

RYAN WEIGHTMAN

Postdoctoral Research Fellow

CONTACT DETAILS

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Research Interests

My research focuses on developing data-informed mathematical models to study and control population-scale dynamical systems, with primary applications in infectious disease epidemiology and public health. I am particularly interested in the integration of sociodemographic heterogeneity and human decision-making into mathematical models. Alongside this work, I am an experienced educator, and I actively design my research agenda and modeling frameworks to be pedagogically accessible and to support student involvement at both the undergraduate and graduate levels.

EDUCATION:

Rutgers University–Camden Graduate School of Arts & Sciences: Camden, NJ
PhD in the Center for Computational and Integrative Biology.
Graduated with Distinction: May 2025

Rutgers University–Camden Graduate School of Arts & Sciences: Camden, NJ
M.S in Pure Mathematics: Awarded May 2020

Rutgers University–Camden Institute for Effective Education: Camden, NJ
Teacher Preparation Program: Mathematics (P-12)
Teaching Certification: Awarded Jan. 2019, CEAS

Rutgers University–Camden College of Arts & Sciences: Camden, NJ
B.A in Mathematics: Awarded May 2018
Minor: Spanish

The University of Salamanca: Salamanca, Spain
Study Abroad: June 2016-Aug. 2016

CURRENT ROLES:

Rutgers Health, Rutgers University: New Brunswick, NJ
Presidential Postdoctoral Fellow – Epidemiological Modeling

- Design and apply mathematical models (e.g., SIR/SEIR, differential equations) to analyze infectious disease transmission and interventions.
- Perform data-driven analyses using case data, demographics, and mobility to estimate key parameters like R_0 and intervention impact.
- Collaborate with teams to translate findings into outbreak response strategies.
- Publish and present modeling methods and results in reports, seminars, and conferences.

Camden County Mosquito Commission: Camden County, NJ
Mosquito Commissioner

- Contribute to public health planning and vector control initiatives
- Attend monthly meetings to advise on mosquito surveillance and disease monitoring.
- Collaborate with county officials to enhance mosquito operations control and community outreach.

Rutgers University–Camden: Camden, NJ
Part Time Lecturer – Mathematics

- Develop and maintain a Canvas site for various courses in the math department.
- Develop and teach course-appropriate lectures.
- Design, administer, and grade assignments.

RESEARCH EXPERIENCE:

Rutgers Health, Rutgers University: New Brunswick, NJ

Presidential Postdoctoral Fellow – Epidemiological Modeling

Fall 2025-Present

- Research to understand how sociodemographic characteristics can affect the dynamics of epidemiological models.
- Record results in publications to disseminate in appropriate scientific journals.
- Attend cohort meetings for professional development.

Rutgers University: New Brunswick, NJ

New Jersey Wind Institute Fellowship through the New Jersey Department of Economic Development

Fall 2023-Fall 2024 and again Fall 2024-Fall 2025

- Attend monthly meetings to learn about the New Jersey Offshore Wind industry.
- Collect public data about the New Jersey power grid.
- Build an energy model to project New Jersey's power production and consumption in the future, with Offshore wind considered.

Rutgers University–Camden: Camden, NJ

Graduate Researcher (PhD) for the Center for Computational and Integrative Biology

Fall 2021-May 2025

- Principal Investigator: Dr. Benedetto Piccoli
- Topics of Study:
 - Apply systems of ordinary differential equations to various biological problems.
 - Develop models in order to quantify biological systems and provide a pipeline for future computational research.

Master's Thesis in Pure Mathematics

Fall 2020

- Supervisor: Dr. Siqi Fu
- Topic of study: Properties of bounded domains and minimizing the first Dirichlet Laplacian Eigenvalue.

Research Assistant for the Center for Computational and Integrative Biology

Fall 2020

- Supervisors: Dr. Benedetto Piccoli and Dr. Sean McQuade
- Topic of Study: Developing an extended SIR model coupled with an Optimal Control Scheme in order to shed light on COVID-19 impact on the state of New Jersey

Researcher at CIRCLES I-24 Motion Test

Fall 2022

- Attend planning meetings for the development of a 100 autonomous vehicle traffic experiment
- Develop a plan for car deployment and collection for experiment days
- Assist the hardware team in the installation and removal of key hardware for data collection
- Direct car deployment live for 5 days of testing during the actual experiment

Yale University: New Haven, Connecticut

Student Facilitator

Spring 2021-Fall 2021

- Receive grant funding for work on projects relating to high-performance computing
- Present goals of the proposed project
- Give weekly project updates to project facilitators.
- Present the progress made on the proposed project over the lifetime of the grant (6 months)

