

Samantha Erwin, PhD

Data Scientist

Pacific Northwest National Laboratory

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EDUCATION	Virginia Polytechnic Institute and State University <i>Ph.D. Mathematics</i> Dissertation Topic: “Mathematical models of immune responses to infectious diseases”	May 2017
	Virginia Polytechnic Institute and State University <i>M.S. Mathematics</i> Thesis Topic: “Modeling of Passive Chilled Beams for use in Efficient Control of Indoor-Air Environments”	June 2013
	Murray State University, <i>B.S. Mathematics</i>	May 2011

PROFESSIONAL EXPERIENCE	Pacific Northwest National Laboratory <i>Data Scientist</i> o Scientist in the National Security directorate working in the Data Science and Analytics Group.	Richland, WA March 2022 – Present
	Oak Ridge National Laboratory <i>Research & Development Associate Staff Member</i> o Scientist in the Computing and Computational Sciences directorate working in the Advanced Computing for Health Sciences section. The group uses artificial intelligence and supercomputing to solve the nation’s leading health initiatives. o I lead a multi-disciplinary team of researchers to analyze data for Naval Information Warfare Systems Command (NAVWAR), which implemented statistical methods, natural language processing, machine learning, and network analysis to deliver results. o I developed a pipeline that utilizes machine learning and deep learning to predict patient outcomes based on electronic health records. This project is in collaboration with two students I mentored who implemented techniques to compare model accuracy. o Participated in a multi-laboratory COVID-19 rapid response team. We developed an interactive dashboard to monitor COVID-19 cases, deaths, and short term predictions. o Modeling work was developed using Python and utilized the Oak Ridge Leadership Computing Facility.	Oak Ridge, TN September 2019 – February 2022
	North Carolina State College of Veterinary Medicine <i>Postdoctoral Research Scholar</i> o Based in Cristina Lanzas’s lab in the Population Health and Pathobiology Department. o I developed models of the complex microbiota based on high dimensional omics data with artificial intelligence using network analysis to elucidate the molecular mechanism in <i>C. difficile</i> infection. I transformed the omics data into a mechanistic model using sparse graphical models and nearest neighbor algorithms. o I developed models of antibiotic resistance using nonlinear mixed effect models based on GIT antibiotic data and performed agent-based model simulations to study environmental transmission. Modeling work was developed in R, MATLAB, and Monolix.	Raleigh, NC July 2017 – August 2019
	Biocomplexity Institute of Virginia Tech <i>Visiting Graduate Student</i> o I collaborated with experimental scientists and directly participated in benchtop work. I developed	Blacksburg, VA Fall 2014 – Fall 2016

a system of ordinary differential equation models and performed stability and bifurcation analysis to make mathematical predictions.

Los Alamos National Lab

Los Alamos, NM

Graduate Research Assistant

Summer 2015

- o A summer research position at the Center for Nonlinear Studies where I modeled the effect of monoclonal antibodies in clinical trials. I worked directly with Phase I clinical trial data to develop a data driven model and calibrated the model using Markov chain Monte Carlo methods.

Interdisciplinary Center for Applied Mathematics

Blacksburg, VA

Research Assistant

Summer 2012 & 2013

- o I developed computational fluid dynamic models for Halton chilled beams. I generated unique meshes based on manufacturer diagrams using Gmsh. I used these models in ANSYS Fluent to predict air flow in a closed room.

Murray State University

Murray, KY

BioMaPS Fellow, Undergraduate Research

2010

- o My collaborator (now Dr. Aron Huckaba) and I collected invasive plant samples, measured growth in different environments, and developed predictive mathematical models.

