networks in biology", at *1st Joint 4EU+/HGS MathComp Annual Colloquium*

hosted by the Heidelberg Graduate School of Mathematical and Computational Methods in the Sciences (via video-conferencing)

2020 "Computational Approaches to Understanding Microbial Interactions in Communities", at *6th Annual Metagenomics and Metadesign of Subways and Urban Biomes (MetaSUB) Conference* (via video-conferencing)

2020 "Constraint-based models: standards, best practices & challenges for curation", at *HARMONY 2020*, Cambridge UK (via video-conferencing)

2020 "Computational insights into metabolic interactions in microbial communities", at *India | EMBO Symposium | Engineering meets evolution: Designing biological systems*, IIT Madras

2020 "Learning on, using and from networks in biology", at *Accelerating Biology 2020: SNiPs to SPiNs*, IISER Pune

2019 "Unravelling Molecular Mechanisms in Traditional Medicine: Systems Approaches to Understanding Diseases", at *Ved-Vigyan Sammelan (VVS) 2019: A Dialogue between Vedic and Modern Sciences*, IIT-BHU Varanasi

2019 "Unraveling microbial interactions in the gut microbiome associated with antibiotic recovery", at International Centre for Theoretical Studies (ICTS) Discussion Meeting on *Mathematical and statistical explorations in disease modeling and public health*

2019 "Computational Approaches to Understanding Complex Biological Networks", at Big Data Research Allahabad Summer School 2019, jointly organised by Allahabad University and Interdisciplinary Center for Scientific Computing (IWR) of Heidelberg University

2019 "Novel ratio-metric features enable the identification of new driver genes across cancer types", at the *3rd Pan-IIT Biotech Meet*, IIT Madras

2018 "Learning and Predicting Novel Metabolic Pathways through Subgraph Mining", at IISc Bengaluru

2018 "A Graph-Theoretic Approach to Understand Metabolic Interactions in Microbial Communities", at the *Annual meeting of Biological Engineering Society of India (BESCON) 2018*, IIT Bombay, Mumbai

2018 "Exploiting alternate optima in linear programming to enumerate minimal cut sets in biochemical reaction networks", at the *33rd Annual Conference of the Ramanujan Mathematical Society (ACRMS-2018)*, New Delhi

2017 "Computational Approaches to Understand and Manipulate Metabolic Networks", at National Centre for Biological Sciences, Bengaluru

2017 "Learning and Predicting Novel Metabolic Pathways through Subgraph Mining", at the *4th IITM-Tokyo Tech Symposium*, IIT Madras

2017 "Predicting Novel Metabolic Pathways through Subgraph Mining", as part of the *Summer School on "Dynamics of Complex Systems"*, at the International Centre for Theoretical Studies (ICTS) Bengaluru, (Week 3: May 23–25, 2017)

2016 "Towards Understanding the Design Principles of Circadian Oscillators", at *Aspects of Gene and Cellular Regulation*, Institute of Mathematical Sciences, Chennai

2016 "Metabolic Engineering of vitamin E Biosynthesis in Sunflower Cell Cultures"at *85th Annual meeting of the Society of Biological Chemists, India (SBCI)*, CFTRI, Mysore

2016 "Revisiting robustness and evolvability: evolution on weighted genotype networks", at *Network Theory: Conceptual Advances and Practical Applications*, Institute of Mathematical Sciences, Chennai

2015 "FAST-SL: An efficient algorithm to identify synthetic lethals in metabolic networks", at the *2015 Annual Meeting of the National Network of Mathematical and Computational Biology (NNMCB)*, Pune

2015 "*In Silico* Modelling Of Metabolic Networks: Insights for Metabolic Engineering", at *BioProcessing India 2015*, Chennai

2015 "Modelling Metabolic Networks: From Biofuels to Better Therapies", at the *2nd Sankara Nethralaya Genetics Convention*, Chennai

2014 "*In Silico* Identification of Drug Targets for Combinatorial Therapy", at the *XVII ADNAT symposium*, Thiruvananthapuram

2012 "Representation and Modelling of Metabolic Networks", at the *Workshop on Analysis of Biological Networks*, IIT Guwahati

2012 "Robustness and evolvability of biological networks", at the *International Conference on Mathematical and Theoretical Biology*, Pune

Posters (selected, *denotes presenting author)

2023 Lavanya Raajaraam and **Karthik Raman*** Microbial communities vs monoculture: model-driven decision making for bioprocessing at the *9thth Metabolic Pathway Analysis (MPA)*, Seoul, South Korea

2023 Indumathi Palanikumar, Himanshu Sinha and **Karthik Raman*** PAGER: Curtailing the uncertainties in analysing microbial communities using genome-scale metabolic models at the *31st Annual International Conference on Intelligent Systems for Molecular Biology (ISMB)*, Lyon, France

2022 Sarayu M, Maziya Ibrahima, Hemalatha Rajendran, Shagun Shagun, Shyam Kumar Masakapalli, **Karthik Raman**, Smita Srivastava* CamGEM – a rational metabolic engineering approach for enhancing camptothecin production in *Nothapodytes nimmoniana* at the *8th Conference on Constraint-Based Reconstruction and Analysis (COBRA 2022)*, Galway, Ireland

2022 Malvika Sudhakar*, Raghunathan Rengaswamy and **Karthik Raman** PIVOT: a machine learning approach to identify personalised driver genes using multi-omic data at the *30th Annual International Conference on Intelligent Systems for Molecular Biology (ISMB)* (Virtual)

2022 Lavanya Raajaraam* and **Karthik Raman** Co-FSEOF: a computational framework to study the co-production of metabolites at the *30th Annual International Conference on Intelligent Systems for Molecular Biology (ISMB)* (Virtual)

