Michael G. Lerner **Associate Professor of Physics, Engineering and Astronomy**

Contact Information

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Research Interests

Computational biophysics, computational oncology, statistical mechanics, membrane structure and dynamics, computational topology, physics education, biophysics education, nucleic acid structure, protein dynamics, structure-based drug design.

Education

University of Michigan, Ann Arbor, MI USA

PhD: Biophysics **Jan 2004 – Nov. 2007**
MS: Biophysics Research Division **Aug. 2001 – Dec. 2003**

Haverford College, Haverford, PA USA

B.S.: Physics, Departmental Honors **May 1999**
Concentration: Computer Science

Honors and Awards

Outstanding Graduate Instructor (University of Michigan Physics Deptartment) **2007**

Michigan Teaching Fellow (University of Michigan) **2006**

Molecular Biophysics Training Grant (NIH) **May 2003 – Apr. 2005**

Haverford College: Departmental Honors in Physics **1999**

Academic and Professional Experience and Fellowships

Earlham College, Richmond, IN USA
Assoc. Professor, Dept. of Physics, Engineering and Astronomy **July 2017 – present**
Asst. Professor, Department of Physics and Astronomy **July 2013 – June 2017**
Visiting Asst. Professor, Department of Physics and Astronomy **July 2011 – June 2013**

Johns Hopkins University, Baltimore, MD USA
Visiting Associate Professor, Department of Biomedical Engineering, Whiting School of Engineering, Johns Hopkins University **August 2019 – December 2020**

National Institutes of Health
National Heart Lung and Blood Institute, Rockville, MD USA
IRTA Postdoctoral Fellow **Dec. 2007 – Aug. 2011**

Schrödinger, New York, NY USA
Warren L. DeLano Memorial PyMOL Open-Source Fellow **Oct. 2010 – Oct. 2011**

Campaign Scientific, Philadelphia, PA
Co-Founder **2005 – 2007**

Ricoh Silicon Valley, Cupertino, CA
Software Engineer **1999 – 2001**

City Year, Chicago, IL
Corps Member **1996 – 1997**

Core Physics Courses Taught Since 2011 (Standard load: 6 hours of classroom instruction and 6 hours of laboratory instruction per semester)

- Physics 125 (Matter in Motion, with Calculus)
- Physics 126 (Calculus-based supplement to General Physics I)
- Physics 230 (Electromagnetism, Waves and Optics)
- Physics 235 (Electromagnetism, Waves and Optics, with Calculus)
- Physics/Math 360 (Mathematical Physics)
- Physics 375 (Statistical and Thermal Physics)
- Physics 435 (Classical Electricity and Magnetism)
- Physics 480 (Senior Seminar: Advanced Statistical Mechanics and Molecular Simulation)
- Physics 480 (Senior Seminar: The Physics of Interfaces)
- Physics 480 (Senior Seminar: Biophysics)
- Physics 286 and 486 (Physics Research)
- Physics 488 (Senior Capstone)

Other Courses Taught Since 2011

- NatSci 101-102 (Science Scholar Seminar)
- Physics 110 (Science and Pseudoscience)
- Earlham Seminar 150 (Science and Pseudoscience)
- Physics/Biology 225 (Biophysics)
- Engineering 300 (Introduction to Biomedical Engineering)
- Physics/Biology 325 (Biophysics)
- Computer Science 290 (Computational Science)
- Physics 484 (Collaborative Research: Watching Molecules Move: Computational Studies of Proteins and Nucleic Acids)
- Physics 484 (Collaborative Research: Modeling Climate Change in New Zealand)
- Physics 485 (Independent Study: Fluid Mechanics)
- Faculty Seminar in New Zealand (Climate Change and Computational Modeling)
- Data Science Applied Group

Publications * student co-author

Bernat Navarro-Serer, Maria F. Wissler, Brandi K. Glover, **Michael G. Lerner**, Harsh H. Oza, Vania Wang, Hildur Knutsdottir, Fatemeh Shojaeian, Kathleen Noller, Saravana Gowtham Baskaran, Sara Hughes, **Alana M. Weaver***, Daniel Wilentz, Oluwatobiloba Olayemi, Joel S. Bader, Elana J. Fertig, Daniele M. Gilkes, Laura D. Wood "P4HA1 mediates hypoxia-induced invasion in human pancreatic cancer organoids". Cancer Research Communications, 2025 *under review.*

Matthew C Perrone, **Michael G Lerner**, Matthew Dunworth, Andrew J Ewald, Joel S Bader "Prioritizing drug targets by perturbing biological network response functions". PLoS computational biology 20(6), 2024.

