Ying Zhang

CONTACT INFORMATION

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RESEARCH INTERESTS

My research interests are in the areas of differential equations (ordinary and partial), stochastic processes, numerical analysis, and mathematical modeling in biology. I am especially interested in developing models and new mathematical tools to study multi-scale stochastic dynamics arising in molecular, cell and systems biology. Recently, my research has centered on several key areas: developing mechanical models to study collective cell migration and identifying the key components contributing to polycystic ovary syndrome (PCOS) and understanding their impact on PCOS-induced cancers through developing models and novel mathematical tools.

APPOINTMENTS

Department of Mathematics and Biology, Northeastern University

Postdoctoral Research Associate in Mathematics, July 2023-Present

Department of Mathematics, Brandeis University

Postdoctoral Associate in Mathematics, June 2020-May 2023

EDUCATION

Department of Mathematics and Statistics, Boston University

Ph.D. in Mathematics, May 2020

- Dissertation Topic: *Particle-Based Stochastic Reaction-Diffusion Methods for Studying T Cell Signaling*
- Advisor: Samuel A. Isaacson

Boston University

B.A. in Mathematics, May 2015

- Graduated with *Magna Cum Laude, Honors in Mathematics*
- Senior Thesis Topic: *A Mathematical Study of Two Soil Microbial Matter Models*
- Advisor: Mark A. Kramer

HONORS AND AWARDS

2017	*Hariri Graduate Fellowship*, Boston University
2015	*Magna Cum Laude*, Boston University
2015	Honors in Mathematics, Boston University
2015	*Robert E. Bruce Prize in Mathematics*, Boston University
2014	Undergraduate Research Opportunity UROP Award, Boston University
2014	Undergraduate Research Opportunity Student Researcher Award, Boston University
2012–2015	CAS Dean's List, Boston University
2012	Journal of the Arts & Sciences Writing Program Prize, Boston University

PUBLICATIONS

Y. Zhang and C. Copos, *Emergence of multiple collective motility modes in a physical model.* (In preparation for submission)

S. A. Isaacson and **Y. Zhang**, *An Unstructured Mesh Convergent Reaction-Drift-Diffusion Master Equation for Reversible Reactions.* (Accepted by Bulletin of Mathematical Biology) Doi: https://doi.org/10.48550/arXiv.2405.00283

A. Huhn, D. Nissley, D. B. Wilson, M. Kutuzov, R. Donat, T. K. Tan, **Y. Zhang**, M. I. Barton, C. Liu, W. Dejnirattisai, P. Sipasa, J. Mongkolsapaya, A. Townsend, W.

James, G. Screaton, P. Anton van der Merwe, C. M. Deane, S. A. Isaacson, and O. Dushek, *The Molecular Reach of Antibodies Crucially Underpins Virus Neutralisation.* (Accepted by Nature Communications)
Doi: https://doi.org/10.1101/2023.09.06.556503

A. Kent, K. Leiderman, A. C. Nelson, S. Sindi, M. M. Stadt, L. Xiong, and **Y. Zhang**. *Studying the Effects of Oral Contraceptives on Coagulation Using a Mathematical Modeling Approach.* In: Mathematical Modeling for Women's Health. The IMA Volumes in Mathematics and its Applications, Vol. 166. Springer, Cham (2024). Doi: https://doi.org/10.1007/978-3-031-58516-6_4

L. Elam, M. Quiñones-Frías, **Y. Zhang**, A. A. Rodal, and T. G. Fai, *Fast Solver for Diffusive Transport Time on Dynamic Intracellular Networks.* SIAM J. On Appl. Math., Vol. 0, No. 0, S476 (2023). Doi: https://doi.org/10.1137/22M1509308

Y. Zhang and T. G. Fai, *Influence of the Vessel Wall Geometry on the Wall-induced Migration of Red Blood Cells.* PLOS Comp. Biol., Vol. 19, No. 7, e1011241 (2023). Doi: https://doi.org/10.1371/journal.pcbi.1011241

