Mykhaylo M. Malakhov

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Education

University of Minnesota **Minneapolis, MN**
PhD in Biostatistics *2020–2025*
- Advised by Wei Pan
- Member of the Interdisciplinary Biostatistics Training in Genetics and Genomics program

Andrews University **Berrien Springs, MI**
BS in Mathematics *2016–2020*
- Minor in Computing
- *Summa Cum Laude*
- J. N. Andrews Honors Scholar

Budapest Semesters in Mathematics **Budapest, Hungary**
Study Abroad *Fall 2019*

Research Positions

University of Minnesota School of Public Health **Minneapolis, MN**
Predoctoral Trainee *2020–present*
- Funded by a T32 Training Grant from the National Institutes of Health
- Helped develop a nonlinear extension of transcriptome-wide association studies (TWAS) and showed that it identifies genes missed by standard TWAS
- Currently working on a method that will identify genes with tissue-specific patterns of genetic regulation
- Currently working on leveraging proteomics data to boost the power of genome-wide association studies (GWAS)
- Methods used: linear and generalized linear models, elastic net regularization, whole-genome sequencing and RNA-Seq data processing
- Mentor: Wei Pan (University of Minnesota)

Institute for Pure and Applied Mathematics **Los Angeles, CA**
Researcher and Project Manager *Summer 2019*
Air Force Research Laboratory team, Research in Industrial Projects for Students program.
- Proposed novel attractor reconstruction and model calibration methods
- Showcased these methods by inferring reaction rate coefficients for hydrogen-oxygen combustion from a time series of one observable
- Methods used: optimal transport, information theory, dynamical systems
- Mentors: Robert Martin and Daniel Eckhardt (Air Force Research Laboratory)

Williams College **Williamstown, MA**
Research Intern *Summer 2018*
Mathematical Ecology group, SMALL REU program.
- Project 1: demonstrated how to improve management outcomes for white-nose syndrome in bats by considering metapopulation dynamics
- Project 2: established guidelines for transboundary infectious disease management when multiple administrative jurisdictions set different objectives
- Methods used: differential equation models, high performance computing, public policy analysis
- Mentors: Julie C. Blackwood (Williams College) and Katriona Shea (Pennsylvania State University)

Andrews University **Berrien Springs, MI**
Undergraduate Research Fellow *Summer 2017*
Mathematical modeling group, Seabird Ecology Team.
- Modeled the effects of climate change on seabird behavior and population dynamics
- Proved that egg cannibalism and egg-laying synchrony can yield strong Allee effects, which allow gull colonies to survive at higher sea surface temperatures than otherwise possible
- Methods used: periodic matrix models, bifurcation theory, stability analysis
- Mentors: Shandelle M. Henson (Andrews University) and J. M. Cushing (University of Arizona)

Honors and Awards

National

American Mathematical Society Travel Grant *2020*

Barry M. Goldwater Scholarship *2018*

University of Minnesota

SPH Current Student Scholarship *2022*

1st place, People's Choice Award at the SPH Research Day conference *2022*

2nd place, Best Poster Award at the SPH Research Day conference *2022*

3rd place in the Interdisciplinary Health Data Competition *2022*

Dean's PhD Scholars Award *2020*

Jean Roberts Biostatistics Fellowship *2020*

Andrews University

Dean's List (every semester) *2016 – 2020*

Awards for Excellence in:
- Linear Algebra (2020)
- Complex Analysis (2019)
- Probability Theory with Statistical Applications (2019)
- Applied Mathematics (2019)
- Abstract Algebra (2019)
- Geometry (2019)
- Differential Equations (2018)
- Mathematical Modeling in Biology (2018)
- Calculus III (2018)
- Foundations of Advanced Mathematics (2017)
- Calculus II (2017)
- Calculus I (2017)

Putnam Competition team member (2017, 2018, 2019) and highest scorer (2018, 2019) at AU

Harold T. Jones Scholarship for highest mathematical excellence *2018*

Louis Ulloth Scholarship for most significant leadership *2018*

Full tuition ACT/SAT Scholarship *2016*

Peer-reviewed Papers

1. Lin Z, Xue H, **Malakhov MM**, Knutson KA, and Pan W. Accounting for nonlinear effects of gene expression identifies additional associated genes in transcriptome-wide association studies. Human Molecular Genetics 2022;31:2462–70.
2. Blackwood JC, **Malakhov MM**, Duan J, et al. Governance structure affects transboundary disease management under alternative objectives. BMC Public Health 2021;21.
3. Duan J, **Malakhov MM**, Pellett JJ, Phadke IS, Barber J, and Blackwood JC. Management efficacy in a metapopulation model of white-nose syndrome. Natural Resource Modeling 2021;34:e12304.

Other Publications

4. **Malakhov MM**, Fitzpatrick BR, Lopez RA, and Shivkumar A. Attractor Reconstruction and Empirical Parameter Inference for Hydrogen-Oxygen Chemistry. Technical Report AD1098889. Air Force Research Laboratory, 2019. URL: `https://apps.dtic.mil/sti/citations/AD1098889`.
5. **Malakhov MM**. Managing White-nose Syndrome in Bats: A Spatially Dynamic Modelling Approach. `https://doi.org/10.32597/honors/216`. Honors Thesis. Andrews University, 2019.

