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Education

Doctor of Philosophy, **Microbiology** September 1997-October 2002
University of Minnesota, Minneapolis, MN

Bachelor of Science, Genetics September 1993-May 1997
University of Kansas, Lawrence, KS

Professional Experience

Professor

Department of Microbiology, Genetics and Immunology (formerly Microbiology and Molecular Genetics), Michigan State University
August 2019-current

Associate Professor

Department of Microbiology and Molecular Genetics, Michigan State University
August 2014-July 2019

Assistant Professor

Department of Microbiology and Molecular Genetics, Michigan State University
August 2008-July 2014

Postdoctoral Research Fellow and Research Associate

Department of Molecular Biology, Princeton University, August 2003-August 2008
Advisor: Bonnie Bassler, Ph.D.

Postdoctoral Research Associate

Department of Microbiology, University of Minnesota, November 2002-August 2003
Advisor: Gary Dunny, Ph.D.

Doctoral Research

Department of Microbiology, University of Minnesota, July 1997-October 2002
Advisor: Gary Dunny, Ph.D.

Research Publications

1. de Dios R, Forsyth VS, Harkova LG, Schache KJ, Hsueh BY, Strat H, Riley B, Rubio A, Pérez-Pulido AJ, **Waters CM**, Mobley HLT, Crépin S, McCarthy RR. (2026). Network-level divergence in cyclic di-GMP signaling drives ecological versatility in Acinetobacter baumannii. ***NPJ Biofilms Microbiomes***.12(1):112. doi: 10.1038/s41522-026-00968-y.

2. Gomez, J.B., Barrick, J.E., and **C.M. Waters.** (2026). Phages use contingency loci as a bet-hedging strategy. ***Nature Microbiology.*** In press

3. Chen, G., Luo, A., Bourgeois, J., Rangarajan, A.A., Camilli, A., **Waters, C.M**., and W.L. Ng (2025). A Phage Ejectosome Protein Moonlights to Inhibit CBASS Anti-Viral Defense System. ***BioRxiV***. https://www.biorxiv.org/content/10.1101/2025.07.23.666291v1.full

4. Aryala, P., Andersona, M., Turrisia, H., Rangarajanb, A.A., Brooksa, M., Rodrigueza, G., Warrellc, D., Pangalinanc, A., Charles-Estainc, G., Abrahama, R., Zaborowskia, H., Seyhana, D., **Waters, C.M.**, and J.E. Heindl. 2025. Analyzing the role of a dual-function diguanylate cyclase/phosphodiesterase for attachment and motility in *Agrobacterium tumefaciens*. ***BioRxiV.*** https://doi.org/10.1101/2025.08.14.670421

5. Tai, J.B., Nam, K.M., Li, C., Nijjer, J., Zhang, S., **Waters, C.M**., and J. Yan. 2025. Single-cell imaging reveals spontaneous phenotypic sorting and bet-hedging in developing biofilms. ***BioRxiV.*** https://doi.org/10.1101/2025.06.03.657734

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7. Grant, N.A., Sontz, J.T., and **C.M. Waters.** 2025. Deployment of a *Vibrio cholerae* ordered transposon mutant library in a quorum-competent genetic background. ***mBio***. 25:e0003625. doi: 10.1128/mbio.00036-25.

8. Wessel, AJ, Johnson, DTT, and **C.M Waters**. 2025. DNA repair is essential for Vibrio cholerae growth on Thiosulfate-Citrate-Bile Salts-Sucrose (TCBS) Medium. ***Journal of Bacteriology.*** 207(4):e0000425. doi: 10.1128/jb.00004-25

9. Rangarajan, A.A., Schroeder, J.W., Hurto, R.L., Severin, G.B., Pell, M.E., Hsieh, M.L., Waters, C.M.* Freddolino, L*. 2024. Negative feedback of cyclic di-GMP levels optimizes switching between sessile and motile lifestyles in *Vibrio cholerae.* ***BioRxiV***. doi: https://doi.org/10.1101/2024.09.01.610008

10. Chen G, Fanouraki G, Rangarajan AA, Winkelman BT, Winkelman JT, Waters CM, Mukherjee S. 2024. Combinatorial control of *Pseudomonas aeruginosa* biofilm development by quorum-sensing and nutrient-sensing regulators. ***mSystems***;9(9):e0037224. doi: 10.1128/msystems.00372-24.

11. Bedore AM, Waters CM. 2024. Plasmid-free cheater cells commonly evolve during laboratory growth. ***Appl Environ Microbiol***. 90(4):e0231123. doi: 10.1128/aem.02311-23.

12. Gomez JB, and **C.M. Waters.** 2024. A Vibrio cholerae Type IV restriction system targets glucosylated 5-hydroxyl methyl cytosine to protect against phage infection. ***Journal of Bacteriology. ep 4:e0014324. doi: 10.1128/jb.00143-24***

13. Severin, G.B., Ramliden, M.S., Ford, K.C., Van Last, A.J., Sanath-Kumar, R., Decker, K.A., Hsueh, B.Y., Chen, G., Yoon, S.H., Demey, L.M., O'Hara, B.J., Rhoades, C.R., DiRita, V.J., Ng, W.L., and **C.M. Waters**. 2023. Activation of a Vibrio cholerae CBASS anti-phage system by quorum sensing and folate depletion. ***mBio***. e0087523. doi: 10.1128/mbio.00875-23

14. Beckman, D.A. and **C.M. Waters**. 2023. Vibrio cholerae phage ICP3 requires O1 antigen for infection. ***Infect Immun.*** 91(9):e0002623. doi: 10.1128/iai.00026-23

15. Hsueh, B.Y., Sanath-Kumar, R., Bedore, A.M., and **C. M. Waters.** 2023. Replication cycle timing determines phage sensitivity to a cytidine deaminase toxin/antitoxin bacterial defense system. ***PLoS Pathog,*** 19(9):e1011195. doi: 10.1371/journal.ppat.1011195

16. Wilburn, K.M., Blaylock, J.B., Metcalfe, K.C, Hsueh, B.Y., Tew, D.J., and **C.M. Waters**. 2022. Development of a 3'3'-cyclic GMP-AMP enzyme linked immunoassay reveals phage infection reduces DncV activity. ***Israel Journal of Chemistry***. https://doi.org/10.1002/ijch.202200084

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    - MSU Today Press Release: "Bacteria versus viruses", https://msutoday.msu.edu/news/2022/bacteria-versus-viruses
18. Hsieh, M.L., Kiel, N., Jenkins, L.M., Ng, W.L., Knipling, L., and **C.M. Waters***, and D.M. Hinton*. 2022. The *Vibrio cholerae* master regulator for the activation of biofilm biogenesis genes, VpsR, senses both cyclic di-GMP and phosphate. ***Nucleic Acids Research.*** 50(8):4484-4499. doi: 10.1093/nar/gkac253. * co-corresponding authors
19. Banerjee, B., Zeng, Q., Hsueh, B.Y., **Waters, C.M.**, and M. Yu and C.H. Yang. 2022. Quorum-sensing master regulator VfmE is a c-di-GMP effector that controls pectate lyase production in phytopathogen *Dickeya dadantii*. ***mSystems***. 10(2):e0180521. doi: 10.1128/spectrum.01805-21.
20. Cox, A.C., Bogacz, M., El Abbar, F., Browning, D.D., Hsueh, B.Y., **Waters, C.M**., Lee, V.T., and Thompson, S.A. 2021. The *Campylobacter jejuni* response regulator and cyclic-di-GMP binding CbrR is a novel regulator of flagellar motility. ***Microorganisms***. 10(1):86. doi: 10.3390/microorganisms10010086.
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22. Silva-Rohwer A.R., Held, K., Sagawa, J., Fernandez, N.L., **Waters, C.M**., and V. Vadyvaloo, V. 2021. CsrA Enhances Cyclic-di-GMP Biosynthesis and *Yersinia pestis* Biofilm Blockage of the Flea Foregut by Alleviating Hfq-Dependent Repression of the *hmsT* mRNA. ***mBio***. 12(4):e0135821. doi: 10.1128/mBio.01358-21
23. Robinson, C., Sweeney, E., Ngo J., Ma, E., Perkins, A., Fernandez, N.L., **Waters, C.M.**, Remington, S.J., Bohannan, B.J.M., Guillemin, K. 2021. Bacterial chemokinesis regulates host colonization in response to amino acid cues. ***Cell Host and Microbe***. 29(8):1221-1234.e8. doi: 10.1016/j.chom.2021.06.003.
24. Bruger, E.L., Synder, D.J., Cooper, V.S., and **C.M. Waters**. 2021. Quorum sensing provides a molecular mechanism for evolution to tune and maintain investment in cooperation. ***ISME J***. doi: 10.1038/s41396-020-00847-0
25. Maiden, M.M, and **C.M. Waters.** 2020. Triclosan depletes the membrane potential in Pseudomonas aeruginosa biofilms inhibiting aminoglycoside induced adaptive resistance. ***PLoS Pathogens***, 16(10):e1008529. doi: 10.1371/journal.ppat.1008529
26. Fernandez, N.L., Nhu, N.T.Q., Hsueh, B.Y., Franklin, J.L., Dufour, Y.S., and **C.M. Waters**. 2020. *Vibrio cholerae* adapts to sessile and motile lifestyles by cyclic di-GMP regulation of cell shape. ***Proceedings of the National Academy of Sciences.*** 117(46):29046-29054. doi: 10.1073/pnas.2010199117
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    - Michigan State University, College of Natural Science, Press Release, "Decades-old Discovery of Shape-Shifting Bacterial Revealed and Revamped" https://natsci.msu.edu/news/decades-old-discovery-of-shape-shifting-bacteria-revealed-and-revamped/

