RICH OLSON, PH.D.
DEPARTMENT OF MOLECULAR BIOLOGY AND BIOCHEMISTRY
MOLECULAR BIOPHYSICS PROGRAM
COLLEGE OF INTEGRATED SCIENCES
WESLEYAN UNIVERSITY
52 LAWN AVE
MIDDLETOWN, CT 06459
PHONE: 650-384-9095 rolson@wesleyan.edu

POSITIONS

July 2016-present	Associate Professor Department of Molecular Biology and Biochemistry Molecular Biophysics Program College of Integrative Sciences Wesleyan University, Middletown, CT
July 2021-present	Director, Wesleyan Mathematics and Science Scholars Program
July 2009-June 2016	Assistant Professor – MB&B, Wesleyan University
Jan. 2004-June 2009	Beckman Postdoctoral Fellow California Institute of Technology, Pasadena, CA PI: Dr. Pamela Björkman *Structure and function of G protein-coupled receptors and associated MHC molecules.*

EDUCATION

1997-2003	Columbia University, New York, NY Ph.D. *with distinction* in Biochemistry and Molecular Biophysics Doctoral advisor: Dr. Eric Gouaux *Structure and function of pore forming toxins and ionotropic glutamate receptor ligand binding domains.*
1993-1997	Cornell University, Ithaca, NY B.A. *cum laude* in Biological Sciences, concentration in Biochemistry

SCHOLARSHIP

Research Interests: Structural biology of proteins involved in infectious disease

My research broadly seeks to understand the structure and function of virulence factors produced by human pathogens with a particular focus on transmembrane and membrane-associated proteins. Recently, this research has focused on the mechanism of biofilm formation in the human pathogen *Vibrio cholerae*. I am interested in understanding the structural mechanism for how various biofilm components form three dimensional assemblies, and how biofilms adhere to varied surfaces. I primarily use X-ray crystallography in my investigations but complement my structural work with additional biophysical and biochemical techniques.

RESEARCH GRANTS

2023-2026 R15 GM152959-01 – NIH, NIGMS – 09/06/2023 - $471,243
"Structural and functional studies of glycosyl hydrolases governing Vibrio biofilm dispersal"

2012-2016 R15 AI101977-01 – NIH, NIAID – 08/12-07/16 - $460,197
"Mechanism of cell membrane targeting by *Vibrio cholerae* cytolysin"

HONORS AND FELLOWSHIPS

2019 JBC Paper selected "Editor's Pick"
2006-2009 Beckman Institute Fellowship, California Institute of Technology
2005 Outstanding Poster Award, Biology Departmental Retreat, California Institute of Technology
2004-2005 Rosalind Alcott Fellowship, California Institute of Technology
2000 Scholarship, National Analytical Ultracentrifugation Facility Training
1998 Honorable Mention, NSF Graduate Research Fellowship
1995, 1996 Howard Hughes Scholar, Cornell University, Summer 1995, 1996.

PUBLICATIONS (undergraduate authors in bold type)

Peer Reviewed Published Works At Wesleyan:

