

John T. Nardini

Assistant Professor
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🐦 BioMathNard

Academic appointments

The College of New Jersey , Ewing, NJ Assistant Professor of Mathematics	2021-present
N. C. State University , Raleigh, NC Postdoctoral Scholar	2018-2021
Statistical and Applied Mathematical Science Institute (SAMSI) , Durham, NC Postdoctoral Scholar (Joint)	2018-2020

Education

University of Colorado Boulder, CO Ph.D., Applied Mathematics Dissertation Title: PDE Models of Collective Migration During Wound Healing Adviser: David M. Bortz Certificate in Interdisciplinary Quantitative Biology	2018
N.C. State University , Raleigh, NC B.S., Mathematics	2013

Research Interests

Data-driven Mathematical Modeling, Analysis and Simulation of Partial Differential Equations, Agent-based Models, Machine Learning, Topological Data Analysis

Grants and Awards

AMS-Simons Travel Grant (\$5,000) <i>American Mathematical Society</i> Funding to aid in travel for research collaboration	2020-22
Professional Development Award (\$698) <i>NC State University Graduate School and the Office of Postdoctoral Affairs</i> Funding to develop innovative metacognitive approaches for undergraduate classrooms	2019-20
SAMSI Postdoctoral Fellowship (\$130,000) <i>National Science Foundation</i> Fellowship on SAMSI's program on precision medicine	2018-20

Research Publications

Peer-reviewed articles (*denotes undergraduate co-author, †denotes equal contribution)

20. N. Khoudari, **J. Nardini**, A. Volkening. Quantifying topological features and irregularities in zebrafish patterns using the sweeping-plane filtration. Accepted for publication in *SIAM Journal on Applied Dynamical Systems*. arXiv 2509.11023.
19. M.V. Ciocanel[†], **J. Nardini**[†], K. Flores, E. Rutter, S. Sindi, A. Volkening. Enhancing generalizability of model discovery across parameter space with multi-experiment equation learning (ME-EQL). *PLOS Computational Biology* 22 (4) 2026 DOI: 10.1371/journal.pcbi.1014161.