RESEARCH PRODUCTS: PUBLICATIONS

1. Weightman, R. (2021). Steiner symmetrization and the eigenvalues of the Laplace operator on polygons (Masters dissertation, Rutgers University-Camden Graduate School).
2. McQuade, S. T., Weightman, R., Merrill, N. J., Yadav, A., Trélat, E., Allred, S. R., & Piccoli, B. (2021). Control of COVID-19 outbreak using an extended SEIR model. *Mathematical Models and Methods in Applied Sciences*, 1-26.
3. Luo, Q., Weightman, R., McQuade, S. T., Diaz, M., Trélat, E., Barbour, W., ... & Piccoli, B. (2022). OPTIMIZATION OF VACCINATION FOR COVID-19 IN THE MIDST OF A PANDEMIC. *Networks and Heterogeneous Media*, 17(3), 443-466.
4. Weightman, Ryan, Anthony Sbarra, and Benedetto Piccoli. "Coupling compartmental models with Markov chains and measure evolution equations to capture virus mutability." *Mathematical Models and Methods in Applied Sciences*(2022).
5. Weightman, Ryan, and Benedetto Piccoli. "Optimization of non-pharmaceutical interventions for a mutating virus." 2023 American Control Conference (ACC). IEEE, 2023.
6. Hayat, A., Alanqary, A., Bhadani, R., Denaro, C., Weightman, R., Xiang, S., ... & Piccoli, B. (2023). Traffic smoothing using explicit local controllers.
7. Weightman, R., Moroney, S., Sbarra, A., & Piccoli, B. (2023). Advanced Models for COVID-19 Variant Dynamics and Pandemic Waves. *Mathematical Models and Computer Simulations for Biomedical Applications*, 33, 217.
8. Morand, V., Müller, N., Weightman, R., Piccoli, B., Keimer, A., & Bayen, A. M. (2024). Deep learning of first-order nonlinear hyperbolic conservation law solvers. *Journal of Computational Physics*, 113114.
9. Weightman, R., Akinode, T., & Piccoli, B. (2024). Optimal control of pandemics via a sociodemographic model of non-pharmaceutical interventions. *Networks and Heterogeneous Media*, 19(2), 500-525.
10. Weightman, R., & Piccoli, B. (2024). Managing an Epidemic Using Compartmental Models and Measure Differential Equations. In *Predicting Pandemics in a Globally Connected World, Volume 2: Toward a Multiscale, Multidisciplinary Framework through Modeling and Simulation* (pp. 157-182). Cham: Springer Nature Switzerland.
11. Hayat, A, et al. "Traffic smoothing using explicit local controllers: Experimental evidence for dissipating stop-and-go waves with a single automated vehicle in dense traffic." *IEEE Control Systems* 45.1 (2025): 95-110.
12. Ameli, M, et al. "Design, preparation, and execution of the 100-AV field test for the CIRCLES consortium: Methodology and implementation of the largest mobile traffic control experiment to date." *IEEE Control Systems* 45.1 (2025): 139-155.
13. Benedetti, G, Weightman, R., and Piccoli, B. "Optimizing overlapping non-pharmaceutical interventions with a socio-demographic model." *Bollettino dell'Unione Matematica Italiana* (2025): 1-22.
14. Sun, Y., Weightman, R., Shi, A., Dogan, T., & Samaranayake, S. (2025). A review of urban resilience frameworks: Transferring knowledge to enhance pandemic resilience. *Urban Resilience and Sustainability*, 3(4), 271–292.
15. Weightman, R. *Mathematical Modeling and Control of Viral Infections: Studying Mutation Dynamics and Adaptive Response*. Diss. Rutgers, The State University of New Jersey-Camden, 2025.
16. Sun, Y., Weightman, R., Yang, Y., Shi, A., Dogan, T., & Samaranayake, S. (2026). From Accessibility to Allocation: An Integrated Workflow for Land-Use Assignment and FAR Estimation. arXiv preprint arXiv:2602.02887.

