



VAUGHN COOPER

CANDIDATE STATEMENT

There's never been a better time to be a microbiologist. We live in a microbial world of continuously evolving microbiomes, relentlessly emerging pathogens, and the promise of microbial solutions to climate, food, and health challenges. Microbial sciences are today's priorities. I would be thrilled to continue serving on the Board to empower our leadership of these diverse fields and to help you advance your contributions. I represent the breadth of our membership as an evolutionary biologist and educator, having published research in all 8 scientific tracks in ASM journals. I am focused on our transition to open access publishing and continue advocating for focused, topical meetings that build communities and engage new members. My experience as COMS Chair and on the Board provided practical understanding of our financial landscape, history, and countless exciting opportunities. I'm eager to help direct and provide stewardship for your society and celebrate your discoveries.

ASM-RELATED ACTIVITIES

- American Academy of Microbiology Fellow, elected 2022
- Board of Directors Programmatic Committee (BDPC), Member, November - December 2021
- Council on Microbial Sciences (COMS), Division Councilor, 2021-2024
- ASM COVID-19 Research Registry, Assistant Curator-in-Chief, 2020-2022
- Editor, *mBio*, 2019-2025
- ASM Board of Directors, Council on Microbial Sciences, (COMS) Elected Board Director, 2019-2023
- Division R (Evolutionary and Genomic Microbiology) Representative, Council on Microbial Sciences (COMS), 2018-2024
- Council on Microbial Sciences (COMS), Chair, 2018-2019

CURRICULUM VITAE

BIOGRAPHICAL

Name: Vaughn Scott Cooper

Home Address: 291 Fairoaks St, Wexford PA 15090 **Birth Place:** Madison, WI, USA

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SYNOPSIS

Vaughn Cooper is an evolutionary biologist and microbiologist. He received his bachelor's degree from Amherst College and his Ph.D. in 2000 from Michigan State University under the mentorship of Richard Lenski, where he studied the evolution of specialization in the Long-Term Evolution Experiment of *E. coli* populations. He was a Postdoctoral Fellow of the Michigan Society of Fellows at the University of Michigan, studying pathogens of the cystic fibrosis airway with John LiPuma. He was Assistant and Associate Professor at the University of New Hampshire from 2004-2015, moving to the University of Pittsburgh in 2015. He is currently Professor of Microbiology and Molecular Genetics, and Computational and Systems Biology, at the University of Pittsburgh, School of Medicine. He co-founded and is Director of the Center for Evolutionary Biology and Medicine. His awards include the 2010 Outstanding Assistant Professor at UNH and an NSF CAREER award. After serving as Chair of the Council of Microbial Sciences for the American Society of Microbiology, he was elected to the Board of Directors. His research is supported by the NIH, NSF, NASA, and by the Cystic Fibrosis Foundation.

The Cooper laboratory studies how bacterial and viral populations (e.g. *Burkholderia*, *Pseudomonas*, *Acinetobacter*, and multispecies communities) evolve to adapt to new hosts and environments, particularly in biofilms. Other major interests include the evolution of antimicrobial resistance and why genome regions mutate or evolve at different rates. We also develop and share a laboratory curriculum called EvolvingSTEM that enables high school students to learn the practice of life science research and key topics in evolution and heredity by conducting a weeklong experiment with bacteria.

EDUCATION and TRAINING

UNDERGRADUATE:

1990-1994	Amherst College	A.B. <i>magna cum laude</i> , 1994	Biology
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GRADUATE:

1995-2000	Michigan State University	Ph.D., 2000	Zoology & Ecology and Evolutionary Biology & Behavior
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POSTGRADUATE

2000-2003	University of Michigan	Postdoctoral Fellow, Michigan Society of Fellows	Dept of Ecology and Evolutionary Biology
2003-2004	University of Michigan	Research Scientist	Dept. of Pediatrics

APPOINTMENTS AND POSITIONS

2004-2010	University of New Hampshire	Assistant Professor, Dept. of Microbiology
2010-2015	University of New Hampshire	Associate Professor, Dept. of Molecular, Cellular, and Biomedical Sciences
2015-	University of New Hampshire	Affiliate Associate Professor, Dept. of Molecular, Cellular and Biomedical Sciences
2015-18	University of Pittsburgh	Associate Professor, Dept of Microbiology and Molecular Genetics, School of Medicine <i>Secondary Appointments:</i> Dept. of Computational and Systems Biology, SOM Dept. of Biological Sciences, Arts & Sciences
2018-	University of Pittsburgh	Professor, Dept of Microbiology and Molecular Genetics, School of Medicine <i>Secondary Appointments:</i> Dept. of Computational and Systems Biology, SOM Dept. of Biological Sciences, Arts & Sciences

MEMBERSHIP in PROFESSIONAL and SCIENTIFIC SOCIETIES

Society for the Study of Evolution	1998-
American Society of Microbiology	2000-
International <i>Burkholderia cepacia</i> Working Group	2003-
Society for Molecular Biology and Evolution	2011-
International Society for Evolution, Medicine and Public Health	2018-

HONORS

National Merit Scholar	1990
Thomas J. Watson Scholar	1990
Oscar E. Schotte Prize, best honors research in biology, Amherst College.	1994
Lucille Markey Predoctoral Fellow, UCSD	1994
Biotechnology Graduate Fellowship, Michigan State University	1995
Tracy A. Hammer Graduate Student Award (Most promising student) College of Natural Sciences, Michigan State University	1998
NSF CAREER award	2009
Outstanding Assistant Professor, University of New Hampshire	2010
Elected Vice-Chair, Gordon Research Conference in Microbial Population Biology, Andover NH.	2017
Elected Chair, Council for Microbial Sciences, American Society of Microbiology	2018
Elected to the Board of Directors, American Society of Microbiology	2019
Re-elected to Board of Directors	2020

Elected Chair, Gordon Research Conference in Microbial Population Biology, Andover NH	2021-3
Fellow, American Academy of Microbiology (AAM)	2022

PUBLICATIONS

Refereed articles

1. Elena SF, **Cooper VS**, Lenski RE. Punctuated evolution caused by selection of rare beneficial mutations. *Science*. 1996;272(5269):1802-4. PubMed PMID: ISI:A1996UT11000047.
2. Turner PE, **Cooper VS**, Lenski RE. Tradeoff between horizontal and vertical modes of transmission in bacterial plasmids. *Evolution*. 1998;52(2):315-29. PubMed PMID: ISI:000073521700003.
3. **Cooper VS**, Lenski RE. The population genetics of ecological specialization in evolving *Escherichia coli* populations. *Nature*. 2000;407(6805):736-9. PubMed PMID: ISI:000089773900040.
4. **Cooper VS**, Bennett AF, Lenski RE. Evolution of thermal dependence of growth rate of *Escherichia coli* populations during 20,000 generations in a constant environment. *Evolution*. 2001;55(5):889-96. PubMed PMID: ISI:000169403100005.
5. **Cooper VS**, Schneider D, Blot M, Lenski RE. Mechanisms causing rapid and parallel losses of ribose catabolism in evolving populations of *Escherichia coli* B. *J Bacteriol*. 2001;183(9):2834-41. PubMed PMID: ISI:000168082000015.
6. Riley MS, **Cooper VS**, Lenski RE, Forney LJ, Marsh TL. Rapid phenotypic change and diversification of a soil bacterium during 1000 generations of experimental evolution. *Microbiology-(UK)*. 2001;147:995-1006. PubMed PMID: ISI:000168105000023.
7. **Cooper VS**. Long-term experimental evolution in *Escherichia coli*. X. Quantifying the fundamental and realized niche. *BMC Evol Biol*. 2002;2(1):12.
8. **Cooper VS**, Reiskind MH, Miller JA, Shelton KA, Walther BA, Elkinton JS, Ewald PW. Timing of transmission and the evolution of virulence of an insect virus. *Proc R Soc Lond B Biol Sci*. 2002;269(1496):1161-5.
9. **Cooper VS**, Carlson WA, LiPuma JJ. Susceptibility of *Caenorhabditis elegans* to *Burkholderia* infection depends on prior diet and secreted bacterial attractants.

PLoS ONE. 2009;4(11):e7961. Epub November 23, 2009. doi:
doi:10.1371/journal.pone.0007961; PMID:19956737.

