

Narmada Sambaturu

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Current Position	Director's Postdoctoral Fellow, Theoretical Biology and Biophysics, Los Alamos National Laboratory, Los Alamos, USA. Mentors: Dr. Thomas Leitner, Dr. Carmen Molina-París.	Oct 2021 - Present
Education	PhD, Interdisciplinary Mathematical Sciences, Mathematical and Computational Biology Stream, IISc Mathematics Initiative, Indian Institute of Science, Bangalore, India. Supervisors: Prof. Nagasuma Chandra, Prof. N. Srinivasan. Thesis: <i>Multi-scale Modelling of Immune Response and Disease Spread: Methods and Applications.</i>	2015 - 2021
	Master of Science, School of Computing, National University of Singapore, Singapore. Supervisor: Prof. Wing-Kin Sung. Thesis: <i>Towards Handling Repeats in Genome Assembly.</i>	2012 - 2015
	Bachelor of Engineering, Computer Science and Engineering, M.S.Ramaiah Institute of Technology, Bangalore, India. Visvesvaraya Technological University.	2005 - 2009
Awards	<ul style="list-style-type: none">• Director's Postdoctoral Fellow, Los Alamos National Laboratory (2021).• Best Student Paper Award, 2015 IEEE International Conference on Bioinformatics and Biomedicine (BIBM).• One of 50 students selected from all over India for participation in a summer camp in Biotechnology at M.S.Swaminathan Research Foundation, Chennai, India (2003).• All India Rank 25 in Secondary School Certificate Examination (Grade 10) (2003).	
Research Experience	<ul style="list-style-type: none">• Director's Postdoctoral Fellow, Theoretical Biology and Biophysics, Los Alamos National Laboratory. Mentors: Dr. Thomas Leitner, Prof. Carmen Molina-París. Within and between host scale integration to model HIV transmission. Building models to study HIV-1 proviral decay after antiretroviral therapy; investigating how HIV-1 provirus becomes established in an infected host and how that expands to the between-host epidemiological level.• Senior Research Scientist, HealSeq Precision Medicine. Analyzing immune response to vaccinations.• PhD Fellow, Interdisciplinary Mathematical Sciences, IISc Mathematics Initiative, Indian Institute of Science, Bangalore, India. Supervisors: Prof. Nagasuma Chandra, Prof. N. Srinivasan. Developing algorithms for multi-scale modeling of immune response and disease spread,	<div>Oct 2021 - Present</div> <div>Summer 2021</div> <div>2015 - 2021</div>

including methods for mining omics-integrated biological networks to identify dysregulated paths and influential nodes, incorporating genetic heterogeneity into epidemic models, and designing vaccine candidates maximising population coverage.

- **Visitor,** Winter 2016
 Department of Applied Mathematics,
 University of Leeds, Leeds, UK
 Supervisors: Prof. Carmen Molina-París, Prof. Grant Lythe.
 Developing method to study the role of genetic heterogeneity in epidemiological spread of H1N1 influenza, as well as modeling tumour immune surveillance.
- **Junior Research Fellow,** Summer 2015
 Indian Institute of Science, Bangalore, India.
 Supervisor: Prof. Nagasuma Chandra.
 Introduction to Systems Biology and graph-theoretical analysis of biological networks.
- **MSc Student,** 2012 - 2015
 School of Computing, National University of Singapore, Singapore.
 Supervisor: Prof. Wing-Kin Sung.
 Developing method to improve handling of repeat regions in genome assembly by exploiting an overhang between adjacent genomic fragments caused by using certain transposons for library preparation.
- **Intern,** 2006
 Bioinformatics Centre,
 Indian Institute of Science, Bangalore, India.
 Supervisor: Prof. K. Sekar.
 Contributed towards development of a method to identify intergenic sRNAs in completely sequenced bacterial genomes.

Teaching Experience

- **Guest Lecturer** for course *Molecular Biology*. Winter 2021
 Pre-Medical Program leading to Doctor of Medicine (MD).
 International Medical School (St. George's University) Bangalore campus, Karnataka, India.
 Topics: *Molecular Biology Tools and Concepts of OMICS, Bioinformatics, Transgenic Plants, Transgenic Animals, Molecular Medicine, Gene Therapy*.
- **Teaching Assistant** for course *Current trends in drug discovery*. Summer 2018
 Indian Institute of Science, Bangalore, Karnataka, India.
- **Learning Enabler**, Tata Consultancy Services. 2010
 Common Initial Learning Program. Bidadi, Karnataka, India.

Work Experience

- **Senior Research Scientist, HealSeq Precision Medicine.** Summer 2021
 Bangalore, India.
- **Developer, Tata Consultancy Services.** 2009 - 2011
 Technology Excellence Group,
 Bangalore, India.