David Robert Bruce, James Borrelli, Gennifer Smith, **Michael G Lerner**, Anne Raich "Commonality of Failure Modes in New Engineering Program Development". 2023 ASEE Annual Conference & Exposition, 2023.

Yea Ji Jeong, Hildur Knutsdottir, Fatemeh Shojaeian, **Michael G Lerner**, Maria F Wissler, Elodie Henriet, Tammy Ng, Shalini Datta, Bernat Navarro-Serer, Peter Chianchiano, Benedict Kinny-Köster, Jacquelyn W Zimmerman, Genevieve Stein-O'Brien, Matthias M Gaida, James R Eshleman, Ming-Tseh Lin, Elana J Fertig, Andrew J Ewald, Joel S Bader, Laura D Wood "Morphology-guided transcriptomic analysis of human pancreatic cancer organoids reveals microenvironmental signals that enhance invasion". The Journal of Clinical Investigation, 133(8), 2023.

PUBLICATIONS (CONT.)

Ling Li, Gilad Halpert, **Michael G Lerner**, Haijie Hu, Peter Dimitrion, Matthew J Weiss, Jin He, Benjamin Philosophe, Richard Burkhart, William R Burns, Russell N Wesson, Andrew MacGregor Cameron, Christopher L Wolfgang, Christos Georgiades, Satomi Kawamoto, Nilofer S Azad, Mark Yarchoan, Stephen J Meltzer, Kiyoko Oshima, Laura M Ensign, Joel S Bader, Florin M Selaru "Protein synthesis inhibitor omacetaxine is effective against hepatocellular carcinoma". JCI insight, 6(12), 2021.

William C. Hahn, Joel S. Bader, Theodore P. Braun, Andrea Califano, Paul A. Clemons, Brian J. Druker, Andrew J. Ewald, Haian Fu, Subhashini Jagu, Christopher J. Kemp, William Kim, Calvin J. Kuo, Michael T. McManus, Gordon B. Mills, Xiulei Mo, Nidhi Sahni, Stuart L. Schreiber, Jessica A . Talamas, Pablo Tamayo, Jeffrey W. Tyner, Bridget K. Wagner, William A. Weiss, Daniela S. Gerhard, ... **Michael G. Lerner** ... "An expanded universe of cancer targets". Cell, 184(5) 2021

Richard M. Venable, Helgi I. Ingolfsson, **Michael G. Lerner**, B. Scott Perrin, Jr., Brian A. Camley, Siewert-J. Marrink, Frank L.H. Brown, Richard W. Pastor "Lipid and peptide diffusion in bilayers: the Saffman-Delbrück model and periodic boundary conditions". Journal of Physical Chemistry B, 121(5), 2017.

Brian A. Camley, **Michael G. Lerner**, Richard W. Pastor, Frank L. H. Brown "Strong influence of periodic boundary conditions on lateral diffusion in lipid bilayer membranes". Journal of Chemical Physics, 143(24), 2015.

Zachary Levine, Richard M. Venable, Max C. Watson, **Michael G. Lerner**, Joan-Emma Shea, Richard W. Pastor, Frank L. H. Brown "Determination of Biomembrane Bending Moduli in Fully Atomistic Simulations". Journal of the American Chemical Society, 136(39), 2014.

Frank C. Pickard IV, Benjamin T. Miller, Vinushka Schalk, **Michael G. Lerner**, H. Lee Woodcock III, Bernard R. Brooks "Web-Based Computational Chemistry Education with CHARMMing II: Coarse-Grained Protein Folding". PLoS Computational Biology, 10(7), 2014.
Paper highlighted in PLoS editorial "Making Biomolecular Simulations Accessible in the Post-Nobel Era", Ruth Nussinov and Quiang Cui.

Jefferson D. Knight, **Michael G. Lerner**, Joan G Marcano-Velázquez, Richard W. Pastor, Joeseph J. Falke "Single molecule diffusion of membrane-bound proteins: Window into lipid contacts and bilayer dynamics". Biophysical Journal, 99(9), 2010.

Michael G. Lerner, Kristin L. Meagher, Heather A. Carlson "Automated clustering of probe molecules from solvent mapping of protein surfaces". Journal of Computer Aided Molecular Design, 10, 2008.

