Mykhaylo M. Malakhov

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Education

University of Minnesota — **Minneapolis, MN**
PhD in Biostatistics — *2020–2025*
Advisor: Wei Pan

Andrews University — **Berrien Springs, MI**
BS in Mathematics — *2016–2020*
Minor in Computing, *Summa Cum Laude*, and 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 National Institutes of Health NIGMS T32 Training Grant through the Interdisciplinary Biostatistics Training in Genetics and Genomics program
- Helped develop a nonlinear extension of transcriptome-wide association studies (TWAS) and showed that it identifies genes missed by standard TWAS
- Proposed statistical tests for determining whether the genetic regulation of gene expression is significantly different between two tissues
- Currently building a causal inference framework for gene co-expression networks based on instrumental variables regression
- Methods used:
  - linear and generalized linear models
  - elastic net regularization
  - whole-genome sequencing and gene expression 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.
- Coordinated a team of four students
- 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.
- Closely collaborated with three other students
- 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.

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. Conference Paper AD1098889. Air Force Research Laboratory, 2020. 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

Attractor Reconstruction and Empirical Parameter Inference for Hydrogen-Oxygen Chemistry. Projects Day; Institute for Pure and Applied Mathematics; University of California, Los Angeles; Los Angeles, 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)

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

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

University of Minnesota School of Public Health

Student Ambassador, Division of Biostatistics   *2022 – present*

I help coordinate and host recruiting events for prospective PhD students and campus visit days for those admitted to the program. I also answer questions from applicants, meet with prospective students, and generally help the Division of Biostatistics throughout each application season.

Pi Mu Epsilon: The National Mathematics Honor Society

President, Michigan Gamma Chapter 2018 − 2020

I organized π Day festivities, game nights, and other fun activities. After one year of service I was reelected for a second term.

Engineers Without Borders USA

Vice President, Andrews University Chapter 2018 − 2019

I oversaw all club administration and functions, as well as the initial phases of a $60,000+ solar energy project for 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 math-related colloquia and events and invited guest speakers. I also organized the first-ever Putnam Competition team and preparation course at AU.

Engineers Without Borders USA

Treasurer, Andrews University Chapter 2017 − 2018

I oversaw all club and project finances, grant applications, and fundraising. During my time as Treasurer we raised about $20,000.

Ruth Murdoch Elementary School

codeShack Student Leader 2016 − 2017

I helped found codeShack, a Google-funded igniteCS project at Ruth Murdoch Elementary School. We designed a computer science curriculum that simultaneously paces and challenges students while connecting them with undergraduate mentors.

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

Completed:
- Honors Analysis I & II
- Theory of Statistics I & II
- Biostatistics: Regression
- Advanced Regression and Design
- Linear Models
- Research Skills in Biostatistics
- Probability Models for Biostatistics
- Statistics for Human Genetics and Molecular Biology
- Seminar: Transethnic Association Studies

Current:

- Foundations of Public Health
- Advanced Statistical Inference
- Bayesian Decision Theory and Data Analysis
- Advanced Statistical Genetics and Genomics
- Seminar: Imaging Genetics

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)