1. Huang, X., Nero, T., Weeraekera, R., Matej, K. H., Hinbest, A., Jiang, Z., Lee, R. F., Wu, L., Chak, C., Nijjer, J., **Gibaldi, I., Yang, H., Gamble, N.**, Ng, W-L., Malaker, S. A., Sumigray, K., Olson, R., Yan, J., (2023) *Vibrio cholerae* biofilms use modular adhesins with glycan-targeting and nonspecific surface binding domains for colonization," *Nature Communications*, 14:2104.
2. Tai, J. B., Mukerjee, S., Nero, T., Olson, R., Tithof, J., Nadel, C. D., & Yan, J., (2022) "Social evolution of shared biofilm components," *Proceedings of the National Academy of Sciences*, 119(27), e2123469119.
3. Jiang, Z., Nero, T., Mukherjee, S., Olson, R.,Yan, J., (2021) "Searching for the secret of stickiness: how biofilms adhere to surfaces," *Frontiers in Microbiology,* 12:686793.
4. Kaplan, A.R., Olson, R., & Alexandrescu, A.T., (2021) "Protein yoga: Conformational versatility of the Hemolysin II C-terminal domain detailed by NMR structures for multiple states," *Protein Science,* May;30(5):990-1005.
5. Kaus, K., **Biester, A., Chupp, E., Lu, J., Visudharomn, C.**, Olson, R., (2019) "The 1.9 Å crystal structure of the extracellular matrix protein Bap1 from *Vibrio cholerae* provides insights into bacterial biofilm adhesion," *Journal of Biological Chemistry*, 294(40), 14,499-511. *Selected Editors' Pick*.
6. De., S., Kaus, K., **Sinclair, S.**, Case, B. C., Olson, R., (2018) "Structural basis of mammalian glycan targeting by *Vibrio cholerae* cytolysin and biofilm proteins." *PLOS Pathogens,* 14(2):e1006841.
7. Kaplan, A. R., Kaus, K., De, S., Olson, R., & Alexandrescu, A. T., (2017) "NMR structure of the *Bacillus cereus* hemolysin II C-terminal domain reveals a novel fold," *Scientific Reports,* 7(1):1-13.
8. Zhang, Q., Li, Y, Olson, R., Mukerji, I., & Oliver, D., (2016) "Conserved secA signal peptide-binding site revealed by engineered protein chimeras and förster resonance energy transfer," *Biochemistry*, 55(9):1291-300.

9. De, S., **Bubnys, A.**, Alonzo, F., **Hyun, J.**, Lary, J.W., Cole, J.L., Torres, V.J. & Olson, R., (2015) "The relationship between glycan-binding and direct membrane interactions in Vibrio cholerae cytolysin, a channel-forming toxin," *Journal of Biological Chemistry,* 290(47):28,402-15.
10. Kaus, K., Lary, J. W., Cole, J. L., and Olson, R., (2014) "Glycan specificity of the *Vibrio vulnificus* hemolysin lectin outlines evolutionary history of membrane targeting by a toxin family." *Journal of Molecular Biology,* 426(15):2800-2812.
11. Kaplan, A. R., Maciejewski, M.W., Olson, R., and Alexandrescu, A.T. (2013) "NMR Assignments for the *Cis* and *Trans* Forms of the Hemolysin II C-Terminal Domain." *Biomolecular NMR Assignments*, pp. 1-5.
12. **Levan, S.**, De, S., and Olson, R., (2013) "*Vibrio cholerae* cytolysin recognizes the heptasaccharide core of complex N-glycans with nanomolar affinity," *Journal of Molecular Biology,* 425:944-957.
13. De, S. and Olson, R., (2011) "Crystal structure of the Vibrio cholerae cytolysin heptamer reveals common features among disparate pore-forming toxins," *Proceedings of the National Academy of Sciences*, 108(18), 7385-90.

Peer Reviewed Published Works Prior to Wesleyan

14. He, Y. and Olson, R., (2010) "Three-dimensional structure of the detergent-solubilized *Vibrio cholerae* cytolysin (VCC) heptamer by electron cryomicroscopy," *Journal of Structural Biology*, 169(1), 6-13.
15. Arnon, T. I., Kaiser, J. T., West, A. P. Jr., Olson, R., Diskin, R., Viertlboeck, B. C., Göbel, T. W., and Bjorkman, P. J., (2008) "The crystal structure of CHIR-AB1: a primordial avian classical Fc receptor," *Journal of Molecular Biology,* 381(4), 1012-24.
16. Olson, R., Dulac, C., and Björkman, P. J., (2006) "MHC homologs in the nervous system – they haven't lost their groove," *Current Opinion in Neurobiology*, 16(3), 351-357.
17. Olson, R., K. E. Huey-Tubman, Dulac, C., and Björkman, P. J., (2005) "Structure of a pheromone receptor-associated MHC molecule with an open and empty groove," *PLOS Biology,* 3(8): e257, 1436-1448.
18. Olson, R. and Gouaux, E., (2005) "Crystal structure of the Vibrio cholerae cytolysin (VCC) pro-toxin and its assembly into a heptameric transmembrane pore," *Journal of Molecular Biology* 350(5), 997-1016.
19. Zagotta, W.N., Olivier, N.B., Black, K.D., Young, E.C., Olson, R., and Gouaux, E., (2003) "Structural basis for modulation and agonist specificity of HCN pacemaker channels," *Nature*, 425, 200-205.
20. Braunstein, J., Brutsaert, S., Olson, R., and Schindler, C., (2003) "STATs dimerize in the absence of phosphorylation," *Journal of Biological Chemistry*, 278, 34133-34140.
21. Olson, R. & Gouaux, E., (2003) "*Vibrio cholerae* cytolysin is composed of an α-hemolysin-like core," *Protein Science*, 12, 379-383.
22. Sun, Y., Olson, R., Horning, M., Armstrong, N., Mayer, M., and Gouaux, E., (2002) "Mechanism of glutamate receptor desensitization," *Nature*, 417, 245-253.
23. Mayer, M.L., Olson, R., and Gouaux, E., (2001) "Mechanisms for ligand binding to GluR0 ion channels: crystal structures of the glutamate and serine complexes and a closed apo state," *Journal of Molecular Biology*, 311, 815-836.
24. Olson, R., Nariya, H., Yokota, K., Kamio, Y., and Gouaux, E., (1999) "Crystal structure of staphylococcal LukF delineates conformational changes accompanying formation of a