- Commentary, Arjes, HA, Huang, KC. "Straightening up for life in a biofilm." Proc Natl Acad Sci U S A. 2020 Dec 15;117(50):31573-31574. doi: 10.1073/pnas.2021127117

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    - Commentary, Harrison, J.J., Parske, M.R., and Tseng, B.S. 2020. Bacterial adaptation in Structured Environments:Lessons from Darwin's Finches. ***Trends in Microbiology.*** 29(1):5-7. doi: 10.1016/j.tim.2020.10.010

28. Martínez-Ortiz IC, Ahumada-Manuel CL, Hsueh BY, Guzmán J, Moreno S, Cocotl-Yañez M, **Waters CM**, Zamorano-Sánchez D, Espín G, Núñez C. 2020. Cyclic di-GMP-Mediated Regulation of Extracellular Mannuronan C-5 Epimerases Is Essential for Cyst Formation in *Azotobacter vinelandii*. ***Journal of Bacteriology.*** 202(24):e00135-20. doi: 10.1128/JB.00135-20.

29. Ahumada-Manuel CL, Martínez-Ortiz IC, Hsueh BY, Guzmán J, **Waters CM**, Zamorano-Sánchez D, Espín G, Núñez C. 2020. Increased c-di-GMP Levels Lead to the Production of Alginates of High Molecular Mass in *Azotobacter vinelandii*. ***Journal of Bacteriology.*** 202(24):e00134-20. doi: 10.1128/JB.00134-20.

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    - Commentary: Toit, A.D. 2020. Accelerating the cell cycle. ***Nature Reviews Microbiology.*** 18(10):541. doi: 10.1038/s41579-020-0427-7

32. Yuan, X., Zeng, Q., Xu, J., Severin, G.B., Zhou, X., **Waters, C.M.**, Sundin, G.W., Ibekwe, A.M., Liu, F., Yang, C.H. 2020. Tricarboxylic acid (TCA) cycle enzymes and intermediates modulate intracellular cyclic di-GMP levels and the production of plant-cell-wall degrading enzymes in soft rot pathogen *Dickeya dadantii*. ***Molecular Plant-Microbe Interactions***, (2):296-307. doi: 10.1094/MPMI-07-19-0203-R.

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35. Fernandez, N.L. and **C.M. Waters.** 2019. Cyclic di-GMP Increases Catalase Production and Hydrogen Peroxide Tolerance in *Vibrio cholerae. **Applied and Environmental Microbiology,*** AEM.01043-19. doi: 10.1128/AEM.01043-19

36. Jarosova, R., Mcclure, S., Gajda, M., Jovic, M., Girault, H., Lesch, A., Maiden, M.; **Waters, C.** and G. Swain. 2019. Inkjet Printed Carbon Nanotube Electrodes for Measuring Pyocyanin and Uric Acid in a

Wound Fluid Simulant and Culture Media. ***Analytical Chemistry***, 16;91(14):8835-8844. doi: 10.1021/acs.analchem.8b05591

37. Maiden, M.M., Zachos, M.P., and **C.M. Waters.** 2019. Hydrogels embedded with melittin and tobramycin are effective against Pseudomonas aeruginosa biofilms in an animal wound model. ***Frontiers in Microbiology.*** doi: 10.3389/fmicb.2019.01348. eCollection 2019. DOI: 10.3389/fmicb.2019.01348
38. Yuan, X., Zeng, Q., Khokhani, D., Tian, F., Severin, G. B., **Waters, C.M**., Xu, J., Zhou, X., Sundin, G.W., Ibekwe, A.M., , Liu, F., Yang, C.H. 2019. A Feed-forward signaling circuit controls bacterial virulence through linking cyclic di-GMP and two mechanistically distinct sRNAs; ArcZ and RsmB. ***Environmental Microbiology***. 21(8):2755-2771. doi: 10.1111/1462-2920.
39. Waldron E.J., Snyder, D., Sileo, E., Inoyama, D., Freundlich, J.S., **Waters, C.M.,** Cooper, V.S., Neiditch, M.B. 2019. Structural Basis of DSF Recognition by its Receptor RpfR and its Regulatory Interaction with the DSF Synthase RpfF. ***PLoS Biology.*** 17(2):e3000123. DOI: 10.3389/fmicb.2019.01348
40. Maiden, M.M., Zachos, M.P., and **C.M. Waters.** 2019. The ionophore oxyclozanide enhances tobramycin killing of *Pseudomonas aeruginosa* biofilms by permeabilizing cells and depolarizing the membrane potential. ***Journal of Antimicrobial Chemotherapy.*** 74(4):894-906. DOI: 10.1093/jac/dky545
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46. Hsieh, M.L., Hinton, D.M.[#], **Waters, C.M**.[#] 2018. VpsR and cyclic di-GMP together drive transcription initiation to activate biofilm formation in *Vibrio cholerae*. ***Nucleic Acids Research***. 28;46(17):8876-8887. [#]co-corresponding authors. DOI: 10.1093/nar/gky606
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51. Fernandez, N.L., Srivastava, D., Ngouajio, A.L., and **C.M. Waters**. 2018. Cyclic di-GMP Positively Regulates DNA Repair in Vibrio cholerae. ***Journal of Bacteriology***. pii: JB.00005-18. doi: 10.1128/JB.00005-18. PMID: 29610212

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association for regulator function. ***Journal of Bacteriology***. 45(12):7527-7537. PMID: 28652300. doi: 10.1128/JB.00344-17

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Reviews and Invited Commentaries

1. Rangarajan, A.A.[#] and **C.M.Waters**[#]. 2026. Roles of divalent metals in the regulation of cyclic di-GMP signaling in bacteria. *Journal of Bacteriology*. In press [#]co-corresponding authors
2. Severin, G.S[#] and **C.M. Waters**[#]. 2026. How to hotwire a flagellum: Interspecies competition short-circuits repression of bacterial motility. ***Current Biology.*** 36(3):R87-R89. doi: 10.1016/j.cub.2025.12.015 [#]co-corresponding authors
3. Ferrell, M.J. and **C.M. Waters.** 2025. Pandemic cholera: a global pathogen shaped by bacteriophage. ***Future Virology.*** In press
4. Ferrell, M.J. and **C.M. Waters.** 2024. Slings and Arrows: sRNAs Mediate Intragenomic Competition. ***Cell Host and Microbe.*** 8;32(5):634-636. doi: 10.1016/j.chom.2024.04.013.
5. Gomez, J.B. and **C.M. Waters**. 2023. Switching on cyclic di-GMP heterogeneity in *Pseudomonas aeruginosa* biofilms. ***Nature Microbiology.*** 8(8):1380-1381. doi: 10.1038/s41564-023-01428-5.
6. Rangarajan, A.A. and **C.M. Waters.** 2022. Double take: A dual-functional Hypr GGDEF synthesizes both cyclic di-GMP and cyclic GMP-AMP to control predation in *Bdellovibrio bacteriovorus* . ***PLoS Genetics***. 8(7):e1010263. doi: 10.1371/journal.pgen.1010263.
7. N.D. Hammer and **C.M. Waters.** 2022. The 27th Annual Midwest Microbial Pathogenesis Conference in the Age of COVID. ***Journal of Bacteriology.*** May 4:e0013622. doi: 10.1128/jb.00136-22
8. **C.M. Waters.** 2021. Au naturale: use of biologically derived cyclic di-nucleotides for cancer immunotherapy. ***Open Biol.*** 11(12):210277. doi: 10.1098/rsob.210277.
9. Yoon, S.H., and **C.M. Waters.** 2021. The ever-expanding world of bacterial cyclic oligonucleotide second messengers. ***Current Opinions in Microbiology.*** 60:96-103. doi: 10.1016/j.mib.2021.01.017.
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11. Hsueh, B.Y. and **C.M. Waters.** 2019**.** Combating Cholera. ***F1000 Research***. Rev-589. doi: 10.12688/f1000research.18093.1. eCollection 2019.
12. Yoon, S.H., and **C.M. Waters**. 2019. *Vibrio cholerae*. ***Trends in Microbiology.*** doi: 10.1016/j.tim.2019.03.005
13. Severin, G.B., and **C.M. Waters**. 2019. Pyrimidines and Cyclic Trinucleotides Join the Second Messenger Symphony. ***Cell Host Microbe***. 25(4):471-473.
14. **Waters, C.M.** and Goldberg, J. 2019. Pseudomonas aeruginosa in Cystic Fibrosis: A Chronic Cheater. ***Proceedings of the National Academies of Sciences,*** 116(14):6525-6527.
15. Fernandez, N., **C.M. Waters.** 2019**.** Analyzing diguanylate cyclase activity in vivo using a heterologous *Escherichia coli* host. ***Current Protocols.*** 52(1):e74.
16. Agostinho Hunt, A.M., Gibson, J.A., Larrivee, C.L., O'Reilly, S., Bozak, S., Busik, J.V., and **C.M. Waters**. 2017. Come to the light side: in vivo monitoring of *Pseudomonas aeruginosa* biofilm infections in chronic wounds in a diabetic hairless murine model. ***JoVE***. Doi: 10.3791/55991. PMID: 29053700