2022 Dinesh Kumar Kuppa Baskaran* and **Karthik Raman** A protocol for studying metabolic interactions in a microbial community using graph-based approaches at the *30th Annual International Conference on Intelligent Systems for Molecular Biology (ISMB)*, Madison, USA (In-person)

2022 Aswathy Raghu* and **Karthik Raman** A constraint-based method to identify function-specific minimal microbiomes from large microbial communities at the *30th Annual International Conference on Intelligent Systems for Molecular Biology (ISMB)*, Madison, USA (In-person)

2022 Indumathi Palanikumar*, **Karthik Raman** and Himanshu Sinha Machine-learning based identification of discriminatory microbial features for the classification of a diarrheal gut microbiota at the *30th Annual International Conference on Intelligent Systems for Molecular Biology (ISMB)* (Virtual)

2022 Sowmya Manojna Narasimha*, Omkar Mohite S, Saketha Nath J and **Karthik Raman** Understanding flux re-routing in metabolic networks through an analysis of synthetic lethal pairs at the *30th Annual International Conference on Intelligent Systems for Molecular Biology (ISMB)* (Virtual)

2020 Gayathri Sambamoorthy* and **Karthik Raman** "Understanding the evolutionary dynamics of microbial communities through *in silico* studies" at the *28th Annual International Conference on Intelligent Systems for Molecular Biology (ISMB)* (Virtual)

2020 Rachita Kumar* and **Karthik Raman** "Systems Modelling of the Skin Microbiome" at the *28th Annual International Conference on Intelligent Systems for Molecular Biology (ISMB)* (Virtual)

2020 Malvika Sudhakar*, **Karthik Raman** and Raghunathan Rengaswamy "BinOpt: An algorithm to optimally assign feature importance to classes" at the *28th Annual International Conference on Intelligent Systems for*

2018 *Molecular Biology (ISMB)* (Virtual) Malvika Sudhakar*, **Karthik Raman** and Raghunathan Rengaswamy "Novel ratio-metric features enable the identification of new driver genes across cancer types" at the *17th European Conference on Computational Biology (ECCB)*, Athens, Greece

2018 Gayathri Sambamoorthy* and **Karthik Raman** "Understanding the evolution of functional redundancy in metabolic networks" at the *17th European Conference on Computational Biology (ECCB)*, Athens, Greece

2017 Aarthi Ravikrishnan*, Meghana Nasre and **Karthik Raman** "ComPass — A graph-based algorithm for pathway analysis in microbial communities" at the *25th Annual International Conference on Intelligent Systems for Molecular Biology (ISMB)/16th European Conference on Computational Biology (ECCB)*, Prague, Czech Republic

2016 Srikiran Chandrasekaran* and **Karthik Raman** "An Analysis of Stochastic Algorithms for Parameter Estimation in Biological Systems", at the *Asia-Pacific Bioinformatics Conference 2016*, San Francisco, USA

2015 Aparajitha Srinivasan*, **Karthik Raman** and Smita Srivastava "Metabolic Engineering Of α-tocopherol in *Helianthus annuus* L.", at the *2nd International Conference on Natural Products Utilization: From Plants to Pharmacy Shelf*, Plovdiv, Bulgaria

2015 Abinaya Badri*, **Karthik Raman** and Guhan Jayaraman "A genome scale metabolic model for studying

hyaluronan synthesis in recombinant *Lactococcus lactis*", at the *5th International Conference on Biomolecular Engineering*, Austin, USA

2014 Nandita Damaraju* and **Karthik Raman** "Design Principles of Circadian Systems", at the *2014 RECOMB/ISCB Conference on Regulatory and Systems Genomics*, San Diego, USA

2013 Karthik Azhagesan and **Karthik Raman*** "'Joint' phylogenetic profiling of protein pairs reveals novel unique protein-protein associations and evolutionarily conserved protein interactions", at the *NetBIO SIG meeting preceding ISMB-ECCB 2013*, Berlin, Germany

2011 **Karthik Raman**, Aditya Barve and Andreas Wagner "Metabolite pairs are predominantly decoupled in genome-scale metabolic networks", at the *Swiss Institute of Bioinformatics Days 2011*, Bienne, Switzerland

2009 **Karthik Raman** and Andreas Wagner "Novel phenotypes and robustness in a complex signalling circuit", at the workshop on *Emerging Modelling Methodologies in Medicine and Biology*, Edinburgh, United Kingdom

2008 Kalidas Yeturu*, **Karthik Raman** and Nagasuma Chandra "Drug Targetability Estimation through Comparative 'Pocket-omics' of Host and Pathogen: A Case Study in *Mycobacterium tuberculosis*" at the *9th International Conference on Systems Biology*, Gothenburg, Sweden

2006 **Karthik Raman** and Nagasuma Chandra, "Protein–protein influences in *Saccharomyces cerevisiae*" at the *7th International Conference on Systems Biology*, Yokohama, Japan

Grants & funding

Extra-mural Funding

2026– Principal investigator on a project "SUKSHMA: A System for Unified Knowledgebase for Structured Harmonised Microbiome Analysis" ANRF-ARG grant (PI) (₹1.14 crores)

2026– Co-investigator on a project "Support to AI CoE for Education" from Google Asia (₹18.02 crores)

2026– Co-investigator on a project "Bodhan AI: AI CoE for Education" from the Ministry of Education, Government of India (≈₹500 crores)

2025– Co-investigator on a project "Herbalife CoE" (funded by Herbalife) along with Prof. Smita Srivastava (PI) (₹6 crores)

2024 Co-investigator on a project "Exploring the adaptive potential of ribosomal protein variants to develop antifungal drug resistance" (funded by Department of Biotechnology, GoI) along with Dr. Himanshu Sinha (PI) (₹81 lakhs)