transmembrane channel," *Nature Structural Biology*, 6, 134-140.

SEMINARS AND TALKS

2024 Invited to talk at Gordon Conference Enzymes, Coenzymes, and Metabolic Pathways, July 28-Aug 2.

2021 Friday NSM Seminar, Wesleyan University, "Sticky fingers: how *V. cholerae* biofilms attach to diverse surfaces," October 29, 2021.

2019 Invited biochemistry colloquium at Freie Universität Berlin, Germany, June 13, "Host glycan targeting by *Vibrio* pathogens."

2017 Invited talk at the University of Connecticut Medical Center Department of Molecular Biology and Biophysics, Farmington, CT, March 2, "*Structural basis for host glycan targeting by Vibrio virulence factors*."

2015 Invited talk at the Wesleyan University Biophysics Retreat, "*Understanding membrane specificity in a family of bacterial pore-forming toxins*."

2014 Invited talk at the University of Connecticut Department of Molecular and Cell Biology, Storrs, CT, April 15, "*Structural insights into cell-targeting by bacterial pore-forming toxins*."

2011 Co-chaired membrane protein structure session and presented platform talk at Biophysical Society meeting, March 2011, Baltimore, MD, "*Crystal structure of the Vibrio cholerae cytolysin heptameric pore.*"

2010 Invited talk at the University of Connecticut Medical Center Department of Molecular, Microbial, and Structural Biology, Farmington, CT, February 18, "*Portable pores: structural studies of bacterial cytolytic toxins*."

2009 Invited talk at the Wesleyan University Biophysics Retreat, "*Poring over the structural basis of Vibrio cholerae cytolysin assembly*."

2004 Invited Talk and Session Chair. "*Uncovering the Structural Basis of Toxin Assembly*." Fifth Workshop on Pore-Forming Toxins, Mainz, Germany, October 10-13, 2004.

POSTER PRESENTATIONS (undergraduate authors in bold)

2023 Weerasekera, R., Huang, X., Moreau, A., **Huynh, Y.**, Hinbest, A., Ashwood, C., Yan, J., and Olson, R., "Characterizing the activity of a glycosyl hydrolase in *V. cholerae* biofilm dispersal," Carbohydrates Gordon Research Conference, June 18-23, 2023, Holderness, New Hampshire.

2023 Huang, X., Nero, T., Hinbest, A., Weerasekera, R., Malaker, S. A., Olson, R., Yan, J., "Adhesion and phase behavior of disordered peptides from bacterial biofilms. American Society for Biochemistry and Molecular Biology conference, March 28, 2023, Seattle WA.

2022 Weerasekera, R., Nero, T., Huang, X., Hinbest, A., Yan, J., & Olson, R., "Molecular mechanism of *Vibrio cholerae* Biofilm Adhesion." American Society for Biochemistry and Molecular Biology conference, April 2-5, 2022, Philadelphia, PA.