Michael G. Lerner, Anna L. Bowman, Heather A. Carlson "Incorporating Dynamics in E. coli Dihydrofolate Reductase Enhances Structure-based Drug Discovery". Journal of Chemical Information and Modeling, 47, 2007.

Anna L. Bowman, **Michael G. Lerner**, Heather A. Carlson "Protein flexibility and species specificity in structure- based drug discovery: Dihydrofolate reductase as a test system". Journal of the American Chemical Society, 129 (12), 2007.

Kristin L. Meagher, **Michael G. Lerner**, Heather A. Carlson "Refining the multiple protein structure method: consistency across three independent HIV-1 protease models". Journal of Medicinal Chemistry, 49 (12), 2006.

Leigi Hu, Mark L. Benson, Richard D. Smith, **Michael G. Lerner**, Heather A. Carlson, "Binding MOAD (Mother of All Databases)". Proteins: Structure, Function and Bioinformatics, 60, 2005.

Grants Since 2011

Increasing Success of STEM Students through Cohort Building, Mentoring, and Career Discerning Experiences: an Interdisciplinary Collaboration
NSF/DUE (Co-Principal Investigator), $747,247 **August 2022**

Computational Prediction of Genetic Drivers of Breast Cancer
NIH/NCI (Principal Investigator) F33, 1F33CA247344-01, $62,848 **February 2020**

Training in RNA-Seq analysis and computational network analysis
Burroughs Wellcome Fund (Principal Investigator), $12,500 **May 2019**

Modeling Climate Change in New Zealand: Collaborative Faculty-Student Research Project.
Earlham College (Principal Investigator), $9,000 **August 2018**

Non-Newtonian Physicists : Assessment mini-grants focusing on Diversity.
Earlham College (Principal Investigator), $500 **January 2018**

Making Molecules Move: Collaborative Faculty-Student Research Project.
Earlham College (Principal Investigator), $10,600 **January 2016**

Expedited Research Grants: Computational Topology and Drug Design.
Earlham College (Principal Investigator), $850 **December 2014**

Experiential Learning Fund: Getting Started with Python: Programming for Everyone.
Earlham College (Principal Investigator), $2,000 **October 2014**

CC*IIE Campus Design: Network Infrastructure for Improved Science Discovery and Education.
NSF (Co-Principal Investigator), $347,228 **August 2014**

Kickstarter Technology Grant: IPython Notebooks for Computer Science and Physics.
Earlham College (Principal Investigator), $500 **August 2013**

Pedagogical Incubator Initiative: Science Scholars Seminar.
Earlham College (Co-Principal Investigator), $2500 **February 2012**

Conferences, Workshops, and Seminars Since 2011 (Undergraduate students shown in **Bold**)

Biophysical Society 69th Annual Meeting **February 2025**
Poster: **Aouss Azzouz**, **Sharon Wong**, Matthew C. Perrone, *Los Angeles, CA*
Joel S. Bader, Michael G. Lerner "Prioritizing Cancer Drug Targets with Monte Carlo Simulations of Network Diffusion"

The Entrepreneurially Minded Engineering Resource Group for Educators (EMERGE) Annual Meeting **May 2024** *Indianapolis, IN*

Biophysical Society 68th Annual Meeting **February 2024** *Philadelphia, PA*

American Society of Engineering Education (ASEE) Annual Conference & Exposition **June 2022** *Minneapolis, MN*

The Entrepreneurially Minded Engineering Resource Group for Educators (EMERGE) Annual Meeting **May 2022** *Chapel Hill, NC*

Conferences, Workshops, and Seminars Since 2011 (Cont.) (Undergraduate students shown in **Bold**)

CTD^2 Site Visit **January 2021**
Johns Hopkins University; Johns Hopkins School of Medicine *Baltimore, MD*
Invited talk: "Patterns of metastasis in human pancreatic cancer."

Biophysical Society 65$^{\text{th}}$ Annual Meeting **February 2021**
Virtual

University of Mary Washington, Department of Physics **February 2020**
Invited colloquium: "Diffusion in biological systems: from simulating biomembranes to predicting the drivers of cancer metastasis." *Fredericksburg, VA*

Cal State Fullerton, Department of Physics **February 2020**
Invited colloquium: "Diffusion in biological systems: from simulating biomembranes to predicting the drivers of cancer metastasis." *Fullerton, CA*

Biophysical Society 64$^{\text{th}}$ Annual Meeting **February 2020**
San Diego, CA

American Association for Cancer Research 109th Annual Meeting **April 2018**
Chicago, IL

University of Groningen, Molecular Dynamics Group, **July 2018**
Department of Biological Chemistry *Groningen, The Netherlands*
Invited colloquium: "Correlated motions and two-point microrheology: calculating diffusion coefficients from membrane simulations."