2023 Co-investigator on a project "National Network Project of National Centre for Biological Sciences - Genome Informatics networks to understand plant stress management" (funded by Department of Biotechnology, GoI) along with Prof. Michael Gromiha (PI) (₹55.68 lakhs)

2022 Co-investigator on a project "Rational Metabolic Engineering Strategies for Enhanced Production of Camptothecin in *Nothapodytes nimmoniana* Plant Cells" for a period of three years (₹53.13 lakhs), with Dr. Smita Srivastava (PI)

2021 Co-Principal investigator on a project "INCENTIVE - Indo-European Consortium for Next-Generation Influenza Vaccine Innovation" (funded by Department of Biotechnology, GoI) for a period of five years (₹265 lakhs), with Dr. Himanshu Sinha (PI), Manikandan Narayanan (co-PI), Nirav Bhatt (co-PI), Ravindran B (co-PI)

2021 Principal investigator on a project "Understanding microbial interactions in microbiomes through metabolic modelling" (funded by Science and Engineering Board, GoI) for a period of three years (₹6.6 lakhs)

2020 Co-investigator on a project "GenomeIndia 10K: Cataloguing the genetic variation in Indians" (funded by Department of Biotechnology, GoI) for a period of five years (₹140 lakhs), with Dr. Himanshu Sinha (IITM, PI) and Dr. Manikandan Narayanan (IITM, co-PI)

2017 Principal investigator on a project "A Computational Pipeline for Identifying the Context of Key Mutations in Cancer Genomes" (funded by the Department of Biotechnology, Government of India) for a period of three years (₹52.8 lakhs), with Dr. Raghunathan Rengaswamy (IITM, co-PI) and Dr. B. Ravindran (IITM, co-PI)

2017 nVidia Hardware Grant, of Titan X graphics processing unit for research

2013 Principal investigator on a project "Metabolic network analysis of pathogenic organisms for designing novel therapeutic intervention strategies" (funded by the Department of Biotechnology, Government of India) for a period of three years (₹24.4 lakhs), with Dr. Manoj N (IITM, co-PI)

2013 Co-investigator on a project "Control of *in vivo* polymerisation by synthetic biology approaches" (funded by the Department of Biotechnology, Government of India) for a period of four years (₹136 lakhs), with Prof. Guhan Jayaraman (IITM, PI)

2013 *CUDA Research Centre* grant from nVidia, including gift of nVidia Tesla K20 graphics processing unit for research

2012 Co-investigator on a project "Enhanced production of α-tocopherol by genetically transformed cell culture of *Helianthus annuus L.*" (funded by the Department of Biotechnology, Government of India) for a period of three years (₹29 lakhs), with Dr. Srivastava S (IITM, PI), Dr. Baskar R (IITM, co-PI)

2011 *CUDA Research Centre* grant from nVidia, including gift of nVidia Tesla C2070 graphics processing unit for research

Intra-mural Funding

2024–25 Principal investigator on a project "Investigating the Microbial Landscape of Urban Microbiomes: A Case Study of IIT Madras Campus" (₹25 lakhs) along with Dr. Himanshu Sinha (Co-PI)

2024–25 Co-investigator on a project "Generation of microbiome and metabolome datasets to enable the discovery of novel biomarkers for the early detection of gestational diabetes mellitus (GDM)" (₹25 lakhs), with Dr. Meiyappan Lakshmanan (PI)

2021–23 Co-investigator on a project "Centre for Integrative Biology and Systems medicinE (IBSE)" (pCoE grant under the IoE scheme) for a period of two years (₹73 lakhs), along with Dr. Himanshu Sinha (PI, IITM) and Dr. Manikandan Narayanan (Co-PI, IITM)

2021–23 Co-investigator on a project "Deployable Artificial Intelligence (DAI)" (pCoE grant under the IoE scheme) for a period of two years, along with Dr. Arun Rajkumar (PI, IITM), Prof. B. Ravindran (Co-PI, IITM), Dr. Gitakrishnan Ramadurai (Co-PI, IITM), Dr. Nandan Sudarsanam (Co-PI, IITM) and Prof. Raghunathan Rengaswamy (Co-PI, IITM)

2021–23 Co-investigator on a project "Cancer Genomics & Molecular Therapeutics" (pCoE grant under the IoE scheme) for a period of two years (₹130 lakhs), along with Prof. Mahalingam S (PI, IITM) and Dr. Himanshu Sinha (Co-PI, IITM)

2021–23 Principal investigator on a project "Bio-surveillance of Antimicrobial Resistance (AMR) and COVID-19 prevalence in Chennai: A MetaSUB approach using metagenomics" (exploratory research project funded by RBCDSAI) for a period of two years (₹40.845 lakhs), along with Dr. Himanshu Sinha (Co-PI, IITM)

2018–19 Principal investigator on a project "Reconstruction and Modelling of a *Lactobacillus* Co-culture for Metabolic Engineering of Lactic Acid" for a period of one year (₹8 lakhs)

2015–17 Co-investigator on a large team project "Interdisciplinary Laboratory for Data Sciences", along with Dr. Ravindran Balaraman (PI, IITM) and several others

2014–15 Principal investigator on a project "Engineering a consortium of microbes for production of Bio-ethanol" (exploratory research project funded by IIT Madras) for a period of one year (₹5 lakhs), with Dr. Smita Srivastava (IITM, co-PI)

2012–15 Principal investigator on a project "MetREC: A Database of Systematically Annotated Genome-Scale Metabolic Reconstructions" (new faculty seed grant funded by IIT Madras) for a period of three years (₹5.23 lakhs)

Industrial Consultancy

2025–27 Principal investigator on a project "Network modelling for ..." funded by Unilever India Private Limited (₹55 lakhs)

