

Curriculum Vitae

Kenneth C. Keiler

Department of Biochemistry and Molecular Biology
The Pennsylvania State University
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Education and Training

DOE-EnergyBiosciences Research Fellow of the Life Sciences Research Foundation,
Stanford University Medical School (1997-2002)

Research Advisor: Professor Lucy Shapiro

Human Frontier Science Program Long-Term Fellow, Institut de Genetique et de Biologie
Moleculaire et Cellulaire, Illkirch, France (1996-1997)

Research Advisors: Professor Pierre Chambon and Professor Dino Moras

Ph.D. in Biology, Massachusetts Institute of Technology (1995)

Research Advisor: Professor Robert Sauer

M. S. in Biology, Stanford University (1989)

Research Advisor: Professor Teresa Wang

B.S. in Chemistry and Biology (honors and distinction), Stanford University (1989)

Positions and Employment

The Pennsylvania State University, Dept. of Biochemistry & Molecular Biology
Professor of Biochemistry & Molecular Biology (2015 – present)

The Pennsylvania State University, Dept. of Biochemistry & Molecular Biology
Associate Professor of Biochemistry & Molecular Biology (2008 – 2015)

The Pennsylvania State University, Dept. of Biochemistry & Molecular Biology
Assistant Professor of Biochemistry & Molecular Biology (2002 – 2008)

Stanford University, Department of Developmental Biology
Postdoctoral Fellow of the Life Sciences Research Foundation (1997 – 2002)

Institut de Genetique et de Biologie Moleculaire et Cellulaire, Illkirch, France
Human Frontier Science Program Long-Term Fellow (1996 – 1997)

Honors and Awards

Fellow, American Academy of Microbiology, 2018 – present

Tombros Faculty Fellowship, Penn State University, 2012-2013

Tershak Teaching Award, Penn State University, 2014

C. I. Noll Award for Teaching Excellence, Eberly College of Science and Eberly College
of Science Alumni Society, 2015

RESEARCH INFORMATION

Professional Societies

American Association for the Advancement of Science (1991 – present)
Sigma Xi (1996 – present)
American Society for Microbiology (1998 – present)
RNA Society (2003 – present)
Protein Society (2007 – present)

Editorial Responsibilities

Editorial Board Member, Future Medicinal Chemistry, 2009-2010
Editor, Methods in Molecular Biology, 2012
Editorial Board Member, Cell and Developmental Biology, 2012-2013
Associate Editor, Frontiers in Microbiology, 2013-2015

Current Faculty Appointments at The Pennsylvania State University

Professor of Biochemistry & Molecular Biology (2015 – present)
Huck Institutes of the Life Sciences Faculty (2002 – present)
Biochemistry, Microbiology, and Molecular Biology Graduate Faculty (2002 – present)
Penn State College of Medicine M.D./Ph.D. Faculty (2007 – present)

Publications

Peer-reviewed Research Papers

30. Alumasa JN, Goralski TDP, Keiler KC (2017) “Tetrazole-Based trans-Translation Inhibitors Kill Bacillus anthracis Spores to Protect Host Cells.” **Antimicrobial Agents & Chemotherapy** **61**: pii: AAC.01199-17. doi: 10.1128/AAC.01199-17.
29. Alumasa JN, Manzanillo PS, Peterson ND, Lundrigan T, Baughn AD, Cox JS, Keiler KC (2017) “Ribosome Rescue Inhibitors Kill Actively Growing and Nonreplicating Persister Mycobacterium tuberculosis Cells.” **ACS Infectious Diseases** **3**:634-644.
28. Dillon NA, Peterson ND, Feaga HA, Keiler KC, Baughn AD (2017) “Anti-tubercular Activity of Pyrazinamide is Independent of trans-Translation and RpsA.” **Scientific Reports** **7**:6135.
27. Keiler KC, Jackson KL, Jaworski L, Lopatto D, Ades SE (2017) “Teaching broader impacts of science with undergraduate research.” **PLoS Biology** **15**: e2001218.
26. Feaga HA, Quickel MD, Hankey-Giblin PA, Keiler KC (2016) “Human cells require non-stop ribosome rescue activity in mitochondria.” **PLoS Genetics** **12**: e1005964.
25. Goralski TD, Dewan KK, Alumasa JN, Avanzato V, Place DE, Markley RL, Katkere B, Rabadi SM, Bakshi CS, Keiler KC, Kirimanjeswara GS (2016) “Inhibitors of ribosome rescue arrest growth of *Francisella tularensis* at all stages of intracellular replication.” **Antimicrobial Agents and Chemotherapy** **60**: 3276-3282.