2021 Huang, X., Nero, T., Hinbest, A., Weerasekera, R., Wu, L., Olson, R., and Yan, J., "Molecular Mechanism of *Vibrio cholerae* Biofilm Adhesion." Cold Spring Harbor Laboratory conference on Microbial Pathogenesis and Host Response, September 21-24, 2021, Virtual.

2015 De, S. and Olson, R. "*Key residues in Vibrio cholera cytolysin involved in membrane binding*." Biophysical Society annual meeting, February 2015, Baltimore, MD.

2014 Kaus, K. and Olson, R. "*Structure and glycan-binding properties of the Vibrio vulnificus hemolysin β-prism lectin*." Biophysical Society annual meeting, March 2014, San Francisco, CA.

2013 De, S. and Olson, R. "*Identification and characterization of the glycan binding site of Vibrio cholerae cytolysin*." Biophysical Society annual meeting, March 2013, Philadelphia, PA.

2012 **Levan, S.** and Olson, R. "*The carbohydrate binding activity of Vibrio cholerae cytolysin*." Gordon Conference on Microbial Toxins & Pathogenicity, Waterville Valley, NH, July 8-13, 2012.

2012 **Levan, S.** and Olson, R. "*The carbohydrate binding activity of Vibrio cholerae cytolysin*." Biophysical Society meeting, March 2012, San Diego.

2011 **Tyssowski, K**. and Olson, R. "*Expression of goldfish olfactory receptor in baculovirus-infected insect cells*." ASBMB annual meeting, April.

2011 De, S. and Olson, R. "*Crystal structure of the Vibrio cholerae cytolysin heptameric pore*." Biophysical Society annual meeting, March 5-9, Baltimore, MD.

2010 **Situ, R**. and Olson, R. "*Structural studies of the ORC45 receptor*," Annual biomedical research conference for minority students (ABRCMS), November 12, Charlotte, NC.

2009 He, Y. and Olson, R. "*Three-dimensional structure of the detergent-solubilized Vibrio cholerae cytolysin (VCC) heptamer by electron cryomicroscopy*." Gordon conference on Microbial Adhesion and Signal Transduction, Regina Salve University, July 26-31.

2002 Olson, R. and Gouaux, E. "*Large Scale Expression, Purification, and Assembly of Vibrio Cholerae Cytolysin*." Biophysical Society 46th Annual Meeting, San Francisco, February 23-27.

PEDAGOGY

Courses at Wesleyan

MB&B 111 *Introduction to Environmental Toxicology* (5 times). In this science course for non-science majors, students learn about anthropogenic toxic chemicals in the environment, with a particular focus on human health concerns. Students learn about where toxins originate, how they move through the environment, and how they enter and affect the human body. Students also learn how scientists evaluate toxic chemical risk through dose-response and epidemiological studies.

MB&B 208 *Molecular Biology* (Co-taught with Prof. Amy MacQueen twice). Gateway molecular biology course for the MB&B major. A comprehensive survey of molecules and molecular mechanisms underlying biological processes. I taught the first half of the course focusing on macromolecular structure and function.

MB&B 237 *Signal Transduction* (5 times). This course examines how cells sense and integrate information from their environment on a molecular level. The approach includes cellular, molecular, and structural aspects of cell signaling with a focus on how changes in signal transduction lead to cancer.

MB&B 303/503 *Receptors, Channels, and Pumps: Advanced Topics in Membrane Protein Structure and Function* (6 times). The past 10 years have seen rapid technological advances that have lead to an exponential expansion in our knowledge about membrane protein structure. This advanced undergraduate/graduate level course engages with primary literature to understand what these new structures tell us about how these essential proteins function in the cell.

MB&B 307/ *Molecular Biophysics Journal Club* (multiple times). Undergraduate and graduate students meet weekly to present and discuss recent papers from the primary literature in the area of Molecular Biophysics.

MB&B 325 *Introduction to Biomolecular Structure* (once). This course aims to provide a framework for understanding three-dimensional structures of proteins, nucleic acids, and their complexes.

MB&B 395 *Structural Biology Laboratory* (7 times). This course represents one of two capstone experiences for MB&B undergraduate majors. Students investigate protein structure through a variety of biophysical techniques using state-of-the-art instrumentation and hands-on instruction.