2025–26 Principal investigator on a project "Microbiome Systems Biology: Understanding Microbial Synergy in Poultry Gut" funded by Kemin Industries South Asia Private Limited (₹15.65 lakhs)

2025–28 Principal investigator on a project "AI Samarth: AI Literacy Curriculum" funded by Central Square

Foundation (₹194.70 lakhs)

2025 Principal investigator on a project "Methods for construction and use of network models from RNA-seq data" funded by Aganitha Cognitive Solutions (₹2.35 lakhs)

2024–25 Principal investigator on a project "Scientific Knowledge Graph Analytics Development" funded by Pfizer Inc. USA (₹20.22 lakhs)

2023 Principal investigator on a project "Genome-scale Metabolic Modelling of Microalgae and Other Organisms" funded by Yokogawa Technology Solutions India (₹4.60 lakhs)

2023–25 Principal investigator on a project "Microbiome Systems Biology: Understanding Microbial Interactions and Identifying Optimal Intervention Strategies in Home Microbiomes" funded by Unilever India Private Limited (₹70.99 lakhs)

2022–23 Principal investigator on a project "Skin Microbiome Systems Biology: Unravelling Metabolic Capabilities of Microbes in Communities" funded by Unilever India Private Limited (₹45.54 lakhs)

2022-25 Co-investigator on "MOOCs on Biological Big Data Analysis" funded by Excelra Knowledge Solutions Private Limited (₹96.8 lakhs)

2017–22 Co-investigator on "Robert Bosch Centre for Data Science and Artificial Intelligence (RBC-DSAI)" funded by Robert Bosch Engineering and Business Solutions Private Limited (₹2000.5 lakhs)

2016–17 Principal investigator on a project "Systems-level modelling approaches for quantitative systems pharmacology" funded by Vantage Research Private Limited, Chennai (₹3.59 lakhs)

Honours *&* awards (selected)

2021 *Institute Research and Development Award (Early Career)* (IIT Madras), for outstanding achievements in teaching, scholarship and creative research work

2015 *Young Faculty Recognition Award* (IIT Madras), for excellence in teaching and research

2011 *Sir Vithal N. Chandavarkar Memorial Medal* for the best Ph. D. thesis of the year in the Supercomputer Education and Research Centre, Indian Institute of Science

Teaching

Graduate and undergraduate courses

BT 1010 – Module on "Big Data in Biology" (Jul–Nov 2017)
BT 2020 – Numerical Methods for Biology (Jan–May 2018, 2019)
BT 3051 – Data Structures and Algorithms for Biology (Jul–Nov 2014–2019, 2021–22)
BT 3240 – Metabolic Regulation (Jul–Nov 2011–2013)
BT 4110 – Computational Biology Lab (Jul–Nov 2015–2017)
BT 4310 – Current Topics in Synthetic Biology (Jul–Nov 2014, 2019)
BT 5240 – Computational Systems Biology (Jan–May 2013–2025, Winter 2017)
DA 1300 – Programming and Data Structures (Jul–Nov 2024, 2025)
DA 1301 – Programming Lab (Jul–Nov 2024, 2025)

Workshops *&* Schools

2025 *Computational Oncology Workshop — Integrative Modelling of Tumour Biology and Therapeutics*, at IIT Madras, March 20–21 2025 (Co-organiser)

2024 Co-organised IITM-EMBL-EBI Workshop on "Reproducible Modelling in Systems Biology", with Dr. Rahuman Sheriff, EMBL-EBI, at *IIT Madras* (August 8–10, 2024)

2023 Lectured (online) on "Biological Networks", "Structure of Networks", "Network Models" and "Applications of Networks Biology" at Statistical Genomics Workshop, NCBS, Bengaluru (August 16–19, 2023)

2022 Co-taught a course "BE506 Biological Modelling and Simulation Course" at IIT Mandi (May 2022)

2021 Co-organised IITM-EMBL-EBI Winter School 2021 on reproducibility and modelling in systems biology, with Dr. Rahuman Sheriff, EMBL-EBI, at *IIT Madras* (December 6–9, 2021)

2021 ISCB Academy tutorial on "Metabolic modelling of microbial interactions in microbiomes" (October 22, 2021)
2021 "Introduction to Constraint-Based Modelling of Metabolic Networks" at the AICTE ATAL Online FDP on Computational Synthetic and Systems Biology, *IIT Guwahati* (July 28, 2021)
2021 Lectures on Computational Systems Biology at The MS University of Baroda (April 2021)
2020 NPTEL Lab Workshop for faculty and PhD scholars from across the country (August 24–27, 2020)
2019 Co-organised IITM-EBI modelling workshop, with Dr. Rahuman Sheriff, EMBL-EBI at *IIT Madras* (December 2–5, 2019)
2019 Lecture and Lab sessions on "Introduction to Network Biology" at the "A National Workshop on Scientific computations using MATLAB", at *Banasthali Vidyapeeth*, Rajasthan (January 19, 2019)
2018 "Introduction to Constraint-Based Modelling of Metabolic Networks", at the IFCAM Summer School, *IISc Bengaluru* (July 23, 2018)
2018 Co-taught at the "Training Workshop on Systems Biology", at the *National Institute of Biomedical Genomics (NIBMG)*, Kalyani, West Bengal (July 21, 2018)
2017 Co-taught a summer school on "Dynamics of Complex Systems", at the *International Centre for Theoretical Studies (ICTS)*, Bengaluru (Week 3: May 23–25, 2017)
2017 Organised an AICTE-approved short-term training programme on "Computational Systems Biology" for faculty from colleges in India, at *IIT Madras* (Feb 6–11, 2017)
2016 Lecture on "Genome-Scale Modelling of Metabolic Networks: Insights for Metabolic Engineering" as part of the Global Initiative on Academic Networks Course on Metabolic Engineering at *IIT Madras* (July 9, 2016)
2016 "Introduction to Constraint-Based Modelling of Metabolic Networks" at *NNMCB Second Instructional School on Mathematical and Computational Biology*, *IISc Bengaluru*
2016 Taught a pre-school on computational biology preceding the NNMCB Second Instructional School on Mathematical and Computational Biology, at *IISc Bengaluru* (May 18–21, 2016)
2015 Taught employees from *Cognizant Technology Solutions* a module on "Basics of Biology/Computation for Biology" in a "Short Term Certification Programme on Bioinformatics"

