

Allison Cruikshank

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Overview

I am a fifth year PhD candidate in Mathematics at Duke University. I study mathematical biology, focusing on mechanistic mathematical modeling of human physiological processes to answer and inform questions in medicine. I plan to obtain a career in the biotech/pharmaceutical industry after completing my PhD in May 2026 and am interested in PK/PD and QSP modeling for drug development.

Education

- **Duke University** Expected May 2026
PhD in Mathematics, Advisor: Professor Michael C. Reed
Thesis: Mathematical biochemistry: Sex Differences in Cell Metabolism and Comodulation of Neurotransmitters in the Brain
- **University of Nebraska-Lincoln** May 2021
BS in Mathematics and Biochemistry with Highest Distinction
Thesis: A Mathematical Model of Pancreatic Cancer Growth and Response to Treatment
Advisor: Professor Huijing Du

Professional Experience

- **FDA QSP Research Fellow** Present
Developing a QSP model for patients with PNH to provide insights into the underlying mechanisms of the disease, effects of current treatments, and potential therapeutic interventions.
Responsibilities: virtual population generation, parameter estimation & calibration, sensitivity analysis, intensive literature review, QSP model generation, and presenting work in project team meetings.
- **Simulations Plus QSP Modeling Intern** Summer 2024
Supported the development of the BIOLOGXsym platform, a QST software focused on complex macro-molecule liver safety. My primary focus was incorporating the downstream effects of Nivolumab on the adaptive immune system and its impact on liver toxicity within BIOLOGXsym.
Responsibilities: data fitting, parameter estimation, sensitivity analysis, intensive literature review and subsequent integration of key mechanisms in model, and presenting work in project team meetings.
- **Johnson & Johnson Clinical Pharmacology and Pharmacometrics Intern** Summer 2023
Supported the development of co-stimulatory combinations of T cell redirectors for treatment of lymphoma through mechanistic mathematical modeling.
Responsibilities: data fitting, parameter estimation, intensive literature review and subsequent integration of key mechanisms in model, and presenting work in project team meetings.

Publications

Graduate Work

- [2025] Mizuki Suzuki, Hwi Young Kim, Michael C Reed, Frederik Nijhout, **Allison Cruikshank**, Manal Abdelmalek, Anna Mae Diehl, Paul M. Yen, Brijesh Kumar Singh, Madhulika Tripathi, Ayako Suzuki. Elevated Homocysteine is Associated with Liver Fibrosis in MASLD in a Sex- and Menopause-Specific Manner. Under Review at Clinical Gastroenterology and Hepatology.
- [2025] **Allison Cruikshank**, Michael C. Reed, H. Frederick Nijhout. A Mathematical Model of Oxidative Stress: Sex Differences and Cystathionine β -Synthase Deficiency. Under Review at Mathematical Biosciences.
- [2025] Michael C. Reed, Ayako Suzuki, **Allison Cruikshank**, Mizuki Suzuki, H. Frederick Nijhout. Differential effects of synthetic estrogen on serum homocysteine levels before and after menopause. Under Review at PLoS One.
- [2024] Sergio Mena, **Allison Cruikshank**, Janet Best, H. Frederick Nijhout, Michael C. Reed, Parastoo Hashemi. Modulation of Serotonin Transporter Expression by Escitalopram under Inflammation; Implications for SSRI Effectiveness. *Communications Biology*. <https://doi.org/10.1038/s42003-024-06240-3>.
- [2024] **Allison Cruikshank**, Michael C. Reed, H. Frederick Nijhout. Sex differences in glutathione metabolism and acetaminophen toxicity. *Metabolism and Target Organ Damage*. <https://doi.org/10.20517/mtod.2023.44>.
- [2024] Anna Marie Buchanan, Sergio Mena, Iman Choukari, Aditya Vasa, Jesseca N. Crawford, Jim Fadel, Nick Maxwell, Lawrence Reagan, **Allison Cruikshank**, Janet Best, H. Frederick Nijhout, Michael Reed, Parastoo Hashemi. Serotonin as a Biomarker of Toxin-Induced Parkinsonian. *Molecular Medicine*. <https://doi.org/10.1186/s10020-023-00773-9>.
- [2023] **Allison Cruikshank**, Janet Best, H. Frederick Nijhout, Michael C. Reed. Dynamical Questions in Volume Transmission. *Journal of Biological Dynamics*. <https://doi.org/10.1080/17513758.2023.2269986>.