18. E. Rohr*, **J. Nardini**. SSRCA: A Novel Machine Learning Pipeline to Perform Sensitivity Analysis for Agent-Based Models. *Bulletin of Mathematical Biology* 88 (48) 2026 DOI: 10.1007/s11538-026-01604-8.
17. A. Malik, K. Nguyen, **J. Nardini**, K. Flores, C. Krona, S. Nedlander. Mathematical Modeling of Multicellular Tumor Spheroids Quantifies Inter-Patient and Inter-Tumor Heterogeneity. *NPJ Systems Biology & Applications* 11 (20) 2025 DOI: 10.1038/s41540-025-00492-3.
16. **J. Nardini**. Forecasting and predicting agent-based model data with biologically-informed neural networks. *Bulletin of Mathematical Biology* 86 (130) 2024. DOI: 10.1007/s11538-024-01357-2.
15. K. Nguyen, C. Jameson, S. Baldwin, **J. Nardini**, R. Smith, J. Haugh, K. Flores. Quantifying fluidization patterns in mesenchymal cell populations using topological data analysis and agent-base modeling. *Mathematical Biosciences* 370 April 2024. DOI: 10.1016/j.mbs.2024.109158.
14. **J. Nardini**, C. Pugh*, H. Byrne. Statistical and topological summaries aid disease detection for segmented retinal vascular images. *Microcirculation* 30 (4) 2023. DOI: 10.1111/micc.12799.
13. **J. Nardini**, B. Stolz, H. Harrington, K. Flores, H. Byrne. Topological data analysis distinguishes parameter regimes in the Anderson-Chaplain model of angiogenesis. *PLoS Computational Biology* 17 (6) 2021. DOI: 10.1371/journal.pcbi.1009094.
12. **J. Nardini**, R. Baker, M. Simpson, K. Flores. Learning differential equation models from stochastic agent-based model simulations. *Journal of the Royal Society Interface* 18 (176) 2021. DOI: 10.1098/rsif.2020.0987.
11. J. Lagergren, **J. Nardini**, R. Baker, M. Simpson, K. Flores. Biologically-informed Neural Networks Guide Mechanistic Modeling from Sparse Experimental Data. *PLoS Computational Biology*. 16 (12) 2020. DOI: 10.1371/journal.pcbi.1008462.
10. **J. Nardini**, J. Lagergren, E. Rutter, A. Hawkins-Daarud, L. Curtin, B. Chandler, K. Swanson, K. Flores. Learning Equations from Biological data with Limited Time Samples. *Bulletin of Mathematical Biology* 82 (119) 2020. DOI: 10.1007/s11538-020-00794-z
9. R. Everett, K. Flores, N. Henscheid, J. Lagergren, K. Larripa, D. Li, **J. Nardini**, P. Nguyen, E. B. Pittman, E. Rutter. A tutorial Review of Mathematical Techniques for Quantifying Tumor Heterogeneity. *Mathematical Biosciences and Engineering*. 17(4), 2020. DOI: 10.3934/mbe.2020207.
8. J. Lagergren[†], **J. Nardini**[†], G. M. Lavigne, E. M. Rutter, K. B. Flores. Learning Partial Differential Equation Models from Noisy Spatiotemporal Data. *Proceedings of the Royal Society A* 476 (2234), 2020. DOI: 10.1098/rspa.2019.0800.
7. D. Bhaskar, A. Manhart, J. Milzman, **J. Nardini**, K. Storey, C. M. Topaz, L. Ziegelmeier. Analyzing Collective Motion with Machine Learning and Topology. *Chaos: an Interdisciplinary Journal of Nonlinear Science* 29 (12) 123125, 2019. DOI: 10.1063/1.5125493.
6. **J. Nardini**, D. M. Bortz. The influence of numerical error on parameter estimation and uncertainty quantification for advective PDE models. *Inverse Problems* 35 (6) 065003, 2019. DOI: 10.1088/1361-6420/ab10bb.
5. **J. Nardini**, D. M. Bortz. Investigation of a Structured Fisher's Equation with Applications in Biochemistry. *SIAM Journal on Applied Mathematics* 78 (3) 1712, 2018. DOI: 10.1137/16M1108546.
4. **J. Nardini**, D. Chapnick, X. Liu, D. M. Bortz. Modeling keratinocyte wound healing dynamics: cell-cell adhesion promotes sustained collective migration. *Journal of Theoretical Biology* 7 July 2016, 103. DOI: 10.1016/j.jtbi.2016.04.015.
3. K. Adoteye, R. Baraldi, K. Flores, **J. Nardini**, H. T. Banks, W. C. Thompson. Correlation of parameter estimators for models admitting multiple parameterizations. *International Journal of Pure and Applied Mathematics*, 105(3) 497, 2015. DOI: 10.12732/ijpam.v105i3.16.
2. T. Huffman, K. Link, **J. Nardini**, L. Poag, K. Flores, H.T. Banks, B. Biasco, J. Jungfleisch, J. Diez. A mathematical model of RNA3 recruitment in the replication cycle of brome mosaic virus. *International Journal of Pure and Applied Mathematics*, 92(1) 27, 2014. DOI: 10.12732/ijpam.v92i1.3.
1. H.T. Banks, A. Choi, T. Huffman, **J. Nardini**, L. Poag, W.C. Thompson. Quantifying CFSE label decay in flow cytometry data. *Applied Mathematics Letters*, 26(5) 571, 2013. DOI: 10.1016/j.aml.2012.12.010

Articles under review

1. A. Wenzel, P. Haughey, K. Nguyen, **J. Nardini**, J. Haugh, K. Flores. Topologically-based parameter inference for agent-based model selection from spatiotemporal cellular data. bioRxiv 2025.06. 13.659586.
2. **J. Nardini**, J. Gevertz. Spatial Model Selection and Uncertainty Quantification: Comparing Continuous and Discrete Wound Healing Models arXiv 2606.10873.
3. W. Lavery, J. Cochrane, C. Olesen, D. Tadele, **J. Nardini**, S. Hamis. Physics-Informed Neural Networks for Biological $2D + t$ Reaction-Diffusion Systems. aRxiv 2604.18548.

Pedagogical Publications

Book chapters (Not peer-reviewed)

1. **J. Nardini**. Trusting Students with Flexible Deadlines, pp. 88 - 96. In Practice and Policies: Advocating for Students of Color in Mathematics, P. E. Harris and A. Winger, independently published, 2021.