Other instruction-related activities

2019 Mentored two schoolchildren from Chennai on a project related to DNA Computing, as part of the RSI-Chennai 2019
2018 Mentored four schoolchildren from Chennai on projects related to DNA Computing and Network Biology, as part of the Research Science Initiative Chennai (RSI-Chennai) 2018
2017 Mentored two schoolchildren from Chennai on a project related to DNA Computing, as part of the RSI-Chennai 2017
2016 Mentored two schoolchildren from Chennai on a project related to DNA Computing, as part of the RSI-Chennai 2016
2015 Mentored two schoolchildren from Chennai on a project related to Network Biology, as part of the RSI-Chennai 2015

Academic Mentorship

PhD (major advisor/co-advisor)

2019 Aarthi Ravikrishnan "*Understanding microbial interactions in communities through an integrated computational and experimental framework*" (co-advised by Dr. Smita Srivastava)
"Best PhD thesis in Data Science (2020)" and DAAD-UGC Fellowship
2021 Gayathri S "*Understanding the design principles of metabolic networks*", recipient of "Institute Research Award (2018-19)"
Institute Research Award (2018-19), given to the top 25 research scholars across IIT Madras
2023 Malvika Sudhakar "*Machine learning on multi-omic data for identifying driver genes in cancer*" (co-advised by Prof. Raghunathan Rengaswamy, Chemical Engineering)
2023 Priyan Bhattacharya "*Systems-Theoretic Approaches to Discover Adaptation-capable Biological Networks*" (co-

advised by Prof. Arun Tangirala, Chemical Engineering)

2024 Prem Jagadeesh "*System Identification of Biological Processes*" (co-advised by Prof. Arun Tangirala, Chemical Engineering)

2025 Pratyay Sengupta (PMRF) "*Decoding Microbial Adaptation and Interactions in Built Environments*" (co-advised by Dr. Kasthuri Venkateswaran, NASA JPL, USA)

2026 Debomita Chakraborty "*A Computational Characterisation of the Genetic Circuit Design Space*" (co-advised by Prof. Raghunathan Rengaswamy, Chemical Engineering)

2026 Lavanya Raajaraam "*Computational Design of Microbial Cell Factories for Efficient Bioprocessing*"

2019– Indumathi P (PMRF, co-advised by Dr. Himanshu Sinha)

2022– Shradha Sharma

2023– Srikrishnan B

2024– Sandhya Vasudevan

2026– Prithvi S Prabhu

PhD (minor advisor)

2020 Aparajitha Srinivasan "*Strategies for enhanced production of alpha-tocopherol in cell culture of Helianthus annuus L.*" (co-advised by Dr. Smita Srivastava; recipient of NAMASTE India-EU Fellowship)

MS (major advisor/co-advisor)

2015 Aditya Pratapa, "*Design of efficient algorithms for synthetic lethality analysis*" (co-advised by Dr. Shankar Balachandran, Computer Science)

2019 Beethika Tripathi, "*Applications of Community Detection and Link Prediction on Multi-relational Networks*" (co-advised by Prof. B. Ravindran, Computer Science

2018 Karthik Azhagesan, "*Machine Learning Approaches to Predict Essential Genes Across Organisms*" (co-advised by Prof. B. Ravindran, Computer Science)

2021 Shayantan Banerjee "*Sequence neighborhoods enable reliable prediction of pathogenic mutations in cancer genomes*" (co-advised by Prof. B. Ravindran, Computer Science)

2023 Dinesh Kumar K B "*A protocol for studying metabolic interactions in microbial communities using graph-based approaches*"

2024– Yuvaram Singh

2025– Dipak Kanzariya

2026– Pratyay P Mishra

MS (minor advisor)

2013–16 Abinaya Badri, "*Investigation of metabolic capabilities of recombinant* Lactococcus lactis *for hyaluronan production using a genome-scale metabolic model*" (co-advised by Prof. Guhan Jayaraman)

Post-doctoral Fellows

2026– Dr. Nithya C

2026– Dr. Aruldoss Immanuel

2026– Dr. Suman Prabha Yadav

2023– Dr. Aarti Ravindran

2017– Dr. Maziya Ibrahim

2025–26 Dr. Pratyay Sengupta

2025–26 Dr. Shubhank Sherekar

2024–25 Dr. Moirangthem Sailash Singh

2023–24 Dr. Chaitranjali Yadla

2021 Dr. Aswathy Raghu

2016–19 Dr. Devika N.T.

