Mykhaylo M. Malakhov

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Education

University of Minnesota — **Minneapolis, MN**
PhD in Biostatistics — *2020–2025*

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*

Experience

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
- Developed a non-linear extension of transcriptome-wide association studies (TWAS) and showed that it identifies genes missed by standard TWAS
- Proposed statistical tests for determining whether the expression levels of a gene are significantly different between two tissues
- Currently building deep learning models that predict Alzheimer's disease by fusing genomic sequencing and brain imaging data
- Methods used:
  - deep neural networks
  - elastic net regularization
  - whole-genome sequencing data, gene expression data, and brain imaging data analysis
- 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.
- 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)

Teaching Positions

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

Peer-reviewed Papers

1. Lin Z, Xue H, **Malakhov MM**, Knutson K, and Pan W. Accounting for non-linear effects of gene expression identifies additional genes in transcriptome-wide association studies. In revision.
2. Blackwood JC, **Malakhov MM**, Duan J, et al. Governance structure affects transboundary disease management under alternative objectives. BMC Public Health 2021;21:1782.
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, 2020. URL: `https://apps.dtic.mil/sti/citations/AD1098889`.

5. **Malakhov MM**. Managing White-nose Syndrome in Bats: A Spatially Dynamic Modelling Approach. https://dx.doi.org/10.32597/honors/216. Honors Thesis. Andrews University, 2019.

Honors and Awards

National

American Mathematical Society Conference Travel Grant: $400 *2020*

Barry M. Goldwater Scholarship: $15,000 *2018*

University of Minnesota

Dean's PhD Scholars Award: $5,000 *2020*

Jean Roberts Biostatistics Fellowship: $13,255 *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: $2,250 *2018*

Louis Ulloth Scholarship: $2,250 *2018*

ACT/SAT Scholarship: $145,000 *2016*

Conference Presentations

Attractor Reconstruction and Empirical Parameter Inference for Hydrogen-Oxygen Chemistry. 2019 RIPS Projects Day; IPAM; UCLA; 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. 2019 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; 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; 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; 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; 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

Data-driven Attractor Reconstruction and Parameter Inference for Hydrogen-Oxygen Chemistry. MAA Student Poster Session; Joint Mathematics Meetings; 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. 2018 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 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 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.

Relevant Skills

Technical:
- Languages: R, Python, LaTeX
- Tools: Unix/Linux, plink, PrediXcan

Human Languages:
- English (bilingual proficiency)
- Russian (bilingual proficiency)
- Spanish (limited working proficiency)