# Matthew J. Bovyn, PhD

## Curriculum Vitae

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01307 Dresden, Germany

## Overview

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

Advisors: Pierre Haas and Marino Zerial

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| PhD Physics<br>MS Physics | University of California, Irvine | 2014-2021 |

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

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| BS Physics<br>BSE Mechanical Engineering | Northern Arizona University | 2007-2012 |

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

## Education

### Graduate

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| 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

PhD Physics:
Intracellular Cargo Transport Is Determined by Motors, Cargo, and Environment — Mar 19 2021

MS Physics:
Geometry Matters for Cargos Navigating 3D Microtubule Intersections — Dec 13 2019

Biophotonics Across Energy, Space, and Time IGERT
Chemical and Materials Physics Concentration
Mathematical, Computational, and Systems Biology Gateway (MCSB) — 2014-2015

### Undergraduate

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| 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: Physics & Mechanical Engineering
Minors: Mathematics & Physical Sciences
Liberal Studies Honors

## Publications

**M. J. Bovyn** and P. A. Haas, "Shaping epithelial lumina under pressure", Biochemical Society Transactions **52**, 331–342 (2024)

J. Delpierre, J. I. Valenzuela, **M. Bovyn**, N. P. Martins, L. Belicova, U. Repnik, M. Bebelman, S. Seifert, P. A. Haas, Y. L. Kalaidzidis, and M. Zerial, "Hepatoblast iterative apicobasal polarization is regulated by extracellular matrix remodeling", bioRxiv, 2024.01.30.578046 (2024)

M. Mukenhirn, C.-H. Wang, T. Guyomar, **M. J. Bovyn**, M. F. Staddon, R. Maraspini, L. Lu, C. Martin-Lemaitre, M. Sano, T. Hiraiwa, D. Riveline, and A. Honigmann, "Tight junctions regulate lumen morphology via hydrostatic pressure and junctional tension", bioRxiv, 2023.05.23.541893 (2023)

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 14-3-3$\epsilon$ 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

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| **Poster:**<br>Hepatocyte apical bulkheads provide a mechanical means to oppose bile pressure | EMBO Workshop: Physics of living systems: From physical principles to biological function Dresden, July 2023. |
| **Selected Talk:**<br>Hepatocyte apical bulkheads provide a mechanical means to oppose bile pressure | EMBO \| EMBL Symposium: Life at the periphery: mechanobiology of the cell surface Heidelberg, June 2023. |

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| **Poster:**<br>Cargo binding to microtubules | Biophysical Society Annual Meeting Virtual, February 2021<br>Cell Bio Virtual, December 2020. |
| **Poster:**<br>Phenotyping of neutrophil populations using deformability cytometry | Biophysical Society Annual Meeting San Diego, February 2020. |
| **Poster:**<br>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.<br>Cellular Dynamics and Models Cold Spring Harbor Laboratory, April 2019.<br>Gordon Research Conference on Stochastic Physics in Biology Ventura, January 2019.<br>American Society for Cell Biology Annual Meeting San Diego, December 2018. |
| **Invited Talk:**<br>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.<br>SIAM Conference on the Life Sciences, Minneapolis, August 2018. |
| **Talk:**<br>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:**<br>Geometry Matters for Cargos Navigating 3D Microtubule Intersections | Biophysical Society Annual Meeting, San Francisco, February 2018.<br>American Society for Cell Biology Annual Meeting, Philadelphia, December 2017. |
| **Poster:**<br>Brownian dynamics simulation reveals freedom of motors in the cargo membrane can influence cargo dynamics | Biophysical Society Thematic Meeting, Taipei, June 2017.<br>Quantitative Cell Biology Network Workshop on Cells as Dynamical Systems. University of California, San Francisco, May 2017.<br>Biophysical Society Annual Meeting, Los Angeles, February 2016.<br>American Society for Cell Biology Annual Meeting, San Diego, December 2015.<br>Quantitative Cell Biology Network Workshop on Cytoskeletal Mechanics. Chicago, October 2015. |
| **Talk:**<br>Driving Sodium-Potassium Pumps With An Oscillating Electric Field: Effects On Muscle Recovery | American Physical Society March Meeting, Baltimore, March 2013.<br>Won "Outstanding Undergraduate Presenter" Award |

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| **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:

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| 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, 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
- 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

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| Summer 2018 | MBL Physiology 2018 Rotations<br>Wallace Marshall Stentor Phototaxis<br>Clare Waterman Neutrophil Extracellular Traps (NETosis)<br>Dan Fletcher Engineering Cell Motility by targeting actin under tension |
| Winter 2014 | Rotation Project<br>Laboratory for Fluorescence Dynamics Irvine, California<br>*Fluorescence Lifetime Imaging of Turbid Samples*<br>Advisors: Professor Enrico Gratton and Dr. Ylenia Santoro |
| Summer 2014 | Graduate Student Researcher<br>Beckman Laser Institute Irvine, California<br>*Deep Tissue Biophotonics for Breast Cancer Diagnostics*<br>Advisors: Professor Bruce Tromberg and Dr. Albert Cerussi |
| Jan 2014 to Jun 2014 | Tutor<br>Tutor Doctor & Varsity Tutors Irvine, California<br>*High School Physics and Calculus* |
| Feb 2013 to Jun 2013 | Research Assistant<br>Univeristy of Puerto Rico, Rio Piedras San Juan, Puerto Rico<br>*Herbarium Server Development*<br>Director: Professor James Ackerman |
| Fall 2012 | Research Assistant<br>Northern Arizona University<br>*Planetary Astrophysics of Icy Outer Solar System Objects*<br>Advisors: Dr. Will Grundy and Professor Stephen Tegler |
| Summer 2012 | NSF Research Experience for Undergraduates<br>Univeristy of South Florida<br>*Manipulating Sodium-Postassium Pumps in working muscle*<br>Advisor: Professor Wei Chen |
| Fall 2011 to Spring 2012 | Research Assistant<br>Northern Arizona University<br>*Planetary Astrophysics of Icy Outer Solar System Objects*<br>Advisors: Dr. Will Grundy and Professor Stephen Tegler |

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| Summer 2011 | NSF Research Experience for Undergraduates<br>Univeristy of Idaho<br>*Solid State Physics of Nanosprings*<br>Advisor: Professor Dave McIlroy |
| Fall 2010<br>to<br>Spring 2011 | NASA Space Grant Intern<br>Northern Arizona University<br>*Temperature dependence of the near-IR spectrum of carbon dioxide ice*<br>Advisors: Dr. Will Grundy and Professor Stephen Tegler |
| Summer 2010 | Research Assistant<br>Lowell Observatory, Flagstaff Arizona<br>*Methane and nitrogen ice mixtures on Aris*<br>Advisors: Dr. Will Grundy and Professor Dave Cornelison |