

Cole Butler

Biomathematics Ph.D. Student

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Personal Statement

Very driven and accomplished student who thoroughly enjoys attacking any problem with rigor and analytical clarity. Skilled in leadership and experienced with working with other people. Enjoys working on tough problems with many people, both peers and professors alike. Knowledgeable in utilizing various programming languages, including but not limited to R and MATLAB. Maintains creative way of thinking and enjoys cultivating new friendships. Passionate about natural models, especially concerning epidemiological systems, and science outreach.

Education

2020- **North Carolina State University**

Ph.D. in Biomathematics, minor in statistics; Genetics and Genomics Scholar; 4.0 GPA

2016-2020 **University of Maine at Orono**

B.S. in Mathematics, summa cum laude; Honors College (highest honors); Dean's list; 3.95 GPA

Relevant coursework

Calculus I, II, III	(Graduate) Nonlinear Systems and Bifurcations
Differential Equations	(Graduate) Topology I, II
Linear Algebra	(Graduate) Advanced Linear Algebra
Vector Calculus	(Graduate) Agent-based Modeling
Dynamical Systems	(Graduate) Abstract Algebra
Complex Analysis	(Graduate) Biomathematics I
Real Analysis I, II	(Graduate) Uncertainty Quantification
Biological Modeling and Simulation	(Graduate) Mathematical Methods and Applications of Machine Learning
Higher Geometry	(Graduate) Statistical Modeling in Ecology
Statistical Machine Learning	

Fellowships

- Center for Undergraduate and Graduate Research Fellowship 2016 and 2019, \$1,000 each
- College of Liberal Arts and Sciences Fellowship 2018, \$4,000
- NC State University Provost's Doctoral Fellowship 2020-21, \$28,000
- NC State University Graduate Fellowship 2020-21, \$4,000
- NC State University Research Training Group, approx. \$5,000

Honors and Awards

- University of Maine Presidential Award
- Edward Morrison Pacesetter Scholarship
- Michael and Jana Cote Scholarship
- Ray M. Boynton Scholarship
- Civil Engineering Department Award

- Theodore and Dorothy Whitehouse Scholarship
- Carl Whitcomb Meinecke Award
- James S. Stevens Award
- College of Liberal Arts and Sciences Outstanding Junior Award
- Margaret Chase Smith Public Affairs Scholarship
- Dominic J. Roux Scholarship
- University of Maine CLAS Student Award (2020-21)

Publications

Butler, C., Cheng, J., Correa, L., Preciado, M., Ríos, A., Montalvo, C., and C. Kribs. Comparison of screening for methicillin-resistant *Staphylococcus aureus* (MRSA) at hospital admission and discharge. *Letters in Biomathematics*. 8 (1); 2021.

Butler, C., and P. Stechlinski. Modeling pharmaceutical opioid use disorder: A case study of the opioid crisis in Maine. (In preparation.)

Butler, C., and A. Lloyd. How the consequences of genetic load are modulated by density-dependence. (In preparation.)

Research experience

2020 – Present

Graduate student in the Lloyd lab

- Working with Prof. Alun Lloyd studying gene drives in mosquito populations
- Current projects include exploring how density dependence in juveniles affects drive performance and the advantages of suppression drives over drives that cause local extinction
- Involves heavy usage of MATLAB and Mathematica for simulating high dimensional population dynamic and genetic systems

2020

Dynamics and Data in the COVID-19 Pandemic

- Workshop hosted by the American Institute of Mathematics to study COVID-19 and develop mathematical models to understand underlying disease dynamics
- Applied optimal control theory to different models to determine mathematically ideal approaches in a variety of situations

2019 – 2020

Opioid project funded by the Margaret Chase Smith Policy Center

- Proposed and received funding from the above mentioned organization for a project developing an opioid epidemic model for the state of Maine
- The goal of the project is to better inform public policy decisions and serve as a template for future mathematical models of opioid use proliferation
- This work culminated in my undergraduate thesis and is in the process of turning into a publication with Prof. Peter Stechlinski