SOFTWARE
SKILLS

**Computer Languages
Software**

Python, Unix shell, LaTeX, MATLAB, R, HTML
Git, Microsoft Tools, Maple, Monolix, ANSYS, GMSH, SQLite

REFEREED
PUBLICATIONS

13. R Stewart, **S Erwin**, J Piburn, N Nagle, J Kaufman, A Peluso, JB Christian, J Grant, B Bhaduri. *A 7-Day monitoring and forecasting tool for real-time COVID-19 situational awareness*. [In Revision].
12. A Spannaus, T Papamarkou, **S Erwin**, JB Christian. *Bayesian state space modelling for COVID-19: with Tennessee and New York case studies*. [Submitted].
11. C Breldsford, M Barnard, A Daughton, **S Erwin**. *Co-evolution of COVID-19 attention, mitigation behavior, and case incidences*. [Submitted].
10. S Norem, A Rice, **S Erwin**, R Bridges, S Oesch, B Weber. *A Mathematical Framework for Evaluation of SOAR Tools with Limited Survey Data*. ESORICS, 2021 [Accepted].
9. I Danciu, **S Erwin**, G Agasthya, J Tate, B McMahon, G Tourassi, A Justice. *Using longitudinal PSA values and machine learning for predicting progression of early stage prostate cancer in veterans*. J Clin Oncol, 38(15), 2020.
8. **S Erwin**, LM Childs, SM Ciupe. *Mathematical model of broadly reactive plasma cell production*. Scientific Reports, 10(1), 1-12, 2020.
7. **S Erwin**, DM Foster, ME Jacob, MG Papich, C Lanzas. *Mathematical model of the effects of antibiotics on antimicrobial susceptibility of enteric bacteria*. PLOS One, 15(1):e0228138, 2020.
6. C Lanzas, K Davies, **S Erwin**, and D Dawson. *On modelling environmentally-transmitted pathogens*. Interface Focus, 10:20190056, 2019.
5. SM Clifton, CL Davis, **S Erwin**, G Hamerlinck, et al. *Modeling the argasid tick Ornithodoros moubata life cycle*. Understanding Complex Biological Systems with Mathematics, 63-87, 2018.
4. JR Fletcher, **S Erwin**, C Lanzas, CM Theriot. *Shifts in the gut metabolome and Clostridium difficile transcriptome throughout colonization and infection in a mouse model*. mSphere, 3:e00089-18, 2018.

3. M Verma, **S Erwin**, V Abedi, S Hoops, R Hontecills, A Leber, J Bassaganya Riera and SM Ciupe. *Modeling the mechanisms by which HIV-associated immunosuppression influences HPV persistence at the oral mucosa*. PLOS One, 12(1):e0168133, 2017.
2. **S Erwin** and SM Ciupe. *Germinal center dynamics during non-chronic and chronic disease*. Math Biosci Eng, 14(3):655-71, 2017.
1. **S Erwin**, A Huckaba, KS He and M McCarthy. *Matrix Analysis to Model the Invasion of Alligatorweed (*Alternanthera philoxeroides*) on Kentucky Lakes*. J Plant Ecol, 6(2):150-7, 2013.

OTHER
PUBLICATIONS

3. **S Erwin**, JR Fletcher, CM Theriot, C Lanzas. *Understanding toxin production during *Clostridioides difficile* infection using high dimensional data*. [In-preparation]
2. **S Erwin**, *Mathematical models of immune responses to infectious diseases*. PhD Dissertation, Virginia Polytechnic Institute and State University, April 4 2017.
1. **S Erwin**. *Modeling of Passive Chilled Beams for use in Efficient Control of Indoor-Air Environments*. Masters Thesis, Virginia Polytechnic Institute and State University, June 10 2013

AWARDS

General

Distinguished Young Alumni Award, Murray State University	2021
SIAM Science and Policy Fellowship	2020 – 2022
ORNL Supplemental Performance Award for Excellence in Research and Community	2020
Top 22 Under 40 – Murray State University Alumni Association	2019, 2020
Best poster award at the NC State Postdoctoral Research Symposium	2019
Favorite Faculty Award from the Division of Student Affairs at Virginia Tech	2016
Silver Oral Presentation at the VT Research Symposium	2016

Grants

Program Development Funds (\$16k)	2021
Co-PI Joint DOE Laboratory Plan for Pandemic Modeling and Analysis Capability (\$4M)	2020
American Institute of Mathematics SQuaRE proposal accepted	2019
Finalist of the Comparative Medical Institute Seed Grant Competition	2018
Biology and Mathematics in Population Studies Fellowship (\$10k)	2010