RESEARCH PRODUCTS: PRESENTATIONS

1. R. Weightman. "Symmetrization and the first fundamental tone." Presentation at the Department of Mathematical Sciences, Rutgers University–Camden Honors Convocation 2021
2. R. Weightman. "Epidemiological Modeling of Covid-19 Over Time." Presentation at Rutgers Camden Center for Computational and Integrative Biology Seminar 2022
3. R. Weightman. "Epidemiological Modeling of a Mutating Virus." Poster Presentation at Rutgers Camden Graduate Research Symposium 2022
4. R. Weightman. "Studying City Resilience to a Virus Through Mobility Modeling." Poster presentation at Rutgers Camden Center for Computational and Integrative Biology Retreat 2023
4. R. Weightman. Organizer of a special session titled "Mathematical modeling of pandemics" The 13th AIMS Conference on Dynamical Systems, Differential Equations and Applications 2023
5. R. Weightman. "Incorporating Viral Mutation Into Epidemiological Models." Presentation at Rutgers Camden Center for Computational and Integrative Biology Seminar 2023
6. R. Weightman. " Optimization of non-pharmaceutical interventions for a mutating virus." Presentation at the 2023 American Control Conference (ACC).
7. R. Weightman. "Gleaning Population Level Insights From Host Level Viral Load Dynamics." Poster presentation at Rutgers Camden Center for Computational and Integrative Biology Summer Research Showcase 2024
8. R. Weightman. "A mathematical model for the optimal design and network integration of an offshore wind farm in New Jersey" Presentation and poster presentation at The Wind Institute Research Symposium- NJDEA 2024
9. R. Weightman. "What do we do? Informing public policy via mathematical modeling" Presentation at the Rutgers Camden Center for Computational and Integrative Biology Retreat 2024
10. R. Weightman. "Understanding Pandemic Transmission Via A High Fidelity Hybrid Epidemiological Model" 2025 Rutgers Camden Showcase of Projects, Art, Research, and Knowledge (Winning presentation)
11. R. Weightman. "Epidemiology and City Mobility." Presentation at Rutgers Camden Center for Computational and Integrative Biology Seminar 2025
12. R. Weightman. "Being a Graduate Researcher In Mathematics." Guest speaker for undergraduate course titled "Careers in Mathematics" 2025
13. R. Weightman. "Hybrid Agent/Equation-Based Modeling for Urban Epidemic Dynamics: A Measure-Theoretic Approach." Presentation at the Rutgers Postdoc Symposium 2025 (Best Talk Award)

SERVICE:

Camden County Mosquito Commission: Camden County, NJ

Spring 2025-present

- Support the Camden County Parks Department by contributing to the planning of public health initiatives and day-to-day vector control as a commissioner.

Voorhees Middle School, Rutgers–Camden collaboration

Fall 2024-present

- Created and taught mathematics lessons to 8th-grade students during department outreach events aimed at introducing college-level concepts in an accessible and engaging format.
 - "Differential Equations: Using math to predict the future"
 - "Cryptography: The Mathematics of Codemaking!"
 - "Cryptography: Codemaking and codebreaking!"

SERVICE CONTINUED:

Peer reviewer: Manuscript reviewer for academic journals
September 2021-Present

Washington Township High School
Spring 2022

- Presented talks about doing research and careers in mathematics.

Faculty Research and Creative Activity Symposium, Rutgers University–Camden
Spring 2023

- Presented research on traffic modeling titled “The Largest Traffic Experiment In History”

13th AIMS Conference on Dynamical Systems, Differential Equations and Applications: Wilmington, NC

May 31 - June 4, 2023

- Special Session Organizer

Exploring Careers in Mathematics, Rutgers University–Camden
Spring 2024

- Gave a reflective talk titled “Being a Graduate Researcher in Math!” about being a PhD student

Rutgers University–Camden Admitted Students Day
Fall 2024

- Engaged prospective students, answered questions about the program, and promoted departmental initiatives

Rutgers University–Camden Discovery Fair
Spring 2025

- Discussed the student experience and academic pathways of the math major with prospective and undecided students

Prison Mathematics Project
Fall 2024 - Present

- Mentor prisoners who have expressed an interest in a stronger understanding of mathematics

Rutgers University School of Public Health
Spring 2026

- Guest lecturer for Environmental and Occupational Epidemiology, lecturing on geospatial data for exposure assessment.

COMPETENCY IN THE FOLLOWING PROGRAMS:

MATLAB

Python

R

HTML

GitHub

LaTeX (for scientific writing)

Canvas

Youtube (for creating educational content)

HONORS AND AWARDS:

South Jersey Institute of Population Health Grant (January 2026)

Rutgers Presidential Postdoctoral Fellowship (September 2025)

Best oral Presentation, 2025 Rutgers Postdoc Symposium (September 2025)

Dissertation accepted with distinction (May 2025)

Top Scoring Stem Poster, SPARK Graduate Poster Exhibition (April 2025)

IEEE ITSS Lead Institution Award (September 2024)

New Jersey Offshore Wind Fellowship (August 2024)

New Jersey Offshore Wind Fellowship (August 2023)

