ALLISON L. LEWIS

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EDUCATION

North Carolina State University July 2016
Ph.D. in Applied Mathematics
Advisor: Dr. Ralph Smith
Thesis: *Gradient-Free Active Subspace Construction & Model Calibration Techniques for Complex Models*

North Carolina State University December 2013
M.S. in Applied Mathematics

University of Portland May 2011
B.S. in Mathematics
Magna Cum Laude, Honors Program Graduate

RESEARCH INTERESTS

Mathematical modeling and uncertainty quantification with biological applications, including reduced-order modeling, active subspaces, and high-to-low fidelity model calibration using Bayesian inference.

EMPLOYMENT

Associate Professor of Mathematics July 2024 - Present
Lafayette College *Easton, PA*

Responsibilities include teaching introductory and upper-level mathematics and statistics courses with a 3-2 teaching load, mentoring undergraduate research, providing department and college-wide service, and maintaining an active research program.

Assistant Professor of Mathematics July 2018 - June 2024
Lafayette College *Easton, PA*

Responsibilities include teaching introductory and upper-level mathematics and statistics courses with a 3-2 teaching load, mentoring undergraduate research, providing department and college-wide service, and maintaining an active research program.

Visiting Assistant Professor of Mathematics July 2017 - May 2018
St. Mary's College of Maryland *St. Mary's City, MD*

Teaching introductory and upper-level mathematics and statistics courses with a 3-3 teaching load.

Senior Professional Staff I July 2016 - July 2017
The Johns Hopkins University Applied Physics Laboratory *Laurel, MD*

Development of mathematical models for maneuvering targets, analysis of data, authoring of technical reports, and development of new analysis tools in support of the integration of tracking data from multiple sensors for use by a weapons system.

Research Assistant October 2013 - July 2016
North Carolina State University *Raleigh, NC*

Development of active subspace selection algorithms and Bayesian model calibration methods for the CASL (Consortium for the Advanced Simulation of Lightwater Reactors) initiative.

Teaching Assistant — August 2011 - December 2013
North Carolina State University — *Raleigh, NC*

Taught two courses as instructor of record and assisted in others by leading recitation sessions and grading.

COURSES TAUGHT

Lafayette College

- MATH161: Calculus I
- MATH162: Calculus II
- MATH186: Applied Statistics
- MATH263: Calculus III
- MATH282: Techniques in Mathematical Modeling
- MATH286: Introduction to Probability and Mathematical Statistics
- MATH287: Introduction to Data Modeling
- MATH301: Case Studies in Math Modeling
- MATH306: Operations Research
- MATH310: Ordinary Differential Equations
- MATH335: Probability
- MATH336: Mathematical Statistics
- MATH383: Numerical Analysis for Math Modeling
- MATH391: Independent Study (Cancer Modeling)
- MATH495/496: Senior Thesis

St. Mary's College of Maryland

- MATH151: Calculus I
- MATH255: Vector Calculus
- MATH485: Applied Probability and Statistics

North Carolina State University

- MATH114: Introduction to Finite Mathematics
- MATH131: Calculus for Life Sciences

UNDERGRADUATE RESEARCH MENTORING

Research Experiences for Undergraduates

- Lafayette College REU (Summer 2023)

  Students: Grace Brophy '24, Audrey Rips-Goodwin '24, Lucy Wilson '25

- St. Mary's College of Maryland Emerging Scholars REU (Summer 2018)

  Students: Kendall Clark '23, Mayleen Cortez '20, Cristian Hernandez '20, Beth Thomas '21

Lafayette College EXCEL Research Program

- Students: Zoey Zou (Summer '24), Phuong Nam Vu (Summer '22), Anna Zittle (Summer '21), Yutian Huang (Summer '20)

Lafayette College Senior Thesis Advisor

- Students: Yutian Huang '22, Anna Zittle '22

Senior Thesis Committee Member

- Students: Annie Hou '24 (Math), Jessica McDivitt '24 (Physics), Evan Flint '23 (Math/Env. Science), Jordan Lam '23 (Biology), Zhaoyi Ding '21 (Biology), Shutian Wu '21 (Mech. Eng.)