Teaching Experience

Course Instructor at TCNJ

Calculus A, MAT 127	7 semesters
Differential Equations, MAT 326	Fall 2024, Spring 2025, Fall 2025, Fall 2026
Computational Mathematics, MAT 341	Fall 2023, Fall 2025
Data Mining & Predictive Modeling, STA 307	Spring 2024, Spring 2026
Statistical Inference & Probability, STA 215	Fall 2026
Linear Algebra: Theory and Applications, MAT 205	Spring 2022

Course Instructor at NC State

Calculus for Life and Management Sciences A, MA 131	Fall 2019
Foundations of Advanced Mathematics, MA 225	Spring 2020, Fall 2020
Applied Differential Equations, MA 341	Spring 2021

Course Instructor at CU Boulder

Calculus I for Engineers, APPM 1350	Summer 2017
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Peer Scholar Groups

AMS Project NExT	2020-21
<i>Professional development program incorporating inclusive teaching methods into math classrooms.</i>	
TRESTLE Faculty Learning Community on metacognition	Spring 2017
<i>Met weekly with group of scholars to discuss methods to promote metacognition in the classroom.</i>	

Mentoring Experience

Undergraduate Research

Joseph McGowan	2025-2026
<i>"Incorporating Neural Networks into the Equation Learning Pipeline for Application to Biological Data"</i>	
Edward Young	2025-2026
<i>"Combining PhysiCell simulations with differential equations: harnessing the benefits of both approaches"</i>	
Antonio Madrigal	2024-2025
<i>"Continuous and discrete models of tumor growth"</i>	
Vijay Manchiraju	2024-2025
<i>"Speeding up BINN model training"</i>	
Eddie Rohr	2023-2024
<i>"Computational summaries of tumor spheroids"</i>	

Alexa Karamanoogian <i>"Mathematical models of enzyme kinetics"</i>	2022-2024
Charlie Pugh <i>"Applying TDA to Retinal Vasculature Segmentations"</i>	2021-2022
Allison Duprey, Fanuel Sisay, Natasha Stewart, and Yangxinyu Xie <i>"Sampling for Equation Learning Methods"</i>	Summer 2019

Graduate Research

Carter Jameson <i>"Using Topology and Machine Learning to Aid Parameter Estimation of Cell Microscopy Models"</i>	2020 - 2021
Mike Ackermann, Jorge Arroyo Esquivel, Jake Cherry, Jimi Kim, Ruby Kim, Natalie Meacham <i>"Learning Equations from Stochastic Agent-based Model Simulations"</i>	Summer 2021

Invited Talks

"Overcoming Challenges Associated With Data-driven Modeling for Agent-based Models" SIAM Conference on the Life Sciences, Cleveland, OH	July 2026
"Decoding ABM behavior: novel methods for prediction and global sensitivity analysis" University of Colorado, Boulder Biomath Seminar, held virtually Society for Mathematical Biology Annual Meetings, Edmonton, Canada	December 2025 July 2025
"Forecasting agent-based model data with biologically-informed neural networks" BIRS workshop on Mechanistic Learning in Oncology, Banff, Canada TCNJ School of Science Colloquium, Ewing, NJ Society for Mathematical Biology Annual Meetings, Seoul, South Korea Seminar of Quantitative Modeling in Biology at UC Riverside, held virtually NJIT Mathematical Biology Seminar, Newark, NJ	January 2025 September 2024 July 2024 February 2024 November 2023
"Statistical and Topological Summaries Aid Disease Detection for Segmented Retinal Vascular Images" Society for Mathematical Biology Annual Meetings, Columbus, OH SIAM Conference on the Life Sciences, Pittsburgh, PA	July 2023 July 2022
"Workshop on Data-driven Mathematical Modeling" SIAM Conference on the Life Sciences, Pittsburgh, PA	July 2022
"Data-driven modeling for noisy biological data and agent-based Models" U. Florida Systems Medicine Seminar, held virtually	April 2021
"Topology Discriminates Models of Angiogenesis" Maathfest, Philadelphia, PA TCNJ School of Science Colloquium, Ewing NJ Society for Mathematical Biology Annual Meetings, held virtually U. Nottingham Mathematical Medicine and Biology Virtual Seminar, held virtually AMS-MAA Joint Math Meetings session, held virtually Second Symposium on Machine Learning and Dynamical Systems, held virtually	August 2022 November 2021 July 2021 March 2021 January 2021 September 2020
"Learning Equations from Biological Data with Limited Time Samples" University of Colorado, Boulder Biomath Seminar, held virtually Data Science, Statistics, and Visualization Conference, held virtually SIAM Conference on the Life Sciences, cancelled due to Covid-19 SIAM Conference on the Mathematics of Data Science, held virtually	November 2020 July 2020 June 2020 June 2020
"Analyzing Collective Motion with Machine Learning and Topology" Society for Mathematical Biology Annual Meetings, held virtually University of Oxford Mathematical Biology Seminar, Oxford, U.K. International Conference on Industrial and Applied Mathematics, Valencia, Spain	August 2020 February 2020 July 2019