24. El-Mowafi SA, Sineva E, Alumasa JN, Nicoloff H, Tomsho JW, Ades SE, Keiler KC (2015) "Identification of inhibitors of a bacterial sigma factor using a new high-throughput screening assay." **Antimicrobial Agents and Chemotherapy** **59**: 193-205.
23. Feaga HA, Viollier PH, Keiler KC (2014) "Release of non-stop ribosomes is essential." **mBio** **5**: e01916.
22. El-Mowafi SA, Alumasa JN, Ades SE, Keiler KC (2014) "A cell-based assay to identify inhibitors of the Hfq-sRNA regulatory pathway." **Antimicrobial Agents and Chemotherapy** **58**: 5500-5509.
21. Ramadoss NS, Alumasa JN, Cheng L, Wang Y, Li S, Chambers BS, Chang H, Chatterjee AK, Brinker A, Engels IH, Keiler KC (2013) "Small molecule inhibitors of *trans*-translation have broad-spectrum antibiotic activity." **Proceedings of the National Academy of Sciences U S A**, **110**: 10282-10287.
20. Ramadoss NS, Zhou X, Keiler KC (2013) "tmRNA is essential in *Shigella flexneri*." **PLoS ONE** **8**: e57537.
19. McGillivray SM, Tran DN, Ramadoss NS, Alumasa JN, Okumura CY, Sakoulas G, Vaughn MM, Zhang DX, Keiler KC, Nizet V (2012) "Pharmacological inhibition of the ClpXP protease increases bacterial susceptibility to host cathelicidin antimicrobial peptides and cell-envelope active antibiotics." **Antimicrobial Agents and Chemotherapy** **56**: 1854-1861.
18. Hughes HV, Huitema E, Pritchard S, Keiler KC, Brun YV, Viollier PH (2010) "Protein localization and dynamics within a bacterial organelle." **Proceedings of the National Academy of Sciences U S A** **107**: 5599-5604.
17. Russell JH, Keiler KC (2009) "Subcellular localization of a bacterial regulatory RNA." **Proceedings of the National Academy of Sciences U S A** **106**: 16405-16409.
16. Cheng L, Keiler KC (2009) "Correct timing of *dnaA* transcription and initiation of DNA replication requires *trans*-translation." **Journal of Bacteriology** **191**: 4268-4275.
15. Russell JH, Keiler KC (2008) "Screen for localized proteins in *C. crescentus*." **PLoS ONE** **3**: e1756.
14. Russell JH, Keiler KC (2007) "Peptide signals encode protein localization." **Journal of Bacteriology** **189**: 7581-7585.
13. Hong S-J, Lessner FH, Mahen EM, Keiler KC (2007) "Proteomic identification of tmRNA substrates." **Proceedings of the National Academy of Sciences U S A** **104**: 17128-17133.
12. Cheng L, Naumann TA, Horswill AR, Hong S-J, Venters BJ, Tomsho JW, Benkovic SJ, Keiler KC (2007) "Discovery of antibacterial cyclic peptides that inhibit the ClpXP protease." **Protein Science** **16**: 1535-1542.
11. Lessner FH, Venters BJ, Keiler KC (2007) "Proteolytic adaptor for tmRNA-

- tagged proteins from α -proteobacteria." **Journal of Bacteriology** **189**: 272-275.
10. Hong S-J, Tran Q-A, Keiler KC (2005) "Cell cycle-regulated degradation of tmRNA is controlled by RNase R and SmpB." **Molecular Microbiology** **57**: 565-575.
 9. Keiler KC, Shapiro L (2003) "tmRNA in *Caulobacter crescentus* is cell cycle regulated by temporally controlled transcription and RNA degradation." **Journal of Bacteriology** **185**: 1825-1830.
 8. Keiler KC, Shapiro L (2003) "tmRNA is required for correct timing of DNA replication in *Caulobacter crescentus*." **Journal of Bacteriology** **185**: 573-580.
 7. Keiler KC, Shapiro L (2001). "Conserved promoter motif is required for cell cycle timing of dnaX transcription in *Caulobacter*." **Journal of Bacteriology** **183**: 4860-4865.
 6. Keiler KC, Shapiro L, Williams KP (2000) "tmRNAs that encode proteolysis-inducing tags are found in all known bacterial genomes: A two-piece tmRNA functions in *Caulobacter*." **Proceedings of the National Academy of Sciences U S A** **97**: 7778-7783.
 5. Keiler KC, Waller PR, Sauer RT (1996) "Role of a peptide tagging system in degradation of proteins synthesized from damaged messenger RNA." **Science** **271**: 990-993.
 4. Keiler KC, Sauer RT (1996) "Sequence determinants of C-terminal substrate recognition by the Tsp protease." **Journal of Biological Chemistry** **271**: 2589-2593.
 3. Keiler KC, Sauer RT (1995) "Identification of active site residues of the Tsp protease." **Journal of Biological Chemistry** **270**: 28864-28868.
 2. Keiler KC, Silber KR, Downard KM, Papayannopoulos IA, Biemann K, Sauer RT (1995) "C-terminal specific protein degradation: activity and substrate specificity of the Tsp protease." **Protein Science** **4**: 1507-1515.
 1. Silber KR, Keiler KC, Sauer RT (1992) "Tsp: a tail-specific protease that selectively degrades proteins with nonpolar C termini." **Proceedings of the National Academy of Sciences U S A** **89**: 295-299.