2019 – 2020

Mosquito species distributions and network models

- Studied how metapopulation network characteristics and mosquito species abundance effect disease transmission with a focus on Zika and Chikungunya
- Among other things, I developed a species distribution model of *Ae. aegypti* mosquito in R

2018

MRSA research at the Mathematical and Theoretical Biology Institute

- Research Experience for Undergraduates (REU) program
- I led a team of international students with the help of Prof. Christopher Kribs
- We studied how hospital screening strategies control within-hospital spread of MRSA
- Our work has been presented at various conferences and resulted in a publication

2017 – 2018

Modeling organisms on artificial landscapes

- Proposed and received funding through a university grant with Prof. David Hiebeler
- Developed a computational model in R simulating artificial ecological systems on a discrete-state lattice
- Presented our findings at a local conference

2017 – 2020

Topological analysis of breast cancer simulations and wavelet processed mammograms

- Was a member of the Computational Modeling, Analysis of Imagery and Numerical Experiments (CompuMAINE) lab
- I wrote an algorithm to scan mammograms using a topological technique attempting to distinguish between benign and malignant cancerous growths
- My work involved extensive use of the ImageJ and R programming languages
- Also spent some time modeling the growth of cancer microcalcifications in artificial environments

Presentations

“Mathematically modeling gene drive control of mosquito-borne diseases,” presented at the following venues:

- 2021 GGI 4th Annual Retreat, James B. Hunt Jr. Library, NCSU, Raleigh, NC
- 2021 Society for Mathematical Biology Annual Meeting, held virtually
- 2021 Society for Industrial and Applied Mathematics Annual Meeting, held virtually

“A mathematical model of the opioid epidemic in Maine,” 2020 Triangle Area Graduate Mathematics Conference (TAGMaC), held virtually.

“A predator-prey model with parasitic infection of the predator,” 2020 Virtual Symposium on Biomathematics and Ecology Education and Research (BEER), held virtually.

“Comparison of screening for methicillin-resistant *Staphylococcus aureus* (MRSA) at hospital admission and discharge,” presented at the following venues:

- 2018 Mathematical and Theoretical Biology (MTBI) Conference, Arizona State University, Tempe, AZ
- 2018 Society for Advancement of Chicanos/Hispanics and Native Americans in Science (SACNAS) Conference, San Antonio, TX
- 2018 National Institute for Mathematical and Biological Synthesis (NIMBioS) Conference, Knoxville, TN

“Population models on continuous-valued heterogeneous landscapes,” 2018 University of Maine Student Symposium, University of Maine, Orono, ME.

Service & Outreach

- Journal reviewer for *Letters in Biomathematics* (2020-)
- Volunteer for NCSU chapter of Undergraduates Union Graduates (UUG) – assisting undergraduates plan for their future (2020-)

- Online tutor for subjects including calculus, differential equations, linear algebra, basic math, programming, and writing (2020-)
- Scholar and proud supporter of the Genetics and Genomics Initiative at NCSU
- Teaching assistant for Calculus II (2021-22)
- Math tutor for college students at NCSU (2021-22)
- Co-organizer of the Triangle Competition in Modeling (TriCOM)
- Vice president of the Biomathematics Graduate Student Association (2021-22)
- Volunteer tutor for local high schools – tutoring students in algebra once a week (2020-21)
- Mentor for correctional education program through UNC-Chapel Hill (2020-21)
- Organizer of the Biomathematics Journal Club at NCSU (2020-21)

Programming Languages

- Very knowledgeable in MATLAB, R, Mathematica, and NetLogo
- Knowledgeable in Python, HTML, C++, and ImageJ

Professional Memberships

Society of Mathematical Biology (SMB)

Society of Industrial and Applied Mathematics (SIAM)

Society for Advancement of Chicanos/Hispanics and Native Americans in Science (SACNAS)