July 9, 2025

Ashlee M. Plummer-Medeiros, Ph.D.

Work Experience

2022-Current — *Bryn Mawr College*

Assistant Professor
Chemistry Department (Bryn Mawr, PA)

2021-2022 — *Gettysburg College*

Visiting Assistant Professor
Chemistry Department (Gettysburg, PA)

2021 — *Emmanuel College*

Adjunct Instructor
Biology Department (Boston, MA)

2017-2021 — *Harvard Medical School*

Post-Doctoral Fellow
Laboratory of Dr. Maofu Liao (Boston, MA)

Education

2012-2017 — *Johns Hopkins University*

Ph.D., Molecular Biophysics
Laboratory of Dr. Karen Fleming (Baltimore, MD)

2008-2012 — *North Carolina State University*

B.S., Chemistry
Laboratory of Dr. Stefan Franzen (Raleigh, NC)

Publications

Shin,Y-C., **Plummer-Medeiros, A. M.**, *et al.,* Liao, M., Chen, Y., (2024) The crystal and cryo-EM structures of PLCγ2 reveal dynamic inter-domain recognitions in autoinhibition, *Sci Adv, 10(48): eadn6037*.

Plummer-Medeiros, A. M., Culbertson, A. T., Morales-Perez, C. L., Liao, M., (2023) Activity and Structural Dynamics of Human ABCA1 in a Lipid Membrane, *J Mol Bio*, 435, 168038.

Devlin, T., Marx, D., Roskopf, M., Bubb, Q., **Plummer, A. M.**, Fleming, K.G., (2023) FkpA Enhances Membrane Protein Folding using an Extensive Interaction Surface, *Protein Sci*, 32, e4592.

Plummer, A. M.*, Culbertson, A. T.*, Liao, M., (2021) The ABCs of Sterol Transport, *Annu. Rev. Physiol.,* 83, 153-181. (*Equally Contributing Authors)

Marx, D. C., **Plummer, A. M.**, Faustino, A. M., Roskopf, M. A., Leblanc, M. J., Devlin, T., Lessen, H. J. Majumdar, A., Amann, B. T., Fleming, P. J., Krueger, S., Fried, S. D., Fleming, K. G., (2020) SurA is a cryptically grooved chaperone that expands unfolded outer membrane proteins, *PNAS*, 117(45), 28026-28035.

Marx, D. C., Leblanc, M., **Plummer, A. M.,** Krueger, S., Fleming, K. G., (2020) Domain Interactions Determine the Conformational Ensemble of SurA, *Protein Science*, 29(10), 2043-2053.

Peterson, J. H., **Plummer, A. M.**, Fleming, K. G., Bernstein, H. D., (2017) Selective pressure for rapid membrane integration constrains the sequence of bacterial outer membrane proteins, *Molecular Microbiology,* 106(5), 777-792.

Mo, G. C. H., Ross, B., Hertel, F., Manna, P., Yang, X., Greenwald, E., Booth, C., **Plummer, A. M.**, Tenner, B., Chen Z., Wang, Y., Kennedy, E. J., Cole, P. A., Fleming, K. G., Palmer, A., Jimenez, R., Xiao, J., Dedecker, P., Zhang,

J., (2017) Genetically-Encoded Biosensors for Visualizing Live-cell Biochemical Activity at Superresolution, *Nature Methods,* 14, 427-434.

Plummer, A. M., Fleming, K. G., (2016) From Chaperones to the Membrane with a BAM!, *Trends in Biochemical Sciences,* 41(10), 872-882.

Costello, S. M., **Plummer, A. M.,** Fleming, P. J., Fleming, K. G., (2016) Dynamic periplasmic chaperone reservoir facilitates biogenesis of outer membrane proteins, *PNAS,* 113(33), E4794-E4800.

Plummer, A. M., Fleming, K. G., (2015) BamA Alone Accelerates Outer Membrane Protein Folding In Vitro through a Catalytic Mechanism, *Biochemistry*, 54(39), 6009-11.

Plummer, A. M.*, Gessmann, D.*, Fleming, K. G., (2015) The role of a destabilized membrane for OMP insertion, *Methods in Molecular Biology*, 1329, 57-65. (*Equally Contributing Authors)

Gessmann, D., Chung, Y. H., Danoff, E. J., **Plummer, A. M.**, Sandlin, C. W., Zaccai, N. R., Fleming, K. G., (2014) Outer membrane β-barrel protein folding is physically controlled by periplasmic lipid head groups and BamA, *PNAS*, 111, 5878-5883.

Plummer, A. M., Thompson, M. K., Franzen, S. (2013) Role of Polarity of the Distal Pocket in the Control of Inhibitor Binding in Dehaloperoxidase-Hemoglobin, *Biochemistry*, 52, 2218−2227.

