Colby Long

The College of Wooster
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Homepage

Education

2016 **Ph.D., Mathematics**, *North Carolina State University*, Advisor: Seth Sullivant.

2013 **M.S., Mathematics**, *North Carolina State University*.

2008 **B.A., Mathematics**, *St. Mary's College of Maryland*, Summa Cum Laude.

Professional Appointments

2025– **Associate Professor of Mathematics and Statistical &Data Sciences**, *The College of Wooster*, Wooster, OH.

2019–2025 **Assistant Professor of Mathematics and Statistical & Data Sciences**, *The College of Wooster*, Wooster, OH.

2016–2019 **Postdoctoral Research Fellow**, *Mathematical Biosciences Institute*, The Ohio State University, Columbus, OH.

Publications and Preprints

(17) **Statistical Learning with Phylogenetic Network Invariants**, with Travis Barton, Elizabeth Gross, and Joseph Rusinko, (to appear in the *Bulletin of the Society of Systematic Biologists*).

(16) **Phylogenomic Models from Tree Symmetries**, with Elizabeth S. Allman and John A. Rhodes, *SIAM J. Appl. Algebra Geometry* **8** (2024), no. 1, 114–137.

(15) **A New Approach to Agent-based Models of Community Resource Management Based on the Analysis of Cheating, Monitoring, and Sanctioning**, with Maya Lapp, *Ecol. Modell.* **468** (2022).

(14) **Hypothesis Testing With Rank Conditions in Phylogenetics**, with Laura Kubatko, *Front. Genet.* **12** (2021), 1062.

(13) **Distinguishing Level-1 Networks on the Basis of Data Generated by Markov Processes**, with Elizabeth Gross, Remie Janssen, Mark Jones, Yuki Murakami, and Leo Van Iersel, *J. Math. Biol.* **83** (2021), 32.

(12) **PhylogeneticTrees: A Macaulay2 package for Phylogenetics**, with Hector Baños, Nathaniel Bushek, Ruth Davidson, Elizabeth Gross, Pamela Harris, Robert Krone, AJ Stewart, Robert Walker, *J. Softw. Algebra Geom.* **11** (2021), no. 1, 1–7.

(11) **Initial Ideals of Pfaffian Ideals**, *J. Comm. Algebra*, **12** (2020), no. 1, 91–105.

(10) **Phylogenetic Networks**, with Elizabeth Gross and Joseph Rusinko, chapter in *A Project-Based Guide to Undergraduate Research in Mathematics*, Birkhäuser Basel (2020).

(9) **Species Tree Inference From Genomic Sequences Using the Logdet Distance**, with Elizabeth S. Allman and John A. Rhodes, *SIAM J. Appl. Algebra Geometry* **3** (2019), no. 1, 107–127.

(8) **Dimensions of Group-based Phylogenetic Mixture Varieties**, with Hector Baños, Nathaniel Bushek, Ruth Davidson, Elizabeth Gross, Pamela Harris, Robert Krone, AJ Stewart, Robert Walker, *Bull. Math. Biol.* **81** (2019), no. 5, 316–336.

(7) **Identifiability and Reconstructibility of a Modified Coalescent**, with Laura Kubatko, *Bull. Math. Biol.* **81** (2019), no. 2, 408–430.

(6) **The Effect of Gene Flow on Coalescent-based Species Tree Inference**, with Laura Kubatko, *Syst. Biol.* **67** (2018), no. 5, 770–785.

(5) **Distinguishing Phylogenetic Networks**, with Elizabeth Gross, *SIAM J. Appl. Algebra Geometry* **2** (2018), no. 1, 72–93.

(4) **L-infinity Optimization to Linear Spaces and Phylogenetic Trees**, with Daniel Irving Bernstein, *SIAM J. Discrete Math.* **31** (2017), no. 2, 875-889.

(3) **Bounds on the Expected Size of the Maximum Agreement Subtree**, with Daniel Irving Bernstein, Lam Si Tung Ho, Mike Steel, Katherine St. John, Seth Sullivant, *SIAM J. Discrete Math.* **29** (2015), no. 4, 2065-2074.

(2) **Tying up Loose Strands: the defining equations of the strand symmetric model**, with Seth Sullivant, *J. Algeb. Stats.* **6(1)** (2015), 17-23.

(1) **Identifiability of 3-Class Jukes-Cantor Mixtures**, with Seth Sullivant, *Adv. In Appl. Math.* **64** (2015), 89-110.

