

# Maggie Beheler-Amass

[mb7989@nyu.edu](mailto:mb7989@nyu.edu) | 608-440-3660 | 4251 Verdugo Rd Apt 2 Los Angeles, CA 90065

## EDUCATION AND HONORS

---

New York University, Graduate Schools of Arts and Sciences

New York, New York

PhD in Computational Biology

2020-Expected June 2025

- GPA: 3.98/4.0
- **Research:** Interpretable ML and neural ODEs for dynamic gene regulatory network inference
- ISMB Merit-Based Travel Grant Recipient (2024)
- Quantitative Biological Systems Training Fellow 2021-22
- Qualifying Exam Passed with Honors
- **Relevant Coursework:** Statistics, Machine Learning, Bioinformatics, Inference

**Thesis Overview:** My research focuses on developing an interpretable deep learning framework (SupirFactor) for gene regulatory network inference (GRNi) and transcription factor activity estimation from biological data. Using **physics-informed deep learning** and **Neural ODEs**, I model the complex dynamics of gene regulation to predict cellular responses to **perturbations** from single-cell RNA-seq and estimate biophysical parameters. This work enables **in silico prediction** of gene expression at unseen time points and inferring responses to experimental perturbations through interpretable biological mechanisms.

University of Wisconsin-Madison, College of Letters and Sciences

Madison, Wisconsin

B.S. in Physics, Astronomy-Physics, French

2014-2018

- Bernice Durand Undergraduate Research Scholarship 2015-2016
- David H. Durra Scholarship 2016-2017
- NSF Graduate Research Fellowship Program Honorable Mention 2017-2018
- **Relevant Coursework:** Ordinary and Partial Differential Equations, Linear Algebra

## SKILLS

---

**Programming:** Python (scikit-learn, PyTorch, TensorFlow, OpenCL), C++, R, Arduino

**Machine Learning & Data Science:** Neural ODEs, Network Inference, Causal

Representation Learning, Graph Neural Networks, Interpretable Deep Learning,

Algorithm Development, Parallel Programming, Agent Based Modeling

**Data Analysis:** Multimodal Integration, Perturbation Analysis, Signal Processing

## PROFESSIONAL EXPERIENCE

---

New York University

2020-Present

*Gene Regulatory Network Inference (GRNi), PhD Student with Professor Richard Bonneau*

- Created an interpretable **Neural Ordinary Differential Equation** model for biophysical, dynamic GRNi to predict gene expression, RNA Velocity, mRNA transcription and degradation rates for **drug-perturbations** in *S. cerevisiae*
- Developed an **interpretable deep learning** framework (SupirFactor) for GRNi and transcription factor activity estimation
- Implemented **multitask-learning** into a PyTorch deep autoencoder framework for GRNi
- Analyzed human immune cells in healthy and diseased populations for GRNi

**Genentech Research and Development (gRED)** 2022  
*GRNi for Oncology Bioinformatics, Intern* South San Francisco, CA

- Developed a **Deep Neural Network Graph-Learning**-based model for GRNi
- Designed data pipeline and code repository to automatically graph structure data for training
- Performed a preliminary performance study of the GRNi model on human immune cells

**Wisconsin Center for Sleep and Consciousness** 2019-2020  
*Causation in Integrated Information Theory, Associate Researcher* Madison, WI

- Designed and evolved Markovian neural networks through agent based modeling in C++
- Developed an **information theoretic framework for causal inference** in complex networks
- Created software to analyze causal inference for nonbinary networks in Python

**University of Wisconsin-Madison** 2014-2018  
*Askaryan Radio Array for Neutrino Particle Physics, Undergraduate Researcher* Madison, WI

- Developed cross correlation algorithms in C++ and Python for neutrino signal processing
- Accelerated computing on GPUs via parallel programming in OpenCL for particle Big Data
- Applied basis spline interpolation to create path raytracing software in C++ and Python

**Nevis Laboratories, Columbia University** 2017  
*Deep Underground Neutrino Experiment, NSF REU Student* New York, New York

- Developed and optimized zero suppression algorithms to wrangle 40 TB/s while remaining sensitive to neutrino signals, successfully retaining ~MB/s
- Simulated particle interactions to analyze efficiency and estimate data rates from algorithms

**Wisconsin IceCube Particle Astrophysics Center, Madison, WI** November 2015-2016  
*IceCube, Undergraduate Research Assistant with WIPAC Director Professor Kael Hanson*

- Created circuit boards and sensors to study mechanisms of scintillation in glass
- Designed pilot python analysis searching for dark-matter-like interactions within IceCube

**Johannes Gutenberg University of Mainz,** 2015  
*Precision IceCube Next Generation Upgrade (PINGU)* Mainz, Germany  
*NSF International Research Experience for Students with Professor Sebastian Böser*

- Concentrated on understanding mechanisms of cold temperature glass scintillation for developing detector aspects
- Created Arduino-based temperature sensors and analyzed data from sensors
- Quantified study through analysis of scintillation intensity spectrums

## **PUBLICATIONS**

---

Beheler-Amass M, Jackson CA, et al. *Biophysically-Motivated Neural ODEs for Dynamic Gene Regulatory Network Inference and Perturbation Response Prediction*, (manuscript in progress).

