

ALEXANDER E. COHEN

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Education

Massachusetts Institute of Technology

Expected 2025

PhD in Computational Science and Engineering and Chemical Engineering

Cambridge, MA

The University of Chicago

June 2020

Bachelor of Science in Molecular Engineering with a Minor in Computer Science

Chicago, IL

Major GPA: 4.00/4.00; Minor GPA: 4.00/4.00; College GPA: 3.98/4.00

Honors: Summa Cum Laude, Enrico Fermi Scholar, Phi Beta Kappa, Dean's List (2016-2020)

Relevant Coursework

- Machine Learning
- Geometric ML
- Matrix Calculus
- Statistics
- Thermo. and Stat. Mech.
- Computer Vision
- Computational Chemistry

Selected Projects

Differentiable, GPU-accelerated pattern forming PDE simulator | *Python, JAX*

Fall 2023

- Created a package for simulating pattern forming PDEs (Cahn-Hilliard, Allen-Cahn, Nonlinear Schrödinger, etc.)
- Implemented equations with both pseudospectral methods and finite differencing with common timesteppers
- Compatible with common neural network libraries in JAX and Gymnasium reinforcement learning package

Interactive mosquito behavior simulation website | *Julia, Python, Flask*

Winter – Spring 2025

- Integrated learned dynamical models for mosquito behavior with an interactive website
- Users can change the type and location of the behavioral cues and watch the mosquitoes adapt in real time

Experience

MIT Physical Applied Math Group

Dec. 2020 – Present

Graduate Researcher

Cambridge, MA

- PhD thesis on integrating machine learning with physical models through dynamical systems inference, low-dimensional representations, and differentiable simulations, focusing on biophysics and materials science
- Thesis work combines numerical methods, machine learning, statistical inference, optimization, and physical modeling
- Co-advised by Professors Jörn Dunkel (Mathematics) and Martin Bazant (Chemical Engineering)
- Published two papers on quantitatively monitoring and controlling airborne transmission risk using indoor air quality sensors, with applications to COVID transmission

Allostery Technology

Apr. 2025 – Present

Machine Learning Consultant

Cambridge, MA

- Develop and train next-generation protein structure prediction models and other ML models in biology
- Manage AWS and other GPU cloud compute providers

Flagship Pioneering

July 2024 – Oct. 2024

AI Research Intern

Cambridge, MA

- Developed LLM-based AI agents for automating bioinformatics and answering questions about tissue and cell type gene expressivity, target-disease genetic associations, current standard of care, and other topics
- Built a front end for interacting with the agent and deployed the application for users throughout Flagship

Pritzker School of Molecular Engineering - Juan de Pablo group

Apr. 2017 – Sep. 2020

Undergraduate Researcher

Chicago, IL

- Developed coarse-grained models for molecular simulations of conjugated polymers with LAMMPS implementation
- Studied confined polymer-stabilized blue phase liquid crystals (PS-BPLCs) with various techniques, including confocal microscopy and thermodynamic measurements
- Tested and optimized PS-BPLCs for use in mechanical and chemical stress sensors
- Published a first author and second author paper on this work

IBM Research - Almaden

June 2018 – Aug. 2018

Research Intern - Spintronics

San Jose, CA

- Developed and optimized an analogue racetrack memory, based on current-driven domain wall motion, for a neuromorphic hardware accelerator for training deep neural networks
- Published manuscript on domain wall motion in synthetic antiferromagnets with a Rhodium spacer layer

Awards

National Defense Science and Engineering Graduate Fellowship (NDSEG)	Spring 2022
National Science Foundation Graduate Research Fellowship (NSF GRFP)	Spring 2022
UChicago College Center for Research and Fellowships Photo Contest: Top 3	Fall 2018
Army Undergraduate Research Apprenticeship Program	Fall 2018