MTech Projects

2026– Nikesh Kumar Mandal
2025–26 Nandhakishore C S (along with Prof. B. Ravindran) "*Development of Reinforcement Learning Algorithm(s) for Structure Constrained Molecule Generation*"
2025–26 Shivangi Dutta "*Microbial Bioprospecting in Space: A Data-Driven Exploration of Antimicrobial Peptides Associated with the International Space Station Microbiome for Biotechnological Innovation*"
2025–26 Shreya Haldar "*Genome-scale metabolic modeling of MAGs isolated from the drinking water of an Indian city*"
2024–25 Varsha V "*Genomic Exploration of Bacteria Isolated from the NASA Mars 2020 Mission Spacecraft Assembly Facility*", 🏅 *Prof. K. B. Ramachandran Award for Best MTech Thesis in Bioprocess Engineering*
2024–25 Aryamitra Srinivasan "*Generalizing Microbiome-Disease Associations: Combined Analysis of Amplicon Datasets in Organ Transplant and Diabetes*"
2023–24 Muthu Arunachalam "*Understanding the Microbial differences between Urban and Rural built-environment*"
2021–22 Divya Dharshini U (with Dr. Smita Srivastava) "*Genome scale metabolic model guided flux analysis to elucidate and improve camptothecin biosynthesis in the endophyte Alternaria burnsii*"
2020–21 Sanjaay Balakrishnan "*A toolbox for the analysis of microbiomes: Applications to ocular and ISS microbiomes*"

MTech (Dual Degree thesis projects)

2026–26 Shuban V "*A System For Unified Knowledgebase For Structured Harmonised Microbiome Analysis*"
2025–26 Pranathi Ravikumar "*Comparative Analysis of Microbial Community Structure Across Human and Environmental Microbiomes*"
2024–25 Pradeep Melpakkam "*On Retroactivity in Biological Oscillators*"
2024–25 Rajagopalan Subramaniam "*Designing DNA-based RNNs & Universal Logic Gates for Temporal Learning & Memory*", 🏅 Batch of 1979 Award for the *Best Dual Degree Project Thesis in Biological Engineering*
2024–25 Aswin Balamurugan "*Computational Drug Repurposing Using Scientific Knowledge Graphs*"
2024–25 Jacqueline Elsa Binu "*Decoding Design Principles Of Genetic Circuits Using Graph Neural Networks*"
2023–24 Shobhan Karthick "*Exploring Microbial Dark Matter: A Deep Dive into Genomics of Space-associated Cleanroom Microorganisms*"
2023–24 Prashanth Joseph Ramanathan "*Leveraging generative AI to learn from and disrupt protein–protein interfaces*"
2022–23 Amrita Mahesh "*Systematic analysis of Indian pancreatic cancer genomes*"
2022–23 Hemanth Ram (with Prof. B. Ravindran, Computer Science) "*Structure-based Drug Design using Distance Prediction with Graph Neural Networks*"
2021–22 Sreeharsha Peesapati S S (with Prof. Arun Tangirala, Chemical Engineering) "*Quantifying adaptation and mapping it to the parameter space in bio-chemical networks using systems theory*"
2021–22 Prashant Govindarajan (with Prof. B. Ravindran, Computer Science) "*Graph generative models for binding site-specific molecule generation*"
2020–21 Ninad Rajandekar "*A computational study of microbial community formation upon evolution*"
2020–21 Rohan Jebin Anbiah "*Identification of Strain Optimization Strategies for Single Organisms and Communities in Metabolic Engineering*"
2020–21 Raghav Moar "*Phylogenetic analysis of Metabolic Pathways: An On-line Tool*"
2020–21 Vishnu Harshit "*Machine learning approach to study protein–ligand interactions*"
2019–20 Rohini J S "*Comparing Circadian Oscillators Across Organisms*"
2019–20 Shreya Swaminathan "*Efficient Enumeration of Synthetic Lethal Reactions for Pan Cancer Lethality Analysis*"
2019–20 Anand A R "*Goal-directed Molecule Generation using Reinforcement Learning*" (with Prof. B. Ravindran, Computer Science)
2018–19 Soorya G (with Prof. Arun Tangirala, Chemical Engineering)
2018–19 Sachin Agrawal, "*Deep Learning for Network Chemistry and Network Biology*" (with Prof. B. Ravindran, Computer Science)
2018–19 Vishnu Narayan, "*Parallelisation of Dynamic Model Simulations*"
2018–19 Abhijeet Mavi, "*Topological Sensitivity Analyses of Target-of-Rapamycin pathway in Saccharomyces cerevisiae*"
2016–18 Saransh Umale (with Prof. Raghunathan Rengaswamy, Chemical Engineering), "*Design Principles of Modular Gene Oscillators: An ODE-based approach*"
2016–18 Muthukumarasamy Saravanan, "*Learning and Predicting Reactions from Metabolic Networks*"

2017–18 Pradeep Natarajan, (with Prof. Raghunathan Rengaswamy, Chemical Engineering), "*Design Principles for the Synthesis of Modular Genetic Oscillators*"
2016–17 Omkar Mohite, "*Understanding redundancy in metabolic networks through analysis of Synthetic Lethals*"
2015–16 Aravind Sankar (with Dr. Sayan Ranu, Computer Science), "*Predicting Chemical Reactions through Graph Mining*"
2015–16 Pallavi Gudipati (with Prof. B. Ravindran, Computer Science), "*Neighborhood Analysis of Genomic Data*"
2015–16 Abhishek Sivaram (with Prof. Raghunathan Rengaswamy, Chemical Engineering), "*Application of Variants of Principal Component Analysis to Biological Systems — A Source Separation Framework*"
2015–16 Aparnna Suresh, "*Identifying Network Topologies That Can Exhibit Switch-Like Behaviour*"
2015–16 Dileep Kishore, "*Discovering the Design Principles of Circadian Rhythms using GPGPUs*"
2014–15 Pankaj Kumar (with Dr. Sayan Ranu, Computer Science), "*Identifying novel reaction routes to synthetic metabolites*"
2014–15 Parthasarathy Gopavarapu (with Prof. B. Ravindran, Computer Science), "*Predicting Essential Genes in Microbes*"
2013–14 Govind Krishna Joshi, "*Multi-timescale multi-algorithm simulation of a cell*"
2013–14 Raghavendran Partha, "*Revisiting robustness and evolvability: evolution on weighted genotype networks*"
2012–13 Sagar Laygude, "*GPU-based massively parallel* in silico *phenotyping*"
2012–13 Namrata Kamat, "*Microbial community modelling*"