Tjärnberg A , Beheler-Amass M, Jackson CA et al. *Structure-primed embedding on the transcription factor manifold enables transparent model architectures for gene regulatory network and latent activity inference*. Genome Biol **25**, 24 (2024).

Jackson CA, Beheler-Amass M, Tjärnberg A et al. *Simultaneous estimation of gene regulatory network structure and RNA kinetics from single cell gene expression*. bioRxiv 2023.09.21.558277 (2023).

Gomez J.D., Mayner W, Beheler-Amass M et al. *Computing Integrated Information ( $\Phi$ ) in Discrete Dynamical Systems with Multi-Valued Elements*. Entropy **2021**, 23, 6 (2021).

Albantakis L, Massari F, Beheler-Amass M et al. *A macro agent and its actions, Top-Down Causation and Emergence*, 135-155 (2021).

P. Allison, et al. *Constraints on the Diffuse Flux of Ultra-High Energy Neutrinos from Four Years of Askaryan Radio Array Data in Two Stations*, Phys.Rev.D 102 4, 043021 (2020).

M. Beheler-Amass et al. (ARA Collaboration), *Neutrino Vertex Reconstruction in South Pole Ice* EPJ Web Conf. **216**, 02011 (2019).

M. Beheler-Amass, et al. (ARA Collaboration), *Interferometric Neutrino Event Reconstruction in Inhomogeneous Media with the Askaryan Radio Array*, PoS (ICRC 2017) **1054** (2017).

P. Allison, et al. *Design and Performance of an Interferometric Trigger Array for Radio Detection of High-Energy Neutrinos*, arXiv:1809.04573 [astro-ph.IM] (2018).

P. Allison, et al. *Observation of Reconstructable Radio Emission Coincident with an X-Class Solar Flare in the Askaryan Radio Array Prototype Station*, arXiv:1807.03335 [astro-ph.HE] (2018).

U. Abdul, et al., *Measurement of the real dielectric permittivity  $\epsilon_r$  of glacial ice*, arXiv: 1712.03301 [astro-ph.IM] (2017).

## **SELECTED TALKS**

---

*Dynamic Gene Regulatory Network Inference with Interpretable, Biophysically-Motivated Neural ODEs*, ISMB, Montreal 2024, (talk, merit-based fellowship awardee).

*Interpretable, Biophysically-Motivated Neural ODEs for Dynamic Gene Regulatory Inference*, RECOMB/ISCB Regulatory & Systems Genomics, Los Angeles, November 2023, (poster).

*Interpretable Deep Learning for Gene Regulatory Network Inference*, Network Biology Meeting, Cold Spring Harbor Laboratory, March 2023, (poster).

*Interpretable Deep Learning for Multimodal Gene Regulatory Network Inference Uncovers Novel Transcriptional Interactions in PBMC*, Winter Quantitative-Biology Conference, Puerto Rico, February 2023, (contributed talk and poster).

*Developing Data Reduction Schemes by Zero-Suppression*, DUNE Collaboration Meeting, Fermilab, August 2017, (invited).

*Developing Zero-Suppression Schemes for the Deep Underground Neutrino Experiment*, Final REU Talk, Nevis Labs, August 2017, (invited).

*Radiospline*, ARA Collaboration Meeting, University of Chicago, August 2016, (invited).

*Dark Matter Analysis*, IceCube Collaboration Meeting, Johannes Gutenberg University in Mainz, October 2016, (invited).

*Spline Raytracing Techniques for Radio Neutrino Event Reconstruction*, Conference for Undergraduate Women in Physics, Black Hills State University, January 2016, (poster).

*Exploring Temperature Dependent Scintillation in Glass*, Johannes Gutenberg University in Mainz, Physics Department Colloquium, August 2015, (invited).

## **EXTERNAL COMMUNICATIONS AND OUTREACH**

|  |      |
|--|------|
| TA for the NYU Center for Data Science Summer AI School for Undergraduates | 2023 |
| Organizer and TA for DeepMay Data Science Intensive Bootcamp               | 2019 |