

Dr. Sabina Jehan Haque

*James Van Loo Independent Postdoctoral Research Fellow
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Employment	University of Michigan Ann Arbor Van Loo Independent Postdoctoral Research Fellow	Jul 2024 - present
Education	Harvard University PhD in Systems Biology Advisor: Jeremy Gunawardena <i>Dissertation title: Graph-theoretic approaches to biochemical reaction networks</i>	Sep 2018 - May 2024
	Middlebury College B.A. in Mathematics (high honors), Molecular Biology & Biochemistry	Sep 2014 - May 2018

Research interests: algebraic graph theory, chemical reaction network theory, structural identifiability, real algebraic geometry, continuous-time Markov processes, non-equilibrium biophysics, dynamical systems theory, fast-slow dynamics and model reduction

Publications

Submitted preprints

1. **Haque S. J.**, Eisenberg, M. Exploring the effect of parametric model reduction on the structural identifiability of linear compartment models. arXiv. (2026).

Published

2. **Haque, S. J.**, Satriano, M., Sorea, M. & Yu, P. Y. The Disguised Toric Locus and Affine Equivalence of Reaction Networks. *SIAM J. Appl. Dyn. Syst.* **22**, 1423–1444 (2023).
3. Chavez, A., Tuttle M, Pruitt B. W., Ewen-Campen B., Chari R., Ter-Ovanesyan D., **Haque S. J. et al.** Comparison of Cas9 activators in multiple species. *Nat. Meth.* **13**, 563–567 (2016).

In Preparation

4. **Haque S. J.**, Nam K.-M., Gunawardena J. A graph construction for analysing the parametric asymptotics of Markov processes (In preparation).
5. **Haque S. J.**, Cetiner U., Gunawardena J. Anomalous behaviour of the Steinberg signature for detecting departure from thermodynamic equilibrium. (In preparation).

Fellowships and Awards

James Van Loo Independent Postdoctoral Fellowship Michigan Center for Applied and Interdisciplinary Mathematics (MCAIM), University of Michigan Ann Arbor	2024 - 2027
Junior Scientists Board Research Grant Challenge (\$10K funding) Center for Complex Particle Systems (COMPASS), University of Michigan Ann Arbor	2024 - 2025
Lynch Foundation PhD Fellowship Department of Systems Biology, Harvard University	2019 - 2021, 2023 - 2024
NSF-Simons QBio PhD Fellowship NSF-Simons Center for Mathematical & Statistical Analysis of Biology, Harvard University	2021 - 2022

Selected Talks

Exploring the effect of parametric model reduction on the structural identifiability of linear compartment models 14th European Conference on Mathematical & Theoretical Biology, University of Graz, Graz, Austria	Jul 13 2026
Exploring the effect of parametric model reduction on the structural identifiability of linear compartment models Chemical Reaction Networks Workshop in Hawai'i 2026, University of Hawai'i at Mānoa, Honolulu, HI	May 18 2026
Graph-theoretic approaches to biochemical reaction networks and structural identifiability Applied Algebra Group, Department of Mathematics, University of Copenhagen, Copenhagen, Denmark	Feb 05 2026
Graph-theoretic and algebraic geometric approaches to biochemical reaction networks Mathematics of Reaction Networks (MoRN) Seminar, virtual	Nov 11 2025
Graph-theoretic and algebraic geometric approaches to biochemical reaction networks	Oct 03 2025

Mathematics Seminar, Algebraic Systems Biology Group, MPI-CBG, Dresden, Germany

A graph construction for analysing the parametric asymptotics of Markov processes

Jul 12 2025

2025 SIAM Conference on Applied Algebraic Geometry, 4th Madison Workshop on Mathematics of Reaction Networks, Madison, WI

The linear framework: graph-theoretic approach to Markov processes with applications in biochemical reaction networks.

Oct 03 2024

Mathematics Department, University of Michigan, Ann Arbor MI

Following the energy: graph-theoretic models of broken detailed balance with biochemical applications.

Jan 12 2024

National Institute for Theoretical and Mathematical Biology, Chicago IL

Following the energy: graph-theoretic models of broken detailed balance with biochemical applications.

