

Joshua A. Lucker

Curriculum Vitae

Second Year PhD student in Biophysics

University of Maryland, College Park

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Education

University of Maryland, College Park (UMD)

PhD in Biophysics

Current GPA = 3.8/4.0

Current

University of Maryland, Baltimore County (UMBC)

B.S in Chemistry, B.A. in Mathematics, Minor in Music

Magna Cum Laude (GPA = 3.9/4.0)

2018

Awards, Honor Societies, and Memberships

Awards

UMD Dean's Fellowship

UMBC Victor Vitullo Award for Undergraduate Research in Chemistry

UMBC President's List (4.0) – Fall 2014, Fall 2016, Spring 2017, Fall 2017

UMBC Dean's List (>3.75) – Spring 2015, Fall 2015

Honor Societies

Phi Beta Kappa

Pi Mu Epsilon

Delta Alpha Pi

National Society of Collegiate Scholars

Memberships and Fellowships

American Chemical Society

UMD COMBINE (Computation and Mathematics for Biological Networks) Fellowship¹

¹COMBINE is an interdisciplinary program at UMD for PhD students who are interested in biological networks. It aims to provide students with experience in the broad disciplines of the life sciences, physical sciences, and computer and engineering. Its purpose is to combine these disciplines with a focus on the area of biological networks broadly defined.

Publications and Presentations

Publications

1. Lucker, J.A.M., Liebman, J.F. Hückel theory and distinguishing between isospectral molecules: 1,4-divinylbenzene and 2-phenylbutadiene, and tetramethylenemethane and cyclobutadiene + carbon. *Struct. Chem.* **31**, 1119–1124 (2020)

Poster Presentations

1. J. Lucker, T.J. Peelen, & Z. Novák. "The Formation of DAP Ligand from Phenanthroline and 4-Methoxyphenylboronic Acid" *UMBC Undergraduate Research Symposium in the Chemical and Biological Sciences* (2017)
2. J. Lucker & J. Liebman. "Hückel Theory: A Mathematical and Theoretical Approach to Determine the Properties of Conjugated Pi Systems" *UMBC Undergraduate Research and Creative Achievement Day* (2018)
3. J. Lucker, "A Computational Approach to Actomyosin Networks" *COMBINE (Computation and Mathematics for Biological Networks) Annual Symposium on Network Biology* (2021)

Research Experience

A novel approach to studying isospectral compounds resulting from Hückel Molecular Orbital Theory (Spring 2016 to Spring 2020)

- Undergraduate research at UMBC in the lab of Prof. Joel Liebman under his discretion and guidance
- Studied the mathematical and theoretical aspects of Hückel Molecular Orbital Theory including isospectral compounds using pen-and-paper tactics as well as MATLAB and Mathematica
- Found a new approach to looking at isospectral compounds with Prof. Joel Liebman
- Presented a poster based on this work at UMBC at the 24th Annual Undergraduate Research and Creative Achievement Day
- Published the findings of this research in early 2020 in *Structural Chemistry*

The formation of DAP ligand from 1,10-phenanthroline and 4-methoxyphenylboronic acid (Summer 2017)

- Part of an international REU experience in Budapest, Hungary in collaboration with both Prof. Timothy Peelen of Lebanon Valley College and Prof. Zoltán Novák of Eötvös Loránd University
- Adapted three procedures for producing DAP ligand from 1,10-phenanthroline and 4-methoxyphenylboronic acid for use in a microwave synthesizer to see which procedure would produce the best yield under these conditions
- Presented a poster based on this work at UMBC at the 20th Annual Undergraduate Research Symposium in the Chemical and Biological Sciences

A study of the ratchet and pawl system (Fall 2020)

- Project during a research rotation with Prof. Christopher Jarzynski at the University of Maryland, College Park
- Studied the ratchet and pawl system, a theoretical perpetual motion machine proposed by Richard Feynman
- Goal was to find the thermodynamic uncertainty relations, a theoretical formulation that has gained much traction within the last 5 years especially in biophysics, for the ratchet and pawl system.
- Project has yet to produce a presentation or publication.

Conversion of an all-atom topology of sphingomyelins to a united atom topology (Winter 2021, Summer 2021)

- Project during a research rotation with Prof. Jeffery Klauda at the University of Maryland, College Park
- Goal was to take palmitoyl sphingomyelin and stearyl sphingomyelin from an all-atom topology and convert to a united atom topology to reduce computational time. To do so, each carbon in the sphingosine and fatty acid chains were grouped with their connected hydrogens to form one group instead of distinct carbon and hydrogen atoms.
- Project was continued over the summer. There is the possible prospect of publishing this research.

MEDYAN: A computational approach to studying cytoskeletal actomyosin networks (Spring 2021 to Fall 2021)

- Project with Prof. Garegin Papoian at the University of Maryland, College Park
- MEDYAN (MEchanochemical DYnamics of Active Networks)² is a computer program specifically designed by the Papoian group to study actomyosin networks in eukaryotic cells.
- Specific projects include investigating the effects of ATP on these networks, investigating the effects of cofilin on actin turnover, and implementing microtubule dynamics into MEDYAN
- Presented at the COMBINE Annual Symposium on Network Biology in 2021, with further prospects of being published.

Computer Experience

Some Molecular Dynamics (CHARMM, VMD, NAMD), MEDYAN (MEchanochemical DYnamics of Active Networks)², Python, MATLAB, Mathematica, LINUX, Windows

²Popov K, Komianos J, Papoian GA (2016) MEDYAN: Mechanochemical Simulations of Contraction and Polarity Alignment in Actomyosin Networks. PLoS Comput Biol 12(4): e1004877. <https://doi.org/10.1371/journal.pcbi.1004877>

Teaching/Tutoring Experience

Teaching/Learning Assistant

- **UMD Graduate Teaching Assistant for General Bioanalytical Chemistry Lab** (Fall 2020) and **General Chemistry I Lab** (Spring 2021)

Description: Along with the professor and 7 to 9 other teaching assistants, was responsible for the education, coordination, and learning in the classes listed above. Each class consisted of ~500 students each. Specific responsibilities included 2 to 4 office hours per week, which consisted of ~20-30 students, in which I answered students' questions about the labs and lab reports, along with answering questions from students via email and a designated discussion board. Due to COVID-19, these labs were conducted online.

- **UMBC Undergraduate Learning Assistant for Organic Chemistry I** (Fall 2016) and **Precalculus** (Spring 2018)

Description: In organic chemistry I, assisted the professors in class and helped answer students' questions alongside the professors. In precalculus, led a discussion section in lieu of direct supervision of the professor as well as proctored and graded quizzes.

Tutoring

- **UMBC Learning Resource Center and Math and Science Learning Center** (Fall 2015 to Spring 2018); **UMBC Chemistry Tutorial Center** (Spring 2018)

Description: Tutored both walk-in and group tutoring in chemistry (general, organic, physical, analytical) and math (algebra, precalculus, calculus I, II, and III, differential equations, linear algebra), along with other subjects (e.g. statistics, physics)

- **Served as a private/independent tutor on and off since high school** (Fall 2012 to present)