Reviews and Book Chapters

18. Alumasa JN and Keiler KC (2015) "Clicking on trans-translation drug targets." **Frontiers in Microbiology** **6**: 498.
17. Keiler KC (2015) "Mechanisms of ribosome rescue in bacteria." **Nature Reviews Microbiology** **13**: 285-297.
16. Keiler KC, Feaga HA (2014) "Releasing nonstop translation complexes is a matter of life and death." **Journal of Bacteriology** **196**: 2123-2130.
15. Keiler KC, Alumasa JN (2013) "The potential of *trans*-translation inhibitors as

- antibiotics.” **Future Microbiology** **8**: 1235-1237.
14. Russell JH, Keiler KC (2012) “RNA visualization in bacteria by fluorescence in situ hybridization.” *In* Keiler KC (ed.) **Bacterial Regulatory RNA**, Springer, New York, NY. 87-95.
 13. Keiler KC (2012) “Tsp protease.” *In* Rawlings N, Salvesen G (eds.) **Handbook of Proteolytic Enzymes, 3rd Edition**, Elsevier, Oxford, UK.
 12. Keiler KC (2011) “Localization of the bacterial RNA infrastructure.” **Advances in Experimental Medicine and Biology** **722**: 231-238.
 11. Keiler KC (2011) “RNA localization in bacteria.” **Current Opinion in Microbiology** **14**: 155-159.
 10. Keiler KC, Ramadoss NS (2011) “Bifunctional transfer-messenger RNA.” **Biochimie** **93**: 1993-1997.
 9. Keiler KC, Browder KB (2011) “RNA Localization in Bacteria.” **SciTopics**, Elsevier: www.scitopics.com/RNA_Localization_in_Bacteria.html.
 8. Hayes CS, Keiler KC (2010) “Beyond ribosome rescue: tmRNA and co-translational processes.” **FEBS Letters** **584**: 413-419.
 7. Keiler KC, Lee DM (2009) “*trans*-Translation.” *In* Atkins JF, Gesteland RF (eds.) **Recoding: Expansion of Decoding Rules Enriches Gene Expression**, Springer, New York.
 6. Keiler KC (2008) “tmRNA (SsrA) and *trans*-Translation.” **SciTopics**, Elsevier: www.scitopics.com/tmRNA_SsrA_and_trans_translation.html.
 5. Keiler KC (2008) “Biology of *trans*-translation.” **Annual Review of Microbiology** **62**: 133-151.
 4. Keiler KC (2007) “Physiology of tmRNA: what gets tagged and why?” **Current Opinion in Microbiology** **10**: 169-175.
 3. Keiler KC, Sauer RT (2004) “Tail-Specific Protease.” *In* Barrett AJ, Rawlings ND, Woessner JF (eds.) **Handbook of Proteolytic Enzymes**, Second Edition, Academic Press, San Diego.
 2. Keiler KC, Sauer RT (2000) “Tsp and other tail-specific proteases.” *In* Dalbey RE, Sigman DS (eds.) **The Enzymes**, Third Edition, vol. XXII. Academic Press, San Diego.
 1. Keiler KC, Sauer RT (1998) “Tsp Protease.” *In* Barrett AJ, Woessner JF, and Rawlings ND (eds.) **Handbook of Proteolytic Enzymes**, First Edition, Academic Press, San Diego.

Patents

1. “Antibacterial and Plasmid Elimination Agents.” KC Keiler and SJ Benkovic (filed 2006) U. S. Patent Application 11/758,995; US20110288008, WO2008054881 (issued).

Patents (cont.)