Oct 17 2023

Barcelona Collaboratorium for Modelling and Predictive Biology, UPF, Barcelona Spain

A graph-theoretic approach to Markov processes with applications in biochemical reaction networks.

Oct 03 2023

Mathematics Department Colloquium, Middlebury College, Middlebury VT

Following the energy: graph-theoretic models of broken detailed balance with biochemical applications.

Apr 25 2023

NSF-Simons QBio Seminar, Harvard University, Cambridge MA

Following the energy: graph-theoretic models of broken detailed balance with biochemical applications.

Mar 26 2023

Systems Biology Department Seminar, Harvard University, Cambridge MA

Graph-theoretic models of detecting broken detailed balance in molecular information processing.

Jul 11 2022

2022 SIAM Annual Meeting MS 26: Trends and New Results in Deterministic Models of Biochemical Interaction Networks, Pittsburgh PA

Investigating mathematical properties of non-equilibrium signatures in biological information processing systems.

Mar 16 2022

Poster at 2022 American Physical Society Annual March Meeting, Chicago IL

Teaching and mentoring

University of Michigan Ann Arbor

Instructor of record:

MATH 404: Intermediate Differential Equations
(Nonlinear Dynamics & Chaos)

Winter 2025
Fall 2025

	Fall 2026
<u>Undergraduate students mentored:</u> Joe Bogdan, University of Michigan	Summer 2025
• Project title: Toric geometry of chemical reaction networks (CRNs) • Independent research study on the effect of network operations on toric dynamical systems • Poster presentation at SIAM Student Chapter Symposium 2025	
Daniel Le (Colby College) and George Simmons (University of Michigan)	Summer 2026
• Project title: Computing Gröbner fans to understand parameter geometry in mathematical biology • Math REU project focused on Gröbner fan algorithm development for structural identifiability	
Harvard University <u>Teaching fellow:</u> AM 50: Introduction to Applied Mathematics	Spring 2020

Service

Conferences and seminars organized

Co-organizer for JMM Special Session (accepted) Joint Mathematics Meetings, Chicago IL	Jan 2027
• Session title: “Algebraic, Combinatoric, and Stochastic Approaches in Mathematical Biology” • Co-organizers: Dr. Ruby Kim, Dr. Naghmeh Akhavan	
Organizer for MCAIM Colloquium University of Michigan, Ann Arbor MI	2026-present
• Invited Dr. Jinsu Kim for a visit and a colloquium talk at Michigan Center for Applied and Interdisciplinary Mathematics • Continuing outreach work for MCAIM to increase visibility and engagement	

University and departmental service

Math Corps summer instructor for high school students University of Michigan, Ann Arbor MI	2026-present
• Developed and taught 5-week class “What is graph theory” for 9th grade students	
Intercollegiate Math Modeling Challenge (IM²C) judge University of Michigan, Ann Arbor MI	Nov 2025
Association for Women in Mathematics (AWM) peer mentor University of Michigan, Ann Arbor MI	2024-present

- Run peer mentoring groups for graduate and undergraduate students at University of Michigan

Public engagement

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| Guest speaker for summer class on Physics of Biological Function
Wentworth Institute of Technology, Boston MA | Jun 2023 |
| Cambridge Science Festival volunteer
Cambridge, MA | Oct 2022 |
| Graduate research assistant in Quantitative Biology grant preparation
NSF-Simons Center for Quantitative Biology, Harvard University, Cambridge MA | May-Jul 2022 |
| “What is Systems Biology?” outreach event creator/coordinator
Cambridge Science Festival, Cambridge MA | Apr 2019 |
- Developed an interactive public event for the Cambridge Science Festival with hands-on activities illustrating concepts from systems biology

Science communication

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| Cellular mathematics: how does math enhance our understanding of life at the molecular level?
https://sabinahaque.substack.com/ | 2022-present |
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- Substack newsletter exploring the intersection between math and biology written for the general public
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| Graph Theory 101
Science in the News (SITN) Special Edition: Networks, Harvard University, Cambridge MA
https://sitn.hms.harvard.edu/flash/2021/graph-theory-101/ | Jun-Aug 2021 |
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- Contributed an article on graph theory to a special edition of SITN on networks written for the general public

Professional societies

Society of Industrial and Applied Mathematics (SIAM)
Society of Mathematical Biology (SMB)