Undergraduate Work

- [2023] Archer Harrold, **Allison Cruikshank**, Bryan Penas, Rebecca Roston. Introducing High School Biology Students to Biochemistry with a Short, Content-Oriented Intervention. *Biochemistry and Molecular Biology Education*. <https://doi.org/10.1002/bmb.21782>.

Awards

- Top 5 Data Science Project in Erdős Data Science Bootcamp Fall 2024
Project: [Thrive or Survive: Predicting the Health of Trees following Forest Fires in Washington](#)
- AWM Poster Award at SIAM Annual Meeting Summer 2024
- SIAM Student Chapter Certificate of Recognition 2024
- NSF RTG Research Assistantship *Duke Applied Math RTG* (\$42,000) Spring 2023, 2024, 2025

Select Presentations

Sex Differences in Oxidative Stress Management

- ICERM Workshop on Uncertainty Quantification - Poster Summer 2025
- University of Pittsburgh AWM Student Seminar Series - Invited Talk Spring 2025
- Virginia Commonwealth University BioMath Seminar - Invited Talk Spring 2025
- Duke Mathematical Biology Seminar - Invited Talk Spring 2025
- Oregon State Math Bio Seminar - Invited Talk Spring 2025
- Joint Mathematics Meeting - Invited Talk Spring 2025
- AMS Fall Sectional Central Meeting - Invited Talk Fall 2024
- AWM Workshop at SIAM Annual Meeting- Poster Summer 2024
- SIAM Life Sciences Meeting - Invited Talk Summer 2024
- Triangle Area Graduate Mathematics Conference (TAGMaC) - Contributed Talk Spring 2024
- Triangle Computational and Applied Mathematics Symposium - Poster Fall 2023
- Association for Women in Mathematics Research Symposium - Poster Fall 2023

Comodulation of Neurotransmitters in the Brain

- SIAM Dynamical Systems - Invited Talk Summer 2025
- Society of Mathematical Biology Annual Meeting - Contributed Talk Summer 2023
- Dynamical Systems in the Life Sciences - Invited Talk Summer 2023

Outreach and Service

- Association for Women in Mathematics (AWM) Present
Chapter Officer, Duke Mathematics Department
Coordinate community-building events, talks, and academic enrichment opportunities.
- Society for Industrial and Applied Mathematics (SIAM) Present
Chapter Officer, Duke Mathematics Department
Organize community-building events, research talks, and career development opportunities.
- Women in Science Identity Group Present
Founding Member, ASCPT
A group that seeks to support and empower women in the field of clinical pharmacology by fostering a collaborative community, promoting personal and career development, and advocating for gender equity within the ASCPT scientific community.
- Triangle Area Graduate Mathematics Conference (TAGMaC) Present
Co-organizer, Duke-UNC-NCSU Mathematics Departments
Rotating conference for mathematics graduate students in the NC Triangle area, sponsored by the AMS and SIAM chapters at Duke, UNC Chapel Hill, and NC State. Co-organized the Fall 2021 TAGMaC.

- Triangle Contest in Mathematical Modeling (TriCoMM) Present
Co-organizer, Duke Mathematics Departments
 Local mathematical modeling contest for undergraduate students based on the international Mathematical Contest in Modeling (MCM). Helped organize logistical meetings and the contest.
 - Semester REU Spring 2024
Graduate Student Support, Duke Mathematics Department
 Assist in a research experience for undergraduates led by Dr. Jacob Madrid in mathematical biology and probability.
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Teaching

- **Duke University** Fall 2024
Instructor of Record
Math 112L: Laboratory Calculus I
 Prepared and presented lectures three days per week and co-designed exams and homework with a team of graduate instructors.
 - **Duke University** Fall 2022
Instructor of Record
Math 111L: Laboratory Calculus I
 Prepared and presented lectures three days per week and co-designed exams with the course coordinator (Professor Shira Viel) and a team of graduate instructors.
 - **Duke University** Fall 2021
Teaching Assistant
Math 111L: Laboratory Calculus I
 Led a discussion section with a partner twice a week. Facilitated group work, answered questions, gave mini-lectures, and graded exams.
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Other Technical Skills

- Programming Languages: Matlab (advanced), Python (proficient)
- Data Science: Regression, Classification, Ensemble Learning, Inference, neural networks