SCHOLARLY PUBLICATIONS

* Indicates undergraduate student

1. G. Brophy*, A. Rips-Goodwin*, L. Wilson*, **A.L. Lewis**, "Using agent-based modeling to understand the impact of community interactions on voter apathy and election outcome", Submitted, 2024.
2. H. Cho, **A.L. Lewis**, K.M. Storey, A.C. Zittle*, "An adaptive information-theoretic experimental design procedure for high-to-low fidelity calibration of prostate cancer models", *Mathematical Biosciences and Engineering*, Vol. 20(10), doi:10.3934/mbe.2023799, 2023.
3. P.N. Vu*, **A.L. Lewis**, "Using dynamic active subspaces to construct surrogate models for calibrating tumor growth models to data", *The PUMP Journal of Undergraduate Research*, Vol. 6, pp. 1-28, 2023.
4. H. Cho, **A.L. Lewis**, K.M. Storey, H.M. Byrne, "Designing experimental conditions to use the Lotka-Volterra model to infer tumor cell line interaction types", *Journal of Theoretical Biology*, Vol. 559(111377), doi:10.1016/j.jtbi.2022.111377, 2023.
5. R.A. Everett, **A.L. Lewis**, A. Kuerbis, A. Peace, J. Li, J. Morgenstern, "Data driven mixed effects modeling of the dual process framework of addiction among individuals with alcohol use disorder", *PLoS ONE*, Vol. 18(8), doi:10.1371/journal.pone.0265168, 2023.
6. Y. Huang*, **A.L. Lewis**, "Predicting tumor response to radiotherapy based on estimation of non-treatment parameters", *Spora: A Journal of Biomathematics*, Vol. 7, pp. 25-35, 2021.
7. H. Cho, **A.L. Lewis**, K.M. Storey, R. Jennings, B. Shtylla, A.M. Reynolds, H.M. Byrne, "A framework for performing data-driven modeling of tumor growth with radiotherapy treatment," *In: Segal, R, Shtylla, B., Sindi, S. (eds) Using Mathematics to Understand Biological Complexity*, Association for Women in Mathematics Series, Vol. 22, Springer, Cham, https://doi.org/10.1007/978-3-030-57129-0-8, 2021.
8. A. Henderson, E. Köse, **A.L. Lewis**, E.R. Swanson, "Mathematical modeling of algal blooms due to swine CAFOs in Eastern North Carolina," *Discrete and Continuous Dynamical Systems - S*, doi: 10.3934/dcdss/2021151, 2021.
9. H. Cho, **A.L. Lewis**, K.M. Storey, "Bayesian information-theoretic calibration of patient-specific radiotherapy sensitivity parameters to inform effective scanning protocols in cancer," *Journal of Clinical Medicine, Special Issue: Latest Developments in Mathematical Oncology and Cancer Systems Biology*, Vol. 9, doi:10.3390/jcm9103208, 2020.
10. S. Elliot, E. Köse, **A.L. Lewis**, A. Steinfield*, E. Zollinger, "Modeling the stem cell hypothesis: investigating the effects of cancer stem cells and TGF-β on tumor growth," *Mathematical Biosciences and Engineering, Special Issue: Practical Insights from Cancer Models*, Vol. 16(6), pp. 7177-7194, 2019.
11. K.B. Clark*, M. Cortez*, C. Hernandez*, B.E. Thomas*, **A.L. Lewis**, "Combating tuberculosis: using time-dependent sensitivity analysis to develop strategies for treatment and prevention," *Spora: A Journal of Biomathematics*, Vol. 5(1), pp. 14-23, 2019.

12. K.D. Coleman, **A.L. Lewis**, R.C. Smith, B.J. Williams, M. Morris, B. Khuwaileh, "Gradient-free construction of active subspaces for dimension reduction in complex models with applications to neutronics," *SIAM/ASA Journal on Uncertainty Quantification*, Vol. 7(1), doi:10.1137/16M1075119, 2018.

13. **A.L. Lewis**, R.C. Smith, B.J. Williams, "Bayesian model calibration on active subspaces," *Proceedings of the American Control Conference*, 2017.

14. **A.L. Lewis**, R.C. Smith, B.J. Williams, "Gradient-free active subspace construction using Morris screening elementary effects," *Computers and Mathematics with Applications*, Vol. 72(6), pp.1603-1615, 2016.

15. **A.L. Lewis**, R.C. Smith, B.J. Williams, V. Figueroa, "An information theoretic approach to use high-fidelity codes to calibrate low-fidelity codes," *Journal of Computational Physics*, Vol. 324, pp. 24-43, 2016.

16. **A.L. Lewis**, R.C. Smith, B.J. Williams, M. Morris, B. Khuwaileh, "Gradient-free construction of active subspaces for dimension reduction in complex models," *CASL Technical Report*, 2015.

17. V. Cuff, **A.L. Lewis**, S.J. Miller, "The Weibull distribution and Benford's Law," *Involve: A journal of mathematics*, Vol. 8(5), pp. 859-874, doi:10.2140/involve.2015.8.859, 2015.