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19. Srivastava, D., and **C.M. Waters.** 2015. A Filter Binding Assay to Quantify the Association of Cyclic di-GMP to Proteins. ***Bio-Protocol.org.*** Vol 5,Iss 3, Jan 05, 2015.
20. Koestler, BJ, and **C.M. Waters.** 2014. Intestinal GPS: bile and bicarbonate control cyclic di-GMP to provide *Vibrio cholerae* spatial cues within the small intestine. ***Gut Microbes.*** 5(6):775-780. PMID: 25621620.
21. **Waters, C.M**. 2013. Bacterial Wheel Locks: Extracellular Polysaccharide Inhibits Flagellar Rotation. ***Journal of Bacteriology,*** 195(3):409-10. PMID: 23204465
22. **C.M. Waters**. The Meteoric Rise of the Signaling Molecule Cyclic di-GMP. 2012. ***Microbe***. August Issue. 353-359.
23. Srivastava, D., and **C.M. Waters**. 2012. A Tangled Web: Regulatory Connections between Quorum Sensing and Cyclic di-GMP. ***Journal of Bacteriology***. 194(17):4485-93. PMID: 22661686
24. **Waters, C.M.**, and B.L. Bassler. 2005. Cell-cell communication in bacteria. ***Annual Review of Cell and Developmental Biology***. 21:319-346. PMID: 16212498

Education Research

1. **C.M. Waters. 2019.** Rock the Chalk: A five-year comparative analysis of a large microbiology lecture course reveals improved outcomes of chalk-talk compared to PowerPoint. ***BioRxiv***, doi: 10.1101/644567

Book Chapters

1. Tai, J.S.#, Ferrell, M.J.#, Yan, J.*, and **C.M. Waters***. 2023. New Insights into *Vibrio cholerae* biofilms from molecular biophysics to microbial ecology. In ***Novel insights on biofilm development in pathogenic Vibrios***. Springer Nature, Switzerland AG. Adv Exp Med Biol. 2023;1404:17-39. doi: 10.1007/978-3-031-22997-8_2.
2. Ramliden, M.S., Severin, G.B., O'Hara, B.J., **Waters, C.M.,** and W.L. Ng. 2020. Microbial cyclic GMP-AMP signaling pathways. In: Römling, U. in ***Microbial Cyclic di Nucleotide Signaling***. Springer Nature Switzerland AG.
3. Hsieh, M.L., Hinton, D.M., and **C.M. Waters.** 2020. Cyclic di-GMP Regulation of Gene Expression. pp 379-394, In: Römling, U. in ***Microbial Cyclic di Nucleotide Signaling***. Springer Nature Switzerland AG.
4. Severin, G.B., and **C.M. Waters**. 2017. "Chapter 7: Spectrophotometric and Mass Spectroscopic Methods for the Quantification and Kinetic Evaluation of In Vitro c-di-GMP Synthesis". In Sauer, K. ***c-di-GMP Signaling: Methods and Protocols***. Springer Nature.
5. Pursley, B.R., Hinshaw, K.C., **Waters, C.M.**, Chandler, J.R., Antunes, L.C.M. 2015. Microbial Signaling. In: Bruce, TB and Trindade-Silva, AE (Eds). In ***Molecular Diversity of Environmental Prokaryotes***, CRC Press, Taylor & Francis Group. London, GB.
6. **Waters, C.M.** 2010, "Chapter 6: Methods for Cyclic di-GMP Detection". In Visick, K. and Wolfe, A. (Eds). "***Second Messenger Cyclic Di-GMP***". Eds. Wolfe and Visick. ASM Press, Washington, DC. 68-75.

Intellectual Property

1. **Waters, C.M.** et. al. 2011, "Benzimidazole Inhibition of Biofilm Formation", Non-Provisional Patent Application, 13/366,278. Filed 2/18/2011. (TEC2011-0028)
2. **Waters, C.M.** et. al. 2012. "Inhibitors of Bacterial Diguanylate Cyclase", Provisional Patent Application, 61/669,393. Filed 7/2012. (TEC2012-0094)
3. **Montgomery, B.** et. al. 2013. "Regulation of Cyanobacterial Cell Sedimentation." Invention Disclosure. TEC2014-0032. Files 9/2013.
4. **Waters, C.M., Hunt. A.** 2015. "Compositions and methods for inhibiting biofilm-forming bacteria", Full Patent Application, PCT/US2015/049159. Files 9/2015. (TEC2015-0051)
5. **Waters, C.M.** et. al. 2014. "Novel Approach to Stimulate Inflammation by Adenovirus Vaccine", Inventors: Christopher Waters and Andrea Amalfitano. Full U.S. Patent Application No.: 15/760,726 , 62/219,387. Filed 9/2015. (TEC2012-0095)
6. **Waters, C.M.** et. al. 2014. "Polysorbates Prevent Escherichia coli O104:H4 Pathogenesis by Inhibiting Biofilm Formation", Invention Disclosure, TEC2016-0097. Filed 1/2016.
7. **Waters, C.M.** et. al. 2017. COMPOSITIONS AND METHODS FOR INDUCING AND ENHANCING AN IMMUNE RESPONSE AGAINST INFECTIONS, DISEASES, AND DISORDERS. U.S. Provisional Application No. 62/219,387, filed 16 September 2015. Invention Disclosure, TEC2018-0012. Filed 7/31/2017
8. **Waters, C.M.** et. al. 2018. "Combining Salicylanilide Anthelmintic Drugs and Tobramycin Significantly Increases Killing of Bacterial Biofilms", Full patent: 11318149, granted 5/3/2022
9. **Waters, C.M.** and Amalfitano, A. 2019. Title: COMPOSITIONS OF STING VARIANTS, COMBINATIONS THEREOF, AND METHODS FOR INDUCING AND ENHANCING AN IMMUNE RESPONSE AGAINST INFECTIONS, DISEASES, AND DISORDERS, Inventors: Christopher Waters and Andrea Amalfitano. Provisional Patent Application, PCT/US2019/044781, Filed August 2, 2019. TEC2018-0012.
10. **Waters, C.M.** et. al. 2018. ""A Bacterial Phospholipase Controlled by a Nucleotide Signal for Use in Bioenergy and Targeted Cell Killing". Invention Disclosure. TEC2019-0005
11. **Waters, C.M.** et. al. 2020. "Triclosan Analogs to Improve Enhancement of Antibiotic Eradication of Bacterial Biofilms", Invention Disclosure, TEC2020-0126. Filed 2/28/2020

Presentations

Graduate Student Sonneborn Lecture, Indiana University, September, 2026
Invited Departmental Speaker, Cornell University, September, 2026
Invited Conference Speaker, ASM Biofilms Conference, Portland, OR. November, 2025
Invited Departmental Speaker, Michigan State University, East Lasing, MI September, 2025
Invited Departmental Speaker, Wake Forest University, Winston-Salem, NC April, 2025
Invited Departmental Speaker, Wayne State University, Detroit, MI April, 2025
Invited Departmental Speaker, Otterbein University, Westerville, OH April, 2025
Invited Speaker, Infectious Disease Fellows Seminar, Sparrow Hospital, Lansing, MI. March, 2025
Invited Speaker, Biology on Tap, Bath, MI, March 2025
Invited Speaker, Princeton Phage Research Group, Princeton University, Princeton, NJ. October 2024
Invited Departmental Speaker, Washington University, St. Louis MO September, 2024
Invited Conference Speaker, Gordon Research Conference, Microbial Toxins and Pathogenicity, Waterville Valley, NH. July, 2024
Invited Conference Speaker, Symposium on the Immune System of Bacteria, Boston, MA. April, 2024
Invited Departmental Speaker, University of Washington, Seattle, WA, April, 2024