Conference Presentations

Accounting for nonlinear effects of gene expression in transcriptome-wide association studies. Environmental Science Section; Andrews Research Conference (ARC); Andrews University; Berrien Springs, MI. (May 2022)

Modeling the impact of bat dispersal on white-nose syndrome control strategies. Mathematics Section; Michigan Academy of Science, Arts, and Letters (MASAL); Alma College; Alma, MI. (March 2019)

Federalism in Epidemic Modeling: Multi-objective Management of Interconnected Populations. AMS-MAA-SIAM Special Session on Research in Mathematics by Undergraduates and Students in Post-Baccalaureate Programs; Joint Mathematics Meetings (JMM); Baltimore, MD. Jointly with Ishan Phadke. (January 2019)

Cannibalism and synchrony in a periodic matrix seabird population model. Mathematics Section; Michigan Academy of Science, Arts, and Letters (MASAL); Central Michigan University; Mount Pleasant, MI. (March 2018)

Backward Bifurcations in a Periodic Matrix Model of Seabird Population Dynamics. MAA General Contributed Paper Session on Modeling and Applications; Joint Mathematics Meetings (JMM); San Diego, CA. (January 2018)

Other Oral Presentations

Attractor Reconstruction and Empirical Parameter Inference for Hydrogen-Oxygen Chemistry. Institute for Pure and Applied Mathematics Projects Day; University of California, Los Angeles; Los Angeles, CA. Jointly with Brianna Fitzpatrick, Rebecca Lopez, and Abhishek Shivkumar. (August 2019)

Application of Convergent Cross Mapping to Chemical Reactions. Air Force Research Laboratory invited guest lecture; Edwards Air Force Base; Boron, CA. Jointly with Brianna Fitzpatrick, Rebecca Lopez, and Abhishek Shivkumar. (August 2019)

Managing White-nose Syndrome in Bats: A Spatially Dynamic Modelling Approach. Honors Thesis Symposium; Andrews University; Berrien Springs, MI. (April 2019)

SMALL Projects for a Big World: Spatial Models of Infectious Disease. eigen*Talk (undergraduate math/physics colloquium); Andrews University; Berrien Springs, MI. (November 2018)

Effects of Sea Surface Temperature on Seabird Behavior in the Pacific Northwest. eigen*Talk (undergraduate math/physics colloquium); Andrews University; Berrien Springs, MI. (September 2017)

Uncertainty in Mathematics: A Historical Analysis of the Validity and Rigor of Mathematical Statements. eigen*Talk (undergraduate math/physics colloquium); Andrews University; Berrien Springs, MI. Jointly with Robert C. Moore and Lukasz Krzywon. (April 2017)

Poster Presentations

Governance structure affects transboundary disease management under alternative objectives. School of Public Health Research Day; University of Minnesota, Twin Cities; Minneapolis, MN. (April 2022)

Data-driven Attractor Reconstruction and Parameter Inference for Hydrogen-Oxygen Chemistry. MAA Student Poster Session; Joint Mathematics Meetings (JMM); Denver, CO. (January 2020)

Managing White-nose Syndrome in Bats: A Spatially Dynamic Modeling Approach. 2019 Honors Scholars and Undergraduate Research Poster Symposium; Andrews University; Berrien Springs, MI. (March 2019)

Efficacy of Control in a Spatially Dynamic Model of White-nose Syndrome. Summer Science Poster Session; Williams College; Williamstown, MA. Jointly with Ishan Phadke. (August 2018)

A Periodic Matrix Model of Seabird Behavior and Population Dynamics. Honors Scholars and Undergraduate Research Poster Symposium; Andrews University; Berrien Springs, MI. (March 2018)

Service and Outreach

Pi Mu Epsilon: The National Mathematics Honor Society
President, Michigan Gamma Chapter *2018 – 2020*
I organized π Day festivities, game nights, and our chapter's induction ceremonies. After one year as President I was reelected for a second term.

Engineers Without Borders USA

Vice President, Andrews University Chapter *2018 – 2019*

I coordinated outreach activities, assisted with engineering design, and planned travel itineraries for a solar energy project at a remote school in Madagascar. The summer of 2018 I traveled to Madagascar to help conduct the assessment phase of our project.

eigen* (Andrews University math/physics club)

Mathematics President *2017 – 2018*

I planned colloquia, vespers, and other events for the math/physics community. I also helped organize the first-ever Putnam Competition preparation course and team at AU.

Engineers Without Borders USA

Treasurer, Andrews University Chapter *2017 – 2018*

I oversaw chapter and project finances, wrote grant applications, and organized fundraising efforts. During my time as Treasurer we raised about $20,000.

Teaching Experience

Andrews University **Berrien Springs, MI**

Teaching Assistant *2017–2020*

- Mathematics Center tutor
  - Tutored undergraduates for math classes of all levels (arithmetic review through abstract algebra).
- LaTeX workshop leader
  - Co-organized and co-taught a short course on LaTeX.
- Grader for Foundations of Advanced Mathematics
  - Wrote solution keys and graded assignments.
- Substitute teacher for calculus sequence
  - Prepared and presented lectures for Calculus I and II several times per semester.

Graduate Courses

Theory:

- Honors Real Analysis I & II
- Theory of Statistics I & II
- Biostatistics: Regression
- Advanced Regression and Design
- Linear Models
- Probability Models for Biostatistics
- Advanced Statistical Inference
- Bayesian Decision Theory and Data Analysis

Electives:

- Statistics for Human Genetics and Molecular Biology
- Advanced Statistical Genetics and Genomics
- GIS and Spatial Analysis for Public Health
- Seminar: Transethnic Association Studies
- Seminar: Imaging Genetics

Other:

- Research Skills in Biostatistics
- Foundations of Public Health
- Biomedical Ethics

Relevant Skills

Technical:

- Languages: R, Python, shell scripting, LaTeX
- Tools: Unix/Linux, plink, PrediXcan, git/GitHub

Human Languages:

- English (bilingual proficiency)
- Ukrainian (working proficiency)
- Russian (bilingual proficiency)