DANIEL LAZAREV

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EDUCATION

Massachusetts Institute of Technology — PhD, Mathematics
2021 – 2026

Renaissance School of Medicine at Stony Brook University — MD
2018 – 2025

Yeshiva University — BA (Hons.), Mathematics, Physics, Pre-medicine
2012 – 2016

EMPLOYMENT EXPERIENCE

Massachusetts Institute of Technology — Cambridge, MA
Graduate Student — *September 2021 – present*

Interests: probability theory and statistics, geometry, physical applied mathematics, mathematical biology, and partial differential equations.

Broad Institute of MIT and Harvard — Cambridge, MA

Graduate Student — *September 2021 – present*
Associate Computational Biologist — *March 2020 – September 2021*

• Working in the Neale lab in the Stanley Center for Psychiatric Research at the Broad Institute of MIT and Harvard and in the Analytic and Translational Genetics Unit at Massachusetts General Hospital.

• Building a Maximum Entropy model of multilayer gene-phenotype networks using data from the UK Biobank that allows the prediction of latent phenotypes mediating complex diseases, such as schizophrenia.

Kochvei HaShamayim — Boston, MA
Founder and CEO — *February 2021 – present*

Kochvei HaShamayim is a nonprofit organization championing the values of family, community, and education by supporting young Jewish couples, allowing them to minimize difficult compromises and to excel in both their family life and their early career or continued education. Visit Kochvei.org for more information.

Yeshiva University, Physics Department — New York, NY
Adjunct Instructor — *August 2016 – May 2018*

Courses taught: Introduction to Physics I Lab, Introduction to Physics II Lab, General Physics II Lab, General Physics III Lab, General Physics I Problem Seminar, General Physics II Problem Seminar.

TABC High School — Teaneck, NJ
Physics Teacher — *January 2018 – June 2018*

Taught two classes of eleventh grade physics.

YRSRH Middle and High School — New York, NY
Math and Science Teacher — *September 2016 – June 2018*

Courses taught: Science (sixth and seventh grades), Algebra I: Regents Prep (eighth and ninth grades), Chemistry: Regents Prep (eleventh grade), AP Physics (twelfth grade), SAT Math Review (twelfth grade).

RESEARCH EXPERIENCE

Mathematical and Computational Biology June 2022 – present
Adviser: Dr. Bonnie Berger *MIT, Mathematics Department*

Developing a mathematical theory for directed evolution with the goal of producing a method for predicting new variants of COVID-19 given current protein sequence and epidemiological data.

Physical Applied Mathematics June 2022 – present
Adviser: Dr. Jörn Dunkel *MIT, Mathematics Department*

Developing a method that uses multiscale spatiotemporal data to find the optimal partitions of cell lines in dynamic bacterial swarms.

Probability and Information Theory February 2022 – present
Adviser: Dr. Henry Cohn *MIT, Mathematics Department*

By introducing the concepts of sup-normalization and information measures, we show how to properly generalize entropy from discrete to continuous spaces to avoid the introduction of negative entropies and thus maintain the valuable interpretation of entropy as a subspace volume. Moreover, this allows the elucidation of the relationship between entropy, symmetry, invariance, and uniformity.

Computational Biology and Statistical Genetics March 2020 – present
Adviser: Dr. Benjamin Neale *Broad Institute; MGH; Harvard Medical School*

Developing a method that uses the Maximum Entropy Principle together with data from the UK Biobank and network topological constraints to build multilayer gene-phenotype interaction networks that allow the prediction of latent traits mediating complex diseases.

Mathematical Physics and Fluid Dynamics December 2018 – December 2020
Adviser: Dr. James Glimm *Stony Brook University, Applied Mathematics & Statistics Department*
Co-adviser: Dr. Gui-Qiang Chen *University of Oxford, Mathematical Institute*

The Euler and Navier-Stokes equations model fluid flow and turbulence, but admit multiple solutions, even when solved numerically. We proved that the maximum entropy production principle is a necessary admissibility condition for the physically relevant solution to those equations.

Nonlinear Dynamics August 2017 – December 2019
Adviser: Dr. Marian Gidea *Yeshiva University, Mathematics Department*

Analyzed the motion of a charged particle in the magnetic field created by a circular wire, perturbed by a constant, external magnetic field as a model for the motion of charged particles in accelerators and other magnetic instruments.