Selected Publications

- Xie, O., **Cohen, A.E.**, Bazant, M.Z., Olsen, B. “Learning nature’s assembly language with polymers.” *In review at PNAS*. (2025).
- Daubner, S., **Cohen, A.E.**, Dorich, B., Cooper, S.J. “evoxels: A differentiable physics framework for voxel-based microstructure simulations.” *arXiv*. (2025).
- Zuo, C.*, Fei, C.*, **Cohen, A.E.***, ..., Dunkel, J., Hu, D.L. “Predicting mosquito flight behavior using Bayesian dynamical systems learning.” *arXiv*. (2025).
- Samantaray, Y., Cogswell, D.A., **Cohen, A.E.**, Bazant, M.Z. “Electrochemically Resolved Acoustic Emissions from Li-ion Batteries.” *Joule*. (2025).
- **Cohen, A.E.**, Hastewell, A., ..., Dunkel, J. “Schrödinger Dynamics and Berry Phase of Undulatory Locomotion.” *Physical Review Letters*. (2023).
- Zhao, H., Deng, H.D., **Cohen, A.E.**, ..., Bazant, M.Z. “Learning Heterogeneous Reaction Kinetics From X-Ray Videos Pixel-by-Pixel.” *Nature*. (2023).
- Risbeck, M.J.*, **Cohen, A.E.***, ..., Bazant, M.Z. “Data-Driven Control of Airborne Infection Risk and Energy Use in Buildings.” *Building and Environment*. (2023).
- **Cohen, A.E.**, Jackson, N.E., and de Pablo, J.J. “Anisotropic Coarse-Grained Model for Conjugated Polymers: Investigations into Solution Morphologies.” *Macromolecules*. (2021).
- **Cohen, A.E.**, ..., Yang, S.H. “Current Driven Chiral Domain Wall Motion in Synthetic Antiferromagnets with Co/Rh/Co.” *Journal of Applied Physics*. (2020).
- Bazant, M.Z., Kodio, O., **Cohen, A.E.**, ..., Bush, J. “Monitoring Carbene Dioxide to Quantify the Risk of Indoor Airborne Transmission of COVID-19.” *Flow*. (2021).
- Sadati, M., Martinez-Gonzalez, J.A., **Cohen, A.E.**, ..., de Pablo, J.J. “Control of Monodomain Polymer-Stabilized Cuboidal Nanocrystals of Chiral Nematics by Confinement.” *ACS Nano*. (2021).

Press

- Research on modeling neural activity and motion of *C. elegans* featured in **MIT Spectrum** (2024)
- *Physical Review Letters* publication on learning complex biophysical dynamics covered by **New Scientist** (2023)
- *Nature* publication on learning physics from images of battery nanomaterials covered in **MIT** and **SLAC News** (2023)
- *Flow* publication on quantifying indoor airborne transmission chosen by journal editor as a **Top 5 Most Influential Paper of 2021** and is listed in the **Top 20 Most Downloaded** articles in the journal (2022)

Teaching

MIT Graduate Teaching Assistant <i>Thermodynamics and Statistical Mechanics</i>	Sep. – Dec. 2022
• Led recitations and office hours and wrote weekly homework and exams for graduate-level chemical engineering course	
MIT Teaching Assistant <i>Physics of COVID-19 Transmission MOOC</i>	Jan. 2021 – Sep. 2021
• Assisted in designing course content and responded to students’ questions through online forum	

Leadership and Service

Seminar Co-Organizer <i>MIT Numerical Methods in Partial Differential Equations</i>	Spring 2023 – Present
• Assist in choosing speakers and organizing visitor schedules	
Volunteer Tutor <i>Petey Greene Project</i>	Sep. 2021 – Sep. 2022
• Tutored math and science for incarcerated young boys in a local youth detention center	
Startup Showcase Organizer <i>MIT Sports Summit</i>	Nov. 2022 – Mar. 2024
• Coordinated with 8 sports-related startups to showcase products to sports executives at annual MIT Sports Summit	
Club President <i>UChicago Tennis Club</i>	May 2019 – June 2020
• Ran practices, organized tournaments, and hosted social events for tennis club with over 50 members	

Technical Skills

Languages: Python, Julia, C, C++, Matlab, R, Bash, **Frameworks/Libraries:** ML – JAX, SciML, PyTorch, e3nn; Computational Chemistry – LAMMPS, Orca, JAX MD; Graphics – Illustrator, PowerPoint

Interests

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| • ML for Biology | • Computer graphics | • Tennis | • Pixar movies | • 20th century history |
| • Hiking | • Neuroscience | • Inverse design | • Education | |