10. **Cooper VS**, Vohr SH, Wrocklage SC, Hatcher PJ. Why Genes Evolve Faster on Secondary Chromosomes in Bacteria. *PLoS Comput Biol*. 2010;6(4):e1000732; PMID:20369015.
11. Ellis CN, **Cooper VS**. Experimental adaptation of *Burkholderia cenocepacia* to onion medium reduces host range. *Appl Environ Microbiol*. 2010;76(8):2387-96. Epub 2010/02/16. 10.1128/AEM.01930-09 [doi]. PubMed PMID: 20154121; PMID:20154121.
12. Flynn KM, Vohr SH, Hatcher PJ, **Cooper VS**. Evolutionary Rates and Gene Dispensability Associate with Replication Timing in the Archaeon *Sulfolobus islandicus*. *Genome Biology and Evolution*. 2010;2:859-69. doi: 10.1093/gbe/evq068; PMID:20978102.
13. Schuster BM, Perry LA, **Cooper VS**, Whistler CA. Breaking the language barrier: Experimental evolution of non-native *Vibrio fischeri* in squid tailors luminescence to the host. *Symbiosis*. 2010;51(1):85-96. doi: 10.1007/s13199-010-0074-2.
14. Abebe E, Akele F-A, Morrison J, **Cooper VS**, Thomas WK. An insect pathogenic symbiosis between a Caenorhabditis and Serratia. *Virulence*. 2011;2(2):158-61. doi: 10.4161/viru.2.2.15337. PubMed PMID: PMC3100764.
15. Poltak S, **Cooper VS**. Ecological succession in long-term experimentally evolved biofilms produces synergistic communities. *The ISME journal*. 2011;5:369-78. doi: 10.1038/ismej.2010.136. PubMed PMID: 20811470.
16. Schuster BM, Tyzik AL, Donner RA, Striplin MJ, Almagro-Moreno S, Jones SH, **Cooper VS**, Whistler CA. Ecology and Genetic Structure of a Northern Temperate *Vibrio cholerae* Population Related to Toxigenic Isolates. *Appl Environ Microbiol*. 2011;77(21):7568-75. Epub 2011/09/20. doi: 10.1128/aem.00378-11. PubMed PMID: 21926213; PMID:21926213.
17. Ellis CN, Schuster BM, Striplin MJ, Jones SH, Whistler CA, **Cooper VS**. Influence of Seasonality on the Genetic Diversity of *Vibrio parahaemolyticus* in New Hampshire Shellfish Waters as Determined by Multilocus Sequence Analysis. *Applied and Environmental Microbiology*. 2012;78(10):3778-82. doi: 10.1128/aem.07794-11.
18. Morrow JD, **Cooper VS**. Evolutionary effects of translocations in bacterial genomes. *Genome Biology and Evolution*. 2012;4:1256-62. doi: 10.1093/gbe/evs099; PMID:23160175.
19. Flynn KM, Cooper TF, Moore FBG, **Cooper VS**. The Environment Affects Epistatic Interactions to Alter the Topology of an Empirical Fitness Landscape.

PLoS Genet. 2013;9(4):e1003426. doi: 10.1371/journal.pgen.1003426; PMID:23593024.

20. Traverse CC, Mayo-Smith LM, Poltak SR, **Cooper VS**. Tangled bank of experimentally evolved *Burkholderia* biofilms reflects selection during chronic infections. *Proceedings of the National Academy of Sciences*. 2013;110(3):E250–E9. doi: 10.1073/pnas.1207025110; PMID:23271804.
21. **Cooper VS**. The Origins of Specialization: Insights from Bacteria Held 25 Years in Captivity. *PLoS Biol*. 2014;12(2):e1001790. doi: 10.1371/journal.pbio.1001790; PMID:24558348.
22. **Cooper VS**, Staples RK, Traverse CC, Ellis CN. Parallel evolution of small colony variants in *Burkholderia cenocepacia* biofilms. *Genomics*. 2014. doi: 10.1016/j.ygeno.2014.09.007. PubMed PMID: 25263109.
23. Ellis CN, Traverse CC, Mayo-Smith L, Buskirk SW, **Cooper VS**. Character displacement and the evolution of niche complementarity in a model biofilm community. *Evolution*. 2015 Feb;69(2):283–93; PMID:25494960.
24. Turner PE, Williams ES, Okeke C, **Cooper VS**, Duffy S, Wertz JE. Antibiotic resistance correlates with transmission in plasmid evolution. *Evolution*. 2014;68(12):3368–80; PMID:25351426.
25. Abebe-Akele F, Tisa LS, **Cooper VS**, Hatcher PJ, Abebe E, Thomas WK. Genome sequence and comparative analysis of a putative entomopathogenic *Serratia* isolated from *Caenorhabditis briggsae*. *BMC Genomics*. 2015;16:531. PubMed PMID: 26187596.
26. Dillon MM, Sung W, Lynch M, **Cooper VS**. The Rate and Molecular Spectrum of Spontaneous Mutations in the GC-Rich Multichromosome Genome of *Burkholderia cenocepacia*. *Genetics*. 2015;200(3):935–46. doi: 10.1534/genetics.115.176834; PMID:25971664.
27. O'Rourke D, Fitzgerald CE, Traverse CC, **Cooper VS**. There and back again: consequences of biofilm specialization under selection for dispersal. *Frontiers in Genetics*. 2015;6:18; PMID:25717335.
28. Whistler CA, Hall JA, Xu F, Ilyas S, Siwakoti P, **Cooper VS**, Jones SH. Use of Whole-Genome Phylogeny and Comparisons for Development of a Multiplex PCR Assay To Identify Sequence Type 36 *Vibrio parahaemolyticus*. *J Clin Microbiol*. 2015;53(6):1864–72. PubMed PMID: 25832299.
29. Xu F, Ilyas S, Hall JA, Jones SH, **Cooper VS**, Whistler CA. Genetic characterization of clinical and environmental *Vibrio parahaemolyticus* from the Northeast USA reveals emerging resident and non-indigenous pathogen lineages. *Front Microbiol*. 2015;6:272. PubMed PMID: 25904905.

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31. Flynn KM, G Dowell, TM Johnson, BJ Koestler, CM Waters, **VS Cooper**. The evolution of ecological diversity in biofilms of *Pseudomonas aeruginosa* by altered cyclic diguanylate signaling. *J Bacteriol.* 2016. PubMed PMID: 27021563.
32. Martin M, Holscher T, Dragos A, **Cooper VS**, AT Kovacs. Laboratory evolution of microbial interactions in bacterial biofilms. *J Bacteriol.* 2016. PubMed PMID: 27044625.
33. Silva, IN, PM Santos, MR. Santos, JEA Zlosnik, DP. Speert, SW Buskirk, EL Bruger, CM Waters, **VS Cooper**, LM Moreira. Long-Term Evolution of *Burkholderia multivorans* During a Chronic Cystic Fibrosis Infection Reveals Shifting Forces of Selection. *mSystems.* 2016.
<https://msystems.asm.org/content/1/3/e00029-16>
34. Guo, Q; Tomich, A; **Cooper, VS**; Stoesser, N; Wang, M; Sluis-Cremer, N; Doi, Y. Glutathione-S-Transferase FosA6 of *Klebsiella pneumoniae* Origin Conferring Fosfomycin Resistance in ESBL-producing *Escherichia coli* J. *Antimicrobial Chemotherapy.* 2016. Sep;71(9):2460-5. doi: 10.1093/jac/dkw177
35. Wang Y, Diaz Arenas C, Stoebel DM, Flynn K, Knapp E, Dillon MM, Wunsche A, Hatcher PJ, Moore FB, **Cooper VS**, Cooper TF. Benefit of transferred mutations is better predicted by the fitness of recipients than by their ecological or genetic relatedness. *PNAS.* 2016. PubMed PMID: 27091964.
<https://doi.org/10.1073/pnas.1524988113>
36. Urquhart EA, Jones SH, Yu J, Schuster BM, Marcinkiewicz AL, Whistler CA, **Cooper VS**. Environmental Conditions Associated with Elevated Risk Conditions for *Vibrio parahaemolyticus* in Great Bay Estuary, NH. *PLoS ONE* 2016 4;11(5):e0155018. doi: 10.1371/journal.pone.0155018.
37. Sung W, Ackerman MS, Dillon MM, Platt TG, Fuqua C, **Cooper VS**, Lynch M. Evolution of the Insertion-Deletion Mutation Rate Across the Tree of Life. *G3 (Bethesda, Md).* 2016. PubMed PMID: 27317782.
<https://www.g3journal.org/content/6/8/2583.long>
38. Peeters C, Meier-Kolthoff JP, Verheyde B, De Brandt E, **Cooper VS**, Vandamme P. Phylogenomic Study of *Burkholderia glathei*-like Organisms, Proposal of 13 Novel *Burkholderia* Species and Emended Descriptions of *Burkholderia sordidicola*, *Burkholderia zhejiangensis*, and *Burkholderia grimmiae*. *Frontiers in Microbiology.* 2016;7:877. PubMed PMID: 27375597.