2. "Reporter Molecules." KC Keiler (filed 2007). U. S. Patent Application 12/111,096 (pending).
3. "Identification of inhibitors of a bacterial stress response." SE Ades and KC Keiler (filed 2010) U. S. Patent Application 13/328,447; US20120157375; WO2012083226A1 (issued).
4. "F2 derivatives as antibacterial agents." KC Keiler and JN Alumasa (filed 2012) U. S. Patent Application 13/833,976; US8,975,288; WO2103154793 (issued).

Active Research Support

Sponsor: **National Institutes of Health, NIGMS R01 GM121650**
Title: Physiology of Ribosome Rescue in Bacteria
Budgeted Effort: 25%
Dates of Funding: 7/17 – 4/21
P.I.: Kenneth Keiler
Co-P.I.: Christine Dunham, Julia Bindow

Sponsor: **National Institutes of Health, NIAID R01 AI132276**
Title: Oxadiazole Inhibitors of Non-Stop Ribosome Rescue to Treat MDR
Neisseria gonorrhoeae
Budgeted Effort: 10%
Dates of Funding: 8/17 – 7/22
P.I.: Zachary Aron (Microbiotix, Inc.)
Co-P.I.: Kenneth Keiler, Ann Jerse

Sponsor: **Huck Institutes Health & Environment Seed Grant Program**
Title: Drug-Loaded Antimicrobial Nanogels for Combinatorial Therapy of Antibiotic-Resistant Tuberculosis
Budgeted Effort: 1%
Dates of Funding: 7/17 – 6/18
P.I.: Scott Medina (Penn State)
Co-P.I.: Kenneth Keiler

Completed Research Support

Sponsor: **National Institutes of Health, NIAID R43 AI113993**
Title: Inhibitors of trans-Translation
Budgeted Effort: 5%
Dates of Funding: 9/14 – 8/17
P.I.: Zachary Aron (Microbiotix, Inc.)
Co-P.I.: Kenneth Keiler

Sponsor: **TB Alliance**
Title: TB-active Inhibitors of trans-Translation

Budgeted Effort: 1%
Dates of Funding: 9/14 – 7/17
P.I.: Kenneth Keiler

Sponsor: **Clinical and Translational Science Institute, Penn State University**
Title: Nanojacket Delivery of Novel Antibiotics
Budgeted Effort: none
Dates of Funding: 11/15 – 5/17
P.I.: Kenneth Keiler
Co-P.I.s: James Adair, Girish Kirimanjeswara, Jay Raman

Sponsor: **National Institutes of Health, NIAID R21/R33 AI111692**
Title: Validation and Development of trans-Translation as a Drug Target for MRSA
Budgeted Effort: 10%
Dates of Funding: 4/14 – 3/17
P.I.: Kenneth Keiler
Co-P.I.s: George Sakoulas (UCSD), Shauna McGillivray (TCU)

Sponsor: **National Institutes of Health, NIGMS R01 GM068720**
Title: The Role of tmRNA in Development of *C. crescentus*
Budgeted Effort: 33%
Dates of Funding: 5/04 – 4/16
P.I.: Kenneth C. Keiler

Sponsor: **National Institutes of Health, NINDS R21 NS071542**
Title: Assay development for inhibitors of the essential sRNA-sigma E virulence factors.
Budgeted Effort: 8.3%
Dates of Funding: 9/10 – 8/12
P.I.: Sarah Ades
Co-P.I.: Kenneth Keiler

Sponsor: **National Science Foundation**
Title: Acquisition of High-Throughput Calorimeters for Ligand-Biopolymer Discovery and Characterization
Budgeted Effort: none
Dates of Funding: 9/09 – 8/12
P.I.: Philip Bevilacqua
Co-P.I.s: Kenneth Keiler, Sarah Assmann, Mary Beth Williams, Scott Showalter

Sponsor: **Clinical and Translational Science Institute, Penn State University**
Title: Chemical Microbiology Tools for Development of Antibiotics Against Multiple Drug-Resistant Organisms
Budgeted Effort: none
Dates of Funding: 9/09 – 8/11
P.I.: Kenneth Keiler

Co-P.I.s: Sarah Ades, Stephen Benkovic, Squire Booker

Sponsor: **Defense Threat Reduction Agency (DTRA), W911NF-06-1-0144**
Title: Selection of tmRNA Inhibitors as Antibacterial and Plasmid Elimination Agents.
Budgeted Effort: 30%
Dates of Funding: 5/06 – 4/09
P.I.: Kenneth Keiler
Co-P.I.: Stephen Benkovic

Sponsor: **Genomics Institute of the Novartis Research Foundation**
Title: Inhibitors of the tmRNA pathway in bacteria.
Total Award: HTS screening
Dates of Funding: 10/06 – 12/08
P.I.: Kenneth Keiler