Peer-reviewed Publications

1. Ushashi Banerjee, Adithya Chedere, Raksha Padaki, Abhilash Mohan, **Narmada Sambaturu**, Amit Singh, and Nagasuma Chandra. "Pathtracer comprehensively identifies hypoxia-induced dormancy adaptations in Mycobacterium tuberculosis". *Journal of Chemical Information and Modeling*, 2023.
2. Vishal Rao, Ushashi Banerjee, **Narmada Sambaturu**, Sneha Chunchanur, R. Ambica, and Nagasuma Chandra. "Pressured cytotoxic T cell epitope strength among SARS-CoV-2 variants correlates with COVID-19 severity." *HLA*, 2023.

3. Emily J. Fray, Fengting Wu, Francesco R. Simonetti, Carolin Zitzmann, **Narmada Sambaturu**, Carmen Molina-París, Alexandra M. Bender et al. “Antiretroviral therapy reveals triphasic decay of intact SIV genomes and persistence of ancestral variants.” *Cell Host & Microbe* 31, no. 3 2023: 356-372.
4. Piyush Agrawal*, **Narmada Sambaturu***, Gulden Olgun, and Sridhar Hannenhalli. “A path-based analysis of infected cell line and COVID-19 patient transcriptome reveals novel potential targets and drugs against SARS-CoV-2.” *Frontiers in immunology* 13 2022. (*equal contribution)
5. **Narmada Sambaturu**, Vaidehi Pusadkar, Sridhar Hannenhalli, and Nagasuma Chandra, “PathExt: a general framework for path-based mining of omics-integrated biological networks.” *Bioinformatics* 37, no. 9 2021: 1254-1262.
6. **Narmada Sambaturu***, Sumanta Mukherjee*, Martín López-García, Carmen Molina-París, Gautam I. Menon, and Nagasuma Chandra. “Role of genetic heterogeneity in determining the epidemiological severity of H1N1 influenza.” *PLoS Computational Biology* 14, no. 3, 2018: e1006069. (*equal contribution)
7. **Narmada Sambaturu**, Madhulika Mishra, and Nagasuma Chandra. “EpiTracer - an algorithm for identifying epicenters in condition-specific biological networks.” *BMC genomics* 17, no. 4, 2016: 543.
8. **Narmada Sambaturu**, Madhulika Mishra, and Nagasuma Chandra. “EpiTracer - an algorithm for identifying epicenters in condition-specific biological networks.” *Proceedings of the 2015 IEEE International Conference on Bioinformatics and Biomedicine (BIBM)*. IEEE Computer Society, 2015. (Best Student Paper Award).
9. Sridhar, Jayavel, **Narmada Sambaturu**, Radhakrishnan Sabarinathan, Hong-Yu Ou, Zixin Deng, Kanagaraj Sekar, Ziauddin Ahamed Rafi, and Kumar Rajakumar. “sR-NAscanner: a computational tool for intergenic small RNA detection in bacterial genomes.” *PLOS ONE* 5, no. 8, 2010: e11970.
10. Annapurna P. Patil, **Narmada Sambaturu**, and Kittaya Chunhaviriyakul. “Convergence time evaluation of algorithms in MANETs.” *International Journal of Computer Science and Information Security*, Vol. 5, No. 1, pp. 144-149, September 2009.

Dissertations

- **Narmada Sambaturu**. “Towards handling repeats in genome assembly.” *MSc dissertation, National University of Singapore*, 2014.
- **Narmada Sambaturu**. “Multi-scale Modelling of Immune Response and Disease Spread: Methods and Applications.” *PhD dissertation, Indian Institute of Science*, 2021.

Manuscripts

- **Narmada Sambaturu**, Emily J Fray, Fengting Wu, Carolin Zitzmann, Francesco R Simonetti, Dan H Barouch, Janet D Siliciano, Robert F Siliciano, Ruy M Ribeiro, Alan S Perelson, Carmen Molina-París, and Thomas Leitner. “Last in first out: SIV proviruses seeded later in infection are harbored in short-lived CD4⁺ T cells”.
- Macauley Locke, **Narmada Sambaturu**, Carmen Molina-París, and Thomas Leitner. “Within-host parameters regulate HIV epidemiological outcomes”.

Workshop and Conference Presentations

- **Narmada Sambaturu**, Emily J. Fray, Fengting Wu, Carolin Zitzmann, Francesco R. Simonetti, Dan H. Barouch, Janet D. Siliciano, Robert F. Siliciano, Ruy M. Ribeiro, Alan S. Perelson, Carmen Molina-París, and Thomas Leitner. **(Talk)** *Longitudinal dynamics of SIV and HIV divergence during antiretroviral therapy is determined by the decay of short- and long-lived cells*. 30th International Dynamics & Evolution of Human Viruses Conference, April 19-22 2023.