18. **A.L. Lewis**, R.C. Smith, B.J. Williams, V. Figueroa, "An information theoretic approach to use high-fidelity codes to calibrate low-fidelity codes," *CASL Technical Report:* CASL-U-2014-0197-000, 2014.

19. **A.L. Lewis**, J.A. McMahan, R.C. Smith, "Model calibration for beam models in the presence of model discrepancy," *Proceedings of the ASME 2014 Smart Materials, Adaptive Structures, and Intelligent Systems (SMASIS)*, doi:10.1115/SMASIS2014-7722, pp. V001T03A041, 2014.

20. B.J. Williams, L.P. Swiler, R. Hooper, **A.L. Lewis**, J.A. McMahan, R.C. Smith and B.M. Adams, "User guidelines and best practices for CASL VUQ analysis using DAKOTA," *CASL Technical Report:* CASL-U-2014-0038-000 (SAND2014-SAND2864 517358), 2014.

PEDAGOGICAL PUBLICATIONS

1. **A.L. Lewis**, "Facilitating inclusivity and student engagement through use of pre-class activities", *The Journal for Research and Practice in College Teaching*, Vol. 8(2), 2023.

2. A. Clifton, **A.L. Lewis**, "But who *should* have won? Simulating outcomes of judging protocols and ranking schemes", *In: E.E. Goldwyn, S. Ganzell, A. Wootton (eds.) Mathematics Research for the Beginning Student, Volume 1, Foundations for Undergraduate Research in Mathematics*, Birkhauser, Cham, doi: 10.1007/978-3-031-08560-4-6, 2022.

3. **A.L. Lewis**, "6-029-S-TumorGrowth", SIMIODE Mathematical Modeling Resources, `https://www.simiode.org/resources/8496`, 2021.

OTHER ARTICLES

1. **A.L. Lewis**, "Bridging the Gap by Building Lasting Mentoring Relationships", *Notices of the American Mathematical Society, Early Career Section*, Vol. 70(4), doi: https://dx.doi.org/10.1090/noti2667, 2023.

2. G. Gordon, **A.L. Lewis**, J. Zhou, "Teaching Lunches at Lafayette College: Don't Talk With Your Mouth Full", *MAA Focus*, Vol. 40(4), 2020.

PROFESSIONAL DEVELOPMENT

Converting Modeling Problems Over to Student Experiences
(COMPOSTE) Workshop — Fall 2023
Math Modeling Hub — *Virtual*

Workshop on Computational Modeling of Cancer Biology and Treatment — July 2021
Centre de recherches mathématiques (CRM) — *Virtual*

Inclusive Instructors Academy — Fall 2021
Center for Integration of Teaching and Learning, Lafayette College — *Easton, PA*

SIMIODE Differential Equations Model and Resource Creators Workshop — July 2021
Systemic Initiative for Modeling Investigations & Opportunities with DEs — *Virtual*

SIMIODE Model Instructors in Differential Equations Workshop — July 2019
Systemic Initiative for Modeling Investigations & Opportunities with DEs — *Newberg, OR*

Collaborative Workshop for Women in Mathematical Biology — June 2019
Institute for Pure and Applied Mathematics — *Los Angeles, CA*

Teaching Squares Program — Spring 2019
Center for Integration of Teaching and Learning, Lafayette College — *Easton, PA*

MAA Project NExT Fellow — 2018 - 2019
Mathematical Association of America

AWARDS AND GRANTS

MAA EPaDel Section Early Career Award — April 2024
Mathematical Association of America

Awarded jointly with colleague Joy Zhou for excellence in teaching and mentoring.

Faculty Research Grant — June 2021
Lafayette College

Funding to support developing research in data-driven mathematical oncology projects for the 2021-2023 academic years.

James A. Crawford Award Recipient — June 2021
Lafayette College

Awarded for the establishment of a mentoring program in the mathematics department to support female and non-binary mathematics students (shared with colleague Joy Zhou.)

Adaptive Interventions Grant — December 2020
National Institute on Alcohol Abuse and Alcoholism

Funding to support continued analysis and publication of a project identifying mechanisms of behavior change among individuals with alcohol use disorder.

Convergence Accelerator Program Grant — August 2020
NSF-Simons Center for Multiscale Cell Fate Research — *UC Irvine*

Funding to support a follow-up visit with collaborators from 2019 Women in Math Biology Workshop.
Postponed due to COVID-19.

MAA Tensor Women and Mathematics Grant — March 2020
MAA Tensor Foundation

Funding to support the ongoing Lafayette Math Department Kovalevsky Society Mentoring Program.