Y. Zhang and S. A. Isaacson, *Detailed Balance for Particle Models of Reversible Reactions in Bounded Domains.* J. Chem. Phys., Vol. 156, No. 20, pp 204105-1 - 204105-19 (2022). Doi: https://doi.org/10.1063/5.0085296

Y. Zhang, L. Clemens, J. Goyette, J. Allard, O. Dushek and S. A. Isaacoson, *The influence of molecular reach and diffusivity on the efficacy of membrane-confined reactions*, Biophysical Journal, Vol. 117, No. 7, pp 1189-1201 (2019).
Doi: https://doi.org/10.1016/j.bpj.2019.08.023

S. A. Isaacson and **Y. Zhang**, *An Unstructured Mesh Convergent Reaction-Diffusion Master Equation for Reversible Reactions*, J. Comp. Phys., Vol. 374, 954-983 (2018).
Doi: https://doi.org/10.1016/j.jcp.2018.07.036

Grants

Fall 2024	Dean's Postdoctoral Travel Award, Northeastern University, Boston, MA, USA
2024 – 2026	AMS-Simons Travel Grant, award number: 25-C-00058
2024 – 2026	AIM's SQuaREs Program, *American Institute of Mathematics*, Pasadena, CA, USA
Summer 2024	NSF Travel Grant, *Mathematical Biosciences Workshop*, Penn State University, PA, USA
Summer 2024	SIAM Early Career Travel Award, *SIAM Conference on the Life Sciences*, Portland, OR, USA
Summer 2023	SMB Landahl Travel Grant, *2023 Annual Meeting of the Society for Mathematical Biology*, Ohio State University, Columbus, OH, USA
Summer 2022	NSF-AWM Travel Grant, *Association for Women in Mathematics*
Summer 2022	SIAM Early Career Travel Award, *SIAM Conference on the Life Sciences*, Pittsburgh, PA, USA
Summer 2022	Institute for Mathematics and its Applications Financial Support, *Collaborative Workshop for Women in Mathematical Biology: Mathematical Approaches to Support Women's Health*, United Health Group, Minnetonka, MN, USA

Grants

Summer 2022 NSF Travel Award, *Frontiers in Applied and Computational Mathematics*, New Jersey Institute of Technology, Newark, NJ, USA

Summer 2019 SMB Landahl Travel Grant, *2019 Annual Meeting of the Society for Mathematical Biology*, Universite de Montreal, Montreal, Canada

Summer 2018 SIAM Student Travel Award, *SIAM Conference on the Life Sciences*, Radisson Blu, Minneapolis, MN, USA

Summer 2017 SMB Landahl Travel Grant, *2017 Annual Meeting of the Society for Mathematical Biology*, University of Utah, Salt Lake City, UT, USA

Summer 2016 NSF Travel Grant, *Stochastic Dynamical Systems in Biology: Numerical Methods and Applications*, University of Cambridge, UK

Winter 2015 NSF Travel Grant, *Stochastic Dynamical Systems in Biology: Numerical Methods and Applications*, University of Cambridge, UK

Invited Talks

Understanding the Biased Distribution in Traction Forces in Cooperative Cell Motility, SIAM Conference on the Life Sciences, Portland. (June 2024)

Understanding the Biased Distribution in Traction Forces in Cooperative Cell Motility, New England Dynamics Seminar, Brown University. (April 2024)

Understanding the Biased Distribution in Traction Forces in Cooperative Cell Motility, Applied and Interdisciplinary Mathematics Seminar, Northeastern University. (April 2024)

Diffusive Transport on Dynamic Intracellular Networks, Mathematical Biology Seminar, Brandeis University. (November 2023)

Studying the Effects of Oral Contraceptives on Coagulation Using a Mathematical Modeling Approach, Annual Meeting of the Society for Mathematical Biology, Columbus. (July 2023)