- **Narmada Sambaturu**, Sumanta Mukherjee, Martín López-García, Carmen Molina-París, Gautam I Menon, and Nagasuma Chandra. **(Talk)** *Role of genetic heterogeneity in determining the epidemiological severity of H1N1 influenza*. Epidemiology meets Immunology and Vice Versa - Linking Math Epidemiology to Math Immunology, SMB Math-Epidemiology/Math-Immunology Subgroups Mid-Year Mini Virtual Conference, February 27-28 2022.
- **Narmada Sambaturu**, Sumanta Mukherjee, Martín López-García, Carmen Molina-París, Gautam I Menon, and Nagasuma Chandra. **(Talk)** *Incorporating genetic heterogeneity into epidemic models for H1N1 influenza*. Mathematical and Statistical Explorations in Disease Modelling and Public Health, International Centre for Theoretical Sciences (ICTS), Bangalore, India, Jul 1 - 11 2019.
- **Narmada Sambaturu**, Madhulika Mishra, Rahul Metri and Nagasuma Chandra. *An Algorithm for Identifying Druggable Targets Among Influential Mutations in Individual Cancer Patients*. **(Poster)** Indo-US Conference on Sculpting the future of medicine - Gateway to the post-proteogenome era, at Advanced Centre For Treatment, Research And Education In Cancer (ACTREC), Mumbai, India, Dec 10 - 11 2018.
- **Narmada Sambaturu** and Nagasuma Chandra. *OptiNeo – an algorithm to optimise the number of neo-antigenic peptides for cancer immunotherapy*. **(Poster)** Nature Big Data and Cancer Precision Medicine, Boston, Massachusetts, Oct 1 - 2 2018.
- **Narmada Sambaturu**, Sridhar Hannenhalli, and Nagasuma Chandra. **(Poster)** *Cutting through the complexity of genomic data: A general method to identify candidate genes*. RECOMB/ISCB Conference on Regulatory and Systems Genomics with DREAM Challenges, New York, NY, Nov 19 - 21 2017.
- **Narmada Sambaturu**, Sumanta Mukherjee, Martín López-García, Carmen Molina-París, Gautam I. Menon, and Nagasuma Chandra. **(Talk)** *Role of genetic heterogeneity in determining the epidemiological severity of H1N1 influenza*. Discussion meeting on Mathematical Models of Infection, Immunity and Inflammation, Indian Institute of Science, Bangalore. April 2017.

Invited Talks

- **Pathways to STEM, Evolution of Human Immunodeficiency Virus**. STEM Santa Fe, New Mexico, USA, Jul 2023.
- **Careers in Computer Science, Modeling Disease Spread**. STEM Santa Fe, New Mexico, USA, Jun 2022.
- **Data Science in Bioinformatics**. Women in Data Science (WiDS) Mysuru, India, Sep 2020.
- **Network Algorithms and their Applications in Biology**. Sanjay Ghodawat University, Kolhapur, India, Dec 2018.
- **Statistical Thinking in Biomedical Research**. KLE College of Pharmacy, Bangalore, India, Apr 2018.

Professional Service

- Review Editor: Frontiers in Systems Biology, Frontiers in Immunology, Frontiers in Genetics, Journal of Theoretical Biology, NPJ Systems Biology and Applications.

Professional Societies

- Lifetime Member, Society for Mathematical Biology.

Graduate Coursework

- PhD (IISc): Current Trends in Drug Discovery, Special Topics in Theoretical Biology.
- MSc (NUS): Advanced Combinatorial Methods in Bioinformatics, Advanced Algorithms, Knowledge Discovery and Data Mining, Modeling and Analysis Techniques in Systems Biology, Advanced Topics in Data Mining.

Skills	Modeling:	Agent Based Modeling, Deterministic (Ordinary Differential Equations) and Stochastic Mathematical Modeling.
	Programming languages:	Python, R, MATLAB, C, C++, Java, Perl, HTML.
	Database management:	SQL.
	Machine learning packages:	scikit-learn, scipy, Weka.
	Bioinformatics tools:	IEDB tools, Cytoscape, STRING, BLAST, CLUSTALW, SAMtools, BWA.
	Version control:	SVN, Git.
	Writing and typesetting:	LaTeX, MS Office, Google Docs.
Outreach	<ul style="list-style-type: none">• Tutoring underprivileged children in local community in topics ranging from arithmetic and English, to Engineering Mathematics and Programming. Helped a student pass Engineering Mathematics course after two prior unsuccessful attempts.• Presenting talks in workshops and undergraduate colleges, aimed at encouraging students to pursue a career in science.<ul style="list-style-type: none">– STEM Santa Fe, New Mexico, USA, Jul 2023.– STEM Santa Fe, New Mexico, USA, Jun 2022.– Women in Data Science (WiDS) Mysuru, India, Sep 2020.– Sanjay Ghodawat University, Kolhapur, India, Dec 2018.– KLE College of Pharmacy, Bangalore, India, Apr 2018.• Proposed workshop for STEM Pathways for Girls Conference, STEM Santa Fe, New Mexico, USA, Oct 2023.	
Community Service	<ul style="list-style-type: none">• Volunteer with STEM Santa Fe, New Mexico, USA.• Volunteer with Habitat for Humanity, USA.• Participated in tree planting initiatives.• Participated in initiatives to clean up hiking trails.	