Sponsor: **Huck Institutes of the Life Sciences, Penn State University**
Title: Development of Cyclic Peptide Antibiotics Targeted Against a Conserved Bacterial RNA.
Dates of Funding: 5/03 – 4/05
P.I.: Kenneth Keiler

Invited Talks

Talks at International Meetings

1. “Control of DNA replication in *Caulobacter*” West Coast Bacterial Physiologists Conference, Asilomar, CA. December 4, 1998.
2. “Spatial and temporal regulation of DNA replication during a bacterial cell cycle” Gordon Research Conference on Plasmid and Chromosome Dynamics, New London, NH. August 5, 1999
3. “Mechanisms of protein localization in bacteria” West Coast Bacterial Physiologists Conference, Asilomar, CA. December 11, 1999.
4. “Protein localization in *Caulobacter*” Molecular Genetics of Bacteria and Phages, Cold Spring Harbor, NY. August 18, 2000.
5. “Regulation of the *Caulobacter* cell cycle by SsrA RNA” West Coast Bacterial Physiologists Conference, Asilomar, CA. December 15, 2001.
6. “A cell-cycle regulated small RNA is required for the control of bacterial cell cycle progression” Caulobacter Meeting, Lac Delage, Quebec. July 8, 2002.
7. “Control of DNA replication factors by tmRNA” Molecular Genetics of Bacteria and Phages, Madison, WI. August 8, 2003.
8. “Regulation of gene expression by tmRNA” ASM General Meeting, New Orleans, LA. May 24, 2004.
9. “A small RNA regulates initiation of DNA replication in *Caulobacter crescentus*” Caulobacter Meeting, Vancouver, BC. July 11, 2005.

10. “Endogenous substrates for the tmRNA protein-tagging pathway” Molecular Genetics of Bacteria and Phages, Madison, WI. August 4, 2005.
11. “Determinants of tmRNA-mediated protein tagging” American Society for Microbiology General Meeting, Orlando, FL. May 21, 2006.
12. “Sculpting the proteome with *trans*-translation” Gordon Research Conference on Microbial Stress Response, West Hadley, MA. July 9, 2006.
13. “Genetic analysis of *trans*-translation” Molecular Genetics of Bacteria and Phages, Cold Spring Harbor, NY. August 22, 2006.
14. “Spatial and temporal control of tmRNA through development” Molecular Genetics of Bacteria and Phages, Madison, WI. August 10, 2007.
15. “Temporal and spatial regulation of *trans*-translation.” Gordon Research Conference on Microbial Stress, West Hadley, MA. July 8, 2008.
16. “Small molecule inhibitors of *trans*-translation kill *Shigella flexneri* and other pathogens.” Molecular Genetics of Bacteria and Phages, Madison, WI. August 6, 2009.
17. “Regulation of *Caulobacter* development by *trans*-translation.” ASBMB Annual Meeting, Washington, D. C. April 10, 2011.
18. “*trans*-Translation: SsrA, SmpB, EF-Tu, RpsA, and PZA.” Demystifying Pyrazinamide—Challenges and Opportunities, NIAID Workshop, September 5, 2012.
19. “The Achilles’ heel of bacterial gene expression.” Molecular Genetics of Bacteria and Phages, Madison, WI. August 6, 2013.
20. “Nonstop death in *Caulobacter crescentus*.” Stalked Bacteria and Relatives: From Genes to Structure (EMBO Conference), Marburg, Germany, April 2, 2014.
21. “Recoding by *trans*-translation.” Recoding and Other Forms of Alternative Reading of the Genetic Code (EMBO Conference), Killarney, Ireland, May 15, 2014.
22. “Nonstop translation can kill bacteria.” Gordon Research Conference: Microbial Stress Response, South Hadley, MA, July 27, 2014.
23. “*trans*-Translation as a target for novel antibiotics.” ASBMB Annual Meeting, San Diego, CA, April 5, 2016.
24. “Recognizing and rescuing non-stop ribosomes.” Molecular Genetics of Bacteria and Phages, Madison, WI. August 9, 2016.
25. “Ribosome rescue in diverse bacteria.” Molecular Genetics of Bacteria and Phages, Madison, WI. August 9, 2017.