39. Guo Q, Ding B, Jové T, Stoesser N, **Cooper VS**, Wang M, Doi Y. Characterization of a novel IncHI2 plasmid carrying tandem copies of blaCTX-M-2 in a fosA6-harboring *Escherichia coli* ST410 strain. *Antimicrobial Agents and Chemotherapy*. 2016. doi: 10.1128/aac.01173-16.
40. Dillon MM, **Cooper VS**. The fitness effects of spontaneous mutations nearly unseen by selection in a bacterium with multiple chromosomes. *Genetics*. 2016. Sep 26. pii: genetics.116.193060. PubMed PMID: 27672096.
41. Dillon MM, Sung W, Sebra R, Lynch M, **Cooper VS**. Genome-wide biases in the rate and molecular spectrum of spontaneous mutations in *Vibrio cholerae* and *Vibrio fischeri*. *Mol Biol Evol*. 2016 Oct 15. pii: msw224. PubMed PMID: 27744412.
42. Jiménez A, Castro JG, Munoz-Price L, de Pascale D, Shimose L, Mustapha M, Spychala CN, Mettus RT, **Cooper VS**, Doi Y. Outbreak of KPC-producing *Citrobacter freundii* at a tertiary acute care facility in Miami, Florida. *Infect Control Hosp Epidemiol*. 2016 Dec 7:1-7
43. Xu F, Gonzalez-Escalona N, Haendiges J, Myers R, Ferguson J, Stiles T, Hickey E, Moore M, Hickey J, Shillaci C, Mank L, DeRosia-Banick K, Matluk N, Robbins A, Sebra R, **Cooper VS**, Jones SH, and Whistler CA. *Vibrio parahaemolyticus* sequence type 631, an emerging foodborne pathogen in North America. *J Clin Microbiol*. 2016 Dec 14. pii: JCM.02162-16.
44. Honsa, ES*, **Cooper VS***, Mhaisse MH, Frank M, Shakera J, Iverson I, Rubnitz J, Hayden RT, Lee RE, Rock CO, Tuomanen EI, Wolf J, Rosch JW. RelA mutant *Enterococcus faecium* with multi-antibiotic tolerance arising in an immunocompromised host. *mBio*. 2017 Jan 3;8(1). pii: e02124-16. doi: 10.1128/mBio.02124-16. *equal contributions.
45. Haidar, G, Philips NJ, Shields RK, Snyder D, Cheng S, Potoski BA, Doi, Y, Hao B, Press EG, **Cooper VS**, Clancy CJ, Nguyen MH. Ceftolozane-tazobactam for the treatment of multidrug-resistant *Pseudomonas aeruginosa* infections: Clinical effectiveness and evolution of resistance. *Clin Infect Dis* 2017 cix182. doi: 10.1093/cid/cix182
46. Peeters C, **Cooper VS**, Hatcher PJ, Verheyde B, Carlier A, Vandamme P. Comparative genomics of *Burkholderia multivorans*, a ubiquitous pathogen with a highly conserved genomic structure. *PLoS ONE* 2017 doi: 10.1371/pone/0176191
47. Pankey MA, Foxall RL, Ster IM, Perry LA, Schuster BM, Donner RA, Coyle M, **Cooper VS**, Whistler CA. Host-selected mutations converging on a global regulator drive an adaptive leap by bacteria to symbiosis. *eLife* 2017 Apr 27;6. pii: e24414. doi: 10.7554/eLife.24414.

48. Hassan AA, Maldonado RF, Dos Santos SC, Di Lorenzo F, Silipo A, Coutinho CP, **Cooper VS**, Molinaro A, Valvano MA, Sa-Correia I. Structure of O-Antigen and Hybrid Biosynthetic Locus in *Burkholderia cenocepacia* Clonal Variants Recovered from a Cystic Fibrosis Patient. *Frontiers in Microbiology*. 2017;8:1027. PubMed PMID: 28642745.
49. Lee N, Le Sage V, Nanni AV, Snyder DJ, **Cooper VS**, Lakdawala SS; Genome-wide analysis of influenza viral RNA and nucleoprotein association. *Nucleic Acids Res* 2017 gkx584. doi: 10.1093/nar/gkx584 [Highlighted by Nat. Rev. Microb]
50. Xu F, Gonzalez-Escalona N, Drees KP, Sebra RP, **Cooper VS**, Jones SH, Whistler CA. Parallel evolution of two clades of a major Atlantic endemic *Vibrio parahaemolyticus* pathogen lineage by independent acquisition of related pathogenicity islands. *Appl Environ Microbiol*. 2017. PubMed PMID: 28687650. *Spotlight selection
51. Guo Y, Tomich AD, McElheny CL, **Cooper VS**, Tait-Kamradt A, Wang M, Hu F, Rice LB, Sluis-Cremer N, Yohei Doi. High-level fosfomycin resistance in vancomycin-resistant *Enterococcus* 14 *faecium*. *Emerg Infect Dis*. 2017 Nov. <https://doi.org/10.3201/eid2311.171130>
52. Leung LM, **Cooper VS**, Rasko DA, Guo Q, Pacey MP, McElheny CL, Mettus RT, Yoon SH, Goodlett DR, Ernst RK, Doi Y. Structural modification of LPS in colistin-resistant, KPC-producing *Klebsiella pneumoniae*. *J Antimicrob Chemother*. 2017. PubMed PMID: 28961916.
53. Lucas, A., R. Ito, M. M. Mustapha, C. L. McElheny, R. Mettus, S. L. Bowler, S. F. Kantz, M. P. Pacey, A. W. Pasculle, **V. S. Cooper**, and Y. Doi. 2017. Frequency and mechanisms of spontaneous fosfomycin non-susceptibility observed upon disk diffusion testing of *Escherichia coli*. *J Clin Microbiol*. Dec 26;56(1). pii: e01368-17. doi: 10.1128/JCM.01368-17. PMID: 2909310
54. Qu Y, Olonisakin T, Bain W, Zupetic J, Brown R, Hulver M, Xiong Z, Tejero J, Shanks RMQ, Bomberger JM, Cooper VS, Zegans ME, Ryu H, Han J, Pilewski J, Ray A, Cheng Z, Ray P, Lee JS. 2018. Thrombospondin-1 protects against pathogen-induced lung injury by limiting extracellular matrix proteolysis. *JCI Insight* 3. 10.1172/jci.insight.96914
55. Shair KHY, Reddy A, **Cooper VS**. New Insights from Elucidating the Role of LMP1 in Nasopharyngeal Carcinoma. *Cancers*. 2018 Mar 21;10(4):86.
56. Grosser MR, Paluscio E, Thurlow LR, Dillon MM, **Cooper VS**, Kawula TH, et al. Genetic requirements for *Staphylococcus aureus* nitric oxide resistance and virulence. *PLoS Pathog*. 2018 Mar 19;14(3):e1006907.

57. **Cooper VS**. Experimental Evolution as a High-Throughput Screen for Genetic Adaptations. *mSphere*. 2018 Jun 27;3(3):e00121-18.
<https://msphere.asm.org/content/3/3/e00121-18>
58. Silva IN, Pessoa FD, Ramires MJ, Santos MR, Becker JD, **Cooper VS**, Moreira LM. OmpR regulator of *Burkholderia multivorans* controls mucoid-to-nonmucoid transition and other cell envelope properties associated with persistence in the cystic fibrosis lung. *J Bacteriol*. 2018 Jun 18;
59. Dillon MM, Sung W, Lynch M, **Cooper VS**. 2018. Periodic Variation of Mutation Rates in Bacterial Genomes Associated with Replication Timing. *mBio* 9:e01371-18.
60. Turner, CB, Marshall, CW and **Cooper, VS**. 2018. Parallel genetic adaptation across environments differing in mode of growth or resource availability. *Evolution Letters*, 2: 355-367. doi:10.1002/evl3.75 2018.
61. Kristofich J, Morgenthaler AB, Kinney WR, Ebmeier CC, Snyder DJ, Old WM, **Cooper VS**, Copley SD. 2018. Synonymous mutations make dramatic contributions to fitness when growth is limited by a weak-link enzyme. *PLOS Genetics* 14:e1007615.
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63. Ezeonwuka C, Harrison LH, Ohm SL, Marsh JW, Pacey MP, Mustapha MM, Doi Y, Snyder D, Cooper VS. 2018. *Clostridioides difficile*: a potential source of NpmA in the clinical environment. *Journal of Antimicrobial Chemotherapy* 74:521–523.
64. Dunlap DG, Marshall CW, Fitch A, Rapport SF, **Cooper VS**, McVerry BJ, Morris A, Kitsios GD. 2018. Improved Detection of Culprit Pathogens by Bacterial DNA Sequencing Affects Antibiotic Management Decisions in Severe Pneumonia. *Am J Case Rep* 19:1405–1409.
65. Le Sage V, Nanni AV, Bhagwat AR, Snyder DJ, Cooper VS, Lakdawala SS, Lee N. 2018. Non-Uniform and Non-Random Binding of Nucleoprotein to Influenza A and B Viral RNA. *Viruses* 10:522.
66. Torres A, Kasturiarachi N, DuPont M, **Cooper VS**, Bomberger J, Zemke A. 2019. NADH Dehydrogenases in *Pseudomonas aeruginosa* Growth and Virulence. *Front Microbiol* 10.10.3389/fmicb.2019.00075
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receptor RpfR and its regulatory interaction with the DSF synthase RpfF. PLOS Biology 17:e3000123.

