

Ying Zhang

CONTACT INFORMATION

Department of Mathematics
Northeastern University
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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

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| 2025 | Nat. Comm. paper selected as an Editor's Highlight |
| 2017 | <i>Hariri Graduate Fellowship</i> , Boston University |
| 2015 | <i>Magna Cum Laude</i> , Boston University |
| 2015 | Honors in Mathematics, Boston University |
| 2015 | <i>Robert E. Bruce Prize in Mathematics</i> , 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, M. M. Stadt, S. Sindi, A. Kent, A. C. Nelson, and K. Leiderman. *A Novel Statistical Analysis Approach of Studying the Impact of Oral Contraceptives on Coagulation*. (In preparation of submission)

Y. Zhang, A. C. Nelson, M-V. Ciocanel, and C. Copos, *Mechanical Understanding of Biphasic Force Scaling with Length of Micropatterns Epithelial Cells*. (In preparation for submission)

Y. Zhang and C. Copos, *Emergence of Multiple Collective Motility Modes in A Physical Model*. (Accepted by Nat. Syst. Biol. Appl.)

S. A. Isaacson and **Y. Zhang**, *An Unstructured Mesh Convergent Reaction-Drift-Diffusion Master Equation for Reversible Reactions*. Bull. Math. Biol., Vol. 87, No. 13 (2025). Doi: <https://doi.org/10.1007/s11538-024-01392-z>

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 Their Viral Neutralisation Capacity*. Nat. Commun., Vol. 16, No. 338 (2025).
Doi: <https://doi.org/10.1038/s41467-024-54916-5>

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. Isaacson, *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

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| 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 |

GRANTS

- 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
- 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

- Why Do Cells Migrate Collectively in Different Modes?*, Biophysics Seminar, Northeastern University. (April 2025)
- Why Do Cells Migrate Collectively in Different Modes?*, Mathematical Biology Seminar, UPenn. (March 2025)
- 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

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)

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| COLLABORATORS | <ul style="list-style-type: none">• Samuel A. Isaacson (Professor of Mathematics and Statistics, Boston University)• Suzanne Sindi (Professor of Applied Mathematics, UC Merced)• Mark A. Kramer (Professor of Mathematics and Statistics, Boston University)• Omer Dushek (Associate professor of Biomedical Sciences, Oxford University)• Thomas G. Fai (Assistant professor of Mathematics, Brandeis University)• Avital Rodal (Associate professor of Biology, Brandeis University)• Karin Leiderman (Associate professor of Mathematics and Biochemistry and Biophysics, University of North Carolina at Chapel Hill)• Calina Copos (Assistant professor of Biology and Mathematics, Northeastern University)• Veronica Ciocanel (Assistant professor of Mathematics and Biology, Duke University)• Anna Nelson (Assistant professor of Mathematics, University of New Mexico) | |
| UNDERGRADUATE ADVISEES | <ul style="list-style-type: none">• 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 |