Talks at Universities, Research Institutes, and Companies

1. Texas A&M University College Station, TX. “A stable RNA regulates cell cycle progression.” January 16, 2001.

2. Northwestern University, Evanston, IL. "A stable RNA regulates cell cycle progression." January 25, 2001.
3. Brandeis University, Waltham, MA. "A stable RNA regulates cell cycle progression." February 6, 2001.
4. Yale University, New Haven, CT. "A stable RNA regulates cell cycle progression." February 8, 2001.
5. Washington University, St. Louis, MO. "A stable RNA regulates cell cycle progression." February 14, 2001.
6. Pennsylvania State University, University Park, PA. "tmRNA coordinates cell cycle processes in bacteria." September 19, 2001.
7. National Institutes of Health, Bethesda, MD. "tmRNA coordinates cell cycle processes in bacteria." September 21, 2001.
8. Johns Hopkins Medical School, Baltimore, MD. "tmRNA coordinates cell cycle processes in bacteria." September 25, 2001.
9. Gettysburg College, Gettysburg, PA. "Control of protein production by a small RNA." October 29, 2003.
10. National Institutes of Health, Bethesda, MD. "Regulation of DNA replication factors by tmRNA." September 23, 2004.
11. Pennsylvania State University, University Park, PA. "tmRNA: a small RNA that makes the ribosome jump." January 4, 2006.
12. Syracuse University, Syracuse, NY. "tmRNA: a small RNA that makes the ribosome jump." April 4, 2006.
13. Scripps Research Institute/Genomics Institute of the Novartis Research Foundation, La Jolla, CA. "tmRNA- jumping ribosomes and discontinuous translation in bacteria." July 17, 2006.
14. Case Western Reserve University, Cleveland, OH. "Peptide signals for protein degradation and localization." October 5, 2006.
15. University of Wisconsin, Madison, WI. "Peptide signals for protein destruction and localization in bacteria." April 19, 2007.
16. Pennsylvania State College of Medicine, Hershey, PA. "Jumping ribosomes, discontinuous translation, and novel antibiotics." April 30, 2007.
17. Pennsylvania State College of Medicine, Hershey, PA. "Peptide signals for protein destruction and localization." October 15, 2007.
18. University of Illinois, Urbana, IL. "Peptide signals for protein destruction and localization." November 8, 2007.
19. University of Alabama, Birmingham, Birmingham, AL. "Peptide signals for protein destruction and localization." January 22, 2008.

20. Ohio State University, Columbus, OH. “Temporal and spatial control of tmRNA and *trans*-translation.” April 2, 2008.
21. Massachusetts Institute of Technology, Cambridge, MA. “Random paths to many specific locations.” July 12, 2008.
22. University of Massachusetts Medical School, Worcester, MA. “Jumping ribosomes, discontinuous translation, and novel antibiotics.” January 21, 2009.
23. University of California, Santa Barbara, Santa Barbara, CA. “Peptide signals for protein localization and destruction.” April 9, 2009.
24. Pennsylvania State Medical School, Hershey, PA. “Antibiotics and adjuvants targeted to bacterial RNAs.” March 1, 2011.
25. Achaogen, South San Francisco, CA. “tmRNA pathway inhibitors are new antibiotics and adjuvants.” November 10, 2011.
26. GlaxoSmithKline, Research Triangle Park, NC. “tmRNA pathway inhibitors are new antibiotics and adjuvants.” December 1, 2011.
27. Global Alliance for TB Drug Development (TB Alliance), New York, NY. “*trans*-Translation pathway inhibitors are new antibiotics and adjuvants.” December 12, 2011.
28. University of Geneva, Geneva, Switzerland. “Attacking bacterial quality-control systems.” October 8, 2012.
29. University of Minnesota, Minneapolis, MN. “Attacking the Achilles’ heel of bacterial gene expression.” October 28, 2013.
30. University of Central Florida, Orlando, FL. “Attacking the Achilles’ heel of bacterial gene expression.” November 1, 2013.
31. Johns Hopkins University, Baltimore, MD. “Attacking the Achilles’ heel of bacterial gene expression.” April 24, 2014.
32. de Duve Institute, Brussels, Belgium. “*trans*-Translation and alternative ribosome release mechanisms.” December 3, 2014.
33. Ruhr-Universität, Bochum, Germany. “*trans*-Translation and antibiotic development.” December 4, 2014.
34. University of Rochester, Rochester, NY. “The power of academic/industry/nonprofit collaboration.” April 3, 2015.
35. Brown University, Providence, RI. “Targeting the Achilles’ heel of bacterial protein synthesis.” May 19, 2015.
36. Microbiotix, Worcester, MA. “Oxadiazole inhibitors of *trans*-translation bind a unique site on the ribosome.” September 30, 2015.
37. National Institutes of Health, Bethesda, MD. “From non-stop ribosomes to new antibiotics and back again.” October 28, 2015.