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69. **Cooper VS**, Warren TM, Matela AM, Handwork M, Scarponi S. 2019. EvolvingSTEM: a microbial evolution-in-action curriculum that enhances learning of evolutionary biology and biotechnology. Evolution: Education and Outreach 12:12
70. Iovleva A, Mettus RT, McElheny CL, Mustapha MM, Van Tyne D, Shields RK, Pasculle AW, **Cooper VS**, Doi Y. 2019. Reduced ceftazidime and ertapenem susceptibility due to production of OXA-2 in *Klebsiella pneumoniae* ST258. J Antimicrob Chemother. 10.1093/jac/dkz183
71. Reeme AE, Bowler SL, Buchan BW, Graham MB, Behrens E, Singh S, Hong JC, Arvan J, Hyke JW, Palen L, Savage S, Seliger H, Huerta S, Ledebor NA, Kotay S, Mathers AJ, **Cooper VS**, Mustapha MM, Mettus RT, Doi Y, Munoz-Price LS. 2019. Use of a cohorting-unit and systematic surveillance cultures to control a *Klebsiella pneumoniae* carbapenemase (KPC)-producing Enterobacteriaceae outbreak. Infect Control Hosp Epidemiol 1–7.
72. Lopez SMC, Martin JM, Johnson M, Kurs-Lasky M, Horne WT, Marshall CW, **Cooper VS**, Williams JV, Shaikh N. 2019. A method of processing nasopharyngeal swabs to enable multiple testing. Pediatr Res. doi: 10.1038/s41390-019-0498-1
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74. Sundermann AJ, Babiker A, Marsh JW, Shutt KA, Mustapha MM, Pasculle AW, Ezeonwuka C, Saul MI, Pacey MP, Van Tyne D, Ayres AM, **Cooper VS**, Snyder GM, Harrison LH. Outbreak of Vancomycin-resistant *Enterococcus faecium* in Interventional Radiology: Detection Through Whole Genome Sequencing-Based Surveillance. Clin Infect Dis., ahead of press doi: 10.1093/cid/ciz666
75. Hall AE, Karkare K, **Cooper VS**, Bank C, Cooper TF, Moore FB-G. 2019. Environment changes epistasis to alter trade-offs along alternative evolutionary paths. Evolution. 2019 Oct;73(10):2094-2105. doi: 10.1111/evo.13825. PMID: 31418459

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<https://www.upmc.com/media/news/102319-cooper-bacterial-lifestyle>
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87. **Cooper VS**, Honsa E, Rowe H, Deitrick C, Iverson AR, Whittall JJ, Neville SL, McDevitt CA, Kietzman C, Rosch JW. 2020. Experimental Evolution In Vivo To Identify Selective Pressures during Pneumococcal Colonization. mSystems 5 (3) e00352-20; DOI: 10.1128/mSystems.00352-20. [Editor's Pick]
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92. Bruger EL, Snyder DJ, **Cooper VS**, Waters CM. 2020. Quorum sensing provides a molecular mechanism for evolution to tune and maintain investment in cooperation. The ISME Journal 1–12. 2021 Apr;15(4):1236-1247. <https://doi.org/10.1038/s41396-020-00847-0>
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97. Konikkat S, Scribner MR, Eutsey R, Hiller NL, Cooper VS, McManus CJ. 2021. Quantitative mapping of mRNA 3' ends in *Pseudomonas aeruginosa* reveals putative riboregulators and a pervasive role for transcription termination in response to azithromycin. PLoS Genetics <https://doi.org/10.1371/journal.pgen.1009634>
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103. Kessler C, Mhatre E, Cooper VS, Kim W. 2021. Evolutionary divergence of the Wsp signal transduction system in β - and γ -proteobacteria. *Appl. Env. Microbiol*, in press. <https://journals.asm.org/doi/10.1128/AEM.01306-2>
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110. Mustapha MM, Srinivasa VR, Griffith MP, Cho ST, Evans DR, Waggle K, Ezeonwuka C, Snyder D, Marsh JW, Harrison LH, Cooper VS, Van Tyne D. 2022. Genomic diversity of hospital-acquired infections revealed through prospective whole genome sequencing-based surveillance. *mSystems* in press [\[link\]](#)
111. Santos-Lopez A, Fritz MJ, Lombardo J, Burr AHP, Heinrich VA, Marshall CW, Cooper VS. 2022. Evolved resistance to a novel cationic peptide antibiotic requires high mutation supply. *Evolution, Medicine, and Public Health*, 10 (1) Pages 266–276, [\[link\]](#)
112. Huo W, Busch LM, Hernandez-Bird J, Hamami E, Marshall CW, Geisinger E, Cooper VS, van Opijnen T, Rosch JW, Isberg RR. 2022. Immunosuppression broadens evolutionary pathways to drug resistance and treatment failure during *Acinetobacter baumannii* pneumonia in mice. *Nat Microbiol* 7:796–809. [\[link\]](#)
113. Waggle KD, Griffith MP, Zhu L, Cooper VS, Snyder DJ, Srinivasa V, Phan T, Wells A, Snyder GM, Van Tyne D, Harrison LH, Marsh JW. 2022. Genomic characterization of SARS-CoV-2 from vaccine breakthrough cases in Allegheny County, Pennsylvania. *PLoS One* 17:e0272954. [\[link\]](#)
114. Groud JA, Dresden BP, Riesmeyer AM, Cooper VS, Bomberger JM, Richardson AR, Alcorn JF. 2022. Novel Requirement for Staphylococcal Cell Wall-Anchored Protein SasD in Pulmonary Infection. *Microbiol Spectr* e0164522. [\[link\]](#)

Preprints

1. Marcinkiewicz AL, Schuster BM, Jones SH, Cooper VS, Whistler CA. 2017. Bacterial community profiles and *Vibrio parahaemolyticus* abundance in individual oysters and their association with estuarine ecology. *bioRxiv* 156851.
2. Wright, ES, Lakdawala SS, Cooper VS. SARS-CoV-2 genome evolution exposes early human adaptations. *bioRxiv*. <https://www.biorxiv.org/content/10.1101/2020.05.26.117069v1>
3. Hodcroft EB, Domman DB, Snyder DJ, Oguntuyo K, Diest MV, Densmore KH, Schwalm KC, Femling J, Carroll JL, Scott RS, Whyte MM, Edwards MD, Hull NC, Kevill CG, Vanchiere JA, Lee B, Dinwiddie DL, Cooper VS, Kamil JP. 2021.

Emergence in late 2020 of multiple lineages of SARS-CoV-2 Spike protein variants affecting amino acid position 677. medRxiv 2021.02.12.21251658. <https://www.medrxiv.org/content/10.1101/2021.02.12.21251658v2>

Reviews, Proceedings, and Book Chapters

1. **Cooper VS**. The study of microbial adaptation by long-term experimental evolution. In: Seifert HA, Dirita VJ, editors. The evolution of microbial pathogens. Washington, DC: ASM Press; 2006.
2. **Cooper VS**. Experimental evolution of pathogens. In: Tibayrenc M, editor. Encyclopedia of Infectious Disease. New York: Wiley; 2007.
3. Jones SH, Striplin MJ, Mahoney JC, **Cooper VS**, Whistler C. Incidence and abundance of pathogenic *Vibrio* species in the Great Bay Estuary, New Hampshire. In: Lassus P, editor. Proceedings of the Seventh International Conference on Molluscan Shellfish Safety; Nantes, France: Quae Publishing; 2010. p. 127-34.
4. Jones SH, Urquhart E, Hartwick M, Taylor M, **Cooper VS**, Whistler CA. Long-term trends of pathogenic *Vibrio* spp. populations in New Hampshire oysters. J Shellfish Res; 8:2015.
5. Xu F, Ilyas S, Hall JA, Jones SH, **Cooper VS**, Whistler CA. Genetic characterization of clinical and environmental *Vibrio parahaemolyticus* from the Northeastern US reveals emerging resident and invasive pathogen lineages. J Shellfish Res; 8:2015:
6. Cooper VS. 2021. The coronavirus variants don't seem to be highly variable so far. Scientific American. <https://www.scientificamerican.com/article/the-coronavirus-variants-dont-seem-to-be-highly-variable-so-far/>
7. Harrison L, Cooper V. 2021 Massive numbers of new COVID-19 infections, not vaccines, are the main driver of new coronavirus variants. The Conversation. <http://theconversation.com/massive-numbers-of-new-covid-19-infections-not-vaccine-s-are-the-main-driver-of-new-coronavirus-variants-166882> [Sept 9, 2021]

Published Abstracts

1. Cooper JW, Rossi AR, **Cooper VS**. Steering of High-Performance Computations Using a Pc Workstation. Abstr Pap Am Chem Soc. 1994;208:153-COMP. PubMed PMID: ISI:A1994PA26101460.

2. **Cooper VS**, Romero EJ, LiPuma JJ, editors. VNTR-based typing of Burkholderia cenocepacia. International Burkholderia cepacia Working Group; 2004; Vancouver, BC.
3. Striplin M, Mahoney, J. C., Cooper, V. S., Whistler, C. A., and Jones, S. H., editor. Identification of Vibrio spp. found in oysters and water from the Great Bay Estuary. 109th Meet Am Soc Microbiol; 2008; Washington, DC.
4. Warren T, **Cooper VS**. Evolution in Action: Experimental Evolution of Biofilms with Pseudomonas fluorescens. Am. Soc. Microbiol General Meeting, Boston; 2014.
5. Flynn K, Johnson T, **Cooper VS**. Evolution of diversity and interdependency in *Pseudomonas aeruginosa* biofilms. PEDIATRIC PULMONOLOGY; 2011:
6. Flynn K, **Cooper VS**. Evolution in chronic *Pseudomonas* infections: biotic interactions drive functional convergence in adaptive targets. PEDIATRIC PULMONOLOGY; 2013
7. Warren T, **Cooper VS**. Evolution in Action: Experimental Evolution of Biofilms with Pseudomonas fluorescens. American Society of Microbiology General Meeting; May, 2014; Boston2014.
8. Jones S, Schuster B, Mahoney J, Yu J, Ellis C, **Cooper VS**, Whistler C. The occurrence, abundance, phylogeny and virulence potential of pathogenic Vibrio species in New Hampshire shellfish waters. J Shellfish Res; 2011

Other Publications

1. Elena SF, **Cooper VS**, Lenski RE. Mechanisms of punctuated evolution - Reply. Science. 1996;274(5293):1749-50. PubMed PMID: ISI:A1996VW71200073.