Laboratory of Computational Biology, NHLBI, National Institutes of Health **July 2018**
Invited colloquium: "Two-point microrheology and correlated motions: a few ways to calculate diffusion coefficients from membrane simulations." *Bethesda, MD*

Biological Membranes and Membrane Proteins: Challenges for Theory **June 2017**
and Experiment *Santa Fe, NM*
Invited speaker: "Diffusion and correlated motions in lipid simulations"

Georgia Tech, Department of Physics **April 2017**
Invited colloquium: "Diffusion, correlated motions and periodic boundary conditions in lipid membranes." *Atlanta, GA*

Biophysical Society 61$^{\text{st}}$ Annual Meeting **February 2017**
Poster: Heather A. Carlson, **Craig J. Earley**, Michael G. Lerner, *New Orleans, LA*
Paul F. Maxson, **Arish Mudra Rakshasa** "Correlated Motions in the DHFR-NADPH Complex"
Poster: Allan T. Ansevin, **Micaela E. Bush**, **Alma Gracic**, **Jinhee Kim**, **Ahsan A. Khoja**, Michael G. Lerner, **Lam T. Nguyen**, **Sunil Pun Ashutosh Rai**, **Alexander K. Seewald**, **Benjamin Yee** "Improved Sampling in Molecular Dynamics Studies of DNA and the B to Z[WC] to Z-DNA Transition".

Conferences, Workshops, and Seminars Since 2011 (Cont.) (Undergraduate students shown in **Bold**)

Biophysical Society 60th Annual Meeting **February 2016**
Poster: **Gwendolyn A. Claflin**, **Rodoula Kyvelou-Kokkaliaris**, *Los Angeles, CA*
Michael G. Lerner, **Hoang T. Tran**, **Tara M. Urner** "Faster, More Accurate Quantification of Diffusion and Correlated Motions in Lipid Bilayers".
Poster: Allan T. Ansevin, **Micaela E. Bush**, **Alma Gracic**, **Jinhee Kim**, Michael G. Lerner, **Ashutosh Rai**, **Alexander K. Seewald**, **Benjamin Yee** "Molecular Dynamic Investigations of Z[WC] DNA and Its Potential Role in the B to Z- Transition".

Earlham College **December 2015**
Faculty Forum: "How did Earlham Students figure out that everybody's error bars were wrong?" *Richmond, IN*

West Virginia University, Department of Chemistry **November 2015**
Invited colloquium: "Faster, more accurate quantification of diffusion and correlated motions in molecular simulations of lipid bilayers." *Morgantown, WV*

American Association of Physics Teachers (AAPT) New Faculty Workshop **November 2015**
Selected participant *College Park, MD*

GLCA Academic Leadership and Innovation (GALI) Institute **October 2015**
Faculty Development Workshop *selected by Earlham to attend* *Ann Arbor, MI*

Indiana University - Purdue University Indianapolis, Department of Physics **October 2015**
Invited colloquium: "Faster, more accurate quantification of diffusion and correlated motions in molecular simulations of lipid bilayers." *Indianapolis, IN*

Biological Membranes and Membrane Proteins: Challenges for Theory and Experiment **July 2015**
Telluride, CO
Invited speaker: "Faster, more accurate diffusion constants"

Biophysical Society 59th Annual Meeting **February 2015**
Poster: **Gwendolyn A. Claflin**, **Rodoula Kyvelou-Kokkaliaris**, *Baltimore, MD*
Michael G. Lerner, **Hoang T. Tran** "Faster Calculations of Diffusion Constants for Lipids, Water and Proteins".
Poster: Allan T. Ansevin, **Alma Gracic**, **Jinhee Kim**, Michael G. Lerner, **Ashutosh Rai**, **Alexander K. Seewald**, **Benjamin Yee** "Molecular Dynamic Studies of Z[WC]-DNA and the B to Z-DNA Transition".