Teaching

The College of Wooster

2019– **Instructor of Record**,
DATA 325: Applied Data Science, S20, S21, S25
DATA 231/230: Applied Statistical Methods, F24
MATH 227: Operations Research, F20, F21, S24
MATH 212: Multivariate Calculus, F19, S20, S21, S24
MATH 279 : Mathematical Contest in Modeling (0.125 credits), S21, S23, S24
MATH 215: Transition to Advanced Mathematics, F19, F20, S22, S23, F23
DATA 102: Introduction to Statistics, F23
MATH 115: Theory of Differential Calculus, S22 1st half, S23 1st half
MATH 125: Theory of Integral Calculus, S22 2nd half, S23 2nd half
DATA 279: DataFest (0.125 credits), S22
FYS 101: All Fun and Games (first-year seminar), F21 .

The Ohio State University

2017-2018 **Instructor of Record**,
MATH 2174: Linear Algebra and Differential Equations for Engineers, F18
STAT 2450: Introduction to Statistical Analysis I, F17.

North Carolina State University

2013–2016 **Instructor of Record**,
MA225: Foundations of Advanced Mathematics, Su16.
MA231: Calculus II for Life Sciences, S16.
MA141: Calculus I, F15.
MA225: Foundations of Advanced Mathematics, S15.
MA141: Calculus I, F13.
MA103: Topics in Contemporary Mathematics, Su13.

2012 **Teaching Assistant/Recitation Leader**,
MA141: Calculus I, F12.
MA131: Calculus I for Life Sciences, S12.

2011-2013 **Lecture Assistant**,
MA341: Applied Differential Equations, S13.
MA231: Calculus II for Life Sciences, F11.

Mentoring

Sum 2024–Present **Co-director, Applied Methods and Research Experience (AMRE)**, *The College of Wooster*, AMRE is an eight-week summer program which typically consists of 8-10 teams of 3-4 students each, advised by faculty members, consulting on technical projects for paying corporate, government, and non-profit clients.

2019–2024 **Independent Study Advisor**, *The College of Wooster*, Advised 25+ year-long senior independent theses in several areas of mathematics and data science including agent-based modeling, sports analytics, graph theory, economic time-series, and neural networks.

2019–2024 **Internship Advisor**, *The College of Wooster*, Advised 10+ internships for credit through the Experiential Learning office (APEX).

Summer 2023 **AMRE Co-director, Advisor**, *CoW Student Affairs*, Co-directed program and co-advised a team of three students consulting for The College of Wooster Student Affairs office in order to develop data-driven key performance indicators..

Summer 2022 **AMRE Assistant Director and Advisor**, *Goodyear Aircraft Team*, Assisted director of program and co-advised a team of three students consulting for Goodyear Tire in order to develop mathematical models of tire stiffness.

Summer 2021 **AMRE advisor**, *Schneider Electric Team*, Co-advised a team of four students consulting for Schneider Electric, a multinational Fortune Global 500 Company, in order to provide data-driven recommendations for clients seeking energy suppliers.

2017, 2018 **REU Assistant**, *Mathematical Biosciences Institute*, Mentored REU students during orientation week; gave an *Introduction to R Programming*, *An Introduction to LaTeX*, and advised on research posters and presentations, Jun 5-9, 2017; Jun 11-15, 2018.

2016 **Phylogenetics Group Assistant**, *Mathematical Research Communities: Algebraic Statistics*, Snowbird, Utah, Jun 12-16.

2015-2016 **Graduate Student Mentor**, *Undergrads Under Grads: Mentoring program to prepare undergraduates from underrepresented groups for careers in mathematics*, Aug 2015-May 2016.

2014 **REU Mentor**, *Mathematical Phylogenetics and the Space of Trees*, Met daily with four REU students to answer questions, establish goals, and direct research. **Award:** *Best Poster, MAA-SE Sectional 2015*, May 27-Aug 1.

Presentations and Professional Activities

Invited Talks

2025 **Algebraic Invariants for Phylogenetic Models**, *University of Hawai'i Algebra Seminar*, Honolulu, HI, Aug 27.

2024 **Phylogenomic Models from Tree Symmetries**, *The Institute for Computational and Experimental Research in Mathematics (ICERM)*, Providence, RI, Sep 20. Click here to view talk.

2023 **Phylogenomic Models from Tree Symmetries**, *SMB 2023: Society for Mathematical Biology*, Columbus, OH, Jul 18.

2023 **Algebraic Invariants for Phylogenetic Models**, *Virginia Commonwealth University Biomathematics Seminar*, (virtual), Mar 31.

2023 **Evolutionary Reconstruction with Linear Algebra**, *Kenyon College*, Gambier, OH, Feb 13.

2022 **Algebraic Invariants for Phylogenetic Models**, *University of Wisconsin Applied Algebra Seminar*, Madison, WI, Oct 27.

2020 **Hypothesis Testing with Rank Conditions in Phylogenetics**, *Algebraic Statistics 2020 (virtual)*, Honolulu, HI, Jun 22.