Invited Departmental Speaker, University of Wyoming, Laramie, WY, February, 2024
Invited Speaker, Infectious Disease Fellows Seminar, Sparrow Hospital, Lansing, MI. December 2023
Invited Conference Speaker, MI-Bio Annual Meeting, Lansing, MI. September 2023
Invited Conference Speaker, Wenner-Gren Symposium, Chemical Signaling in Bacteria, Stockholm, Sweden. August 2023
Invited Departmental Speaker, Karolinska Institute, Stockholm, Sweden, August, 2023
Invited Departmental Speaker, University of Toledo, April, 2023
Invited Departmental Speaker, University of Kansas Medical Center, March, 2023
Invited Conference Speaker, HFHS-MSU Joint Cancer Symposium, Detroit, MI, November, 2022
Invited Conference Speaker, CF Celebration of Hope, East Lansing, MI, October, 2022
Invited Conference Speaker, Midwest Microbial Pathogenesis, Madison, WI, September, 2022
Invited Speaker, Cayman Chemicals, Ann Arbor, MI, March 2022
Invited Conference Speaker, Microbial Stress Gordon Research Conference, South Hadley, MA, July, 2022
Invited Conference Speaker, ASM Microbe, Virtual, June 2021
Invited Speaker, Infectious Disease Fellows Seminar, Sparrow Hospital, Lansing, MI. December 2020
Postdoc Invited Department Speaker, Wayne State University, Detroit, MI. October, 2020
Invited Speaker, Infectious Disease Fellows Seminar, Sparrow Hospital, Lansing, MI. March 2020
Invited Conference Speaker, Sensory Transduction in Microorganisms (STIM) Gordon Research Conference, Ventura, CA, January, 2020
Invited Speaker, Translational Science Seminar Speaker, Grand Rapids, MI, December 2019
Invited Distinguished Speaker, University of Minnesota, Celebration of the 100-year anniversary of the department of microbiology, Minneapolis, MN July, 2019
Neil Welker Keynote Address, Windriver Conference, Estes Park, CO, June, 2019
Invited Departmental Speaker, Ohio State University, March 2019
Invited Conference Speaker, World Aquaculture Society, New Orleans LA, March 2019
Invited Speaker, Biology on Tap, Lansing, MI, February 2019
Invited Departmental Speaker, Bowling Green University, February 2019
Invited Conference Speaker, DOD Defense TechConnect Summing, Tampa, FL, October 2018
Invited Departmental Speaker, Eastern Carolina University, October 2018
Invited Conference Speaker, International Symposium on Nucleotide Second Messengers in Bacteria, Berlin, Germany, October 2018
Session organizer and Speaker, Microbe 2018, Atlanta, GA, June 2018
Invited Departmental Speaker, Uniformed Services University, March 2018
Invited Departmental Speaker, College of William and Mary, February 2018
Invited Conference Speaker, Molecular Genetics of Bacteria and Phages 2017, Madison, WI, August 2017
Invited Departmental Speaker, Tufts University, May 2017
Invited Departmental Speaker, Dartmouth University, March 2017
Invited Departmental Speaker, University of Michigan, November 2016
Invited Keynote Speaker, Michigan/Michigan State University joint retreat, October 2016
Invited Conference Speaker, Lake Arrowhead, Los Angeles, CA, October 2016
Invited Conference Speaker, ASM Microbe General Meeting, Boston, MA, June 2016
Invited Departmental Speaker, Indiana University, April 2016
Invited Departmental Speaker, National Institutes of Health, Bethesda, MS, April 2016
Invited Departmental Speaker, University of Maryland, College Park, MD, April 2016
Invited Departmental Speaker, University of Minnesota, Minneapolis, MN, March 2016
Invited Departmental Speaker, University of Iowa, Iowa City, IA, September, 2015
Invited Conference Speaker, Washington University, St. Louis, MO, "Symposium on the Evolution of Mutlicellularity" May, 2015
Invited Departmental Speaker, Northwestern University, Chicago, IL, May, 2015
Invited Departmental Speaker, University of Washington, Seattle, WA, March, 2015
Invited Departmental Speaker, University of Wisconsin, Madison, WI, October, 2014

Invited Conference Speaker, Molecular Genetics of Bacteria and Phages 2014, Madison, WI, August 2014
Invited Conference Speaker, 5th Annual National ERIN meeting, Ann Arbor, MI, June 2014
Invited Departmental Speaker, University of Illinois, Urbana, IL, January, 2014
Invited Departmental Speaker, University of Michigan, Ann Arbor, MI, November, 2013
Invited Conference Speaker, Society of General Microbiology (SGM) Annual Meeting, Sussex, England, September, 2013
Invited Conference Speaker, 5th Annual Federation of European Microbiological Sciences (FEMS) Biannual meeting, Leipzig, Germany, July 2013
Invited Conference Speaker, Montana Biofilm Science and Technology Meeting, Bozeman, MT, July 2013
Invited Departmental Speaker, 113th General American Society of Microbiology General Meeting, Denver, CO, May 2013.
Invited Departmental Speaker, Western Michigan University, Kalamazoo, MI, March, 2013
Invited Departmental Speaker, Wadsworth Center, The University of Albany, Albany, NY, March, 2013
Invited Departmental Speaker, Grand Valley State University, Grand Rapids, MI, February, 2013
Invited Departmental Speaker, Emory University, Atlanta, GA, November, 2012
Invited Departmental Speaker, Georgia Tech University, Atlanta, GA, November, 2012
Invited Conference Speaker, Great Lakes Regional Center of Excellence Annual Meeting, Chicago, IL, August, 2012
Invited Departmental Speaker, Stanford University, Palo Alto, CA, June, 2012
Invited Departmental Speaker, Wayne State University, Detroit, MI, May, 2012
Invited Departmental Speaker, University of New Hampshire, Durham, NH, May, 2012
Invited Departmental Speaker, University of Toledo, Toledo, OH, May, 2012
Invited Departmental Speaker, Indiana University Northwest, Gary, IN, April, 2012
Invited Departmental Speaker, University of Illinois-Chicago, Chicago, IL, February, 2012
Invited Platform Speaker, 10th Annual American Society of Microbiology Biodefense and Emerging Disease Conference, Washington, DC, February, 2012
Invited Conference Speaker, Sensory Transduction in Microorganisms Gordon Research Conference, Ventura, CA, January, 2012
Invited Conference Speaker, Great Lakes Regional Center of Excellence Annual Meeting, Chicago, IL, August, 2011
Invited Conference Speaker, 111th American Society of Microbiology General meeting, New Orleans, LA, May, 2011
Invited Conference Speaker, Regional Centers of Excellence National Meeting, Denver, CO, April, 2011
Invited Departmental Speaker, University of Kentucky, Lexington, KY, February, 2011
Invited Conference Speaker, 54th Annual Windriver Conference, Aspen, CO, June, 2010
Invited Departmental Speaker, UMDNJ, Newark, NJ, April, 2010
Invited Departmental Speaker, University of Michigan, Ann Arbor, MI, 2010
Invited Conference Speaker, 16th Annual Midwest Microbial Pathogenesis Conference, Purdue University, LaFayette, IN, October, 2009
Invited Departmental Speaker, 1st Annual University of Toledo Symposium, Toledo, OH, October, 2008

Teaching Experience

2026-*Lecturer***-**Integrative Microbial Biology, MGI801
2010-current-*Course Administrator*, Microbial Genetics, MMG/MGI 431
2024-2025-*Course Administrator*, Graduate Microbial Genetics, MMG/MGI 991
2020-*participant*-Summer Online Instruction Readiness for Educational Excellence
2020-*Lecturer***-**Chemical Biology of Pathogens
2008-2015-*Lecturer,* Integrative Microbial Biology, MMG801
2011-2013-*Course Developer and Administrator,* Seminar Series, MMG 892

2009, 2011, 2013-*Instructor,* Graduate Microbial Pathogenesis, MMG891
2010, 2012-*Instructor*, Molecular Pathogenesis, MMG 461
2010-*Lecturer*, Frontiers in Microbiology and Molecular Genetics, MMG 103
2009-*Instructor*, Microbial Genetics, MMG 431
2009-*Attended*, *Facilitating Learning in Large Lecture Classes*
2009-2010-*Lecturer*, Quantitative Biology, QB 828
2006-*Teaching assistant*, Graduate level, Molecular Biology of Prokaryotes, Professor Tom Silhavy, Princeton
1999-*Instructor*, Undergraduate level, Introduction to Microbiology, University of Minnesota
1998-*Instructor*, Undergraduate level, Physiology and Diversity of Bacteria, University of Minnesota

Academic Awards

2026-MSU College of Natural Sciences, Meritorious Faculty Award
2026-28-American Society of Microbiology, Distinguished Lecturer
2023-Research Excellence Award, College of Osteopathic Medicine, Michigan State University
2022-William J. Beal Outstanding Faculty Award, given to no greater than 10 faculty annually at Michigan State University for leadership in research, teaching, and service
2022-Elected to the American Academy of Microbiology
2019- Excellence Award in Interdisciplinary Scholarship by the MSU Chapter of the Honor Society of Phi Kappa Phi.
2019-Selected as a distinguished speaker for the 100-year anniversary celebration for the Department of Microbiology, University of Minnesota
2019-Selected by the student and postdoctoral organizers of the Windriver Conference as the Welker/Streips Keynote Speaker
2015-Member, Faculty of 1000
2015-College of Natural Science, Teacher-Scholar Award, Michigan State University
2014-College of Osteopathic Medicine Early Promise of Research Excellence Award, Michigan State University
2014-Undergraduate Research Faculty Mentor of the Year, Michigan State University
2013- Young Investigator Award. Center for Biofilm Engineering, Montana State University
2012-NSF CAREER award recipient
2004- Ruth L. Kirschstein National Research Service Award
2003-Microbiology, Immunology, and Cancer Biology (MICaB) program nominee for "Best Dissertation" in biology and the medical sciences, University of Minnesota
2002-Golden Pipetman Award 2001-MICaB program student representative, University of Minnesota
1997-Undergraduate graduation with highest distinction, University of Kansas
1997-Cassandra Ritter Award for outstanding achievement as an undergraduate in microbiology, University of Kansas
1996-Summer Undergraduate Research Award, University of Kansas

Professional Service-International

2026-Member, NIH Study Section, Bacterial Virulence
2025-26-President, MI ASM Branch
2025-Member, NIH Study Section, Molecular Infectious Disease
2024-25-President Elect, MI ASM Branch
2024-Member, NIH Study Section, K99 special panel
2023- External Promotion Reviewer-Penn State University
2023,2025-External Grant Review-Italian Cystic Fibrosis Foundation
2023-Invited guest editor, *mBio* (2 times)
2023-25-panelist-COMPASS fireside chat (mentoring and time management)
2022-current-Board member, MI ASM Branch

