

# Mykhaylo M. Malakhov

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## Education

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### University of Minnesota

*PhD in Biostatistics*

Advisor: Wei Pan

**Minneapolis, MN**

*2020–2025*

### Andrews University

*BS in Mathematics*

Minor in Computing, *Summa Cum Laude*, and J. N. Andrews Honors Scholar

**Berrien Springs, MI**

*2016–2020*

### Budapest Semesters in Mathematics

*Study Abroad*

**Budapest, Hungary**

*Fall 2019*

## Research Positions

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### University of Minnesota School of Public Health

*Predoctoral Trainee*

**Minneapolis, MN**

*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
- Currently working on a method that will identify genes with tissue-specific patterns of genetic regulation
- 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

*Researcher and Project Manager*

**Los Angeles, CA**

*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

*Research Intern*

**Williamstown, MA**

*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

*Undergraduate Research Fellow*

**Berrien Springs, MI**

*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

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### 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

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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

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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, 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

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*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)

*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)

*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

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*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 Krzywón. (April 2017)

## Poster Presentations

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*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

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### 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  $\pi$  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

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### 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).
- $\text{\LaTeX}$  workshop leader
  - Co-organized and co-taught a short course on  $\text{\LaTeX}$ .
- 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

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

**Current:**

- Biomedical Ethics
- Microbial Genomics and Bioinformatics
- Genetics in Public Health in the Age of Precision Medicine

**Relevant Skills**

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**Technical:**

- Languages: R, Python, shell scripting,  $\text{\LaTeX}$
- Tools: Unix/Linux, plink, PrediXcan, git/GitHub

**Human Languages:**

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