MB&B 516 *Advanced Topics in Structural Biology* (2 times). This course examines how researchers use the tools of structure determinination to explore current fundamental questions in the biological sciences.

MB&B 557 *Research Seminars in Molecular Biology and Biochemistry* (once). This 558 course involves weekly presentations by graduate students and undergraduate thesis writers on the current state of their independent research.

CIS 121/112 *Wesleyan Mathematics and Science Scholars Colloquium I/II.* This is the weekly colloquium for the WesMaSS program. The course includes study skills, introductions to resources on campus, team-building exercises, and visits from scientists to help students make the important transition from high school to college in STEM fields.

***Prior to Wesleyan**:*

2008 Instructor, "Receptors, Channels, and Pumps: The Structure and Function of Membrane Proteins" (undergraduate course), California Institute of Technology,

Spring 2008.

2004-2005 Research Advisor, Summer Undergraduate Research Fellowship Program, California Institute of Technology. Supervised 10-week research projects for exceptional undergraduate students at Caltech.

1998 Teaching Assistant, "Molecular Biophysics" (graduate course), Profs. Barry Honig, Arthur Palmer, Arthur Karlin, and Wayne Hendrickson.

Advising:

2010-present Faculty advisor for freshmen and sophomores

2017-present Faculty advisor for WesMaSS program (for traditionally underrepresented students in mathematics and sciences)

STUDENTS

Graduate students

Ranjuna Weerasekera (MB&B, Ph.D., 2020-)
Alex Hinbest (MB&B, Ph.D., 2020-)
Shaquille Bowie (MB&B, M.A., 2023)
Swastik De (MB&B; Ph.D., 2009-2016)
Katie Kaus (MB&B; Ph.D., 2012-2018)
Sergei Pourmal (MB&B; BA/MA ABD, Ph.D. student at UCSF)

Rotation graduate students

Joyce Noble, Qi Zhang, Xeliang Zheng, Bo Song, Legairre Radden, Brandon Case, Lorencia Chigweshe, Meagan MacDonald, Jaime Alberto Carrazco-Carrillo, Andrea Baez Gonzalez.

Undergraduate students mentored in Olson lab research

Elizabeth Kenworthy ’10 (U. of Stony Brook Medical School)
Kelsey Tyssowski ’11 (Hughes Summer Research Fellow, Firshein Award, Ph.D. student at Harvard)
Sophie Levan ’12 (Hughes Summer Research Fellow, Butterfield prize, Graham prize, Hawk prize, MD/Ph.D. student at UCSF)
Robert Situ ’12 (McNair Summer Research Fellow)
Lee Gottesdiener ’12 (Hughes Summer Research Fellow, Graham Prize, Hawk Prize)
Li Lin ’14 (McNair Summer Research Fellow)
Adele Bubnys ’14 (Hughes Summer Research Fellow, Ph.D. program at Rockefeller University)
Jinsol Hyun ’15 (Hughes Summer Research Fellow)
Emily Gao (Hughes Summer Research Fellow, visiting from Williams College)
Shu Wang ’13 (McNair Summer Research Fellow, joint with Prof. Erika Taylor)
Lucas McLaughlin ‘15
Chloe Leeds ‘16
Shada Sinclair ‘16
Benjamin Kaufman ’17 (Summer Research Program and College of Integrative Sciences Summer Program)
Mitchell Ramsey ’17 (Summer Research Program)

Kyle Hardy ’18 (Summer Research Program, Wesleyan Black Alumni Council Memorial Prize)
Simone Harrison (Summer Research Program) ‘18
Alison Biester ‘19
Jianyi Lu ‘17 (Summer Research Program)
Charlie Visudharomn ’17 (Summer Research Program)
Ethan Chupp ‘19 (Summer Research Program)
Nathan Gamble ‘21
Hang Yang ’22 (McNair Program, WesMaSS Program)
Shaquille Bowie ’22 (Summer research program)
Isabella Gibaldi ‘22
Andrew Cao ’23
Arden Weilheimer ‘23
Mingyu Wang ‘24
Owen Cannizzo ‘24
Christine Butawo ‘25
Yun Hyun ‘25
Ryan Gordon ‘27