Travel Awards

Comparative Medical Institute, Society of Mathematical Biology, Montreal, Canada (\$2,000)	2019
BAMM! Travel Award, BAMM!, Richmond, VA (\$800)	2016, 2017 & 2019
AWM Travel Award, Society of Mathematical Biology, Sydney, Australia (\$2,000)	2018
AMS Travel Grant, Joint Math Meetings, Atlanta, GA (\$500)	2017
AMS Travel Grant, AMS Sectional Meetings, Raleigh, NC (\$250)	2016
Virginia Tech Graduate Student Travel Fund Recipient (\$390)	2015 & 2016
SIAM Student Travel Award, SIAM LS and Annual Meeting, Boston, MA (\$650)	2016
Student Travel Award, SEARCDE, Greensboro, NC (\$435)	2015
Landahl Travel Grant, SMB Annual Meeting, Atlanta, GA (\$100)	2015
Student Travel Award, q-Bio, Albuquerque, NM (\$1,300)	2014
Student Travel Award, SEARCDE, Winston-Salem, NC (\$300)	2012
MathFest Travel Grant, MathFest, Pittsburg, PA (\$300)	2010

NON-DEGREE & **ORNL Career Development Path**, Oak Ridge, TN **August 2021**
SHORT COURSES This multiyear program focuses on the employee's self-awareness, goal development, and communication skills. This path is designed to provide core development that will promote a common knowledge base across ORNL.

NextProf Science Future Faculty Workshop, Ann Arbor, MI **May 2019**
This workshop is designed to encourage talented scientists and mathematicians with a demonstrated commitment to diversity to consider academia. The workshop helps scientists develop strategies to strengthen their abilities to pursue an academic career.

MBI, Women Advancing Mathematical Biology, Columbus, OH **April 2017**
This workshop tackled a variety of biological and medical questions using mathematical models to understand complex system dynamics.

Writing in the Sciences, Stanford University, Online **Fall 2015**
Teaches scientists to become more effective writers, using practical examples and exercises. Topics included: principles of good writing, tricks for writing faster and with less anxiety, the format of a scientific manuscript, and issues in publication and peer review.

q-bio Summer School, Albuquerque, NM **August 2014**
The school intended to advance predictive modeling of cellular regulatory systems by exposing participants to a survey of work in quantitative biology and by providing in-depth instruction in selected techniques.

NIMBioS, Workshop for Women in the Mathematical Sciences, Knoxville, TN **April 2014**
Attended the three day workshop that familiarized women in the mathematical sciences with professional opportunities in academics, industry and government labs to help them thrive in mathematics-related fields.

SAMSI, Undergraduate modeling workshop, Raleigh, NC **Summer 2010**
Attended the week-long workshop that focused on disease modeling. Researched and presented models on long-term influenza data.

PRESENTATIONS **Invited Talks**

12. Joint Mathematics Meetings, Seattle, WA January 2022
11. Lehigh University Computer Science Department, Virtual October 2021
10. SIAM Conference on Computational Science and Engineering Virtual, March 2021
9. Iowa State University, Mathematical Biology Seminar, Virtual October 2020
8. AMS Fall Sectional Meeting, (Canceled, COVID), Chattanooga, TN October 2020
7. Your Science in a Nutshell, Competition Finalists, Virtual August 2020
6. Society of Mathematical Biology, Montreal, Canada June 2019
5. Virginia Tech Math-Bio Seminar Speaker, Blacksburg, VA January 2019
4. SIAM Life Sciences, Minneapolis, MN August 2018
3. Society of Mathematical Biology, Sydney, Australia July 2018
2. Virginia Commonwealth University Biomath Seminar Speaker, Richmond, VA March 2018
1. AMS Fall Southeastern Sectional Meeting, Raleigh, NC November 2016

Contributed Talks

22. Naval Applications of Machine Learning, Virtual March 2021
21. **Session Chair:** SIAM Life Sciences, (Canceled, COVID) Garden Grove, CA June 2020
20. Biology and Medicine through Mathematics, Richmond, VA May 2019
19. Women's Intellectual Network Research Symposium, Charlottesville, VA September 2018
18. Annual College of Veterinary Medicine Research Forum, Raleigh, NC August 2018