MAA Tensor Women and Mathematics Grant — March 2019
MAA Tensor Foundation

Funding to initialize the Lafayette Math Department Kovalevsky Society Mentoring Program.

LEADERSHIP AND SERVICE

Minisymposium Organizer
"Moving Beyond Traditional Grading in the Applied Mathematics Classroom" — July 2024
SIAM Conference on Applied Math Education — *Spokane, WA*

Minisymposium Organizer
"Research by Undergraduate Students in Applied Mathematics" — October 2023
SIAM NNP Annual Meeting — *Newark, NJ*

Co-Organizer, Mid-Atlantic Mathematical Biology (MAMBio) Day — April 2024
Brin Mathematics Research Center — *College Park, MD*

Organizing Committee Member, SIAM Applied Math Education Conference '24 — 2023 - 2024
Society for Industrial and Applied Mathematics — *Spokane, WA*

Secretary, SIAM Applied Math Education Activity Group — 2023 - Present
Society for Industrial and Applied Mathematics

Lafayette College Team Advisor, COMAP MCM & ICM Contests — 2023
Consortium for Mathematics and its Applications

Grader for COMAP Mathematical Contest in Modeling — 2020 - Present
Consortium for Mathematics and its Applications

Minisymposterium Organizer
"Verification, Validation, and Uncertainty Quantification in the Medical Sciences" — March 2021
SIAM Conference on Computational Science and Engineering — *Virtual*

Grader for SIMIODE Challenge Using Differential Equations Modeling — October 2020
Systemic Initiative for Modeling Investigations & Opportunities with DEs

Minisymposium Co-organizer
"Incorporating Community-Client Projects into Applied Math Courses" — July 2020
SIAM Conference on Applied Math Education — *Philadelphia, PA*

Note: Cancelled due to COVID-19.

Minisymposium Co-organizer
"Women in Mathematical Biology: Recent Advances in the Field" — June 2020
SIAM Conference on the Life Sciences — *Garden Grove, CA*

Co-Director, Kovalevsky Society Mentoring Program — 2019 - Present
Lafayette College Mathematics Department — *Easton, PA*

Speaker, "Taking Charge of Our Own Narrative" — April 2019
Women in STEM Week, Lafayette College — *Easton, PA*

Minisymposium Co-organizer
"Building Interdisciplinary Bridges" — January 2019
Joint Mathematics Meetings — *Baltimore, MD*

Panelist on Women in STEM — November 2018
Women in Computing Group, Lafayette College — *Easton, PA*

Minisymposium Co-organizer
"Math and Social Justice in the Classroom" — July 2018
SIAM Conference on Applied Math Education — *Portland, OR*

AWM Mentor — 2018 - 2019
Association for Women in Mathematics

Southern Maryland Math Circle Contributor — October 2017
Lexington Park Library — *Lexington Park, MD*

SIAM Student Chapter Faculty Co-Advisor — 2017 - 2018
St. Mary's College of Maryland — *St. Mary's City, MD*

AWM Student Chapter Faculty Co-Advisor — 2017 - 2018
St. Mary's College of Maryland — *St. Mary's City, MD*

SIAM Student Chapter President — 2015 - 2016
North Carolina State University — *Raleigh, NC*

Applied Mathematics Graduate Student Seminar Organizer — 2014 - 2016
North Carolina State University — *Raleigh, NC*

SIAM Student Chapter Treasurer — 2014 - 2015
North Carolina State University — *Raleigh, NC*

NC State SIAM Student Chapter Representative — March 2015
SIAM Computational Science and Engineering Conference — *Salt Lake City, UT*

PRESENTATIONS

Designing Open-Ended Modeling Projects to Balance Skill Assessment and Student Creativity — July 2024
SIAM Conference on Applied Math Education — *Spokane, WA*

Inferring Tumor Cell Line Interaction Types Using the Lotka-Volterra Model with Various Experimental Designs — January 2024
Joint Mathematics Meetings — *San Francisco, CA*

Inferring Tumor Cell Line Interaction Types Using the Lotka-Volterra Model with Various Experimental Designs — October 2023
SIAM NNP Annual Meeting — *Newark, NJ*

Curing Cancer—Mathematicians Want a Piece of That! — October 2023
Mathematics Colloquium Series, Moravian University — *Bethlehem, PA*

Analyzing Parameter Identifiability Using a Dimension Reduction Approach to Model Calibration for Applications in Mathematical Oncology — May 2023
SIAM Conference on Applications of Dynamical Systems — *Portland, OR*

Curing Cancer—Mathematicians Want a Piece of That! — April 2023
Marquis Scholars and Fellows Faculty Talk Series, Lafayette College — *Easton, PA*