PROFESSIONAL ACTIVITIES

TEACHING:

Undergraduate and Graduate Instruction

University of Michigan, 2000-2004

HIST196 *Epidemics and History*, freshman seminar, 3 credit hours, 16 students
2001-2002

UC262 *Evolutionary Biology and Human Disease* (course co-founder),
sophomore-senior non-majors, 4 credit hours, team-taught, 80 students
2001-2003

BIOL111 *Emerging and Re-Emerging Infectious Diseases*, freshman seminar 16
students, 3 credit hours, 2003

University of New Hampshire, 2004-2015

MICR 503 General Microbiology, 120-140 students, 5 credit hours, 2004-2006

GEN 604 Fundamentals of Genetics, 120-150 students, 4 credit hours, 2011, 2013

MICR 711/811 Genomics and Bioinformatics, 25 students, 4 credit hours, 2005

MICR 795 Problems in Microbiology [topical seminar on microbial evolution], 4-12
students, 2-4 cr, 2004-2011

MICR / GEN Microbial Ecology and Evolution, 15-25 junior/senior/graduate students, 4
713 / 813 credit hours, 2006-2014. Developed new blog-based method for student
participation and discussion

GEN715/815 Molecular Evolution, 15-32 junior/senior/graduate students, 4 credit hours,
2008-2010, 2012, 2014

MICR 997 Microbiology Seminar leader, 8-15 PhD students, 1 credit hour,
2005-2006, 2008-9

MICR 905 Current Topics in Microbiology (Microbial Genomics), 5-10 PhD students,
2 credit hours, 2005, 2007, 2012

LSA 950 Scientific Communication (new course for new PhD program in Molecular
& Evolutionary Systems Biology that I developed and directed), 8-15
graduate students, 2 credit hours, 2013-4.

University of Pittsburgh, 2015-current

2016-current

- Fall: Human Genetics PBL and TBL with Saleem Khan, lead instructor.
- Fall: Guest lecture, "Special Topics in Biological Sciences" on Genomics for Kate Gardner
- Fall: Program in Microbiology/Immunology, 2 lectures.

- Spring: PBL section for Medical Microbiology, led by Fernanda Silveira.
- Spring: Program in Microbiology/Immunology, 2 lectures/discussion.

2020, 2022: New course in Evolutionary Biology and Human Disease, 6 lectures

Ad hoc:

- 2017, 2019: Lecture, Molecular Evolution course (led by Nathan Clark, Dennis Kostka, Computational Biology)
- 2017: Course section for Integrative Systems Biology “Model Systems” course, led by Dr. Neil Hukriede

Research mentorship

Postdoctoral researchers: primary mentor

	<u>Name</u>	<u>Research Topic</u>	<u>Year</u>	<u>Present Position</u>
1	Steffen Poltak	Evolution in biofilms	2011-12	Science Teacher, St Paul School, NH
2	Jarrett Morrow	Replication timing and genome evolution	2012-14	Bioinformatics faculty, Channing Laboratory, Harvard Medical School
3	Sean Buskirk	Molecular mechs of biofilm adaptation	2014-15	Assistant Professor, West Chester University
4	Erin Urquhart	Ecology and climate influence on pathogenic Vibrio	2014-15	Staff Scientist, NASA
5	Caroline Turner	NASA Postdoctoral Fellow, Eco-evolutionary interactions in biofilms	2015-19	Assistant Professor, Loyola University (Chicago)
6	Christopher Marshall	Evolution in human microbiome populations	2016-19	Assistant Professor, Marquette University
7	German Traglia	Evolution and genomics of <i>Burkholderia contaminans</i> in CF	2017-18	Staff scientist, Argentina
8	Alfonso Santos-Lopez	Experimental evolution of antibiotic resistance	2017-20	Marie Curie fellow, Madrid
9	Eisha Mhatre	Experimental evolution of mixed-species biofilms	2017-20	
10	Abigail Matela	Research and expansion of EvolvingSTEM	2018-	

11	Francine Arroyo	evolution-in-action curriculum and program Evolutionary ecology of antimicrobial resistance strategies	2020-22	Assistant Professor, Fresno State
12	Michelle Clay	Evolutionary dynamics in biofilms	2021-	

Postdoctoral researchers: guidance committee

	<u>Name (PI)</u>	<u>Research Topic</u>	<u>Year</u>	<u>Present Position</u>
1	Megan Kiedrowski, PhD (Bomberger)	MVM: effects of coinfections on CF airway inflammation	2016-20	Assistant Professor, Univ Alabama- Birmingham
2	Santiago Lopez, MD (Williams)	Viral co-infection & immune responses during Acute bacterial sinusitis	2016-19	Sanford Burnham, ND
3	Georgios Kitsios, MD (Morris)	Dysbiosis and ARDS in the ICU	2017-19	Assistant Professor, Pitt PACCM
4	Catherine Armbruster, PhD (Bomberger)	Microbial coevolution in the CF airway	2018-	
5	Yasmin Hilliam, PhD	Microbiome dynamics in the CF sinuses	2021-	
6	Glenn Rapsinski, MD, PhD	Microbiome and pathogen evolution in CF	2022-	

Masters and Ph.D. students

	<u>Name</u>	<u>Program</u>	<u>Years</u>	<u>Present Position</u>
1	Morel Henley	Computer Science, M.S	2005-2008	aerospace industry
2	Crystal Ellis	Genetics, M.S., Ph.D.	2005-2011	Asst. Prof, MCPHS Boston
3	Sarah Wrocklage	Microbiology, M.S.	2006-2009	pharmaceutical industry
4	Steffen Poltak	Microbiology, Ph.D	2006-2010	Lecturer, University of New Hampshire
5	Laura Benton	Microbiology, M.S.	2007-2009	St. Michael's College (VT)
6	Feseha Abebe-Akele	Genetics, Ph.D. (co-advisor)	2007-2013	UNH Bioinformatics Staff Scientist
7	Kenny Flynn	Microbiology, M.S., Ph.D.	2009-2014	RedOwl Analytics -> Cybrary

8	Rachel Staples	Microbiology, M.S	2010-2012	University of Houston
9	Charles Traverse	Microbiology, M.S.	2010-2012	PhD from UT-Austin, analyst for Wayfair
10	Keith Ferguson	Microbiology, M.S.	2010-2012	Boston-area biotechnology
11	Marcus Dillon	Microbiology, Ph.D.	2011-2016	Assistant Professor, University of Toronto
12	Taylor Warren McLeod	Biochemistry, M.S.	2013-14	Outreach Coordinator, Advanced Regenerative Modeling Institute
13	Meghan Hartwick	Molecular/Evol Sys Biol Ph.D.	2013-19	Postdoc at Tufts
14	Devon O'Rourke	Molecular/Evol Sys Biol Ph.D.	2014-15	changed advisor with my move
15	Daphne Welter	Microbiology, Ph.D.	2014-15	transferred to Cornell
16	Katrina Harris	Integrative Sys Biol, Ph.D.	2015-	
17	Michelle Scribner	Program in Microbiology and Immunology, Ph.D.	2017-21	
18	Alecia Rokes	Program in Microbiology and Immunology, Ph.D.	2019-	
19	Nanami Kubota	PMI, Ph.D.	2020-	

Undergraduate Student Researchers (*fellowship winners)

	<u>Name</u>	<u>Major</u>	<u>Years</u>	<u>Position following graduation</u>
1	Sarah Comeau	Microbiology	2004-2006	Cubist Pharmaceuticals
2	Meghan Parks	Microbiology	2005	
3	Scott Powers	Microbiology	2004-2006	EMT
4	Angela Kuehn	Microbiology	2005-2007	PhD program, Virginia Commonwealth University
5	Holly Schurk	Microbiology	2005-2006	
6	Erica Boudreau	Microbiology	2006-7	FirstLight Pharmaceuticals
7	Keith Morley	Biochemistry	2006-2008	Dartmouth Medical School
8	Stephen Perros	Biochemistry	2006-2007	medical school
9	Charles Traverse	Microbiology	2005-9	M.S., UNH, Ph.D., UT-Austin
10	Kasia Szymanska	Microbiology	2006-7	Mass General Hospital Research
11	Jillian Armstrong	Microbiology	2007	M.S. public health
12	Tom Perry*	Microbiology	2007-8	
13	David Dotchin	Microbiology	2007-9	

14	Danielle Morse	Microbiology	2007-9	Research technician, Harvard Medical School
15	Julie Morrison	Biochemistry	2007-9	University of Toledo Medical School
16	Rachel Staples	Microbiology	2009-10	Ph.D. Univ of Houston
17	AJ Troiano	Microbiology	2009-10	University of Connecticut Medical School
18	Megan McLaughlin	Microbiology	2009-13	Research specialist, Dana-Farber Cancer Institute
19	Shain Eighmey	Microbiology	2010-	Lonza Biologics
20	Thomas Johnson	Biochemistry	2010-12	University of Texas Ph.D. MCB
21	Melissa Levesque	Microbiology	2010-11	UNH-Manchester, MPH
22	Jordan Stinson	Microbiology	2010-11	Cell Signaling Technologies
23	Taylor Warren	Biology: MCD	2011-13	M.S. Biochemistry, UNH
24	Brian Paul	Chemical Engineering	2011-12	Chemical Engineer
25	Leslie Mayo-Smith	Biology: EEB	2009-12	Research technician, Mass General Hospital
26	Brian van Dam	Biomed Sci	2012-14	EMT, medical school
27	Cody Fitzgerald*	Mathematics / Genetics	2012-15	PhD candidate, comp. biology, Utah
28	Gabbie Bergeron	Genetics	2012-13	Plymouth State College
29	David Morejon*	Biomed Sci	2012-14	McNair Scholar, QC Technician
30	Gabrielle Dowell	Genetics	2013-14	Research technician
31	Chelsea Jones	Genetics	2013-14	
32	Sarah Kremer	Genetics	2013-15	Jackson Laboratory-CT
33	Caroline Ward*	Biomed Sci	2013-14	Medical school
34	Nicholas Rouillard	BMS: Micro	2014-15	NY Genome Center
35	Celeste Souza	BMS: Micro	2014-15	
36	Matthew Eskuchen*	Biology	2015-17	Boren Fellowship, China
37	Nathan Phillips	Mathematical Biology	2015-17	Bioinformatics Staff Scientist, University of Chicago
38	Delilah Bourque	Biology	2016-18	
39	Abe Cullom*	Biology	2015-18	PhD student, Virginia Tech
40	Karl Keat*	CPCB REU, Bioinformatics	2017	PhD student, UPenn
41	Jeffrey Lombardo*	Biology	2017-19	