2022-Member, NIH Study Section, Genetic Variation and Evolution
2022-Mentor-American Society of Microbiology Future Leaders Program
2022- External Grant Reviewer-Swiss National Science Foundation
2022-External Promotion Reviewer-Ghent University
2021-Member, NIH Study Section, Bacterial Pathogenesis
2021-External Grant Reviewer-U.S.-Israel Binational Science Foundation
2021-Member, NIH Study Section, PAR20-117: Maximizing Investigators' Research Award (MIRA) for Early Stage Investigators
2021-Invited guest editor, *mBio*
2021-External tenure promotion review, Ecole polytechnique fédérale de Lausanne (EPFL), Switzerland
2021- External PhD thesis reviewer, Instituto de Tecnologia Quimica e Biologica, Lisbon, Portugal
2020-Co-organizer for the 27th Midwest Microbial Pathogenesis Conference to be hosted at Michigan State University (postponed until 2021)
2020-Invited guest editor, *mBio*
2020- External grant reviewer, Department of Defense
2019- External grant review, University of Nebraska
2019-21-Member, *Infection and Immunity*, Editorial Board
2018-Extenal grant review, Deutsche Forschungsgemeinschaft (German Research Foundation)
2018-Chaired, organized, and presented at a symposium at the 2018 Microbe Meeting titled: "Harnessing Microbiology to Treat Cancer"
2018-2020-Member, *Frontiers in Cellular and Infection Microbiology* Editorial Board
2018-Ad Hoc Panel Member: Prokaryotic and Cellular Molecular Biology Study Section, NIH, June 2018
2018- External grant review, Wellcome Trust
2018-External tenure promotion review, University of Washington
2018-Member, National Science Foundation study section
2018-Extenal grant review, Department of Defense
2017-Invited guest editor, *PNAS*
2017-External tenure promotion review, Swarthmore College
2017-Ad Hoc Panel Member: Prokaryotic and Cellular Molecular Biology Study Section, NIH, June 2017
2017-External Thesis Examiner, Sarah Jung, Tufts University, May 2017
2017-External Thesis Examiner, Amy Baker, Dartmouth University, March 2017
2016-2018-Panel member, reviewer American Diabetes Association
2016-Ad Hoc Reviewer: March, 2016-Biotechnology and Biological Sciences Research Council (BBSRC), UK
2015-2017-Member, *Molecular Microbiology* Editorial Board
2015-Ad Hoc Reviewer: September, 2015-NSF CAREER panel
2015-Panel member, reviewer Beckman Scholar Program
2015- Member, National Science Foundation study section
2015-2023-Member, *Journal of Bacteriology* Editorial Board
2013-Ad Hoc Reviewer: May, 2013-International Foundation for Science Grant Application
2013-Ad Hoc Reviewer: April, 2013-Hungarian Scientific Research Fund (OTKA)
2012-Chaired and organized a symposium at the 112th Annual International American Society of Microbiology Meeting titled: "New paradigms in second messenger signaling"
2010-2012-Panel member for ASM Undergraduate Research Fellowships
2009-current-MSU institutional representative for the Midwest Microbial Pathogenesis Conference
2008-current-Invited Journal Reviewer: *ACS Chemical Biology, Antimicrobial Agents and Chemotherapies, Applied and Environmental Microbiology, Biofouling , Biotechnology Advances, BMC Microbiology, Cell, Current Opinions in Microbiology, eLife, Environmental Microbiology Reports, Environmental Science and Technology, FEMS Microbiology, Frontiers Microbiology, Future Medicinal Chemistry, Gut Microbes, Infection and Immunity, Journal of Antimicrobial Chemotherapy, Journal of Applied Microbiology, Journal of Bacteriology, Journal of Biological Chemistry, JoVE, Journal of Wound Care, MBio, Microbiology, Molecular Microbiology, Nature, Nature Chemical Biology, Nucleic Acids*

Research, Pathogens and Disease, Phytopathology, PLoS Biology, PLoS Genetics, PLoS One, PLoS Pathogens, Phytopathology, PNAS, Protein and Cell, Science Signaling

Professional Service-Local

2026- Member, Microbiology, Genetics, and Immunology Faculty Advisory Committee
2025-current-Provost Distinguished Faculty Promotion and Tenure Review Panel, Michigan State University
2024-reviewer-Corwell-MSU Alliance grant
2023-2024-member, Microbiology and Molecular Genetics Microbial Oncogenesis faculty search committee
2023-current-Chair, Microbiology and Molecular Genetics awards committee
2022-2023-Member, Microbiology and Molecular Genetics awards committee
2022-current- member, Microbiology and Molecular Genetics Microbial Oncogenesis faculty search committee
2021-2022-member, Microbiology and Molecular Genetics Host/Pathogen faculty search committee
2020-2022, Chair, Microbiology and Molecular Genetics Faculty Advisory Committee
2020-Member, BEACON proposal review panel, MSU
2020-2021, Member, University committee to incorporate Diversity, Equity, and Inclusion into faculty tenure, promotion, and annual review
2019-2020, Member, Microbiology and Molecular Genetics Faculty Advisory Committee
2019-2020, Member, Microbiology and Molecular Genetics Strategic Planning committee
2019-2020, Member, Microbial Ecology Pathogenesis Faculty Search Committee, Microbiology and Molecular Genetics, MSU
2019-2020, Member, David J. Ellis Endowed Chair on antimicrobial resistance, Large Animal Clinical Sciences, MSU
2018-2019- Member, Awards Committee, Microbiology and Molecular Genetics, MSU
2017-18-Members, Mass Spectrometry Faculty Search Committee, Biochemistry and Molecular Biology, MSU
2017-current-Member, University Committee on Faculty Tenure representing the College of Natural Sciences
2016-2017- Member, Seminar Committee, Microbiology and Molecular Genetics, MSU
2016-2020, Chair, MSU Radiation Safety Committee
2015-2018, Member, MSU Sponsored Programs Advisory Committee
2015-2017, Member, Microbiology and Molecular Genetics FAC committee
2015-16-Member, Drug Development Faculty Search, Pharmacology and Toxicology, MSU
2015-2018-BEACON Thrust Group I leader, "Genes and Genomes"
2015-16-Member, Rudolph Hugh Endowed Chair Search Committee, Microbiology and Molecular Genetics, MSU
2014-15-Chair, Microbial Ecology Pathogenesis Faculty Search Committee, Microbiology and Molecular Genetics, MSU
2014-Member, Strategic Partnership Grant Study Section, Health and Biomedical Sciences, MSU
2014-15. Member, Rudolph Hugh Endowed Chair Search Committee, Microbiology and Molecular Genetics, MSU
2013-14. Member, Microbial Ecology Pathogenesis Faculty Search Committee, Microbiology and Molecular Genetics, MSU
2013-2015-MSU faculty senate and University Council
2013-2015-Member, MSU Radiation Safety Committee
2013-2015-Member, College of Osteopathic Medicine Curriculum Committee
2013-Chair, Strategic Partnership Grant Study Section, Health and Biomedical Sciences, MSU
2011-13-Member, Microbiology and Molecular Genetics Graduate Student Committee

Grants Awarded

2026 National Institutes of Health, R21 RAI190733A

Computationally predicting bacterial strain susceptibility to phages
Role-PI, 2/2026-1/2028, $435,379

MSU-Strategic Partnership Grant
Developing Anti-Microbial Bacteriophages for Agricultural Application
Role-PI, 7/2026-6/2029, $480,000

2025 **MSU Jennison Award**
Restoration of funds for F31 AI186463
Role-PI, $22,617

MSU Ecology and Evolutionary Biology Pilot Award
Computationally predicting bacterial strain susceptibility to phages
Role-PI, $9674

2024 **Michigan State University Tetrad Proposal**
Cyclic di-nucleotides cross talk at the intersection of plant microbe interaction
Role-coPI, $30,000

National Institutes of Health, F31 AI186463
Discovery of new phage defense systems in *Vibrio cholerae*
Role-mentor, graduate student Jasper Gomez-PI, 8/24-7/26, $105,205

National Institutes of Health, R35 GM139537, equipment supplement
Exploring cyclic di-nucleotide signaling across the tree of life
Role-PI, 5/25-12/24, $34,246

2023 **National Institutes of Health, R03 AI176255**
Novel Antibiofilm Treatments for Pseudomonas aeruginosa Infection
Role-PI, 4/2023-3/2025, $149,898

2022 **Dell Postdoctoral Fellowship, Michigan State University College of Osteopathic Medicine**
Studying enzymes that modify nucleotides in biological defense, supporting Dr. Micah Ferrel
Role-PI, 7/2022-6/2023, $50,000

National Institutes of Health, R35 GM139537, diversity supplement
Exploring cyclic di-nucleotide signaling across the tree of life
Supports Dr. Nkrumah Grant
Role-PI, 8/2022-7/2024, $ $235,808

Pardee Foundation
Activating STING in tumors using viral gene therapy
Role-PI, 10/1/22-9/30/23, $187,349

2021 **National Institutes of Health, R01 AI158433**
The contribution of novel cytidine deaminase regulatory systems to bacterial evolution
Role-PI, 2/2021-1/2026, $2,873,956