Research Experience

2022-Current *Bryn Mawr College*

Principle Investigator (Department of Chemistry)

My lab concentrates on the functional, computational, and structural characterization of bacterial membrane proteins which play a role in the widespread virulence of bacteria. Cell membranes are amazingly complex mixtures of phospholipids and membrane proteins – these membranes surround cells and create a protective barrier against outside threats. The proteins that reside within membranes work in many critically important processes and the dysfunction of these proteins is linked to innumerable diseases, including atherosclerosis, cancer, and neurodegenerative disorders. Our work combines several different experimental techniques, including in vitro biochemical assays, structural biology-based studies, cell-based assays, and computational simulations to understand 1) how these proteins work and 2) how they interact with the surrounding lipid bilayer.

2022-Current *Molecular Education and Research Consortium in Undergraduate Computational Chemistry (MERCURY)*

My lab is a current member of the MERCURY consortium which strives to facilitate research collaborations in computational Chemistry at Primarily Undergraduate Institutions (PUIs) across the country.

2017-2021 *Harvard Medical School*

Post-Doctoral Fellow (Department of Cell Biology, Laboratory of Dr. Maofu Liao)

My post-doctoral research investigated how cholesterol is exported by the eukaryotic ATP-Binding Cassette (ABC) transmembrane protein ABCA1 – dysfunction of ABCA1 is related to increased risk of cardiovascular disease and various cancers. I utilized cryo-electron microscopy (EM) to interrogate the mechanism of ABCA1-cholesterol extraction and understand how the conformations of ABCA1 correspond to its ATP-hydrolysis cycle. I complemented these studies with both *in vitro* and *in vivo* transport assays and molecular dynamics simulations to better understand the details of binding interactions between ABCA1 and cholesterol.

2012-2017 *Johns Hopkins University*

Dissertation Work (Department of Molecular Biophysics, Laboratory of Dr. Karen Fleming)

My Ph.D. research aimed to understand how *E. coli* Outer Membrane Proteins (OMPs) interact with two protein folding factors: the periplasmic chaperone SurA and the OMP-folding catalyst BamA. The bacterial outer membrane is the first barrier that antibiotics must cross to gain entrance into the cell, therefore understanding OMP biogenesis is prerequisite to the design of effective, novel antibiotics. During my dissertation work, I utilized SDS-PAGE based folding assay to monitor OMP folding; biochemical crosslinking to construct a structural model for this complex by

integrating analytical ultracentrifugation, circular dichroism and fluorescence spectroscopy, and small-angle neutron scattering experimental data; and I mentored an undergraduate student in the development of a holistic MATLAB model for OMP biogenesis; I conceptualized this project and actively worked towards its completion and subsequent publication (*Costello, et al., PNAS 2016*). Themes throughout my dissertation work involve aiming to understand membrane protein folding and quality control, while also using collaborations and holistic modeling to piece together the details of the OMP folding pathway into the larger cellular puzzle.

2010-2012 *North Carolina State University*
Zhejiang University (Hangzhou, China)

Undergraduate Researcher (Department of Chemistry, Laboratory of Dr. Stefan Franzen)

My introduction to protein structure-function studies came in my undergraduate work on the bioremedial enzyme Dehaloperoxidase which converts environmentally toxic trihalogenated phenols into dihalogenated quinones. I designed and studied mutants utilizing UV-Vis and Resonance Raman spectroscopy, molecular dynamics, and X-ray crystallography experiments. I conducted X-ray crystallography experiments at Argonne National Laboratory. During my summer study abroad in Hangzhou, China (2010), I collaborated with local students to build and run molecular dynamics simulations of protein variants.

Teaching Experience

In-Classroom Teaching & Training

2022-Current *Chemistry Department, Bryn Mawr College*
CHEM-B103: General Chemistry 1
CHEM-B242: Biological Chemistry
CHEM-B251 & 252: Research Methodology Laboratory
BIO-B354: Topics and Concepts of Biochemistry
CHEM-B377/577: Biochemistry 2 – Metabolism

2022 ACS-New Faculty Workshop *American Chemical Society (Baton Rouge, LA)*
2022 Teaching and Learning Institute: Students as Learners & Teachers Program *Bryn Mawr College*
2021 *Chemistry Department, Gettysburg College*
General Chemistry 1 & Biochemistry I Laboratory (*Fall, 2021*)
Biochemistry 2 – Metabolism Lecture & Laboratory sections (*Spring, 2022*)

2021 *Biology Department, Emmanuel College*
Organism and Evolutionary Biology Laboratory
2020 New England Future Faculty Workshop *Northeastern University*
2019 Teaching Institute: Theory, Practice, & Navigating STEM Education Workshop *Harvard Medical School*
2016-2017 Preparing Future Faculty Certification Program *Johns Hopkins University*

In-Laboratory Mentoring

2022-Current *Chemistry Department, Bryn Mawr College*
My group at Bryn Mawr College has six current undergraduate students. Individual projects are conceptualized for each student spanning biochemical and computational characterization of bacterial membrane proteins.

2019 *Harvard Medical School Cell Biology Research Scholars Program*
For this project, I designed and oversaw the completion of experimental protocols by a visiting undergraduate student. I also provided constructive criticism for written and oral presentations.