BTech (Undergraduate thesis projects)

2014–15 Narasimhan Balakrishnan (with Prof. Arun Tangirala, Chemical Engineering)
2014–15 Adarsh Chavakula (with Prof. Shankar Narasimhan, Chemical Engineering)
2014–15 Balaji Kumar
2014–15 Srikiran Chandrasekaran
2014–15 Sanjan T P
2014–15 Aravindabharathi Ramakrishnan
2013–14 Nandita Damaraju
2012–13 Aditya Sriganesh
2012–13 Shashank Garlapati

Junior Research Fellows/Project Associates/Post-baccalaureate fellows

2025– Sabdhayini K B (WSAI Post-baccalaureate Fellow)
2026– Harsiddhi A (NPTEL Post-baccalaureate Fellow)
2026– Aishwarya Sekar (NPTEL Post-baccalaureate Fellow)
2026– Zunaim Malik (NPTEL Post-baccalaureate Fellow)
2025–26 Harippriya Siva (NPTEL Post-baccalaureate Fellow)
2025–26 Somil Shah (NPTEL Post-baccalaureate Fellow)
2025–26 Durga Burande (IBSE Post-baccalaureate Fellow)
2024–26 Prithvi Prabhu (IBSE Post-baccalaureate Fellow)
2025–26 Hari Priya Narahari (WSAI Post-baccalaureate Fellow)
2024–25 Sounak Mukherjee (IBSE Post-baccalaureate Fellow)
2024–25 Hari Priya Narahari (NPTEL Post-baccalaureate Fellow)
2024–25 Sabdhayini K B (IISER Tirupati, Dual Degree project)
2023–25 Barathi L (IBSE Post-baccalaureate Fellow)
2023–25 Tanisha Malpani (IBSE Post-baccalaureate Fellow)
2023–24 Anirudh Rao (Young Research Fellow)
2023–24 Aditya Ray (Young Research Fellow)
2022–23 Rajagopal Subramaniam C (Young Research Fellow)
2021–22 Harish Manoharan (Young Research Fellow)
2019–22 Keerthika Moorthy (Project Associate)
2020–21 Amrita Mahesh (Young Research Fellow)
2020–21 Sai Sruthi A (Junior Research Fellow)

2020–21 Shreyansh Umale (IBSE post-baccalaureate Fellow)
2020–21 Rachita Kumar (IBSE post-baccalaureate Fellow)
2019–21 Senthamizhan V (IBSE post-baccalaureate Fellow)
2018–20 Anjana A S (Project Associate)
2017–19 Priyanka Maripuri (Project Associate)
2015–16 Smrithi Krishnan (Project Associate)
2017–18 Likith Reddy (Junior Research Fellow)
2015–16 Sivaratna Kumari Narisetti (Project Associate)
2014–15 Murali Karthikeyan (Project Associate)
2013–15 Priyanka Barman (Project Associate)

Outreach Activities

Science Outreach/Media

RBCDSAI blog
Lab website blog
Our work featured in the press

Best Place to Build (IIT Madras): How Computational Microbiology drives disease research and treatment
WSAI Faculty Spotlight
The Times of India Education Times: CBSE's AI & CT curriculum for classes III-VIII focuses on building algorithmic, data skills
The Times of India Education Times: Rebuilding engineering curriculum for a tech-driven future
ContraMinds Podcast: Dr. Karthik Raman on The Computational Future of Biology and the Researcher-Entrepreneur
Outlook India: Column | What Should We Learn And Unlearn To Bring The Impact of AI To Our Extremely Capable Children?

Business Line: *Future of data centres: It's all in the DNA*
Nature India: *Policy push for India's bioeconomy*
Times of India: *Why is Big data on Biology so big*
BioSpectrum India: *IITs make giant strides in precision onco research*
DataQuest India 'DeepTech' podcast: *Biotechnology 2.0: IIT Madras Prof on the era of biology, math and programming combined*

International Outreach Activities

2016 Represented IIT Madras at the *Graduate Program India–Heidelberg* meeting organised by *University of Heidelberg*, Jun 21–23, Heidelberg; also gave a talk on "Computational Approaches to Understand and Manipulate Metabolic Networks"
2011 Represented IIT Madras at the *Seminar on Synthetic Biology* organised by the *Academy of Finland*, Nov 21–22, Helsinki

National Outreach Activities

2020 Drug Discovery Hackathon 2020 (DDH2020) platform was an open source drug discovery Hackathon against COVID-19, and a joint initiative of AICTE, CSIR and supported by Office of Principal Scientific Advisor, Govt. of India, NIC and MyGov. I was part of an expert panel that put out problem statements, reviewed submissions and mentored successful teams. My challenge, to "*Develop a reinforcement learning-based algorithm to identify lead molecules by emulating ligand-protein interactions*" can be viewed at https://innovateindia.mygov.in/drug_ps/ddt2-01/.

