

# 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/biotech industry after completing my PhD in May 2026, with a particular interest in applying modeling approaches to support drug development.

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## Education

### Duke University

Expected May 2026

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

Thesis: *Mechanistic Mathematical Models of Sex Differences and Oxidative Stress in Health and Disease*

### 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*

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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. *Gastro Hep Advances*. <https://doi.org/10.1016/j.gastha.2025.100800>.
- [2024] Sergio Mena, **Allison Cruikshank**, Janet Best, H. Frederick Nijhout, Michael C. Reed, Parastoo Hashemi. Modulation of Serotonin Transporter Expression by Escitalopram under Inflammation. *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>.

## Preprints

- [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.
- [2025] **Allison Cruikshank**, Michael C. Reed, H. Frederick Nijhout. A Mathematical Model of Oxidative Stress: Sex Differences and Cystathionine  $\beta$ -Synthase Deficiency. In Prep.
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## Professional and Research Experience

### PhD Researcher, Duke University

2021 - Present

- Created mechanistic models of hepatic oxidative stress management to study sex differences and the differential effects of estradiol supplementation in pre- and post-menopausal women on key metabolites.
- Uncovered glutathione-mediated mechanisms of sex differences in acetaminophen toxicity.
- Investigated the interaction of serotonin and dopamine in Parkinson's Disease, revealing serotonin as a biomarker.

### Mathematical Modeling Consultant, Zyphore Therapeutics

2025 - Present

- Designed and calibrated mechanistic models of metabolic processes to support drug discovery strategy.
- Delivered modeling insights in regular reports to align computational and experimental objectives.

### FDA QSP Research Fellow

2024- Present

- Refined an established QSP model of the Alternative Complement Pathway in Paroxysmal Nocturnal Hemoglobinuria (PNH) to capture therapy effects on disease biology.
- Validated model predictions against Phase 3 complement inhibitor trials, ensuring accurate prediction of biomarkers and supporting mechanistic interpretation of therapy effects.

### Simulations Plus QSP Modeling Intern

Summer 2024

- Integrated the downstream effects of Nivolumab on the adaptive immune system and its impact on liver toxicity within BIOLOGXsym, a QST software designed for large molecule liver safety.
- Generated and analyzed virtual patient populations to evaluate how T cell variability influences different mechanisms of Nivolumab-related liver toxicity.
- Parameterized drug-induced liver toxicity mechanisms using LAMPs organ-on-a-chip experimental data to support translational safety modeling.

### Johnson & Johnson Clinical Pharmacology and Pharmacometrics Intern

Summer 2023

- Incorporated novel mechanisms of immunological synapse formation into a mechanistic model of T cell redirectors for lymphoma treatment.
- Implemented and tested co-stimulation hypotheses to evaluate potential combination strategies.

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## Awards

FDA ORISE Fellowship

November 2024 - Present

Best Collaborative Project at ISoP QSP SIG Student Symposium

Summer 2025

Top 5 Data Science Project in Erdős Data Science Bootcamp

Fall 2024

Project: [Thrive or Survive: Predicting the Health of Trees following Forest Fires](#)

AWM Poster Award at SIAM Annual Meeting (Honorable Mention)

Summer 2024 (Summer 2025)

SIAM Student Chapter Certificate of Recognition

2024

NSF RTG Research Assistantship *Duke Applied Math RTG* (\$42,000)

Spring 2023, 2024, 2025

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## Presentations

### Sex Differences in Glutathione and Oxidative Stress

SIAM Annual Meeting - Contributed Poster and Invited Talk

Summer 2025

ISoP QSP Special Interest Group Student Symposium - Contributed Talk

Summer 2025

SIAM Dynamical Systems - Invited Talk

Summer 2025

ICERM Workshop on Uncertainty Quantification - Contributed 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

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| 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 - Contributed Poster                             | Summer 2024 |
| SIAM Life Sciences Meeting - Invited Talk  | Summer 2024 |
| Triangle Area Graduate Mathematics Conference - Contributed Talk                     | Spring 2024 |
| Triangle Area Computational and Applied Math Research Symposium - Contributed Poster | Fall 2023   |
| Association for Women in Mathematics Research Symposium - Contributed Poster         | Fall 2023   |

### Co-modulation of Neurotransmitters in the Brain

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

### Internship Presentations

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| ISoP QSP Special Interest Group Student Symposium - Contributed Talk<br><i>Nivolumab-mediated Liver Toxicity</i>          | Summer 2025 |
| Johnson & Johnson Internship Symposium - Contributed Poster<br><i>Mechanisms of Co-stimulation for T Cell Redirectors</i> | Summer 2023 |

## Outreach and Service

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| Society for Industrial and Applied Mathematics (SIAM), <i>Chapter Officer</i> | 2021 - Present |
| ASCPT Women in Science Identity Group, <i>Founding Member</i>                 | 2024 - Present |
| Triangle Contest in Mathematical Modeling (TriCoMM), <i>Co-organizer</i>      | 2022 - Present |
| Triangle Area Graduate Mathematics Conference (TAGMaC), <i>Co-organizer</i>   | 2021-2025      |
| Association for Women in Mathematics (AWM), <i>Chapter Officer</i>            | 2021-2025      |
| Semester REU, <i>Graduate Student Support</i>                                 | Spring 2024    |

## Teaching

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| Laboratory Calculus II, <i>Instructor of Record, Duke University</i> | Fall 2024 |
| Laboratory Calculus I, <i>Instructor of Record, Duke University</i>  | Fall 2022 |
| Laboratory Calculus I, <i>Teaching Assistant, Duke University</i>    | Fall 2021 |

## Professional Memberships

International Society of Pharmacometrics (ISoP)  
American Society for Clinical Pharmacology & Therapeutics (ASCPT)  
Society of Mathematical Biology (SMB)  
Society of Industrial and Applied Mathematics (SIAM)

## Relevant Skills

Programming Languages: Matlab, Python, R, SAS  
Data Science: Regression, Classification, Ensemble Learning, Inference, neural networks