Atomic Force Microscopy September 2015 – June 2017
Adviser: Dr. Fredy Zypman *Yeshiva University, Physics Department*

Built a mathematical model to find the size and charge of a ring sample *in vacuo* and in electrolytic environments given data typically provided by an atomic force microscope.

Network Science November 2014 – April 2015
Adviser: Dr. Marian Gidea *Yeshiva University, Mathematics Department*

Investigated small-world networks, with application to the spread of cancer-promoting behaviors on college campuses.

PUBLICATIONS (ACADEMIC)

5. D. Lazarev, A. Bloemendal, C. Churchhouse, D. King, T. Poterba, R. Walters, P. Schultz, P. Cummings, and B. M. Neale, Deconstructing the genetic architecture of complex traits using independent latent-trait decomposition. In preparation.
4. D. Lazarev, Information Measures for Entropy and Symmetry. Submitted. Preprint: arXiv:2211.14857.
3. J. Glimm, D. Lazarev, and G.-Q. Chen, Maximum entropy production as a necessary admissibility condition for the fluid Navier-Stokes and Euler equations, *SN Applied Sciences* **2**, 2160 (2020).
2. D. Lazarev and F. R. Zypman, Charge and size of a ring in an electrolyte with atomic force microscopy, *Journal of Electrostatics* **87**, 243 (2017).
1. D. Lazarev and F.R. Zypman, Determination of size and charge of rings by atomic force microscopy, *Journal of Electrostatics* **83**, 69 (2016).

PUBLICATIONS (POPULAR)

1. D. Lazarev, Collaborative Communities – The Key To Family and Career Success For Everyone, *Jewish Press* (July 2022).

VOLUNTEER AND LEADERSHIP EXPERIENCE

Massachusetts Institute of Technology Cambridge, MA

- *DRP Mentor* *December 2021 – February 2022*
  December 2021 – February 2023

Served as a graduate mentor to 1-2 undergraduate mathematics students in the Directed Reading Program (DRP) during Winter Session of 2021-2022 and 2022-2023.

- *PRIMES Mentor* *January 2023 – January 2024*

Serving as a graduate mentor to high school students in MIT's Program for Research in Mathematics, Engineering and Science for High School Students (PRIMES) during calendar year 2023.

Yeshiva University New York, NY

- *Student Course Assistant*: General Physics (Honors) *September 2015 – May 2016*
- *Honors Program Advisor:* *November 2015 – May 2016*

Advised lowerclassmen in the Honors Program regarding coursework, and helped them devise a four-year course of study

- *Peer and Private Tutor*: Calculus, Physics, Chemistry and Writing *January 2014 – May 2016*
- *Member of Student Government:* *August 2013 – May 2016*

Sophomore Class President ('13–'14), Junior Class President ('14–'15), Senior Justice of the Student Court ('15–'16)

- *Student Ambassador:* *September 2013 – May 2016*

Gave tours, participated in panel discussions, and represented the Mathematics Department, the Physics Department, and the Honors Program

- *Mentorship Program Volunteer:* *January 2013 – January 2016*

Helped run science modules for elementary school students in underrepresented schools and for young patients in children's hospitals as a member of several initiatives, including Project START, CollegeEDge, the YU Literacy Program, and Project TEACH

AWARDS AND ACHIEVEMENTS

- **OU Impact Accelerator Grant:** Selected as one of five nonprofits out of over seventy organizations to be part of Cohort IV of the OU Impact Accelerator, which includes extensive professional training and a $10,000 grant. May 2022.
- **Jay and Jeanie Schottenstein Honors Program:** Additional Honors Program course requirements; Honors Thesis; full scholarship for undergraduate studies at Yeshiva U.
- **Professor Arnold & Bertha Lowan Memorial Award for Excellence in Physics Research:** Awarded April 2016 with a cash award of $1200.
- **Dr. Ron and Cheryl Nagel Award for Excellence in Pre-Medical Studies:** Awarded May 2016.
- **The Lawrence P. Fischer Memorial Award** for "the best Hebrew paper on some aspect of Jewish History." Awarded May 2016 with a prize of $1500.
- **Imrei Shefer Writing Contest:** First place in a Yeshiva U. writing contest with a prize of $1500. Awarded January 2016.
- **Dean's List:** 2012 – 2016.