Influence of the Endothelial Surface Layer on the Motion of Red Blood Cells, Mathematical Biology Seminar, University of British Columbia. (October 2022)

Influence of the Endothelial Surface Layer on the Motion of Red Blood Cells, Dynamics Club, University of Southern California. (September 2022)

Influence of the Endothelial Surface Layer on the Wall-induced Migration of Red Blood Cells, SIAM Conference on the Life Sciences, Hybrid. (July 2022)

The Influence of the Endothelial Surface Layer on the Motion of Red Blood Cells, Brown/BU/UMass seminar on Dynamics and PDE, University of Massachusetts, Amherst. (November 2021)

The Influence of the Endothelial Surface Layer on the Motion of Red Blood Cells, Mathematical Biology Seminar, Brandeis University. (October 2021)

A Switch-like Behavior in Membrane-confined Bimolecular Reactions with Respect to Diffusivity and Molecular Reach, Mathematical Biology Seminar, Brandeis University. (November 2019)

A Switch-like Behavior in Membrane-confined Bimolecular Reactions with Respect to Diffusivity and Molecular Reach, Annual Meeting of the Society for Mathematical Biology, Montreal, Canada. (July 2019)

A Stochastic Reaction-Diffusion Model for Tethered Enzymatic Reactions, Boston Graduate Math Colloquium, Boston. (April 2018)

A Stochastic Reaction-Diffusion Model for Tethered Enzymatic Reactions, BU/Brown PDE Seminar, Boston University. (November 2017)

A Stochastic Reaction-Diffusion Model for Enzymatic Reactions, Annual Meeting of the Society for Mathematical Biology, Salt Lake City. (July 2017)

A 2D Convergent Reaction Diffusion Master Equation on Unstructured Mesh, BU/Brown PDE Seminar, Boston University. (November 2015)

Contributed Talks

Understanding the Biased Distribution in Traction Forces in Cooperative Cell Motility, Mathematical Biosciences Workshop, Penn State University, Pennsylvania. (August 2024)

Influence of the Endothelial Surface Layer on the Wall-induced Migration of Red Blood Cells, Annual Meeting of the APS Division of Fluid Dynamics, Hybrid. (November 2022)

Immersed Boundary Simulations of Red Blood Cells Near Vessel Walls, Annual Meeting of the Society for Mathematical Biology, Virtual. (June 2021)

The Influence of Boundary Conditions in Immersed Boundary Simulations of Vesicles Near Walls, SIAM Conference on Computational Science and Engineering, Virtual. (March 2021)

Poster Presentations

"Diffusive Transport on Dynamic Intracellular Networks". Poster presented at Stochastic Physics in Biology Gordon Research Conference, Ventura, California. (January 2025).

"Understanding the Biased Distribution in Traction Forces in Cooperative Cell Motility". Poster presented at the 2024 American Society for Cell Biology Meeting, San Diego, CA (December 2024).

"Influence of the Endothelial Surface Layer on the Wall-induced Migration of Red Blood Cells". Poster presented at the Mechanics of Life Workshop, Flatiron Institute, New York City, NY (May 2022).

"Influence of the Endothelial Surface Layer on the Wall-induced Migration of Red Blood Cells". Poster presented at the Frontiers in Applied and Computational Mathematics, Newark, NJ (May 2022).

"The Influence of Molecular Reach and Diffusivity on the Effectiveness of Membrane-confined Reactions". Poster presented at the SIAM Conference on the Life Sciences, Minneapolis, MN (August 2018).

"The Influence of Molecular Reach and Diffusivity on the Effectiveness of Membrane-confined Reactions". Poster presented at the Annual Meeting of the Society for Mathematical Biology, Sydney, AU (July 2018).

"Numerical Methods for Stochastic Reaction-Diffusion Master Equations on Unstructured Mesh". Poster presented at the SIAM Conference on the Life Sciences, Boston, MA (July 2016).