Undergraduate honors student theses from the Olson lab
Sophie Levan ’12 (High Honors) – “Discovering the role of carbohydrate binding in cell recognition by *Vibrio cholerae* cytolysin”
Adele Bubnys ’14 (High Honors) - “Investigations of the membrane binding of *Vibrio cholerae* cytolysin”
Simone Harrison ’18 (Honors) – “Identification and characterization of a novel secreted β-prism lectin domain from *Vibrio crassostrea*”

SERVICE

Department

2023-2024	Member, MB&B search committee for Biochemistry tenure-track position
2022-2023	Faculty mentoring committee for Candice Etson
2020-2024	Faculty mentoring committee for Teresita Padilla-Benavides
2020-2021	Grad student advising committee
2019-2020	Member, MB&B search committee for Biochemistry tenure-track position (hired Teresita Padilla-Benavides)
2018	Member, Professor of the Practice search committee (hired Cori Anderson)
2015-2016	Member, faculty search committee for open Molecular Biophysics Program hire (hired Colin Smith)
2013-2014,	Member, equipment committee
2017-2018	
2021-2024	
2013-2014,	Member, first year graduate advising committee

2021-2022

2009-2016, 2024 Member, graduate admissions committee

2009-2012 Member, graduate oral exam committee

2009-present Faculty advisor, MB&B majors

University

2021-present Director, Wesleyan Mathematics and Science Scholars Program (WesMaSS)

2021,22-24 Review and Appeals Board (elected)

2020-2023 Service on new science building planning committee

2020 Service on Goldwater selection committee

2019-2021 Service on Advisory committee (Promotions and Tenure, elected)

2019-2022 Service on Fries Center for Global Studies advisory committee

2018 Service on Library- Faculty Advisory Committee (L-FAC), Spring semester

2014-2016 Service on Faculty Committee on Rights and Responsibilities (elected)

2015,2016 Led 2-day Wesleyan Summer Research Program workshop on scientific abstract writing

2014-2015 Wesleyan Orchestra (trombone)

2012-2014 Service on the University Majors Committee (chaired by Dean Marina Melendez)

2011-2015 Service on the Division III Information and Technology Services (ITS) computing committee.

Various dates Participated in Wesfest sessions and tours, panelist in two 3D printing sessions and Div. III research soirée on molecules, initiated and organized Molecular Biophysics Program lab tours (2013-2015)

Scientific community

2004-present Paper referee for *Structure*, *Proceedings of the National Academy of Sciences, PLoS One, Journal of Structural Biology, Biochemistry, Journal of Bacteriology, Journal of Biological Chemistry, BBA Biomembranes, Acta Crystallographica Section F, Biochemical Journal, Biophysical Journal, Nature Communications, Microbial Pathogenesis, Infection and Immunity, Frontiers in Microbiology,* and *FEBS Letters.* Served as an outside reviewer for NSF grants (2010, 2015).

2013 Poster judge for North Eastern Structure Symposium, Storrs CT.

2004-2009 Interviewer for Admissions to Graduate and MD/PhD Programs, California Institute of Technology and University of California, Los Angeles.

2004, 2005, 2008 Chair, Biology Culminating Session, Summer Undergraduate Research Fellowship Program, California Institute of Technology.

OTHER EXPERIENCE

2007-2008	Society for Neuroscience Meeting, San Diego, CA, October 31-November 3, 2007 and Washington DC, November 15-19, 2008.
2005, 2007	West Coast Protein Crystallography Workshop, Asilomar Conference Center, Pacific Grove, CA, March 20-23, 2005 and March 11-14, 2007.
2005	Surface Plasmon Resonance (Biocore) Training, California Institute of Technology.
2000	Analytical Ultracentrifugation: Theory and Practice, National Analytical Ultracentrifugation Facility, University of Connecticut, May 22-24, 2000.
1999	Analytical Ultracentrifugation Training, Beckman Coulter, Inc., Palo Alto, CA, May 3-5, 1999.

PROFESSIONAL SOCIETY MEMBERSHIPS

Biophysical Society
American Society for Biochemistry and Molecular Biology (ASBMB)