Lilly International Conference on College Teaching **November 2014**
Miami, OH

Biophysical Society 58th Annual Meeting **February 2014**
Poster: Michael G. Lerner, **Hoang T. Tran** *San Francisco, CA*
"Measuring diffusion coefficients using non-equilibrium techniques".
Poster: Allan T. Ansevin, **Jinhee Kim**, Michael G. Lerner, **Alexander K. Seewald**
"Molecular Dynamic Studies of Z[WC]-DNA and the B to Z-DNA Transition".

National Institutes of Health 2014 Orloff Science Awards **January 2014**
Invited speaker *Bethesda, MD*

Biological Membranes and Membrane Proteins: Challenges for Theory and Experiment **July 2013**
Sowmass, CO
Invited participant

Conferences, Workshops, and Seminars Since 2011 (Cont.) (Undergraduate students shown in **Bold**)

Biophysical Society 57th Annual Meeting — **February 2013**, *Philadelphia, PA*

South Dakota State University — **December 2012**, *Brookings, SD*
Invited seminar: Computational and theoretical studies of protein and lipid dimers and trimers diffusing in lipid membranes.

Earlham College Economics Department — **December 2012**, *Richmond, IN*
Invited speaker/panel discussion member:
The Nate Silver Phenomenon – Methodological Issues.

Laboratory Instruction Beyond the First Year of College — **July 2012**, *Philadelphia, PA*
Invited session chair: Statistical Physics/Soft Matter Instructional Labs.
Poster: Michael G. Lerner, "Using computer simulations to teach the Jarzynski equality".

Biophysical Society 56th Annual Meeting — **February 2012**, *San Diego, CA*

Biological Membranes and Membrane Proteins: Challenges for Theory and Experiment — **July 2011**, *Sowmass, CO*
Invited speaker: "Diffusion of tethered dimer and trimer systems"

Service Since 2011

Convener (Chair): Department of Physics, Engineering and Astronomy, Fall 2013-Spring 2015, Fall 2016-Spring 2019, Fall 2020-present.

S-STEM (NSF Scholarships in Science, Technology, Engineering, and Mathematics Program) Mentor: Fall 2023-Present.

Convener (Chair) and Program Liaison: 3-2 Engineering Program, Fall 2016, Fall 2024.

Convener: Natural Science Division, Spring 2021-Fall 2022.

Maintainer: Physics Professors Slack, a Slack for Physics professors at primarily undergraduate institutions, with a focus on teaching and DEI work. 2020-2024.

Organizer: Decolonising science reading group, August 2017.

Faculty Convener: Earlham College Ultimate Frisbee Team, 2013 - 2018.

Committees: twenty two search committees (convener of thirteen), board observer/liaison, campus life advisory committee, Curricular Policy Committee, ABET accreditation committee, GLI internship implementation group, science phase 2 building committee, scientific equipment fund (convener), mentoring committee (Earlham-wide), mentoring committee (Departments of Mathematics, Physics and Computer Science, 2016-2017), *Ad hoc* committee on general education goals at Earlham, student conduct council, academic advisory committee.

Convener: yearly review for Physics/Engineering/Astronomy/Mathematics/Computer Science/Data Science administrative staff.

Adviser: Typical load: 20 advisees, including 10 first-year students. Periodically: auxiliary duties for all 3-2 students (roughly 15 at a time).

Research mentor: forty one undergraduate research students and one graduate student (co-mentor) over several summers and several semesters, resulting in poster presentations (by students) at four national meeting, three in-progress publications, several invited talks, and one successful PhD defense. Student conference presentations have directly resulted in job offers and graduate school applications for several students.

Organizer: Earlham College Python Workshop, an immersive introduction to Python, taught by Software Carpentry-certified instructors, Jan 11-12, 2015.

Earlham Panels and presentations: Faculty Forum – "The Science and Religion of Oppenheimer", September 2023. Teaching students to deeply understand primary scientific and social science literature using the Paperbox, New Faculty Orientation Panel (*Who are We*), August 2014. Earlham economics panel (see above). Faculty Forum – interactive, reproducible lessons with IPython Notebooks, November 2013. Faculty Forum – "How did Earlham Students figure out that everybody's error bars were wrong?", December 2015. Mentorship panel for new science faculty – presentation on efficiency, October 2016.

NSF Panel: Invited participant, January 2016.

NIH Study Section: Outside reviewer, 2021.

Reviewer: *Biophysical Journal*, *Journal of Chemical Information and Modeling*, *PLoS Computational Biology*, *Journal of Chemical Theory and Computation*, *Nature: Scientific Reports*.