Lectures at Industries

2026 Lecture on "Computational Design of Microbiomes and Metabolism for Industrial Biotechnology" at Kemin Industries, Chennai (March 31, 2026)
2023 Lecture on "AI Meets Biology: A Powerful Partnership for Understanding Life" at Zydus Research, Ahmedabad (December 14, 2023)
2023 Lecture on "Social networking in microbes: from deep sea to outer space" at Hindustan Unilever Research Centre, Bengaluru (June 21, 2023)
2017 Lecture on "Robustness and Evolvability in Complex Systems" at Culture Machine, Mumbai (January 4, 2017)
2016 Lectures on "Introduction to Mathematical Modelling and Systems Biology" at Vantage Research Private Limited, Chennai (June 2016)
2014 Lecture on "Engineering Metabolic Networks using *in silico* approaches" at Hindustan Petroleum Corporation Limited, Bangalore (January 30, 2014)
2012 Lecture on "Metabolic Engineering" at Samsung India Software Operations, Bangalore (April 20, 2012)

Professional Service

Institutional Service — IIT Madras

BS Curriculum Committee, IITM Zanzibar (2023)
Advisor, Office of Global Engagement (2020–)
Research Committee (2021–23)
Course allotment committee (2014 Aug—2020)
Department Faculty Meeting Secretary (2011)
Ph. D/M. S. admission committee (2011 Dec–2015 Dec)
Faculty applications screening committee (2013, 2015)

Outside IIT Madras

2025– Chair, Expert Committee for Development of AI Curriculum for School Education (Central Board of Secondary Education, Government of India)
2025– Expert Panel Member — AI Samarth (AI Literacy initiative for Middle and High Schools)
2025– Chair, Technology Advisory Committee (TAC) on Infrastructure, Integration, and Technical Standards under PFRDA regulatory framework
2024– Member, Board of Studies, SASTRA University (2024–)

Grant Referee

Department of Biotechnology , Council of Science and Technology UP , Biotechnology Industry Research Assistance Council (BIRAC) , Indian Council for Medical Research , Science and Engineering Board
Breast Cancer Now , Dutch Research Council (NWO) , European Research Council , Swiss National Science Foundation (SNSF) , UK Research and Innovation (UKRI) , Vienna Science and Technology Fund

Editorial Responsibilities

2023– *PLoS Complex Systems*, **Editorial Board Member**
Responsibilities: Assess whether manuscripts should be sent for peer review, manage peer review of manuscripts, make final editorial decisions
2023– *npj Systems Biology and Applications*, **Editorial Board Member**
2022– *Microbial Biotechnology*, **Editorial Board Member**

2022– *PLoS ONE*, **Editorial Board Member**
Responsibilities: Assess whether manuscripts should be sent for peer review, manage peer review of manuscripts, make final editorial decisions

2021– *ACS Synthetic Biology*, **Editorial Advisory Board**

2019– *Scientific Reports*, **Editorial Board Member**
Responsibilities: Assess whether manuscripts should be sent for peer review, manage peer review of manuscripts, make final editorial decisions

Conference Committees

2025 *Symposium on Artificial Intelligence and Pharmaceutical Medicine (AIPM–India)*, at IIT Madras, September 10–11 2025 (Co-organiser)

2025 *5th IBSE International Symposium — Microbiomes: Exploring Invisible Frontiers in Health, Habitat, Space, and Beyond*, at IIT Madras, February 19–21 2025 (Co-organiser)

2022 *4th IBSE International Symposium — Microbiomes in Environment, Space and in Human Health*, at IIT Madras, October 31–November 2 2022 (Co-organiser)

2022 *RBCDSAI-IBSE HPC Symposium*, at IIT Madras (online), January 4–7, 2022 (Co-organiser)

2022 *Advances in Control & Optimization of Dynamical Systems (ACODS) 2022* (Associate Editor)

2020 *ISMB 2020* (Programme Committee Member of NetBio COSI: Network Biology)

2020 *2nd IBSE International Symposium — EMBO | India Symposium | Engineering meets Evolution: Designing biological systems*, at IIT Madras, January 30–February 1 2020 (Co-organiser)

2020 *Advances in Control & Optimization of Dynamical Systems (ACODS) 2020* (Associate Editor)

2019 *ISMB/ECCB 2019* (Programme Committee Member of NetBio COSI: Network Biology)

2018 *ISMB 2018* (Programme Committee Member of NetBio COSI: Network Biology)

2018 *Advances in Control & Optimization of Dynamical Systems (ACODS) 2018* (Associate Editor)

2018 *1st IBSE International Symposium — From Genotype to Phenotype: Computational Approaches to Understand Biological Systems*, at IIT Madras, January 22–24 2018 (Co-organiser)

Journal Referee

Archives of Medical Research, *ACS Synthetic Biology*, *Applied Mathematical Modelling*, *BBA Molecular Basis of Disease*, *Biochemical Society Transactions*, *Bioinformatics*, *Bioresource Technology*, *BMC Bioinformatics*, *BMC Genomics*, *BMC Systems Biology*, *Cells Tissues Organs*, *Computational and Structural Biotechnology*, *Computational Biology and Chemistry*, *Computers in Biology and Medicine*, *Critical Reviews in Biotechnology*, *Frontiers in Bioengineering and Biotechnology*, *Genome Biology*, *Gigascience*, *IEEE Access*, *IEEE/ACM Transactions on Computational Biology and Bioinformatics*, *iScience*, *ISME Communications*, *ISME Journal*, *Journal of Applied Microbiology*, *Journal of Biosciences*, *Journal of Computational Biology*, *Journal of Theoretical Biology*, *Journal of the Indian Institute of Science*, *Journal of the Royal Society: Interface*, *Life Sciences in Space Research*, *Mathematical Biosciences*, *Metabolic Engineering Communications*, *Microbial Biotechnology*, *Microbial Cell Factories*, *Microbiology Spectrum*, *Molecular Ecology*, *Molecular Microbiology*, *Molecular Nutrition and Food Research*, *Molecular Omics*, *mSystems*, *Nature Microbiology*, *Nature Chemical Biology*, *Nature Communications*, *npj Systems Biology and Applications*, *Nucleic Acids Research: Cancer*, *Nucleic Acids Research: Genomics & Bioinformatics*, *Nucleic Acids Research*, *Pathogens and Disease*, *Physica A*, *PLoS Computational Biology*, *PLoS ONE*, *Review Commons*, *Scientific Data*, *Tuberculosis*