17. Biology and Medicine through Mathematics, Richmond, VA May 2017
16. **Session Chair:** Joint Math Meetings, Atlanta, GA January 2017
15. SIAM Annual Meeting and Life Science Conference, Boston, MA May 2016
14. Biology and Medicine through Mathematics, Richmond, VA May 2016
13. **Award Winner:** VT Graduate Student Research Symposium, Blacksburg, VA March 2016
12. SEARCDE, Greensboro, NC October 2015
11. Theoretical Biology and Biophysics Workshop, Los Alamos, NM August 2015
10. Center for Nonlinear Studies Student Seminar, Los Alamos, NM August 2015
9. Virginia Tech Graduate Student Research Symposium, Blacksburg, VA March 2015
8. SIAM Mid-Atlantic Student Conference, Fairfax, VA March 2015
7. 8th Annual q-Bio Summer School, Albuquerque, NM August 2014
6. 8th Annual q-Bio Student Symposium, Albuquerque, NM August 2014
5. SIAM Student Conference, Clemson, SC February 2013
4. Joint Math Meetings, New Orleans, LA January 2011
3. Nebraska Conference for Undergraduate Women in Math, Lincoln, NE January 2011
2. NIMBioS, Knoxville, TN November 2010
1. MathFest, Pittsburg, PA August 2010

Posters

10. Society of Mathematical Biology, (Canceled, COVID), Heidelberg, Germany September 2020
9. **Award Winner:** Research Triangle Postdoctoral Symposium, Raleigh, NC May 2019
8. Center for Gastrointestinal Biology and Disease Research Day, Chapel Hill, NC October 2018
7. NC American Society for Microbiology, Raleigh, NC October 2017
6. Los Alamos Student Symposium, Los Alamos, NM August 2015
5. Society of Mathematical Biology, Atlanta, GA June 2015
4. q-Bio Conference, Santa Fe, NM August 2014
3. Spring Opportunities Workshop for Women in the Math Sciences, Knoxville, TN April 2014
2. Virginia Tech Graduate Student Research Symposium, Blacksburg, VA March 2014
1. SIAM Graduate Student Poster Session, Blacksburg, VA February 2014

Invited Panels

9. Pathways to Computing Internship Workshop, Career Panel, Oak Ridge, TN July 2021
8. Virginia Tech, Association for Women in Math E-Alumni Day, Virtual March 2021
7. NC State Postdoc Alumni Career Panel, Virtual November 2020
6. MORE: Math - Opportunities in Research and Education Workshop, Virtual October 2020
5. Virginia Tech Grad Student Career Panel, "Where are they now?", Virtual September 2020
4. Early Career Workshop at SMB, (Canceled, COVID) Heidelberg, Germany September 2020
3. College of Veterinary Medicine Grad Program Postdoc Panel, Raleigh, NC October 2017
2. Virginia Tech Mathematics Career Day, Blacksburg, VA December 2016
1. Nebraska Conference for Undergraduate Women in Math, Lincoln, NE January 2014

TEACHING EXPERIENCE

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- Oregon State University**, Corvallis, OR **2021 – Present**
M.S. Student
 – Rachel Wofford Summer 2022
- Tennessee Tech University**, Cookeville, TN **2021 – Present**
M.S. Student
 – Mary Adkisson Spring 2022
- Oak Ridge National Laboratory**, Oak Ridge, TN **2019 – 2022**
Science Undergraduate Laboratory Internship
 – Mary Adkisson Summer 2021
 – Thomas Grogan Summer 2020

