Matthew J. Bovyn, PhD

Curriculum Vitae

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Overview

ELBE Postdoctoral Fellow	Max Planck Institute for Physics of Complex Systems Max Planck Institute for Cell Biology and Genetics Center for Systems Biology Dresden	2021-current

Advisors: Pierre Haas and Marino Zerial

PhD Physics MS Physics	University of California, Irvine	2014-2021

Biophysics of cargo transport by molecular motors
Advisors: Jun Allard and Steven Gross

BS Physics BSE Mechanical Engineering	Northern Arizona University	2007-2012

Compositions and optical properties of astrophysical ices
Advisors: Will Grundy, Stephen Tegler, David Corneilson

Education

Graduate

Physiology Course	Marine Biological Laboratory	Summer 2018
Summer Research Program in Biomedical Sciences	University of Tsukuba, Japan	Summer 2016

University of California, Irvine (UCI) 2014-2021
- Biophotonics Across Energy, Space, and Time IGERT 2018-2019
- Chemical and Materials Physics Concentration 2015-2017
- Mathematical, Computational, and Systems Biology Gateway (MCSB) 2014-2015

Undergraduate

Research Experience for Undergraduates in Physics	University of South Florida	Summer 2012
Summer Undergraduate Research Program	University of Idaho	Summer 2011
NASA Space Grant Program	Lowell Observatory	2010-2011

Northern Arizona University (NAU) 2007-2012
- Majors in Physics & Mechanical Engineering
- Minors in Mathematics & Physical Sciences
- Liberal Studies Honors

Publications

M. P. Bebelman, **M. J. Bovyn**, C. M. Mayer, J. Delpierre, R. Naumann, N. P. Martins, A. Honigmann, Y. Kalaidzidis, P. A. Haas, and M. Zerial, "Hepatocyte apical bulkheads provide a mechanical means to oppose bile pressure", Journal of Cell Biology **222**, 10.1083/JCB.202208002 (2023)
*** Bovyn and Bebelman contributed equally (Co-First Authors)**

C. Combs, D. D. Seith, **M. J. Bovyn**, S. P. Gross, X. Xie, and Z. S. Siwy, "Deep learning assisted mechanotyping of individual cells through repeated deformations and relaxations in undulating channels", Biomicrofluidics **16**, 014104 (2022)

M. J. Bovyn, *Intracellular Cargo Transport Is Determined by Motors, Cargo, and Environment* (ProQuest Dissertations and Theses, Sept. 2021), p. 193, ISBN: 9798522946715

M. Bovyn, B. Reddy, S. Gross, and J. Allard, "Diffusion of kinesin motors on cargo can enhance binding and run lengths during intracellular transport", Molecular Biology of the Cell, mbc.E20–10–0658 (2021)

M. J. Bovyn, B. J. N. Reddy, S. P. Gross, and J. F. Allard, "Roles of motor on-rate and cargo mobility in intracellular transport", bioRxiv, 2020.07.13.201434 (2020)

M. J. Bovyn, *Geometry Matters for Cargos Navigating 3D Microtubule Intersections* (ProQuest Dissertations Publishing, 2019), p. 79, ISBN: 9798641784113

D. E. Chapman, B. J. N. Reddy, B. Huy, **M. J. Bovyn**, S. J. S. Cruz, Z. M. Al-Shammari, H. Han, W. Wang, D. S. Smith, and S. P. Gross, "Regulation of in vivo dynein force production by CDK5 and 14-3-3ϵ and KIAA0528", Nature Communications **10**, 228 (2019)

J. P. Bergman, **M. J. Bovyn**, F. F. Doval, A. Sharma, M. V. Gudheti, S. P. Gross, J. F. Allard, and M. D. Vershinin, "Cargo navigation across 3D microtubule intersections.", Proceedings of the National Academy of Sciences **115**, 537–542 (2018)
*** Bovyn and Bergman contributed equally (Co-First Authors)**

W. M. Grundy, S. J. Morrison, **M. J. Bovyn**, S. C. Tegler, and D. M. Cornelison, "Remote sensing D/H ratios in methane ice: Temperature-dependent absorption coefficients of CH3D in methane ice and in nitrogen ice", Icarus **212**, 941–949 (2011)