National Institutes of Health, R35 GM139537, administrative equipment supplement
Exploring cyclic di-nucleotide signaling across the tree of life
Role-PI (and sole laboratory supported), 1/2021-12/2025, $ 54,224.25

National Institutes of Health, R01HL153165
Role of disrupted ASL pH regulation in small airways in CF lung disease pathogenesis
Role-co-PI, 1/2021-12/2025, $20,000

2020 **National Institutes of Health, R35 GM139537**
Exploring cyclic di-nucleotide signaling across the tree of life
Role-PI (and sole laboratory supported), 1/2021-12/2025, $2,622,748

2019 **Molecular Discovery Grant, MSU**
Identifying triclosan analogs that improve synergy with tobramycin to eradicate biofilms
Role-PI, 5/2019-4/2020, $20,000

BEACON Center for the Study of Evolution in Action, MSU- DBI-0939454
Characterizing The Role of Unique Genomic Islands in Pandemic Vibrio cholerae Evolution
Role co-P.I., Period: 5/2019-4/2020, $46,736

Cystic Fibrosis Foundation
AAV4 as a delivery vector for gene therapy of CF lung disease
Role: consultant (Xiaopeng Li-PI), 02/01/2020 - 01/31/2022, $84,000

2018 **MTRAC-Kickstart**
Eradicating Biofilms in Diabetic Chronic Wounds
Role-PI, 4/1/2018-3/31/2019, $21,608

BEACON Center for the Study of Evolution in Action, MSU- DBI-0939454
Characterizing Unique Genomic Islands in Modern Pandemic *Vibrio cholerae* Evolution
Role co-P.I., Period: 5/2018-4/2019, $43,301

Venn Therapeutics-Sponsored Research Agreement
Using adenovirus to deliver genes that activate STING to treat cancer
(Role: co-PI), Period: 4/1/2018-10/31/2018, $148,944

National Institutes of Health- R21AI144395
Uncovering the first 5'-pGpG signaling system
Role-PI, $ 397,971

National Institutes of Health- STTR with company TSRL
A novel combination therapy to treat biofilm-based pneumonia infections
Role-PI, $400,000

2017 **National Institutes of Health-F30GM123632**
Determining the transcriptional mechanism of c-di-GMP-dependent biofilm gene activation
Role-mentor, DO/PhD student Meng-Lun Hsieh, $97,070.00

National Science Foundation-Proposal 1714612
Stochastic phenotype switching controlled by c-di-GMP in Vibrio cholerae
Role: co-PI, Dufour-PI, 08/01/2017-07/31/20, $760,000

2017 MSU Molecular Discovery Grant Pilot Grant
Identifying compounds that enhance biocide killing of waters system biofilms
Role: PI, 11/2017-10/2018, $15,000

2016 Venn Therapeutics-Sponsored Research Agreement
Evaluating the Anti-Cancer Effects of AdVCA0848 Pre-Clinically in Colon and Melanoma Animal Model (Role: co-PI), Period: 6/1/2016-5/31/2017, $249,245.00

National Institutes of Health-NIGMS-R03- R03AI130554
Developing novel technologies to address fundamental questions about second messenger signaling (Role: P.I.), Period: 1/2017-12/2019, $144,104

2015 USDA-NIFA
Dissection of regulatory events triggering rapid transition from T3SS-mediated pathogenesis to ooze extrusion in *Erwinia amylovora* (Role: co-PI), Period: 1/2015-12/2017, $499,970.00

National Institutes of Health-NIGMS-R01-GM110444
Molecular mechanisms of adaptive diversity in Burkholderia biofilms (Role: co-P.I.), Period: 3/2015-2/2020, $1,432,075

National Institutes of Health-NIGMS-R01-GM109259
From structure to systems: Understanding cyclic di-GMP control of transcription (Role: P.I.), Period: 4/2015-3/2019, $2,496,149

BEACON Center for the Study of Evolution in Action, MSU- DBI-0939454
Applying evolution in action to understand the mechanisms of novel antimicrobial therapies (Role co-P.I.), Period: 8/2015-7/2016, $169,302

BEACON Center for the Study of Evolution in Action, MSU- DBI-0939454
The Wisdom of Quorums (Role co-P.I.), Period: 8/2015-7/2016, $68,395

CTSI-Hunt for a Cure
Treating cystic fibrosis *Pseudomonas aeruginosa* biofilms with triclosan and tobramycin (Role P.I.), Period 9/2015-8/2016, $40,000

2014 CTSI-Hunt for a Cure
Developing new therapeutics to inhibit Pseudomonas aeruginosa biofilm formation in cystic fibrosis (Role P.I.), Period 9/2014-8/2015, $35,000

BEACON Center for the Study of Evolution in Action, MSU- DBI-0939454
Evolution of communication and cooperation in social systems. (Role co-P.I.), Period: 5/2014-4/2015, $119,560

American Diabetes Association-1-14-BS-220
Elucidating the role of bacterial chemical signaling in diabetic chronic non-healing wounds (Role P.I.), Period: 1/1/2014-12/31/2016, $333,500

2013 National Science Foundation-CAREER-MCB1253684
Title: CAREER: Elucidating the molecular mechanism of the Vibrio cholerae cyclic di-GMP riboswitch (Role P.I.), Period: 6/2013-5/2018, $500,000

National Institutes of Health-NIAID-R21AI105499
Novel vaccine targeting Clostridium difficile using the adjuvant cyclic di-GMP (Role: P.I.), Period: 6/2013-5/2015, $396,477

BEACON Center for the Study of Evolution in Action, MSU- DBI-0939454
Exploring Hamilton's Rule in Quorum Sensing Systems? (Role co-P.I.), Period: 5/2013-4/2014, $191,585

BEACON Center for the Study of Evolution in Action, MSU- DBI-0939454
Searching for self-encoded RNAs-Remnants of the RNA World? (Role co-P.I.), Period: 5/2013-4/2014, $98,459

The Michigan Initiative for Innovation and Entrepreneurship (MIIE)
Evaluating anti-biofilm compounds in the treatment of chronic wounds (Role P.I.), Period 2/1/13-1/31/-14, $35,000

2012 CTSI-Hunt for a Cure
Examine the efficacy of anti-biofilm compound developed in my laboratory to treat cystic fibrosis (Role P.I.), Period 9/2012-8/2013, $21,250

ERIN-Pilot Project, NIH-NIAID-U19AI090872
Increasing efficacy of an Adenovirus vaccine targeting *Clostridium difficile* using the adjuvant cyclic di-GMP (Role co-P.I.), Period: 8/2012-7/2013, $57,000

ERIN-Pilot Project, NIH-NIAID-U19AI090872
Inhibiting biofilm formation to treat O104:H4 *Escherichia coli* infections (Role P.I.), Period: 8/2012-7/2013, $57,000

Strategic Partnership Grant, MSU Foundation
Prevention of bacterial biofilm formation on surfaces (Role P.I.), Period: 8/2012-7/2015, $400,000

ASM-Undergraduate Research Fellowship
Exploring the activity of degenerate active sites (Role-mentor, Jessica Hunter-mentee), Period: 6/1/2012-9/1/2012, $7,000

ASM-Undergraduate Research Fellowship
Identifying the mechanism of GGDEF inhibitors (Role-mentor, Josh Smith-mentee), Period: 6/1/2012-9/1/2012, $7,000

BEACON Center for the Study of Evolution in Action, MSU- DBI-0939454
Can Communication Stabilize Cooperation? (Role co-P.I.), Period: 5/2012-4/2013, $173,730

2011 CTSI-Hunt for a Cure
Can anti-biofilm compounds treat cystic fibrosis? (Role P.I.), Period 9/2011-8/2012, $27,470

Great Lakes Regional Center of Excellence, NIAID, Development Project
Identification and Characterization of anti-Biofilm Compounds (Role P.I.), Period: 3/2011-2/2013, $357,824

BEACON Center for the Study of Evolution in Action, MSU- DBI-0939454

A Bio-Computational Study of Cooperation in Pathogenic Bacteria (Role co-P.I.), Period: 5/2011-4/2012, $80,184

Center for Microbial Pathogenesis, Michigan State University
Characterizing the role of the Vibrio cholerae Type II secretion system in biofilm formation (Role P.I.) Period: 01/2011-07/2011, $26,750

2010 **NIAID AARA Research Supplement for K22- K22AI080937**
Funding for Undergraduate Summer Research (Role P.I.), Period 5/2010-9/2010, $5,022

BEACON Center for the Study of Evolution in Action, MSU- DBI-0939454
A Bio-Computational Study of Cooperation in Pathogenic Bacteria (Role co-P.I.), Period: 6/2010-3/2011, $80,184

Project Green, Michigan State University
Inhibition of biofilm formation and fire blight disease caused by *Erwinia amylovora* (Role co-P.I.), Period: 3/2010-2/2011, $35,000

NIH-NIAID- U19AI090872
Host-microbiota-pathogen interactions govern health and disease (Role co-I..), Period 8/2010-7/2015, $7,375,561

2009 **Center for Microbial Pathogenesis, Michigan State University**
Regulation of virulence by cyclic-di-GMP signaling system in *Vibrio cholerae* (Role co-P.I.), Period: 11/2009-10/2010, $15,000

Center for Waters Sciences Postdoctoral Fellowship, Michigan State University
Targeting Cyclic di-GMP to Prevent Cholera (Role P.I.), Period: 9/1/2009-8/31/2011, $133,430

NIH-NIAID Research Scholar Development Award-K22AI080937
Characterization of the Cyclic Di-GMP Signaling System of *Vibrio cholerae* (Role P.I.), Period: 10/1/2009-9/30/2011, $270,000

2004 **Ruth L. Kirschstein National Research Service Award-F32AI058649-01S1**
Analysis of *Vibrio harveyi* quorum sensing, Period: 3/1/2004-2/28/2007

Outreach

2019, 2025-I presented my research on cancer immunotherapy (2019) and phage therapy (2025) at a local bar for the MSU "Biology on Tap" program to a general audience to educate them about science and our specific research.