Mixing it Up: Alternative Assessment Strategies for Supporting Diverse Learners — April 2023
Institute for Future PUI Faculty, Lafayette College — *Easton, PA*

Applying Model Reduction Techniques to Enable Efficient Parameter Estimation in Tumor Growth Models — March 2023
Biomathematics Seminar, Virginia Commonwealth University — *Virtual*

An Undergraduate Research Program in Data-Driven Mathematical Oncology — January 2023
Joint Mathematics Meetings — *Boston, MA*

Connecting the Dots Between Math Modelers and Clinical Oncologists — August 2022
MAA MathFest — *Philadelphia, PA*

Curing Cancer—Mathematicians Want a Piece of That! — July 2022
Research Experience for Undergraduates, Clarkson University — *Potsdam, NY*

Mixing it Up: Alternative Assessment Strategies for Supporting Diverse Learners — April 2022
Institute for Future PUI Faculty, Lafayette College — *Easton, PA*

Harnessing the Power of Tumor Dynamics Modeling to Assist with Clinical Decision-Making — November 2021
Mathematics Colloquium Series, Clarkson University — *Potsdam, NY*

Bayesian Information-Theoretic Calibration of Tumor Models for Informing Effective Scanning Protocols — June 2021
Society of Mathematical Biology Annual Meeting — *Virtual*

Bayesian Information-Theoretic Calibration of Radiotherapy Sensitivity Parameters for Informing Effective Scanning Protocols in Cancer — March 2021
SIAM Conference on Computational Science and Engineering — *Virtual*

Bayesian Information-Theoretic Calibration of Radiotherapy Sensitivity Parameters for Informing Effective Scanning Protocols in Cancer — January 2021
Joint Mathematics Meetings — *Virtual*

Bayesian Information-Theoretic Calibration of Radiotherapy Sensitivity Parameters for Informing Effective Scanning Protocols in Cancer — October 2020
Applied Statistics Colloquium Series, Lawrence Livermore National Laboratory — *Virtual*

Using Mutual Information to Select Optimal Data Collection Times for Tumor Model Calibration — August 2020
MAA MathFest — *Philadelphia, PA*

Note: Canceled due to COVID-19.

A True Team Effort: Full-Class Collaboration to Address a Community Client Question — July 2020
SIAM Conference on Applied Math Education — *Philadelphia, PA*

Note: Canceled due to COVID-19.

Using Mutual Information and Bayesian Experimental Design to Determine Optimal Data Collection for Cancer Model Calibration — June 2020
SIAM Conference on the Life Sciences — *Garden Grove, CA*

Note: Canceled due to COVID-19.

A Framework for Data-Driven Modeling of Tumor Growth and Treatment — March 2020
Math Department Research Colloquium Series, Lehigh University — *Bethlehem, PA*

Curing Cancer—Mathematicians Want a Piece of That! — February 2020
Math Department Student Colloquium Series, Bucknell University — *Lewisburg, PA*

Why Haven't We Cured Cancer? (Modeling the Effects of Cancerous Stem Cells on Tumor Growth) — February 2019
Mathematical Adventures and Diversions Series, Lafayette College — *Easton, PA*

Investigating the Effects of Cancerous Stem Cells on Tumor Growth — January 2019
Joint Mathematics Meetings — *Baltimore, MD*

Answering the Question, "When Are We Ever Going to Use This?"; Arming Our Students With the Tools Needed to Change the World For the Better — July 2018
SIAM Conference on Applied Math Education — *Portland, OR*

Adaptive Morris Techniques for Active Subspace Construction — October 2015
SIAM Conference on Applied Linear Algebra — *Atlanta, GA*

Gradient-Free Construction of Active Subspaces for Dimension Reduction in Complex Models — October 2015
NC State Applied Mathematics Graduate Student Seminar — *Raleigh, NC*

An Information Theoretic Approach to Use High-Fidelity Codes to Calibrate Low-Fidelity Codes — March 2015
SIAM Conference on Computational Science and Engineering — *Salt Lake City, UT*

An Information Theoretic Approach to Use High-Fidelity Codes to Calibrate Low-Fidelity Codes — October 2014
NC State Applied Mathematics Graduate Student Seminar — *Raleigh, NC*

Theory and Applications of Benford's Law — January 2011
Joint Mathematics Meetings — *New Orleans, LA*

Theory and Applications of Benford's Law — October 2010
SUMS Conference, James Madison University — *Harrisonburg, VA*

Why Groups are Fundamental — December 2009
University of Portland Mathematics Colloquium — *Portland, OR*