2019 **Evolutionary Reconstruction with Linear Algebra**, *Ohio Wesleyan University*, Delaware, OH, Oct 24.

2018 **Evolutionary Reconstruction with Linear Algebra**, *Mt. Holyoke College Math/Stat Club Seminar*, South Hadley, MA, Sep 19.

2018 **Identifiability and Reconstructibility of a Modified Coalescent**, *AMS Spring 2018 Eastern Sectional*, Boston, MA, Apr 21.

2018 **Rank Conditions for Phylogenetic Inference**, *MBI Postdoctoral Seminar*, Columbus, OH, Apr 5.

2017 **Identifiability and Reconstructibility of a Modified Coalescent**, *SIAM Conference on Applied Algebraic Geometry*, Atlanta, GA, Jul 31.

2017 **L-infinity Optimization to Linear Spaces and Phylogenetic Trees**, *AMS Spring 2017 Eastern Sectional*, New York, NY, May 7.

2017 **Identifiability and Reconstructibility of a Modified Coalescent**, *Phylogenetics Research Group*, University of Alaska Fairbanks, Fairbanks, AK, Mar 28.

2016 **Bounds on the Expected Size of the Maximum Agreement Subtree**, *International Symposium on Biomathematics and Ecology Education and Research*, Charleston, SC, Oct 16.

2015 **Initial Ideals of Pfaffian Ideals**, *Algebraic Geometry and Number Theory Seminar*, Clemson University, Clemson, SC, Oct 20.

2015 **Tying up Loose Strands: the defining equations of the strand symmetric model**, *AMS Fall 2015 Western Sectional*, Chicago, IL, Oct 2.

2015 **Tying up Loose Strands: the defining equations of the strand symmetric model**, *Algebraic Statistics 2015*, Genoa, Italy, Jun 8.

2014 **Identifiability of 3-Class Jukes-Cantor Mixtures**, *AMS Fall 2014 Western Sectional*, San Francisco, CA, Oct 26.

Other Presentations

2017 **Distinguishing Phylogenetic Networks**, *Algebraic and Combinatorial Phylogenetics (poster)*, Barcelona, Spain, Jun 28 .

2017 **Algebraic Geometry of Phylogenetic Models**, *MBI Postdoc Seminar (talk)*, Columbus, OH, Feb 2.

2016 **Initial Ideals of Pfaffian Ideals**, *Joint Mathematics Meeting 2016 (contributed talk)*, Seattle, WA, Jan 7.

2015 **Applications of Algebra in Phylogenetics**, *NCSU Graduate Student Algebra Seminar (talk)*, Raleigh, NC, Sep 30.

2015 **IBL in the Mathematics Classroom**, *NCSU OFD Teaching and Learning Symposium (poster)*, Raleigh, NC, Apr 14.

2015 **Tying up Loose Strands: the defining equations of the strand symmetric model**, *Triangle Area Graduate Math Conference (talk)*, Raleigh, NC, Feb 21.

2014 **Identifiability of 3-Class Jukes-Cantor Mixtures**, *NCSU Graduate Student Algebra Seminar (talk)*, Raleigh, NC, Nov 5.

2014 **Identifiability of 3-Class Jukes-Cantor Mixtures**, *Algebraic Statistics 2014 (poster)*, Chicago, IL, May 20.

Workshops and Conferences

2026 **Collaborate@ICERM: Reconstructing Phylogenetic Networks**, *Providence, RI*, Jul 20–24.

2025 **University of Hawai'i Graduate Research Community 2025**, *Honolulu, HI*, Aug 4–22.

2024 **AIM SQuaRE Workshop on Phylogenetics**, *Santa Clara, CA*, Aug 19–23.

2020 **Joint Mathematics Meeting 2020**, *Denver, CO*, Jan 15–18.

2019 **MathFest**, *Cincinnati, OH*, Jul 31–Aug 3.

2011–2015 **Triangle Lectures in Combinatorics**, *University of North Carolina, North Carolina State University, Duke University*.

2014 **Teaching and Learning Conference 2014**, *Elon University, Elon, NC*, Aug 14.

2014 **NSF/CBMS Conference: Mathematical Phylogeny**, *Rock Hill, SC*, Jun 28-Jul 2.

2011 **Joint Mathematics Meeting 2011**, *Boston, MA*, Jan 6-9.

Professional Development

2019–2020 **Project NExT Fellow**, *Project NExT (New Experiences in Teaching) is a year-long professional development program for new or recent Ph.D.s in the mathematical sciences*, As part of the program, I completed workshops at three conferences on a number of topics, including innovative approaches in teaching and ways to support students from historically underserved groups.