38. University of Massachusetts, Amherst, MA. "From non-stop ribosomes to new antibiotics and back again." November 3, 2015.
39. St. Jude's Children's Hospital, Memphis TN. "Targeting a non-stop challenge in bacteria and mitochondria." July 8, 2016.
40. Microbiotix, Worcester, MA. "Oxadiazole inhibitors of *trans*-translation: an update." July 22, 2016.
41. Uniformed Services University, Bethesda, MD. "Targeting a non-stop challenge in bacteria." October 2, 2017.

TEACHING AND MENTORING INFORMATION

Funding for Teaching

Honors Course Development Grant, Schreyer's Honors College (2009-2010).

This grant provided funds to develop BMB 498A Antibiotics: Development and Resistance.

Tombros Faculty Fellowship (2012-2013).

This is the most prestigious education fellowship offered by the College of Science at Penn State. Funding was provided for career development activities, expansion of BMB 488 Communities of Practice, and development of Micrb 202-IQB Inquiry Based Microbiology Laboratory.

Teaching Seminars Presented

"Integrating Research into the Undergraduate Curriculum" Center for Excellence in Science Education, Penn State University, April 23, 2013.

"Integrating Research into the Undergraduate Curriculum" Department of Biochemistry & Molecular Biology, Penn State University, April 8, 2014.

"Workshop on Communities of Practice in BMB" Department of Biochemistry & Molecular Biology, Penn State University, April 15, 2014.

Professional Teaching Development

ASM Conference for Undergraduate Education meeting, San Mateo, CA, May 11-13, 2012.

Schreyer Institute for Teaching Excellence Assessment Workshop "Summarizing, Understanding, and Using Assessment Evidence to Improve Student Learning" (selected by Dean of Science), January 31, 2013.

College of Science Academic Leadership Forum, May 6, 2013.

Freshman Research Initiative Conference, Austin, TX (representative of Penn State), May 8-10, 2013.

Courses Developed

Prokaryotic Development (BMMB 597D) – graduate level microbiology course designed as a combination of lectures, critical literature analysis, and group projects.

Current Literature in Molecular Microbiology (BMMB 510) – graduate level course on critical analysis of primary literature.

Antibiotics: Development and Resistance (BMB 498A) – undergraduate seminar that integrates classroom learning and primary research experience – an Honors Course Development Grant from the Schreyer’s Honors College was awarded to support development of this course.

Communities of Practice in Biochemistry and Molecular Biology (BMB 488) – an expanded and generalized version of BMB 498A designed to be adaptable to a wide variety of research areas in biochemistry and molecular biology. This course was developed as part of a Fellowship in the Center for Excellence in Scientific Education.

Introductory Microbiology Laboratory: Inquiry Based Lab (MICRB 202) – undergraduate laboratory course designed to teach students to ask and answer interesting scientific questions. This course was developed as part of a Tombros Faculty Fellowship.

Courses Taught

- Fall 2002 Prokaryotic Development (BMMB 597D) – graduate level lecture course
Primary Instructor (15 hours)
- Fall 2003 Prokaryotic Development (BMMB 597D) – graduate level lecture course
Primary Instructor (15 hours)
- Spring 2004 Graduate Microbial Biology (BMMB 597C) – graduate level lecture course
Course Coordinator & Primary Instructor (75 hours)
- Fall 2004 Prokaryotic Development (BMMB 597D) – graduate level lecture course
Primary Instructor (22.5 hours)
- Current Literature in Molecular Microbiology (BMMB 510) – graduate
level seminar
Primary Instructor (15 hours)
- Spring 2005 Graduate Microbial Biology (BMMB 597C) – graduate level lecture course
Primary Instructor (8 hours)
- Current Literature in Molecular Microbiology (BMMB 510) – graduate
level seminar
Primary Instructor (15 hours)
- Fall 2005 Microbial Molecular Genetics (BMB/MICRB 450) – undergraduate lecture
course
Primary Instructor (30 hours)
- Current Literature in Molecular Microbiology (BMMB 510) – graduate