S. C. Tegler, D. M. Cornelison, W. M. Grundy, W. Romanishin, M. R. Abernathy, **M. J. Bovyn**, J. A. Burt, D. E. Evans, C. K. Maleszewski, Z. Thompson, and F. Vilas, "Methane and nitrogen abundances on Pluto and Eris", The Astrophysical Journal **725**, 1296–1305 (2010)

Selected Conference and Workshop Presentations

Poster: Cargo binding to microtubules	Biophysical Society Annual Meeting Virtual, February 2021. Cell Bio Virtual, December 2020.
Poster: Phenotyping of neutrophil populations using deformability cytometry	Biophysical Society Annual Meeting San Diego, February 2020.
Poster: Freedom of molecular motors in the membrane of intracellular cargos allows both fast binding and robust transport	Biophysical Society Annual Meeting San Diego, February 2020. Cellular Dynamics and Models Cold Spring Harbor Laboratory, April 2019. Gordon Research Conference on Stochastic Physics in Biology Ventura, January 2019. American Society for Cell Biology Annual Meeting San Diego, December 2018.

Invited Talk: 3D stochastic simulations of cargo transport reveal the influence of cargo and environment	Mathematics of the Cell: Mechanical and Chemical Signaling across Scales. Banff International Research Station for Mathematical Innovation and Discovery, August 2018. SIAM Conference on the Life Sciences, Minneapolis, August 2018.
Talk: Brownian dynamics simulation reveals how properties of the cargo and its environment can influence multiple motor transport	American Physical Society March Meeting, Los Angeles, March 2018.
Poster: Geometry Matters for Cargos Navigating 3D Microtubule Intersections	Biophysical Society Annual Meeting, San Francisco, February 2018. American Society for Cell Biology Annual Meeting, Philadelphia, December 2017.
Poster: Brownian dynamics simulation reveals freedom of motors in the cargo membrane can influence cargo dynamics	Biophysical Society Thematic Meeting, Taipei, June 2017. Quantitative Cell Biology Network Workshop on Cells as Dynamical Systems. University of California, San Francisco, May 2017. Biophysical Society Annual Meeting, Los Angeles, February 2016. American Society for Cell Biology Annual Meeting, San Diego, December 2015. Quantitative Cell Biology Network Workshop on Cytoskeletal Mechanics. Chicago, October 2015.
Talk: Driving Sodium-Potassium Pumps With An Oscillating Electric Field: Effects On Muscle Recovery	American Physical Society March Meeting, Baltimore, March 2013. Won "Outstanding Undergraduate Presenter" Award
Talk: Temperature Effects in the Near-IR Spectrum of CO2 Ice	Arizona NASA Space Grant Symposium, Phoenix, April 2011.

Funding and Awards

Graduate

UCI CCBS Opportunity Award: $10,000 to develop a project on determining cell state from cell physical properties. Preliminary results presented at the UCI Center for Complex Biological Systems (CCBS) retreat, March 2019.

Contributed to application for NIH R01 awarded to Jun Allard and Steve Gross (NIGMS R01 GM123068), which funded my work.

NSF GRFP: Honorable Mention 2014

Fellowships: Won fellowship support for 5 years:

Years 4 & 5	NSF Integrative Graduate Education and Research Traineeship (IGERT) DGE-1144901 to Vasan Venugopalan, UCI Beckman Laser Center
Years 2 & 3	NIH T32 Training Grant EB009418-07 to Arthur Lander and Qing Nie, UCI Center for Complex Biological Systems
Year 1	UCI Mathematical, Computational and Systems Biology Fellowship

Undergraduate

Outstanding Senior: Selected as the outstanding senior of the NAU College of Engineering, Forestry and Natural Sciences

Gold Axe Award: NAU award for graduating seniors, one of 10 selected by the university

Bedwell Scholarship: awarded by NAU Department of Physics and Astronomy

Adel Scholarship: awarded by NAU Department of Physics and Astronomy

Raytheon Missile Systems Scholarship

Chair's Scholarship: awarded by NAU Department of Physics and Astronomy

Arizona Board of Regent's High Honors Tuition Scholarship: Four year scholarship awarded based on high school achievement

Dean's List: 7 Semesters

Professional Activity & Service

Peer Reviewer

- Nano Letters: 2022
- PLoS Computational Biology: 2020
- ASME Journal of Computational and Nonlinear Dynamics: 2019

Postdoc

Founded and Organized The Interdisciplinary Talk Initiative at MPI-CBG and MPI-PKS

- Created a system for people with upcoming talks to request feedback from people outside their discipline, to help talks appeal to audiences from multiple disciplines
- Planning community events to help institute members understand and be interested in what other disciplines value

Graduate

Founded and Organized UCI Biophysics and Systems Biology Seminar Series

- Began a series of research in progress talks for students in the MCSB program with co-founder Kerrigan Blake, 2016. Organized 66 talks 2016-2019.
- Expanded the seminar series to host invited speakers, 2017. Hosted 9 visiting speakers 2017-2019.