42	Arianna Boccardi	Biology	2019-20	
43	Bret Walton	Biology	2019-20	MPH student, George Washington U
44	Justin Hoang	Biology	2019-20	
45	Brayan Vilanova Cuevas	CPCB REU, Comp Bio	2019	PhD student, UC Davis
46	Tyler McAloon	Biology	2019-20	
47	Samantha Hong	Biology	2019-21	MS, Science Teaching
48	Alden Paine	Biology	2019-20	
49	Michelle Liu*	CPCB REU, Comp Bio	2020	Cornell University
50	Santiago Cardenas*	CPCB REU, Comp Bio	2020	
51	Marisa Abundis*	CPCB REU, Comp Bio	2021	
52	Simran Randhawa	Biology	2021-	

Member of Thesis Committee for M.S. or Ph.D.:

	<u>Name</u>	<u>Program</u>	<u>Year</u>	<u>Present Position</u>
1	Anne Marie France	MPH, Univ of Michigan	2002	
2	Ethan Romero	MPH, Univ of Michigan	2004	
3	Darren Bauer	Ph.D. Genetics	2007	
4	Alicia Ballok	M.S. Genetics	2007	Postdoctoral fellow, Harvard Microbiology
5	Sana Hussain	M.S. Natural Resources	2008	
6	Julia Butzler	Ph.D. Biology, Dartmouth	2009	
7	Lauren Perry	M.S. Microbiology	2009	Research coordinator, Recon Strategy
8	Abe Tucker	Ph.D. Genetics	2009	Assistant Professor, Arkansas
9	Brian Schuster	M.S., Microbiology	2011	SeresHealth
10	Way Sung	Ph.D., Genetics	2011	Assistant Professor, UNC-Charlotte
11	Wei Yao	Ph.D., Biochemistry	2013	Postdoctoral fellow, China

12	Lauren Petersen	Ph.D., Microbiology	2014	Postdoctoral fellow, Jackson labs
13	Behailu Aklilu	Ph.D. Biochemistry	2015	Postdoctoral fellow, Texas A&M
14	Mike Taylor	Ph.D. Microbiology		Food Safety Industry
15	Jeffrey Sun	M.S. Microbiology	2014	
16	Feng Xu	Ph.D. Microbiology	2017	NH State Public Health labs
17	Kevin Schuster	Ph.D. Biochemistry	2016	Industry
18	Eric Morrison	Ph.D. NRESS	2018	Postdoc, UNH
19	Ashley Marciniewicz	M.S. Microbiology	2016	Wadsworth Center, NY Public Health
20	Bailey Carignan	M.S. Microbiology, Plymouth State Univ	2017	PhD student, Univ of NH
21	Ravi Patel	PhD Pharmacology	2019	Data Science fellow
22	Aletheia Atzinger	PhD Biol. Sci (EEB)		
23	Malachi Blundon	PhD Biological Sciences, Carnegie Mellon	2018	Postdoctoral fellow, UT-Austin
24	Jennifer Grousd	PhD PMI		
25	Alison Welp	PhD PMI		
26	Kimberly Cowallis	PhD Chemistry	2020	
27	Qiao Lin	PhD EDM	2021	
28	Collin Kessler	PhD Duquesne Bio	2022	
29	Sean Yu Hao Wang	PhD PMI		

High School student researchers:

2005: Charles Traverse, 2006: Kaitlyn Schena, 2007: Katie LaRoche, 2008: Robert Keith, 2009: Gabbie Bergeron; 2010: Greta Gadbois, Cody Fitzgerald, Kristen Dowling; 2011: Keely Fitzgerald, 2019-20: Sachin Thiagarajan (Sci-Tech, Pittsburgh), 2019-2020:

RESEARCH

Grant Support

Current Grant Support

Grant number	Grant Title	Role in Project	Years Inclusive	Source and Amount
Zemke19A0	Clinical and microbiological assessment of CFTR modulators on CF Sinus Disease	co-I	2022-2024	CFF
R01 DK120697	Mechanisms of maternal Immunoglobulin A control over the neonatal microbiota and the development of Necrotizing Enterocolitis	co-I	2021-2025	NIDDK
NIH NIGMS R21/R33	REMISE: Remnant samples to illuminate sepsis	co-I (\$	1/22-12/27	NIGMS
1U01AI124302	Predicting the emergence of antibiotic resistance through multi-omics approaches and Immune System-surveillance	PI (22.5%) (MPI)	3/16-4/22	NIH-NIAID \$1,686,148 (\$9,892,074 total)
1R01AI127472-01	Enhanced Detection System for Healthcare-Associated Transmission of Infection	Co-I (10%)	9/16-8/21	NIH-NIAID \$555,265 (\$3,811,110 total)
Gilead Investigator-Sponsored Research	Viral infections and microbial communities in the respiratory tract in CF	Co-I (10%)	1/17-1/19	Gilead \$288,139 total
1R61HL137077-01	Impact of virome on microbial communities in the respiratory tract	Co-I (15%)	5/17-23	NIH-NHLBI \$523,965 total
R01AI133351-01	Novel antimicrobial agents to overcome antibiotic resistant Pseudomonas and MRSA respiratory infection	Co-I (5%)	7/17-6/22	NIH-NIAID \$538,447 total
NSF MCB-1818131	Collaborative Proposal: Role of tRNA base modifications in genetic code accuracy and cellular fitness	PI (5%)	6/1/18-5/30/22 (NCE)	National Science Foundation \$66,431

R01 CA233576 (Smithgall)	Precision Targeting of Myeloid Src-family Kinases in Acute Myelogenous Leukemia	co-I (5%)	07/01/2019-06/30/2024	NIH-NCI \$45,000
R01 DK120697-01A1 (Hand)	Mechanisms of maternal Immunoglobulin A control over the neonatal microbiota and the development of Necrotizing Enterocolitis	co-i (5%)	3/01/20-2/28/25	NIH-NIDDK \$12,000

Prior Grant Support

NAI CAN-7 NNA15BB04A	RELIVING THE PAST: Experimental Evolution of Major Transitions in the History of Life	co-PI (15%)	1/15-1/20	NASA Astrobiology Institute \$920,000 (\$8,200,000 total)
R01GM110444	Molecular mechanisms of adaptive diversity in <i>Burkholderia</i> biofilms	PI (15%)	1/15-1/20	NIH-NIGMS \$1,432,075
R21 AI135522 (Doi)	Study Network of Acinetobacter as a Carbapenem-Resistant Pathogen (SNAP)	Co-I (10%)	05/01/2018 – 04/30/2020	NIH-NIAID \$10,142
Cystic Fibrosis RDP, University of Pittsburgh	Pilot project: Tracking evolution of antibiotic resistance in the CF airway and by paired experimental evolution	PI (10%)	7/17-6/19	Cystic Fibrosis Foundation RDP \$60,000/yr
R/CE-137	Microbial interactions influencing the emergence of pathogenic vibrios in oysters.	PI	3/12-2/14	NOAA / Sea Grant \$160,000
DEB-0844157	Collaborative research: Understanding the basis of interactions between adaptive	PI	7/09-6/12	NSF-DEB \$196,775

	mutations and their environment			
1R15AI082528-01	The roles of adaptive radiation and phenotypic switching in biofilm diversity	PI	5/09-4/12	NIH-NIAID \$206,500
1R03AI081102-01	Ecological population structure and emergence of virulent <i>Vibrio parahaemolyticus</i>	Co-PI	6/09-5/11	NIH-NIAID \$139,938
NHAES-NH00496	Bacterial-nematode interactions: identifying mechanisms predisposing mutualism or pathogenesis	PI	10/06-9/09	NH Agricultural Experimental Station \$241,123
DEB-9801538	DDIG: Causes and consequences of ecological specialization	co-PI	6/98-5/00	NSF-DEB \$10,000

Invited Seminars and Lectureships

1. "Evolutionary ecology of virulence traits in *Vibrio cholerae*," Society for the Study of Evolution meetings, Champaign, IL, 6/2002
2. "VNTR-based typing of *Burkholderia cenocepacia*." 9th Annual Meeting, International Burkholderia cepacia Working Group. Vancouver, B.C., Canada. 4/2004
3. "Liquid *C. elegans* culture for the study of *Burkholderia* pathogenesis." 10th Annual Meeting, International *Burkholderia cepacia* Working Group. Oklahoma City, OK, 4/2005
4. "Emerging bacterial pathogens: jacks-of-all-trade, but masters of how much?" Dept of Organismic and Evolutionary Biology, Harvard University. 9/2005
5. "Adaptive diversification in biofilms produces a synergistic community." The Forsyth Institute, Harvard University. 1/2009