2014-2016 *Johns Hopkins Undergraduate Research Fellows*
I mentored two research fellows on two projects during my dissertation work: one project involved the development of a holistic MATLAB model for OMP biogenesis, while a second project centered on the investigation of the solution properties of a chaperone protein. I worked actively with both students to ensure the success of their research. To

this end, I designed computational and experimental projects for respective students. I had numerous one-on-one meetings with undergraduates to keep projects on track. I actively collaborated in the writing and editing of a publication on the OMP biogenesis computation model (*Costello, et al., PNAS 2016*).

2013-2014 *Biophysics Research for Baltimore Teens, Johns Hopkins University*
I served as a mentor for two summers for visiting local high school students. I designed cloning projects for each student, oversaw their weekly progress, and assisted them with preparation of oral presentations.

Grants, Resources, and Fellowships

2024 *Tri-Co Mellon Seed Grant*
Title: Tri-Co Biochemistry Consortium Meeting; funding for annual meeting between Biochemistry groups from Swarthmore, Haverford, and Bryn Mawr Colleges

2023 *National Science Foundation, XSEDE/ACCESS Start-Up Allocation*
Title: Investigation of the Bacterial Membrane Protein Dynamics and Lipid Interactions

2022 *Tri-Co Mellon Brainstorming Grant*
Title: Tri-Co Biochemistry Consortium Meeting (*Spring 2023*); funding awarded to host an interest group for Biochemistry faculty from Swarthmore, Haverford, and Bryn Mawr Colleges

2021 *NSF, XSEDE Research Allocation*
Title: Molecular Dynamics Simulations of Membrane-Embedded ABC Transporters

2020-2021 *NSF, XSEDE Start-Up Allocation*
Title: Investigation of the Role of Drug Binding and Lipid Interactions on the Conformational Landscape of a Multidrug Exporter

2018-2020 *American Heart Association Post-Doctoral Fellowship*
Title: Elucidation of the mechanism for cholesterol and phospholipid transport by ABCA1

2014-2017 *National Science Foundation Graduate Research Fellowship*
Title: The role of the periplasmic chaperone SurA in outer membrane protein biogenesis

Selection of Invited Talks/Conferences as a PI

2025	Invited Lecture, Dept. of Chemistry	*Ursinus College, PA*
2025	Invited Lecture, Dept. of Chemistry & Biochemistry	*Villanova University, PA*
2024	Invited Lecture, Dept. of Chemistry	*St. Joseph's University, PA*
2024	Joint Membrane Protein Biophysics Group Meeting	*Bryn Mawr College, PA*
2023	Joint Membrane Protein Biophysics Group Meeting	*Swarthmore College, PA*
2023	Invited Guest Lecturer, Dept of Biophysics	*Johns Hopkins University, MD*
2022	Invited Career Panel Member, Annual Biophysics Retreat	*Johns Hopkins University, MD*
2022	BioSphere Biology Student Club Evening Series	*Gettysburg College, PA*
2022	Student Invited Speaker, Sceptical Chymists Student Club	*Gettysburg College, PA*

Student Presentations

2025 Annual MERCURY Symposium *Pittsburgh, PA*
Student poster title: A Computational and Biochemical Investigation of the *E. coli* Pqi Lipid Transport System (*J. Mackenroth, V. Durcan*)

2024 Annual MERCURY Symposium *Merced, CA*

Student poster titles: Investigation of the role of the N-terminus of YebS on lipid-protein interactions (*A. Champlin*)

Investigation of electrostatic interactions of YebS transmembrane regions with lipid substrates (*S. Bower & S. Kamholtz-Roberts*)

2024 Biophysical Society Annual Meeting *Los Angeles, CA*

Student poster titles: Molecular Dynamics Investigation of Membrane Protein Function (*S. Bower*)

Comparison of Molecular Dynamics Approaches on Lipid-Protein Interactions (*A. Champlin*)

Function of the Pore-Lining Loops in Lipid-Trafficking Protein LetB (*M. McDonald*)

2023 Annual MERCURY Symposium *Furman College, SC*

Student poster title: Molecular Dynamics Simulations of Bacterial Lipid Trafficking Proteins (*M. Rajbhandari, C. Blair, E. Cheng*)

Service to Bryn Mawr College

2024-Current		*Committee on Undergraduate Student Awards*
2022-2023, 2024-2025		*Director of the Graduate Program of Chemistry*
2022-2023, 2024-2025		*Graduate Council Committee*
2022	Panel member on CV Preparation	*Bryn Mawr College, Graduate Group of Science & Math*

Community Outreach

2024-Current	STEM-Scholars Workshop Collaborator	*Franklin Institute, PA*
2021	Teaching Assistant	*Harvard Medical School Cell Biology Research Scholars Program*
2021	Science Fair Judge	*Boston Public Science Fair*
2020-2021	Member of the Committee for Diversity and Equity	*Cell Biology Department, Harvard Medical School*
2016	White House Visit for STEM Policy Discussions with JHU students	*Washington, DC*
2014, 2016	U.S. Science and Engineering Festival Volunteer	*Washington, DC*
2013-2014	Biophysics Research for Baltimore Teens Volunteer Mentor	*Johns Hopkins University*

Peer Review Experience

2019-2021	Early Career Reviewer	*Journal of Biological Chemistry*
2019	Peer Reviewer of Post-Doctoral Fellowship Applications	*American Heart Association*