<i>NSF Mathematical Sciences Graduate Internship</i>		
– Rachel Wofford		Summer 2021
North Carolina State College of Veterinary Medicine, Raleigh, NC		2017 – 2019
<i>Teaching Assistant</i>		
– CBS 595: Infectious Disease Modeling		Spring 2018
<i>Mentor</i>		
– Advised Hillary Dimig’s undergraduate honors thesis.		Fall 2017 – Spring 2018
– Thesis Topic: “Impact of intestinal antibiotic concentration on the microbiota and antimicrobial susceptibility of foodborne pathogens”		
Virginia Polytechnic Institute and State University, Blacksburg, VA		2011 – 2017
<i>Instructor of Record</i>		
– Math 2214: Differential Equations		Fall 2014, Spring 2015
– Math 1226: Calculus II		Spring 2016, Spring 2017
– Math 1225: Calculus I		Fall 2015, Fall 2016
– Math 1205: Calculus I		Fall 2012, Summer 2014
– Math 1016: Elementary Calculus with Trig		Summer 2012, Summer 2016
<i>Teaching Assistant</i>		
– Math 2214, Differential Equations, Grader		Spring 2012
– Math 1224, Vector Geometry, Recitation Leader		Spring 2013, Spring 2014
– Math Emporium, Assistant for 6 online courses		Fall 2011
Johns Hopkins, Center for Talented Youth, Haverford, PA		Summer 2013
<i>Mathematical Modeling Instructor</i> , independently developed unique and engaging curriculum and hands on activities for gifted middle and high school students. Also developed activities for my teaching assistant and mentored her in lesson preps and classroom teaching.		

SERVICE

National Service		
SIAM Committee on Science and Policy		2020 – Present
Society for Mathematical Biology, Membership Chair		2019 – Present
Oak Ridge National Laboratory		
National Science Foundation - Mathematical Sciences Graduate Internship, Liaison		2020 – Present
Oak Ridge Computer Science Girls, Volunteer		2020
Hour of Code, Instructor at Bowers Elementary School		2019
North Carolina State University		
College of Veterinary Medicine Postdoctoral Association President		2018
College of Veterinary Medicine Research Forum Poster Judge		2018
CMI Annual Research & Innovation Summit Poster Judge		2018
Virginia Tech		
Math Department Representative, Graduate Student Assembly		Fall 2015 – Spring 2016
Graduate Student Research and Development Program Reviewer		Fall 2014 – Spring 2016
Vice President, Graduate Student Assembly		Fall 2014 – Spring 2015
Computational Resources Committee Math Department		Fall 2014 – Spring 2015
Graduate Student Representative, University Council		Fall 2013 – Spring 2015
Graduate Student Research Symposium Abstract Reviewer		Fall 2014 – Spring 2015
Student Budget Board		Spring 2015
Graduate Student Travel Fund Program Reviewer		Spring 2014 & Spring 2015
Secretary, Graduate Student Assembly		Fall 2013 – Spring 2014

Member of the Commission on Graduate Studies and Policies	Fall 2013 – Spring 2014
Co-President, Association for Women in Mathematics (AWM)	Spring 2012 – Fall 2013
Math Department Representative, Graduate Student Assembly	Fall 2012 – Spring 2013
GUMP mentor	Spring 2013 Murray State University
President, Pi Mu Epsilon	Fall 2010 – Spring 2011
Vice President, Euclidean Math Club	Fall 2009 – Spring 2011
Undergrad Rep, Zone 5 Intercollegiate Horse Show Assoc Ethics Committee	Fall 2009 – Spring 2010
Public Relations, MSU Horseman's Club	Fall 2007 – Spring 2009

JOURNAL REVIEWER	Journal of Theoretical Biology
	PLOS Computational Biology
	IEEE Access
	Journal of Veterinary Pharmacology and Therapeutics
	SIAM Undergraduate Research Online

PROFESSIONAL SOCIETIES	American Mathematical Society (AMS)
	Association for Women in Mathematics (AWM)
	• <i>Co-founder of Virginia Tech chapter</i>
	Comparative Medicine Institute - Associate Member
	Society for Industrial and Applied Mathematics (SIAM)
	Society of Mathematical Biology (SMB)

COMMUNITY ACTIVITIES	New Life Center for Thoroughbreds, Board of Directors	2020 – Present
	Eventing at Virginia Tech	2014 – 2017
	Educational Chair, Blue Ridge Eventing	2014 – 2015
	Alumni Coordinator, Intercollegiate Horse Show Association Zone 5 Region 4	2011 – 2012
	Intercollegiate Horse Show Association	2006 – 2011
	• <i>2011 Individual National Champion</i>	
	Murray State Equestrian Team Captain	2008 – 2011