

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

- 2019– **Assistant Professor of Mathematics**, *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.

Awards and Honors

- 2017 **Mathematical Research Communities Collaboration Grant**, \$5250, San Jose, CA, Apr 26–29.
- 2016 **Winton Rose Award**, \$1000, for thesis: *Algebraic Geometry of Phylogenetic Models*, Apr 25.
- 2016 **Recognition for Excellence in Classroom Teaching**, North Carolina State University, Mar 21.

Presentations and Professional Activities

Invited Talks

- 2024 **Phylogenomic Models from Tree Symmetries**, *The Institute for Computational and Experimental Research in Mathematics (ICERM)*, Providence, RI, Sep 16–20.
- 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](#)
- 2024 **AIM SQuaRE Workshop on Phylogenetics**, Santa Clara, CA, Aug 19–.
- 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.

Teaching

The College of Wooster

- 2019– **Instructor of Record**,
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
DATA 325: Applied Data Science, S20, S21 .

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

- Summer 2024 **Co-director, Applied Methods and Research Experience (AMRE)**, *The College of Wooster*, Co-directed the eight-week summer program which consisted of nine teams of 3-4 students, advised by a faculty members, consulting on technical projects for paying corporate, government, and non-profit clients. .
- 2019–2024 **Independent Study Advisor**, *The College of Wooster*, Advised 22 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 nine internships for credit through the Experiential Learning office (APEX).
- Summer 2023 **AMRE Co-director, Advisor, CoW Student Affairs**, Co-directed the eight-week summer 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*, Co-advised a team of three students consulting for Goodyear Tire in order to develop mathematical models of stiffness for radial airplane tires.
- 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 informed, 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 L^AT_EX*, 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.

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

- Aug 2022– **Co-Director**, *Applied Methods and Research Experience (AMRE)*.
- Fall 2023– **MCS Admissions 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, L^AT_EX