2014–2015 **Preparing the Professoriate**, *A selective yearlong future faculty preparation program*, Observed and then independently taught an advanced proof-writing course. Completed teaching workshops, conducted peer and faculty observations, presented a professional development project, and created a teaching portfolio.

2013–2015 **Certificate of Accomplishment in Teaching Program**, *A teaching development program for graduate students at North Carolina State University*, Completed teaching workshops, faculty observations, two semesters of teaching, and created a teaching portfolio.

Teaching Seminars and Workshops

2021 **Foundations of Classroom Incivility**, *Facilitator: Chavella Pittman*, Fall 2021.

2018 **Diversity 101: The Role of Implicit Bias and Privilege**, *Facilitator: Marcela Hernandez*, Aug 2.

2015 **Active Learning: The Learner-Centered Classroom**, *Facilitators: Maxine P. Atkinson and Scott Grether*, Jan 28.

2014 **Course Design: From Assessment to Zombies**, *Facilitator: Beth Overman*, Oct 28.

2014 **Leading With Care: Recognizing and Responding to Emotional Distress in Others**, *Facilitators: Pete Adams and Jenny Policari*, Oct 14.

2014 **Effective Teaching With Technology**, *Facilitator: Beth Overman*, Sep 23.

2013 **Introduction to Teaching**, *Facilitator: Susanna Klingenberg*, Aug 30.

2011,2012 **NCSU Mathematics Teaching Assistant Workshops**, *Facilitators: Molly Fenn and Brenda Burns Williams.*

Service and Outreach

2025 **Organizer**, *Session on "Algebraic Methods for Evolutionary Biology"*, 2025 SIAM Confgerence on Applied Algebraic Geometry, Jul 7-11.

Fall 2023– **MCS Admissions Liaison**.

Fall 2024– **Search Committee Member**, Part of successful search to fill two tenure track positions in Statistical and Data Sciences.

Fall 2024– **Member**, *Classroom Stewards Committee.*

Fall 2023– **MCS APEX Liaison**.

2023 **Reviewer**, *Bulletin of Mathematical Biology.*

Fall 2023 **Search Committee Member**, Part of the successful search for a tenure-track Assistant Professor of Computer Science.

Spring 2023 **Search Committee Member**, Part of the successful search for a Visiting Assistant Professor of Mathematics.

2022–2023 **Member**, *Campus Sustainability Committee* .

2020–2023 **MCS Representative**, *STEM Success Initiative Advisory Board*.

2022 **Assistant Director**, *Applied Methods and Research Experience (AMRE)*.

2022 **Reviewer**, *Algebraic Statistics*.

2022 **Reviewer**, *Bulletin of the Society of Systematic Biologists*.

2022 **Reviewer**, *Advances in Applied Mathematics*.

2021-2022 **MCS Assessment Coordinator**, Collected and analyzed data for the Mathematics biennial assessment report.

2021–2022 **MCS Admissions Liaison**.

2019-2022 **Colloquium Czar**, Organized the MCS department colloquium, which includes talks by students, alumni, and outside speakers.

2021 **Search Committee Member**, Part of the successful search for a tenure-track Assistant Professor of Statistical and Data Sciences.

2021 **Reviewer**, *Journal of Mathematical Biology*.

2021 **Reviewer**, *Bulletin of Mathematical Biology*.

2021 **Reviewer**, *Vietnam Journal of Mathematics (Special issue dedicated to Bernd Sturmfel's 60th birthday)*.

2020 **Search Committee Member**, Part of the successful search for a two-year Visiting Assistant Professor of Statistical and Data Sciences.

2019 **Search Committee Member**, Part of the successful search for a three-year Visiting Assistant Professor of Mathematics .

2019 **Reviewer**, *Theory and Applications of Graphs*.

2018 **Organizer**, *Special Session on "The Mathematics of Phylogenetics"*, AMS Spring 2018 Central Sectional Meeting, Mar 17-18.

2017-2018 **Organizer**, *MBI Postdoc Seminar*, The Ohio State University, Sep 2017 - May 2018.

2017 **Reviewer**, *Discrete Applied Mathematics*.

2017 **Panelist**, *Sampling Advanced Mathematics for Minority Students*, Mathematical Biosciences Institute, Jul 25.

2017 **Judge**, *Ohio State Chapter of Sigma Xi*, Ohio Academy of Science State Science Day, May 13.

2016 **Reviewer**, *SIAM Journal on Discrete Mathematics*.

2016 **Reviewer**, *SIAM Journal on Applied Algebra and Geometry*.

2015 **Judge**, *MAA Student Poster Session*, JMM 2016, Jan 8.

2015 **Panelist**, *NCSU Graduate Student Recruitment Weekend*, Feb 28.

Programming and Software

R, Python, Maple, Macaulay2, LaTeX