American Control Conference Travel Grant (May 2023)

Rutgers Global Grant (January 2023)

Camden Graduate Scholarship recipient (Jan. 2018-May 2020)

Meritorious Achiever Award recipient (Sept. 2014- May 2018)

Academic Excellence Scholarship recipient (Sept. 2014-May 2018)

Mathematical Sciences Career Motivation Award recipient (May 2018)

Phi Beta Kappa Honor Society

International Mathematics Honor Society (Pi Mu Epsilon of New Jersey Gamma)

The National Leadership Honor Society (Omicron Delta Kappa)

Rutgers University–Camden Athenaeum Honor Society

Rutgers University–Camden Civic Scholar Scholarship recipient (Sept. 2014- May 2018)

Rutgers University–Camden Honors College (Sept. 2014-May 2018)

TEACHING AND MENTORSHIP:

Rutgers University–Camden: Camden, New Jersey

Undergraduate and Graduate Research Mentor & Project Lead

Department of Mathematical Sciences and Center for Computational and Integrative Biology,
Rutgers University–Camden

September 2019 – 2025

- Mentor undergraduate and Master's-level students in mathematical biology, modeling, and scientific programming.
- Supervise student-led research projects through all stages including literature review, conceptual development, model construction, data analysis, presentation, and publication.
- As a project lead in the Piccoli Lab, provided mentorship and research guidance to a team of 5 undergraduate students, 9 graduate students, and 3 interns.

Teaching Assistant (TA)

Jan. 2020-2022

- Assigned to grade homework assignments, answer student questions, and assist in the administration of exams
- Assisted various professors in the development and implementation of their remote courses, including, but not limited to: assisting in the development of lecture videos, attending virtual lectures for technical support, assisting in the development of virtual learning resources, assisting in communication between professors and students
- Courses:
 - Calculus For Business (Spring 2021, Summer 2021, Summer 2022, Spring 2022)
 - Calculus II (Fall 2020, Spring 2021, Fall 2021, Spring 2022)
 - Calculus III (Fall 2020)
 - Differential Equations (Spring 2022)
 - Linear Algebra (Spring 2020)
 - Intro to Statistics (Spring 2020)

TEACHING EXPERIENCE CONTINUED:

Instructor of Record / Part-Time Lecturer (PTL), Mathematics

Spring 2019 – Present

- Served as instructor of record for a broad range of undergraduate mathematics courses, including calculus, quantitative reasoning, and algebra, at the introductory and intermediate levels.
- Designed and delivered lectures, assessments, and course materials; incorporated diverse instructional methods and educational technology to support student learning and engagement.

Courses Taught:

- **Precalculus:** Fall 2026
- **Calculus 1:** Fall 2023 (one section), Summer 2025 (two sections), Spring 2026 (one section), Summer 2025 (two sections)
- **Essentials of Bio Math:** Spring 2025 (one section)
- **Business Calculus:** Spring 2025 (one section)
- **Numbers and Beyond:** Spring 2020 (one section), Spring 2021 (one section)
- **Introduction to Math Thought:** Summer 2021 (one section), Fall 2021 (two sections)
- **Accelerated Elementary/Intermediate Algebra:** Spring 2019 (one section), Fall 2019 (two sections), Fall 2020 (one section)
- **Introduction to College Algebra:** Fall 2024 (one section)

Course Developer

Sept. 2020

- Assigned to develop the online section of an introductory algebra course for Rutgers University–Camden
- Involving, but not limited to creating: lecture videos, syllabus, course schedule, exams and homework, grading scale, and course expectations for a partially asynchronous version of the course

Collingswood High School: Collingswood, New Jersey

Long-Term Substitute Teacher

March. 2018-June 2018

- Possess a State of New Jersey Substitute Teacher Certification
- Long-term substitute for AP Calculus and Honors Trigonometry (April 2018-June 2018)
- Instruct 80 sophomore, junior, and senior year students in the absence of the classroom teacher
- Help to prepare AP Calculus students for the College Board AP exam
- Create, implement, and manage online resources for students participating in a Twilight program

Substitute Teacher

Sept. 2016-June 2019

Cinnaminson Middle School: Cinnaminson, New Jersey

Student Teacher

Sept. 2018-Dec. 2018

- Plan and execute Common Core-aligned pre-algebra lessons for 90 seventh-grade students of varying skill levels
- Participate in parent-teacher conferences, staff meetings, and department meetings
- Implement classroom management strategies
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First Korean United Methodist Church (FKUMC): Cherry Hill, NJ

Pre-Calculus and AP Calculus Instructor

June 2018-Sept. 2018