2017-current-I organized and led the "Microbial Magic" station at the annual Michigan State University Science Festival. Hands on demonstrations included bioluminescent bacteria, antibiotic resistance, microbes in generation of food and drink, and other aspects of microbiology.

2021-2022-I organized and am leading the "MSU Foldscope Team". This is a team of five students that are developing Foldscope activities for local high school biology students.

2021-During the pandemic, in lieu of the in-person Michigan State Science Festival I had 8 zoom meetings with various Michigan classrooms ranging from elementary to high school demonstrating bioluminescent bacteria, other aspects of microbiology, and aspects of being a professional scientist.

2014-2016-I organized and led "Microbiology Day" at the Impression 5 Science Museum in Lansing, MI. This event involved ~8 microbiology laboratories from MSU to illustrate various aspects of microbiology to participants.

2013-I was a representative for Michigan State University at the "Rally for Research" day in Washington, D.C. My team met with ~8 congressional offices to emphasize the critical importance of federal investment in research.

2013-current-On an annual basis, I speak with the Michigan State University Microbiology club about being a professional microbiologist and give them a tour of my lab.

2012-current-Murphy and Rayla Elementary School Science Night-My students and I show participants bioluminescent bacteria and microbial life in ponds to educate students and their parents on microbiology.

2012-I spoke with 10 Michigan high school biology teachers about microbiology, gave them a tour of my lab, and then let them plate their own bioluminescent bacteria to take back to their classrooms.

2011-current-I regularly speak with an AP Biology class from Dewitt High School (Michigan) about being a professional scientist and give them a tour of my lab.

Laboratory Training

High School Students

1. **Maurice Stepp**-June, 2013-current, URM, Future Scientist Program, currently attending MSU
2. **Gucci Fan**, May 2015-September 2015
3. **Neehal Tumma**-August 2016-August 2019

Undergraduate Students

1. **Lauren Priniski**-September 2008-2012, current graduate student in microbiology at Northwestern
2. **Carolyn Chan**-September 2008-June, 2011, current medical student, Wayne State
3. **David Szandzik**-October 2008-May, 2009
4. **Amanda Ngouajio**-January 2009-2012, URM, current medical student, Indiana University
5. **Kuenyoung Jang**-May 2009-August, 2010
6. **Jon Massie**-February 2010-2013; member UBM program, current medical student, New York University
7. **Josh Smith**-August 2010-2013; current dental school student at the University of Michigan
8. **Evan Reynolds**-September 2010-2013; member UBM program, current graduate student at the University of Michigan
9. **Jessica Hunter**-September 2010-2013; CNS Professorial Assistant, current graduate student at Harvard University
10. **Ashley Konal**-March 2011-2012; member UBM program; obtained Masters at Michigan
11. **Megan Hull**-May 2011
12. **Rachel Rudlaff**-September 2011-2014; CNS Professorial Assistant; current graduate student at Harvard University
13. **Sarah Smaga**-September 2011-2014; CNS Professorial Assistant; current graduate student at Yale University
14. **Alani Adkins**-Summer, 2012; SROP URM

15. **Mark Johnson**-May, 2013
16. **Jennifer Nyberg**-September, 2013-May 2016; current Masters student at MSU
17. **Melanie Callaghan**-May, 2013-August, 2013; currently in graduate school at Wisconsin
18. **Prateek Garg**-May, May, 2013-August, 2013, Khorana Scholar Program
19. **Zamone Sawyer**-May 2014-August 2014; URM
20. **Kevin Baker**-September 2014-May 2015; current graduate student at MSU
21. **Markus Sievertsen**-2013-2015; currently working in biotech
22. **Katherine Magoulick**-September 2014-May 2015; current undergraduate at MSU
23. **Cassie Larrivee**-September, 2014-May, 2016; CNS Undergraduate Research Support Scholarship
24. **Chris Rhoades**, May 2015 to May 2018; SROP URM
25. **Charnay Gloss**, January 2015 to current; URM
26. **Jake Gibson**, May 2014-May 2016; Beckman Scholar, College of Natural Science Dean's Research Scholar, current graduate student at Harvard
27. **Mitch Zachos,** January 2016-May 2018, MSU Veterinary Medicine
28. **Morgan Miller,** January 2016-May, 2016
29. **Macy Pell,** May, 2016-August 2016, May 2017-August 2017
30. **Hannah Smith,** September, 2016-May, 2019, Current graduate student at Emory
31. **Connor Riegal,** September, 2016-May, 2018
32. **Lara Behrman,** January, 2017-May, 2017, German exchange student
33. **Nils Benning,** May, 2017-May, 2019-May, 2021 graduate student Johns Hopkins
34. **Ben Franco,** May, 2017-July, 2017, DO/PhD SUPER summer student
35. **Sebastian Myllek,** September 2017-December 2017-German exchange student
36. **Alyssa Corpus,** September, 2017-May, 2019, CNS Professorial Assistant
37. **Emily Segerni,** June-August, 2018, DO/PhD SUPER student
38. **Megan Seyerle,** September, 2018-May, 2020, Professorial Assistant
39. **Joe Williams,** September, 2018-May, 2019
40. **Jacob Hieber,** September, 2018-May, 2020
41. **Kyle McCoy,** January 2019-May, 2020
42. **Nikla Kiel,** January, 2019-May 2019, German exchange student
43. **Brennan Grimes,** September 2019-December, 2022, CNS Professorial Assistant
44. **Drew Beckman,** September 2019-current, CNS Professorial Assistant
45. **Marius Karbach,** January 2020-May 2020, German exchange student
46. **Elise Trost,** May 2021-current, Professorial Assistant
47. **Ram Kumar**, May 2021-current
48. **Elisa Klienfeld,** Fall, 2021, German exchange student
49. **Aubree Muethel,** May, 2022-current
50. **Marissa Malleck**, September, 2022-current
51. **Sammy Mechrouki**, September-December, 2022-German exchange student
52. **Drew Johnson,** September, 2023-current
53. **Mehak Banga,** September, 2023-current
54. **Yannik Grans,** January, 2024-April, 2024, German exchange student
55. **Ariana Straus,** March, 2024-current
56. **Preethika Lakshminarayanan,** September, 2024-current
57. **Ashlynn Linet,** September, 2024-current
58. **Anna Cope,** September, 2024-2025
59. **Jack Marsh,** June, 2026-current, Summer Research Program student
60. **Thomson Zeng,** September-December, 2026-German exchange student

Medical Students

1. **Jennifer Pusavat**, Fall 2021-College of Human Medicine
2. **Jordan Sontz,** March, 2023-May, 2024-College of Osteopathic Medicine

3. **Ilon Goldberg,** December, 2025-March, 2026

Rotation Students

1. **Ben Roller**-February, 2009
2. **Disha Srivastava** -February, 2009
3. **Ben Koestler**-May, 2009
4. **Adam Edmunds**-May, 2009
5. **Jetaime Ross**-September, 2009
6. **James Kremer**-September, 2009
7. **Ben Pursley**-February, 2010
8. **Rudy Sloup**-February, 2010
9. **Marco Agostoni**-September, 2010
10. **Eric Bruger**-November, 2010
11. **Michelle Korir**-September, 2012
12. **Jennifer Kirk**-December, 2012
13. **Huizing Zheng**, December, 2012
14. **Natalia Porcek**, February, 2013
15. **Geoff Severin**-September, 2013
16. **Thomas LaBar**-November, 2013
17. **Doug Wilkinson**-February, 2014
18. **John Lee**, June-August, 2014
19. **Kevin Nehil**-August-December, 2014
20. **Kyle Card**-August-December, 2014
21. **Nico Fernandez**-December, 2014
22. **Hinako Terauchi**-September, 2015
23. **Soo Hun Yun-**June-August, 2016
24. **Lucas Demey-**September, 2016
25. **John Williams-**September, 2016
26. **Cole McCutcheon**-November, 2016
27. **Brian Hsueh**-June-August, 2017
28. **Jon Kalketa**-June-August, 2017
29. **Kayla Conner**-August, 2017
30. **Justin Lee**-August-November, 2017
31. **Basma Al-Masraf**-November, 2017
32. **Macy Pell**-June-August, 2018
33. **Kati Ford-**September-October, 2018
34. **Sean Thomas-**September-October, 2018
35. **Beth Ottosen-**November-December, 2018
36. **Paige Kies-**November-December, 2018
37. **Kelsey Quinn**-June-August, 2019
38. **Douglas Guizor**-September-December, 2019
39. **Hunter North-**January-February, 2020
40. **Veronica Albrecht-**August-October, 2020
41. **Alex Wessel--**August-October, 2020
42. **Kaylee Wilburn**-October-December, 2020
43. **Troy Burtchett**-October-December, 2020
44. **Jasper Gomez**-August-October, 2021
45. **Kaitlin Decker**-August-October, 2021
46. **Claudia Sepulvada**-October-December, 2021
47. **Emily Perez**-August-October, 2022
48. **Ali Bavandpour**-August-December, 2022

