

James Wolfe

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EDUCATION

University of Pennsylvania, Ph.D. in Applied Mathematics and Computational Science 2022–Present

Advisor: Joshua B. Plotkin

Dissertation: *Learning in Heterogeneous Populations: Exploration, Cooperation, and Social Optimality*

Harvard University, B.A. *cum laude* in Mathematics

2018–2022

PREPRINTS AND MANUSCRIPTS

J. P. Wolfe and J. B. Plotkin. “Multi-Agent Learning of Reactive Strategies in Iterated Games.” *arXiv preprint* (2026). arXiv:2610.15054. Code.

- Show analytically and computationally how heterogeneous learning rates promote cooperation among selfish gradient learners in the iterated prisoner’s dilemma.
- Prove sufficient conditions for convergence to defection or tit-for-tat; establish how learning-rate heterogeneity enables cooperation to recover after perturbations.

J. P. Wolfe and J. B. Plotkin. “Competitive Exploration in Structured Environments.” *arXiv preprint* (2026). arXiv:2610.34643. Code.

- Derive optimal exploration rates for ϵ -greedy reinforcement learners in spatial environments using exact Markov-chain methods.
- Characterize equilibria, local stability, and social dilemmas among competing learners; show how minimal signaling eliminates inefficient equilibria.

TALKS AND PRESENTATIONS

“**Learning and Social Dilemmas in Competitive Foraging**”

May 2027

SIAM Conference on Applications of Dynamical Systems, Atlanta. Minisymposium: Mathematical modeling of social, political, and socio-environmental processes. *Invited speaker*.

“**Exploration and Exploitation in Spatially Structured Environments**”

January 2026

International Conference on Mathematical Modeling and Applications (ICMMA), Meiji University, Tokyo. *Invited speaker*.

RESEARCH EXPERIENCE

Graduate Researcher, Plotkin Lab, University of Pennsylvania

2022–Present

- Analyze collective outcomes in biologically motivated multi-agent systems using dynamical systems, stochastic processes, and numerical simulation.
- Provide open-source software with seeded simulations, numerical checks, and reproducible figure-generation workflows.

Undergraduate Researcher, Mathematical Biosciences Institute, Ohio State University

2021

- Studied collective decision-making and population stability with Simon Garnier and Jason Graham.

Undergraduate Researcher, Radcliffe Institute for Advanced Study

2020–2021

- Studied stability in coupled economic and ecological models with James P. O’Dwyer.

TEACHING

Teaching Assistant, Introduction to Biology B, University of Pennsylvania Spring 2024

Teaching Assistant, Numerical and Applied Analysis, University of Pennsylvania Fall 2023

Course Assistant, Quantitative Analysis, Harvard University Fall 2021–Spring 2022

TECHNICAL SKILLS

Programming: Python (NumPy, SciPy, pandas, Matplotlib), Mathematica, R, L^AT_EX

Methods: Multi-agent and reinforcement learning, Markov chains, stochastic processes, dynamical systems, game theory, numerical methods