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 2018
Dissertation Title: PDE Models of Collective Migration During Wound Healing
Adviser: David M. Bortz
Certificate in Interdisciplinary Quantitative Biology

University of Colorado, Boulder, CO
M.S., Applied Mathematics 2016

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) 2020-22
American Mathematical Society
Funding to aid in travel for research collaboration

Professional Development Award ($698) 2019-20
NC State University Graduate School and and the Office of Postdoctoral Affairs
Funding to develop innovative metacognitive approaches for undergraduate classrooms

SAMSI Postdoctoral Fellowship ($130,000) 2018-20
National Science Foundation
Fellowship on SAMSI's program on precision medicine

Research Publications

Peer-reviewed articles ([†]denotes equal contribution)

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

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

Calculus I for Engineers, APPM 1350 (CU Boulder)	Summer 2017
Calculus for Life and Management Sciences A, MA 131 (NCSU)	Fall 2019
Foundations of Advanced Mathematics, MA 225 (NCSU)	Spring 2020, Fall 2020
Applied Differential Equations, MA 341 (NCSU)	Spring 2021
Calculus A, MAT 127 (TCNJ)	Fall 2021
Linear Algebra: Theory and Applications, MAT 205 (TCNJ)	Spring 2022

Guest Lecturer

Modeling of Biological Systems, BMA 567 (NCSU)	Fall 2018
Introduction to Machine Learning in Biology, BMA 790 (NCSU)	Fall 2019, Fall 2020

Teaching Assistant

Calculus II for Engineers, APPM 1360 (CU, Boulder)	Spring 2016
Calculus I for Engineers, APPM 1350 (CU, Boulder)	Summer 2016
Pre-Calculus for Engineers, APPM 1235 (CU, Boulder)	Fall 2016
Introduction to Differential Equations, APPM 2360 (CU, Boulder)	Spring 2017

Peer Scholar Groups

AMS Project NExT	2020-21

Professional development program incorporating inclusive teaching methods into math classrooms.

TRESTLE Faculty Learning Community on metacognition	Spring 2017

Met weekly with group of scholars to discuss methods to promote metacognition in the classroom.

Mentoring Experience

Undergraduate Research

Allison Duprey, Fanuel Sisay, Natasha Stewart, and Yangxinyu Xie	Summer 2019

"Sampling for Equation Learning Methods"

Charlie Pugh	2021-2022

"Applying TDA to Retinal Vasculature Segmentations"

Graduate Research

Carter Jameson	2020 - 2021

" Using Topology and Machine Learning to Aid Parameter Estimation of Cell Microscopy Models"

Mike Ackermann, Jorge Arroyo Esquivel, Jake Cherry, Jimi Kim, Ruby Kim, Natalie Meacham	Summer 2021

"Learning Equations from Stochastic Agent-based Model Simulations"

Invited Talks

"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"

TCNJ School of Science Colloquium, Ewing NJ	November 2021
Society for Mathematical Biology Annual Meetings, held virtually	July 2021
U. Nottingham Mathematical Medicine and Biology Virtual Seminar, held virtually	March 2021
AMS-MAA Joint Math Meetings session, held virtually	January 2021
Second Symposium on Machine Learning and Dynamical Systems, held virtually	September 2020

"Learning Equations from Biological Data with Limited Time Samples"

University of Colorado, Boulder Biomath Seminar, held virtually	November 2020
Data Science, Statistics, and Visualization Conference, held virtually	July 2020
SIAM Conference on the Life Sciences, cancelled due to Covid-19	June 2020
SIAM Conference on the Mathematics of Data Science, held virtually	June 2020

"Analyzing Collective Motion with Machine Learning and Topology"
Society for Mathematical Biology Annual Meetings, held virtually	August 2020
University of Oxford Mathematical Biology Seminar, Oxford, U.K.	February 2020
International Conference on Industrial and Applied Mathematics, Valencia, Spain	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

Outreach and Pedagogical Work

"How to apply to and thrive in quantitative biology REUs"
Post in the AMS E-mentoring Network in the Mathematical Science blog	November 2021

"Topological data analysis for an angiogenesis ABM"
Speaker in Southeast Center for Mathemtical Biology's Modeling Accelerator undergraduate research program.	June 2021

"Machine Learning and Math Modelling of Wound Healing"
Featured on the Pod of Asclepius podcast	June 2020

"From Homework to Home Work"
Interviewed on my virtual teaching experience during COVID-19 for the Against the Grain blog	May 2020

"The Topology of Data"
Lecture at the NCSU SUM Series for Undergraduates, Raleigh, NC	November 2019

"Introduction to Data Science: Classifying Flocks in Biology"
Plenary lecture at NC Central University's "Black Men in STEM" Event Durham, NC	April 2019

"The Mathematics Underlying Cell Migration During Wound Healing"
Lecture at the Wake Technical Community College STEM Center Speaker Series, Raleigh, NC	January 2019

"Mathematical Modeling for Precision Medicine"
Tutorial at the SAMSI Undergraduate Workshop on Precision Medicine, Durham, NC	October 2018

"Inverse Problems for Precision Medicine"
Developed and lead hands-on project at the SAMSI Undergraduate Workshop on Precision Medicine, Durham, NC	October 2018

"2018 Graduation Special (Part 1)"
Featured on the How On Earth Podcast	May 2018

Conference Organizing

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

Departmental

   TCNJ Mathematics and Statistics Department Colloquium organizer   2021 - present

   TCNJ Applied Mathematics Committee   2021 - present

   TCNJ Statistics Committee   2021 - present

To the field

   Reviewer for: *Bulletin of Mathematical Biology, Journal of Theoretical Biology, Inverse Problems, Nature Computational Science, Engineering Computations, PLOS One, Heliyon*

   SMB Methods for Biological Modeling subgroup co-chair   2019 - present
   Participated in professional development panels for:
     - SAMSI undergradate workshop on Methods of Uncertainty   February 2019
     - SAMSI undergradate workshop on Precision Medicine   October 2018

   Poster Judge, Joint Math Meeting Undergraduate Poster Session   January 2019

   Mentor, SMB Annual Meetings,   July 2019, August 2020, July 2021