"A 2D Convergent Reaction-Diffusion Master Equations on Unstructured Mesh". Poster presented at Stochastic Dynamical Systems in Biology: Numerical Methods and Applications, Cambridge, UK (January 2016).

"Numerical Methods for Stochastic Reaction-Diffusion Master Equations on Unstructured Mesh". Poster presented at the Undergraduate Research Awardee Symposium, Boston, MA (September 2014).

Conference and Workshops

Stochastic Physics in Biology Gordon Research Conference, Ventura, California. (January 2025)

2024 American Society for Cell Biology Meeting, San Diego, California. (December 2024)

BIRS Workshop: Dynamical Models Inspired by Biology, Virtual. (October 2024)

Mathematical Biosciences Workshop, Penn State University, Pennsylvania. (August 2024)

SIAM Conference on the Life Sciences, Portland, Oregon. (June 2024)

Annual Meeting of the Society for Mathematical Biology, Ohio. (July 2023)

Annual Meeting of the APS Division of Fluid Dynamics, Hybrid. (November 2022)

SIAM Conference on the Life Sciences, Pittsburgh. (July 2022)

Collaborative Workshop for Women in Mathematical Biology: Mathematical Approaches to Support Women's Health, United Health Group, Minnesota. (June 2022)

Mechanics of Life, Flatiron Institute, New York. (May 2022)

Frontiers in Applied and Computational Mathematics, New Jersey. (May 2022)

BIRS Workshop: Mathematics of the Cell: Integrating Signaling, Transport and Mechanics, Banff. (October 2021)

Annual Meeting of the Society for Mathematical Biology, Virtual. (June 2021)

SIAM Conference on Computational Science and Engineering, Virtual. (March 2021)

SIAM Conference on the Life Sciences. (June 2020)

Annual Meeting of the Society for Mathematical Biology, Montreal. (July 2019)

SIAM Conference on the Life Sciences, Minneapolis. (August 2018)

Annual Meeting of the Society for Mathematical Biology, Sydney, (July 2018)

AMS-MRC: Agent-based Modeling in Biological and Social Systems, Rhode Island. (June 2018)

Annual Meeting of the Society for Mathematical Biology, Salt Lake City, (July 2017)

SIAM Conference on the Life Sciences, Boston. (July 2016)

Stochastic Dynamical Systems in Biology: Numerical Methods and Applications, University of Cambridge. (December 2015)

Collaborators

- Prof. Samuel A. Isaacson (Professor of Mathematics and Statistics, Boston University)

- Prof. Omer Dushek (Associate professor of Biomedical Sciences, Oxford University)
- Prof. Thomas G. Fai (Assistant professor of Mathematics, Brandeis University)
- Prof. Avital Rodal (Associate professor of Biology, Brandeis University)
- Prof. Karin Leiderman (Associate professor of Mathematics and Biochemistry and Biophysics, University of North Carolina at Chapel Hill)
- Prof. Calina Copos (Assistant professor of Biology and Mathematics, Northeastern University)
- Prof. Mark A. Kramer (Professor of Mathematics and Statistics, Boston University)

Undergraduate Advisees

- Lachlan Elam (Brandeis University)

Teaching Experience

2018 Fall	MA226 Differential Equations (TA), Boston University
2019 Spring	MA242 Linear Algebra (Instructor), Boston University
2019 Fall	MA226 Differential Equations (TA), Boston University
2020 Spring	MA570 Stochastic Methods of Operations Research (TA), Boston University
2020 Fall	MATH35 Advanced Calculus and Fourier Analysis (Instructor), Brandeis University
2021 Fall	MATH20 Multivariable Calculus (Instructor), Brandeis University
2022 Fall	MATH20 Multivariable Calculus (Instructor), Brandeis University

Relevant Skills

Languages:	Chinese, English, Spanish
Computer:	C++, Python, MATLAB, Java, Copasi, IMOD, R, Mathematica, Maple, Adobe Illustrator, Word, Excel, PowerPoint