

# Allison Cruikshank

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## Overview

I am a fifth-year PhD candidate in Mathematics at Duke University, where I develop mechanistic mathematical models to represent human physiological processes and address questions in medicine. I plan to pursue a career in the pharmaceutical or biotech industry after completing my PhD in May 2026, with a particular interest in applying QSP to drug development.

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## Education

### Duke University

Expected May 2026

PhD in Mathematics, Advisor: *Professor Michael C. Reed*

Thesis: *Mechanistic Modeling to Investigate Sex Differences in Oxidative Stress Management*

### 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*

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## Professional Experience

### Mathematical Modeling Consultant, Zyphore Therapeutics

Present

Apply mechanistic mathematical modeling and systems-level analysis of metabolic processes to inform research strategies and support experimental design in a biotech setting.

Responsibilities: parameter estimation & calibration, literature review, mechanistic model generation, and presenting work in project team meetings.

### 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 macromolecule 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 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 by incorporating and parameterizing novel mechanisms in a mechanistic mathematical model.

Responsibilities: data fitting, parameter estimation, intensive literature review, and presenting work in project team meetings.

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## Publications

- [2025] Mizuki Suzuki, Hwi Young Kim, Michael C Reed, Frederik Nijhout, **Allison Cruikshank**, et al. Elevated Homocysteine is Associated with Liver Fibrosis in MASLD in a Sex- and Menopause-Specific Manner. Under Review at Gastro Hep Advances.
- [2025] **Allison Cruikshank**, Michael C. Reed, H. Frederick Nijhout. A Mathematical Model of Oxidative Stress: Sex Differences and Cystathionine  $\beta$ -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>.
- [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

Best Collaborative Project at ISoP QSP SIG Student Symposium	Summer 2025
Top 5 Data Science Project in Erdős Data Science Bootcamp	Fall 2024
Project: <a href="#">Thrive or Survive: Predicting the Health of Trees following Forest Fires in Washington</a>	
AWM Poster Award at SIAM Annual Meeting	Summer 2024
SIAM Student Chapter Certificate of Recognition	2024
NSF RTG Research Assistantship <i>Duke Applied Math RTG</i> (\$42,000)	Spring 2023, 2024, 2025

## Select Presentations

### Sex Differences in Oxidative Stress Management

SIAM Annual Meeting - Oral and Poster Presentation	Summer 2025
ISoP QSP Special Interest Group Student Symposium - Oral Presentation	Summer 2025
ICERM Workshop on Uncertainty Quantification - Poster	Summer 2025
University of Pittsburgh AWM Student Seminar Series - Oral Presentation	Spring 2025
Virginia Commonwealth University BioMath Seminar - Oral Presentation	Spring 2025
Duke Mathematical Biology Seminar - Oral Presentation	Spring 2025
Oregon State Math Bio Seminar - Oral Presentation	Spring 2025
Joint Mathematics Meeting - Oral Presentation	Spring 2025
AMS Fall Sectional Central Meeting - Oral Presentation	Fall 2024
AWM Workshop at SIAM Annual Meeting - Poster	Summer 2024
SIAM Life Sciences Meeting - Oral Presentation	Summer 2024
Association for Women in Mathematics Research Symposium - Poster	Fall 2023

## Comodulation of Neurotransmitters in the Brain

SIAM Dynamical Systems - Oral Presentation	Summer 2025
Society of Mathematical Biology Annual Meeting - Oral Presentation	Summer 2023
Dynamical Systems in the Life Sciences - Oral Presentation	Summer 2023

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## Outreach and Service

Association for Women in Mathematics (AWM) <i>Chapter Officer, Duke Mathematics Department</i> Coordinate community-building events, talks, and academic enrichment opportunities.	Present
Society for Industrial and Applied Mathematics (SIAM) <i>Chapter Officer, Duke Mathematics Department</i> Organize community-building events, research talks, and career development opportunities.	Present
Women in Science Identity Group <i>Founding Member, ASCPT</i> 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.	Present
Triangle Area Graduate Mathematics Conference (TAGMaC) <i>Co-organizer, Duke-UNC-NCSU Mathematics Departments</i> 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.	Present
Triangle Contest in Mathematical Modeling (TriCoMM) <i>Co-organizer, Duke Mathematics Departments</i> Local mathematical modeling contest for undergraduate students based on the international Mathematical Contest in Modeling (MCM).	Present
Semester REU <i>Graduate Student Support, Duke Mathematics Department</i> Research experience for undergraduates led by Dr. Jacob Madrid in mathematical biology and probability.	Spring 2024

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## Teaching

Laboratory Calculus II <i>Instructor of Record, Duke University</i> Prepared and presented lectures three days per week and co-designed exams and homework with a team of graduate instructors.	Fall 2024
Laboratory Calculus I <i>Instructor of Record, Duke University</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.	Fall 2022
Laboratory Calculus I <i>Teaching Assistant, Duke University</i> Led a discussion section with a partner twice a week. Facilitated group work, answered questions, gave mini-lectures, and graded exams.	Fall 2021

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## Other Technical Skills

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