6. Evolution of synergistic diversity in experimental biofilms recapitulates evolution in chronic infections.” University of Toledo Medical School, September, 2009.
7. “Causes and consequences of bacterial adaptation to novel environments,” University of Southern Maine, October, 2009.
8. “Diversification in experimentally evolved biofilms enhances productivity and recapitulates evolution in chronic infections,” Emerging Pathogens Institute, University of Florida, January 2010.
9. “Evolution in biofilm communities: ecological engineers and genetic revolutions.” Hughes Summer Lecture Series, Wesleyan University, June 2010.
10. “Evolution in biofilm communities: ecological engineers and genetic revolutions.” University of Idaho, November, 2010
11. New England Junior Science and Humanities Symposium (<http://jshs.org>), Plenary Speaker May 2011.
12. “A tangled bank: laboratory biofilm evolution mimics the ecology of chronic infections.” Department of Microbiology and Molecular Genetics, Michigan State University; September 2011
13. “Replication timing directs the arrow of genome evolution,” EEBB program, Michigan State University; September 2011
14. “A tangled bank: laboratory biofilm evolution mimics the ecology of chronic infections.” University of Tennessee-Knoxville, October 2011
15. “A tangled bank: laboratory biofilm evolution mimics the ecology of chronic infections.” Massachusetts Institute of Technology, November 2011 ([student invitation](#)).
16. “A tangled bank: laboratory biofilm evolution mimics the ecology of chronic infections.” University of Washington; January 2012:

17. "A tangled bank: laboratory biofilm evolution mimics the ecology of chronic infections."
University of Massachusetts-Amherst; September 2012.
18. "A tangled bank: laboratory biofilm evolution mimics the ecology of chronic infections."
University of Montana; October 2012
19. "A tangled bank: laboratory biofilm evolution mimics the ecology of chronic infections.":International *Burkholderia cepacia* Working Group, Ann Arbor, MI. April 2013 (keynote).
20. "Population genomics and community ecology of experimentally evolved *Burkholderia* biofilms" Department of Organismal and Evolutionary Biology, Harvard University, November 2013.
21. "Replication timing directs the arrow of genome evolution" FAS Department of Systems Biology, Harvard University, November 2013.
22. "Population genomics and community ecology of experimentally evolved *Burkholderia* biofilms" Rutgers-NJ Medical School, November 2013.
23. "Experimental evolution of *Burkholderia* and *Pseudomonas* biofilms: pattern, process, function," Gordon Research Conference on Acute Respiratory Infections," Lucca, Italy, February 2014.
24. "Using evolutionary biology and genomics to understand chronic infections (and why location matters in genomes)." Children's Hospital Pittsburgh, May, 2014.
25. "Causes of heterogeneity in evolutionary rate in divided bacterial genomes"
International *Burkholderia cepacia* Working Group Nimes FR, April 2014,
26. "Experimentally evolved biofilm communities can shed light on chronic infections." 1st ASM Meeting on Experimental Microbial Evolution, opening plenary, Washington D.C., June 2014.

27. "Experimental evolution in biofilms to understand adaptation during chronic infections," Department of Biology, Boston College, October 2014.
28. "Experimental evolution in biofilms to understand adaptation during chronic infections," Department of Biology, Emory University, November 2014
29. "Experimental evolution in biofilms to understand adaptation during chronic infections," Department of Microbiology, University of Zurich, SUI, 11/ 2014.
30. "Experimental evolution in biofilms to understand adaptation during chronic infections," Biology Department, Clark University, 2/2015.
31. "Evolution in biofilms and the origins of multicellularity." Department of Molecular and Cellular Biology, University of Montana, April 2015.
32. "Experimental evolution in biofilms to understand adaptation during chronic infections," Institute for Genome Science, U. Maryland School of Medicine, Baltimore, MD, May 2015.
33. Session co-chair, NASA Astrobiology Conference "Survival: Exploring the Effects of Stress on Microbial Evolution Rates and Survival Strategies" Chicago, IL July 2015
34. "Why genome regions evolve at different rates: lessons from bacteria with multiple chromosomes" University of Pittsburgh-Carnegie Mellon Computational Biology Program, October 2015.
35. "Experimental evolution to understand adaptation in biofilms" 7th ASM Biofilm Conference, Chicago, IL October 2015.
36. "Experimental evolution to understand adaptation during infections." Department of Biology, Carnegie-Mellon University, October 2015.
37. Simons Foundation Workshop on Dynamics of Microbial Ecology and Evolution, New York, NY Nov 2015.

38. "Experimental evolution to understand adaptation in biofilms", MicroBiotec2015 Congress, Portuguese Societies of Microbiology and Biotechnology, Evora, Portugal, Dec 2015. Plenary Speaker.
39. "How do bacterial populations evolve when growing on surfaces?" Department of Biology, University of Pennsylvania, Feb 2016.
40. "Peering into the tangled bank of biofilms using experimental evolution." Department of Bacteriology Distinguished Lecture Series, University of Wisconsin, March 2016
41. "Forecasting evolution within chronic bacterial infections of the CF lung." Infectious Diseases Division, St. Jude's Research Institute, Memphis, TN Nov 2016.
42. "Evolutionary dynamics within biofilms, and the promise of predicting bacterial adaptations during chronic infections." Keynote Speaker, 25th Annual Philadelphia Infection and Immunity Forum, ASM Eastern PA branch student invitee. Drexel University, Dec 2016.
43. "Evolutionary dynamics within biofilms and in biofilm-associated infections." UNC Charlotte, Bioinformatics Department, Jan 2017
44. "Evolutionary genomics reveals selective forces within biofilms and during host-pathogen interactions." University of Oklahoma Health Sciences Campus, Department of Microbiology, Feb 2017
45. "Why mutation rates vary among organisms and within genomes." Duquesne University, Dept. of Biology, Feb 2017
46. "Evolutionary dynamics within biofilms and in biofilm-associated infections." Plymouth State University, March 2017

47. "Experimental evolution to reveal selective forces in bacterial biofilms and during infections." Microbiology Society General Meeting, Edinburgh, UK. April, 2017, invited plenary.
48. "Experimental evolution to reveal selective forces in bacterial biofilms and during infections" [plenary, student invitation], University of Minnesota, Department of Microbiology and Immunology, May 2017.
49. "Evolutionary dynamics within biofilms and in biofilm-associated infections". Departments of Biology and Chemistry, Wake Forest University, Sept 18, 2017
50. "Peering into the tangled bank of biofilms using experimental evolution." Department of Biology, Indiana University, October 20, 2017.
51. "Toward translational evolutionary biology using the lens of genomics." Division of Biology, Programs in EEB and MMI, Brown University, November 14, 2017.
52. "Toward translational evolutionary biology using the lens of genomics." Department of Ecology and Evolutionary Biology, University of Michigan, November 30, 2017.
53. "Toward translational evolutionary microbiology using the lens of genomics." Biology Department, Amherst College, Feb 12, 2018
54. "Why biofilm growth can generate fundamentally different dynamics and mechanisms of antimicrobial resistance," Harvard School of Public Health, ID Epidemiology Series, Feb 15, 2018
55. "How biofilm growth influences AMR evolution, and why some adaptations might be predictable," Ohio State University Department of Microbiology, March 2018.
56. "Toward translational evolutionary microbiology using the lens of genomics." Biodesign Institute, Arizona State University, April 9, 2018

57. "Toward translational evolutionary microbiology using the lens of genomics." Drexel University College of Medicine, April 26, 2018
58. "Why evolution in biofilms is different, and a few remarkable consequences." Biofilms8 conference, invited plenary, Aarhus, DK, May 30, 2018
59. "Forecasting adaptive evolution by opportunistic bacteria to drugs and hosts". Penn State University, CIDD, November 8 2018
60. "Watching bacterial evolution in real-time and its potential predictability." West Virginia University, Department of Biology, January 25, 2019
61. "EvolvingSTEM: a microbial evolution-in-action curriculum that improves learning of genetics and evolution." ASM Microbe, San Francisco, June 21, 2019
62. "EvolvingSTEM: a microbial evolution-in-action curriculum that improves learning of genetics and evolution." ASM CUE, McLean VA, August 2, 2019
63. "The roles of chance, history, and natural selection in the evolution of pathogenesis and antimicrobial resistance." Dept of Microbiology, University of Washington, Feb 11, 2020
64. *The roles of chance, history, and natural selection in the evolution of pathogenesis and antimicrobial resistance." Genetics Training Program, Student Plenary Speaker, University of California, San Diego, March 10, 2020
65. "Life in the crowd: how biofilms alter the evolution of antimicrobial resistance." Dept of Biology, Texas A&M University, September 1, 2020
66. "Why evolution in biofilms is different, and the adaptations that build slimy communities." University of Massachusetts-Dartmouth, October 9, 2020
67. "Life in the crowd: how biofilms alter the evolution of antimicrobial resistance." Department of Biology, SUNY Binghamton, Nov 6 2020.