49. **Hazel McGuffin**-October-December, 2022
50. **Sole Escobar**-September-December, 2022
51. **Angela Prete**-September-December, 2023
52. **Jisung Park,** January-February, 2024
53. **Fatma Afify,** March-April, 2024
54. **Kendall Mara,** March-April, 2024
55. **Defei Jiang,** September-December, 2025
56. **Soren Colfax,** September-October, 2026
57. **Amany Rabie,** September-October, 2026
58. **Madison Havens**, October-November, 2026
59. **Riley Oesch,** October-November, 2026

Graduate Students

1. **Disha Srivastava**, May 2009-June, 2014, obtained Ph.D., medical strategist, Klick
2. **Ben Koestler**, June 2009-May, 2014, obtained Ph.D., current, Assistant Professor, Western Michigan University
3. **Adam Edmunds**, August 2009-July, 2012, obtained M.Sc.,
4. **Ben Pursley**, April 2010-August, 2016, obtained Ph.D.
5. **Rudy Sloup**, April 2010-current-August, 2016, obtained Ph.D.
6. **Eric Bruger**, April 2011-July, 2016, obtained PhD., Research Assistant Professor, University of Minnesota
7. **John Shook**, BS/MS student, May 2015-May, 2016, obtained M.Sc., current PhD graduate student at the University of North Carolina
8. **Meng Hsieh**, DO/PhD, April 2013-October, 2018, obtained PhD, currently in medical residency
9. **Geoff Severin**, April 2014-May 2020, obtained PhD, Current Research Assistant Professor, Michigan State University
10. **Michael Maiden**, DO/PhD, January 2015-September, 2018, obtained PhD, currently in medical residency
11. **Nico Fernandez**, April 2015-October 2019, obtained PhD, Assistant Professor, University of Michigan, Dearborn
12. **Amber Bedore**, BS/MS student, August 2017-May, 2019, obtained M.Sc., current laboratory manager
13. **Soo Yoon,** DO/PhD, November 2016-May, 2022, obtained PhD, current finishing DO training
14. **Brian Hseuh,** April 2017-April, 2022, obtained PhD, obtained job in industry
15. **Kelsey Quinn,** March 2020-2021
16. **Alex Wessel**-January 2021-2025-obatined PhD, current employment at the State of Michigan Veterinary Diagnostic Lab
17. **Kaylee Wilburn**-March 2021-March 2023
18. **Jasper Gomez**-March 2022-2025-postdoc University of Pittsburgh, Vaughn Cooper lab
19. **Angela Prete**-March 2024-May, 2026

Postdoctoral Researchers

1. **Natasa Vukov**- February, 2009-January, 2010
2. **Karthik Sambanthamoorthy**- March, 2009-April, 2011, Walter Reed Army Institute of Research
3. **Alessandra Hunt**-February, 2013-October, 2019, current biosafety officer at Michigan State University
4. **Will Soto**-BEACON Distinguished Postdoc, 2014-August, 2016, current faculty member William and Mary University
5. **Ben Pursley**-August 2016-January 2017
6. **Rudy Sloup**-August 2016-Januarty 2017
7. **Micah Ferrel**-October, 2021-current
8. **Aathmaja Rangarajan**-January 2022-current

9. **Nkrumah Grant**-August 2022-October, 2023, current faculty member at University of Illinois, Urbana-Champaign
10. **Geoff Severin**, October 2024-, Research Assistant Professor, Michigan State University

Visiting Scholars

1. **Ann-Katrin Kieninger**-September, 2015-December, 2015
2. **Antoine Glorieux,** February-June, 2023-Belgian exchange student

Graduate Committees

Masters

1. Scott Henderson, BS/MS dual degree, Manning laboratory
2. Javiera Ortiz-Villalobos, CMIB, Britton laboratory
3. Rachel Greenberg, MMG, Mulks laboratory
4. Michael Witte, MMG, Hardy laboratory
5. Briana Tell, MMG, Heath-Heckman laboratory
6. John Lee, MMG, Dufour laboratory
7. Tyler Verburg, MMG, Aldhamen/Amalfitano laboratory
8. Victoria Agrella, MGI, Quinn laboratory
9. Yogit Goyal, MGI, Chan laboratory
10. Jessica Bailey, MGI, Hammer laboratory

Ph.D.

1. Cathy Robinson, MMG, Britton laboratory
2. Eric Carter, MMG, Hausinger laboratory
3. J.P. Jerome, MMG, Mansfield laboratory
4. Mike Manzella, MMG, Reugerra laboratory
5. Robert Parker, MMG, Manning laboratory
6. Marco Agostoni, CMB, Montgomery laboratory
7. Luisa Castiblanco, Plant Pathology, Sundin laboratory
8. Laura Ortiz, CMIB, Britton laboratory
9. Yiseul Kim, MMG, Rose laboratory
10. Michelle Koir, MMG, Manning laboratory
11. Huiching Zheng, MMG, Abramovitch laboratory
12. Ben Johnson, MMG, Abramovitch laboratory
13. Shreya Saha, MMG, Kroos laboratory
14. Sandy Olenic, MMG, Kroos laboratory
15. Phillip Brooks, BMIB, Mansfield laboratory
16. Kristen Entwistle, Chemistry, Spence laboratory
17. Jeff Schachterle, BMS, Sundin laboratory
18. Lavida Brooks, MMG, Mias laboratory
19. Y Hoang, MMG, Kroos laboratory
20. Thomas LaBar, MMG, Adami laboratory
21. Roshan Angoshtari, MMG, Marsh laboratory
22. Anya Vostinar, CSE, O'Fria laboratory
23. Kyle Card, MMG, Lenski laboratory
24. Nkrumha Grant, Lenski laboratory
25. Andrew Heller, Chemistry, Spence laboratory
26. Roshni Kharadi, Sundin laboratory
27. Alshae Logan, MMG, Montgomery laboratory
28. Heather Selheimer, MMG, Manning laboratory
29. Nhu Nguyen, MMG, Dufour laboratory

30. John Williams, MMG, Abramovitch laboratory
31. Shelby Dechow, MMG. Abramovitdch laboratory
32. Lucas Demey, MMG, DiRita laboratory
33. Ted Vanalst, MMG, DiRita laboratory
34. Kristin Jacob, MMG, Reguerra laboratory
35. Paige Kies, MMG, Hammer laboratory
36. Daniel Claiborne, MMG, Mansfield laboratory
37. Justin Lee, MMG, Hardy laboratory
38. Christin Ponnampalam, Genetics, Gulbransen laboratory
39. Rebecca Shay, Plant Biology, Trail laboratory
40. Macy Pell, MMG, Manning laboratory
41. Hunter North, MMG, Crosson laboratory
42. Natash George, MMG, Orlando lab
43. Kokarakis, Manos, MMG, Dukat lab
44. Curtis Jab, MMG, DiRita laboratory
45. Adam Kibiloski, MMG, Abramovitch laboratory
46. Hazel McGuffin, MMG, Parent laboratory
47. Kai-Ching Hsiao, BMB, Kuo laboratory
48. Jisung Park, MGI, Abramovitch laboratory
49. Sophia Liberto, MGI, Hulin laboratory
50. Jessica Hodgkins, MGI, Milbrath laboratory
51. Chris Chavtur, MGI, Rowe laboratory
52. Ira Zibbu, MGI, Barrick laboratory
53. Jade LeBris, MGI, Manning laboratory
54. Lily Saar, Plant Pathology, Sundin laboratory
55. Jessica Hodgkins, MGI, Milbrath laboratory
56. Grace Seaman, MGI
57. Deklan Rummerl, MGI, Quin laboratory

Media highlights

1. **https://www.eurekalert.org/news-releases/1140065**
2. **https://ca.news.yahoo.com/gut-viruses-evolving-tricks-beat-063015955.html**
3. **https://eeb.msu.edu/news/mutation-hotspots-help-friendly-viruses-outmaneuver-the-bacteria-in-your-gut.aspx**
4. **https://msutoday.msu.edu/news/2022/bacteria-versus-viruses**
5. **https://natsci.msu.edu/news/decades-old-discovery-of-shape-shifting-bacteria-revealed-and-revamped/**
6. **https://msutoday.msu.edu/news/2021/03/msu-nih-grant-unknown-genes-cholera**
7. **https://msutoday.msu.edu/news/2020/03/outsmarting-antibiotic-resistance**
8. **https://www.michiganpublic.org/news/2018-05-19/common-ingredient-in-toothpaste-shows-promise-in-cystic-fibrosis**
9. **https://www.wkar.org/radio-made-in-michigan/2014-01-16/msu-scientist-considers-perils-of-a-post-antibiotic-world**
10. **https://bioengineer.org/antibacterial-in-your-toothpaste-may-combat-severe-lung-disease/**
11. **https://www.fox47news.com/we-are-spartans/simple-food-additive-slows-e-coli-poisoning**