“Learning PDE Models from Noisy Spatiotemporal Data”	
Society for Mathematical Biology Annual Meetings, Montreal, Canada	July 2019
International Conference on Industrial and Applied Mathematics, Valencia, Spain	July 2019
VCU Biomath Seminar, Richmond, VA	April 2019
“Parameter Estimation and Uncertainty Quantification in the Presence of Numerical Error”	
NCSU Tutorial Workshop on Parameter Estimation for Biological Models, Raleigh, NC	July 2019
“A Stage-structured Fisher’s Equation with Applications in Biochemistry”	
SIAM Central States Section Meetings, Fort Collins, CO	October 2017
Society for Mathematical Biology Annual Meetings, Salt Lake City, UT	July 2017
“Modeling Wound Healing: Cell-Cell Adhesion Promotes Collective Migration”	
SIAM Meeting on the Life Sciences, Boston, MA	July 2016
Society for Mathematical Biology Annual Meetings, Atlanta, GA	July 2015

Conference Organizing

Data-Driven Mathematical Modeling (with Kevin Flores and Erica Rutter)	
Minisymposium Organizer at SMB Annual Meetings, Columbus, OH	July 2023
Combining Topological, Data-Driven, and Modeling Perspectives for Complex Biological Systems (with Veronica Ciocanel and Alexandria Volkening)	
Minisymposium Organizer at SIAM conference on the Life Sciences, Pittsburgh, PA	July 2022
Combining Modeling and Inference in Cell Biology (with Veronica Ciocanel)	
Minisymposium Organizer at SMB annual Meetings, held Virtually	July 2021
e-Society of Mathematical Biology (SMB) Annual Meetings 2020	
Served on the Organizing Committee and coordinated the mentoring program and scheduling for a virtual conference, held virtually	August 2020
Topological and Network Analyses for Data (with Veronica Ciocanel)	
Minisymposium Organizer at SMB annual Meetings, held Virtually	August 2020
Leveraging Machine Learning for Discovery of Mathematical Models in Biology	
(with John Lagergren and Kevin Flores) Minisymposium Organizer at SIAM Conference on the Mathematics of Data Science, held Virtually	June 2020
Data-Driven Mathematical Models of Cell Migration (with Erica Rutter and Kevin Flores)	
Minisymposium Organizer at International Conference on Industrial and Applied Mathematics, Valencia, Spain	July 2019
NCSU Postdoctoral Research Symposium	
Co-organizer for postdoctoral research symposium at NC State, Raleigh, NC	May 2019
Stage-structured Populations Models in Biology (with David Bortz)	
Minisymposium Organizer at SMB Annual Meetings, Salt Lake City, UT	July 2017
Quantitative Biology Symposium: Systems Biology in the Context of Aging and Disease	
Co-organizer for student symposium at University of Colorado, Boulder, CO	May 2017
Migration and Signaling Waves in Cellular Biology (with David Bortz)	
Minisymposium Organizer at SMB Annual Meetings, Atlanta, GA	July 2015

Outreach and Service

TCNJ Service

TCNJ School of Science Interdisciplinary Research Committee	2024 - present
TCNJ Applied Mathematics Committee	2021 - present

TCNJ Applied Mathematics Committee (chair)	2023 - present
TCNJ Mathematics and Statistics Department Colloquium organizer	2021 - 2024
TCNJ Mathematics and Statistics Bachelor of Arts Committee	2022
TCNJ Mathematics and Statistics Mid-level Curriculum Committee	2022
Service to the field	
Associate Editor for <i>Mathematical Biosciences</i>	2024 - present
Reviewer for: <i>Bulletin of Mathematical Biology</i> , <i>Journal of Theoretical Biology</i> , <i>Mathematical Biosciences</i> , <i>Mathematical Biosciences and Engineering</i> , <i>Inverse Problems</i> , <i>Nature Computational Science</i> , <i>Computer Physics Communications</i> , <i>Engineering Computations</i> , <i>PLOS One</i> , <i>Heliyon</i> , <i>SIAM Undergraduate Research Online</i> .	
Guest editor for <i>Bulletin of Mathematical Biology</i> 's special issue on "Data-driven mathematical modeling."	2022-2023
SMB Methods for Biological Modeling subgroup co-chair	2019 - present
Participated in professional development panels for:	
- SAMSI undergraduate workshop on Methods of Uncertainty	February 2019
- SAMSI undergraduate workshop on Precision Medicine	October 2018