Founded UCI CCBS Outreach Program

- Began an outreach program for the UCI Center for Complex Biological Systems with co-founder Sean Horan

- Won ASCB COMPASS outreach grant for project with local high schools

Assisted with Peer Review

- Bulletin of Mathematical Biology: 2019
- PLoS Computational Biology: 2020, 2018
- Molecular Biology of the Cell: 2019, 2018, 2017
- Biophysical Journal: 2017
- Physics Letters A: 2016
- Biology Direct: 2016
- PNAS: 2020, 2017, 2015

Undergraduate

President: NAU Society of Physics Students

- Organized and led outreach events to local schools and wider community
- Organized "Zone Meeting" for chapters throughout Arizona
- Led weekly meetings for members

Member: Tau Beta Pi, The Engineering Honor Society

Member: Sigma Pi Sigma, National Physics Honor Society

Teaching

Organizer and Lecturer, UCI MCSB Bootcamp 2019
Built a new curriculum from scratch to teach incoming first year graduate students coding and computer skills, as well as mathematical modeling (one week). Lessons taught on git and GitHub, command line, generating and analyzing mathematical models, fitting models to data.

Teaching Assistant, UCI:

- Physics 106W: Laboratory Skills and Scientific Writing for Applied Physics Majors
- Physics 193 / Biology 108 / Chemistry 193: Research Methods for CalTeach (high school teacher preparation program)

Supplemental Instructor, NAU:

- Physics 111: General Physics I (mechanics, non-calculus based)
- Physics 262: University Physics II (electricity and magnetism, calculus based)

Other Projects

Summer 2018	MBL Physiology 2018 Rotations Wallace Marshall Stentor Phototaxis Clare Waterman Neutrophil Extracellular Traps (NETosis)

	Dan Fletcher Engineering Cell Motility by targeting actin under tension
Winter 2014	Rotation Project Laboratory for Fluorescence Dynamics Irvine, California *Fluorescence Lifetime Imaging of Turbid Samples* Advisors: Professor Enrico Gratton and Dr. Ylenia Santoro
Summer 2014	Graduate Student Researcher Beckman Laser Institute Irvine, California *Deep Tissue Biophotonics for Breast Cancer Diagnostics* Advisors: Professor Bruce Tromberg and Dr. Albert Cerussi
Jan 2014 to Jun 2014	Tutor Tutor Doctor & Varsity Tutors Irvine, California *High School Physics and Calculus*
Feb 2013 to Jun 2013	Research Assistant Univeristy of Puerto Rico, Rio Piedras San Juan, Puerto Rico *Herbarium Server Development* Director: Professor James Ackerman
Fall 2012	Research Assistant Northern Arizona University *Planetary Astrophysics of Icy Outer Solar System Objects* Advisors: Dr. Will Grundy and Professor Stephen Tegler
Summer 2012	NSF Research Experience for Undergraduates Univeristy of South Florida *Manipulating Sodium-Postassium Pumps in working muscle* Advisor: Professor Wei Chen
Fall 2011 to Spring 2012	Research Assistant Northern Arizona University *Planetary Astrophysics of Icy Outer Solar System Objects* Advisors: Dr. Will Grundy and Professor Stephen Tegler
Summer 2011	NSF Research Experience for Undergraduates Univeristy of Idaho *Solid State Physics of Nanosprings* Advisor: Professor Dave McIlroy
Fall 2010 to Spring 2011	NASA Space Grant Intern Northern Arizona University *Temperature dependence of the near-IR spectrum of carbon dioxide ice* Advisors: Dr. Will Grundy and Professor Stephen Tegler
Summer 2010	Research Assistant Lowell Observatory, Flagstaff Arizona *Methane and nitrogen ice mixtures on Aris* Advisors: Dr. Will Grundy and Professor Dave Cornelison