68. "Evolutionary biology of SARS-CoV-2". Invited speaker, Biology Department, Middlebury College, April 16, 2021
69. "Evolutionary biology of SARS-CoV-2". "Contagion" invited speaker, Amherst College, May 7, 2021
70. "The role of biofilms in the evolution of antimicrobial resistance." American Society of Microbiology - Spain Microbiology Society joint symposium, May 10, 2021
71. "Biofilm-dependent evolutionary pathways to antibiotic resistance." ECCMID invited symposium, June 7, 2021 [online]
72. "Biofilm-dependent evolutionary pathways to AMR in *Acinetobacter baumannii* and *Pseudomonas aeruginosa*." BEAT-AMR Consortium, Federal Institute for Materials Research and Testing, Berlin, Germany, June 10, 2021 [online]
73. "Decoding evolution in action in classroom experiments that simulate infection, using breseq." ASM World Microbe Forum, workshop presentation, June 28, 2021 [online]
74. "The genetics of eco-evolutionary interactions in bacteria colonizing surfaces or causing infections". Dept of Biology, Emory University, student invited speaker. Oct 14, 2021
75. "The evolutionary biology of *Pseudomonas aeruginosa* during infections lasting days or years". Loyola University School of Medicine, November 18, 2021
76. "Evolutionary genetics of opportunistic bacteria in structured environments and hosts." NIH Microbiology Special Interest Group seminar series, Lambda lunch, April 6, 2022

Other research related activities

1. Founder and Director, EvolvingSTEM, a program for evolution-in-action in high school science classrooms, currently in 10 high schools involving 18 teachers and reaching more than 400 students/year. <http://EvolvingSTEM.org>.

2. NIH Genetic Variation and Evolution (GVE), ad hoc review
(2009-2011,2013,2014,2016,2019)
3. NIH special emphasis panels (4 different ZRG panels), and two for Microbiome research (2011-13).
4. NIH-NHGRI H3Africa study section, 2017.
5. Cystic Fibrosis Foundation, *ad hoc* review 2016
6. NASA Postdoctoral Fellowship program, ad hoc reviews 2014-16
7. Panelist, Department of Defense, Peer Reviewed Medical Research Program - Infectious Diseases, 2016
8. Panelist, Canadian Institutes of Health Research, 2016-17
9. NSF Panelist at DEB (2011,2012,2013).
10. Panelist, NIH Reservoirs of Antibiotic Resistance RFP (2006).
11. External Advisory Board, Seacoast School of Technology Biotechnology (Exeter, NH) program 2007-2014
12. Ad hoc reviewer for NSF, USDA, NASA, Kentucky Science & Engineering Foundation, Austrian Science Foundation, Portuguese Science Foundation, Innovation Canada, Canadian NSERC, NASA Astrobiology Program,
13. Associate Editor, *BMC Microbiology* 2013-18
14. Associate Editor, *Evolution*. 2017-20
15. Associate Editor, *Evolution, Medicine and Public Health*, 2018-
16. Associate Editor, *mBio*, 2019-
17. Associate Editor, *eLife*, 2020-

18. Guest associate editor, *PLoS Genetics*, *mBio* on multiple occasions.
19. *Ad Hoc* reviewer for *Applied & Environmental Microbiology*, *American Naturalist*, *Biology Letters*, *BMC Evolutionary Biology*, *BMC Microbiology*, *Cell*, *Current Biology*, *Ecology*, *Ecology Letters*, *Environmental Microbiology*, *Evolution*, *Genetics*, *Gen. Biol. Evol.*, *Infection*, *Genetics, and Evolution*, *ISME Journal*, *J. Bacteriology*, *J. Evolutionary Biology*, *J. Molecular Evolution*, *J. Phycologica*, *Molecular Microbiology*, *Molecular Biology and Evolution*, *Molecular Ecology*, *Microbiology*, *mBio*, *mSystems*, *Nature*, *Nature Microbiology*, *Nature Genetics*, *Nature Ecology and Evolution*, *PLoS Biology*, *PLoS Pathogens*, *PLoS Genetics*, *PLoS ONE*, *Proc. Roy. Soc. Lond. B.*, *PNAS*, *Q. Rev Biol*, *Science*, *Scientific Reports*.
20. Televised lecturer: “Darwin Meets the Hot Zone: Ecology and Emerging Infectious Disease,” Ann Arbor Public Library, Ann Arbor, MI 2003. Also: “[The Timing of Biological Evolution](#),” Saturday Morning Physics, Ann Arbor, MI, 2003
21. YouTube videos on SARS-CoV2 evolution, >15,000 unique views, https://www.youtube.com/channel/UCKeTd4BIYSudg3qmrta5LQ?view_as=subscriber

CURRENT RESEARCH INTERESTS:

We are broadly interested in the evolution of infectious disease and evolutionary processes in microbial populations. Major questions that motivate our research include:

1. How do microbes adaptively evolve when colonizing eukaryotic hosts, either as pathogens or symbionts? How does antimicrobial resistance evolve? Can we predict these dynamics and identify driver mechanisms to guide therapy?
2. How do bacteria evolve and form communities within biofilms, especially within infections? What does this teach us about nascent multicellularity?
3. How and why do ecological tradeoffs evolve?
4. Why do genome regions replicated at different times evolve at different rates?
5. Evolution is best taught by hands-on experimentation. How do we deliver this on a massive scale?

We have been developing methods for studying evolution in the laboratory for 20 years and has pioneered the study of long-term evolution in bacterial biofilms (Poltak and Cooper, ISMEJ 2011, Traverse et al., PNAS 2013, Flynn et al J Bact. 2016). We have led research to measure evolutionary forces acting on mutations (e.g. Flynn et al, PLoS Genetics, 2013, Dillon et al. 2016, 2018) and cost-effective, high-throughput sequencing methods (Dillon et al, Genetics 2015, Dillon et al MBE 2016, Turner et al 2018). More recently the lab has been studying similar dynamics in longitudinal clinical samples from various infections, including those affecting persons with cystic fibrosis (CF) (Silva et al. 2016, 2018). With the lab's move to the University of Pittsburgh School of Medicine in 2015, we embarked on new studies in clinically relevant systems, such as the evolution and systems biology of antibiotic resistance, the evolution of microbial communities during pulmonary infections of persons with cystic fibrosis, and even during acute infections, and the evolution of cancers as they become resistant to chemotherapy.

SERVICE and LEADERSHIP

University

At University of Pittsburgh, 2015-

1. Director and co-founder, Center for Evolutionary Medicine
2. Associate Director for Education and Outreach, Center for Microbiome and Medicine, Department of Medicine
3. Associate Director for Genome-Based Diagnostics, Center for Innovative Antimicrobial Therapy, Department of Medicine
4. Admissions Committee, Program in Microbiology and Immunology PhD program, 2017-present
5. Curriculum Committee, Integrative Systems Biology PhD program, 2017-present

Highlighted Service from University of New Hampshire, 2004-2015

1. Cross-college Ph.D. program in Molecular and Evolutionary Systems Biology, Chair of organizing committee 2011-14, Program Coordinator, 2014-.
2. COLSA Undergraduate Research Conference Committee (2005-). Chair, 2010-13.
3. Member of the COLSA Dean's Search Committee (2006-2007) and Genomics Search Committee (2013)
4. University Tuition Scholarship Selection Committee (2005-2008)
5. VP Research Research and Engagement program to train faculty seeking external support (2012-present)
6. Member of graduate admissions committees for Microbiology, Genetics, and/or MESB, 2005-2015

7. Microbiology Graduate Coordinator (2006-2008). Coordinate application review and assist in assigning assistantships.
8. Microbiology Seminar Series Coordinator (2005-2007, 2008-9)
9. Member of the Proteomics Search Committee (2007-2008).
10. Member of the Vision and Planning Committee for the new Dept. of Cellular, Molecular, and Biomedical Sciences (2008)
11. Committee for College of Life Sciences and Agriculture reorganization and development of new Genetics curriculum (2007-2011)

National / International

1. Associate Curator, COVID-19 Research Registry, American Society of Microbiology, 2020-
2. Board of Directors, American Society of Microbiology, 2019-
3. Chair of the Council on Microbial Sciences (COMS), American Society of Microbiology, 2018-19
4. Division R (Evolutionary and Genomic Microbiology) Representative, COMS, American Society of Microbiology, 2018-21
5. Vice Chair, Gordon Research Conference on Microbial Population Biology, 2019. Co-Chair, 2021
6. Program Committee and co-founder, ASM Conference on Experimental Microbial Evolution, 2014-2016

Community activities and Outreach

1. Director of EvolvingSTEM curriculum at Peters Township High School in Greater Pittsburgh, PA. Our curriculum is now offered at 7 schools in PA, NH, and MT, reaching >1000 students and involving 14 teachers per year.
2. Biannual Panelist for our EvolvingSTEM program and Member, New Hampshire Science Teachers Association
3. External Advisory Board, Seacoast School of Technology Biotechnology (Exeter, NH) program 2007-2015
4. Panelist, BioConnectNH (<http://bioconnectnh.org>) high school student symposium, March, 2008
5. Faculty Mentor for Research and Engineering Apprenticeship Program, which encourages economically and socially disadvantaged high school students to pursue careers in math, science, and technology through hands-on experience in research and development (2005-2013)
6. Faculty Mentor for the McNair Program, a graduate school preparation program for underrepresented undergraduates and for undergraduate students in the UNH UROP and SURF programs (2011-2015)