- level seminar
Primary Instructor (15 hours)
- Spring 2006 Graduate Microbial Biology (BMMB 597C) – graduate level lecture course
Primary Instructor (4 hours)
- Current Literature in Molecular Microbiology (BMMB 510) – graduate level seminar
Primary Instructor (15 hours)
- Fall 2006 Microbial Molecular Genetics (BMB/MICRB 450) – undergraduate lecture course
Primary Instructor (30 hours)
- Current Literature in Molecular Microbiology (BMMB 510) – graduate level seminar
Primary Instructor (15 hours)
- Spring 2007 Graduate Microbial Biology (BMMB 597C) – graduate level lecture course
Primary Instructor (4 hours)
- Current Literature in Molecular Microbiology (BMMB 510) – graduate level seminar
Primary Instructor (15 hours)
- Fall 2007 Microbial Molecular Genetics (BMB/MICRB 450) – undergraduate lecture course
Primary Instructor (30 hours)
- Genetic Model Systems (GENET 597A) – graduate lecture course
Instructor (4 hours)
- Current Literature in Molecular Microbiology (BMMB 510) – graduate level seminar
Primary Instructor (15 hours)
- Spring 2008 Current Literature in Molecular Microbiology (BMMB 510) – graduate level seminar
Primary Instructor (15 hours)
- Fall 2008 Core Concepts in Biochemistry, Microbiology, and Molecular Biology (BMMB 501) – graduate level lecture course
Co-Instructor (15 hours)
- Microbial Molecular Genetics (BMB/MICRB 450) – undergraduate lecture course
Primary Instructor (30 hours)
- Current Literature in Molecular Microbiology (BMMB 510) – graduate level seminar
Primary Instructor (15 hours)

- Spring 2009 Antibiotics: Development and Resistance (BMB 498A) – undergraduate seminar course
Primary Instructor (15 hours)
Current Literature in Molecular Microbiology (BMMB 510) – graduate level seminar
Primary Instructor (15 hours)
- Fall 2009 Microbial Molecular Genetics (BMB/MICRB 450) – undergraduate lecture course
Primary Instructor (30 hours)
Antibiotics: Development and Resistance (BMB 498A) – undergraduate seminar course
Primary Instructor (15 hours)
Current Literature in Molecular Microbiology (BMMB 510) – graduate level seminar
Primary Instructor (15 hours)
- Spring 2010 Antibiotics: Development and Resistance (BMB 498A) – undergraduate seminar course
Primary Instructor (15 hours)
- Fall 2010 Microbial Molecular Genetics (BMB/MICRB 450) – undergraduate lecture course
Primary Instructor (30 hours)
Antibiotics: Development and Resistance (BMB 498A) – undergraduate seminar course
Primary Instructor (15 hours)
- Spring 2011 Antibiotics: Development and Resistance (BMB 498A) – undergraduate seminar course
Primary Instructor (15 hours)
- Spring 2012 Antibiotics: Development and Resistance (BMB 498A) – undergraduate seminar course
Primary Instructor (30 hours)
- Fall 2012 Introductory Microbiology Laboratory – Inquiry-based (MICRB 202) – undergraduate laboratory course
Primary Instructor (60 hours)
Antibiotics: Development and Resistance (BMB 498A) – undergraduate seminar course
Primary Instructor (15 hours)
- Spring 2013 Introductory Microbiology Laboratory – Inquiry-based (MICRB 202) – undergraduate laboratory course

- Primary Instructor (60 hours)
Antibiotics: Development and Resistance (BMB 488) – undergraduate seminar course
Primary Instructor (15 hours)
- Fall 2013 Antibiotics: Development and Resistance (BMB 488) – undergraduate seminar course
Primary Instructor (15 hours)
- Spring 2014 Introductory Microbiology Laboratory – Inquiry-based (MICRB 202) – undergraduate laboratory course
Primary Instructor (60 hours)
Antibiotics: Development and Resistance (BMB 488) – undergraduate seminar course
Primary Instructor (15 hours)
- Fall 2014 Antibiotics: Development and Resistance (BMB 488) – undergraduate seminar course
Primary Instructor (15 hours)
- Spring 2014 Introductory Microbiology Laboratory – Inquiry-based (MICRB 202) – undergraduate laboratory course
Primary Instructor (60 hours)
Antibiotics: Development and Resistance (BMB 488) – undergraduate seminar course
Primary Instructor (15 hours)
- Fall 2014 Antibiotics: Development and Resistance (BMB 488) – undergraduate seminar course
Primary Instructor (15 hours)
- Spring 2015 Introductory Microbiology Laboratory – Inquiry-based (MICRB 202) – undergraduate laboratory course
Primary Instructor (60 hours)
Antibiotics: Development and Resistance (BMB 488) – undergraduate seminar course
Primary Instructor (15 hours)
- Fall 2015 Antibiotics: Development and Resistance (BMB 488) – undergraduate seminar course
Primary Instructor (15 hours)
- Spring 2016 Introductory Microbiology Laboratory – Inquiry-based (MICRB 202) – undergraduate laboratory course
Primary Instructor (60 hours)

- Antibiotics: Development and Resistance (BMB 488) – undergraduate seminar course
Primary Instructor (15 hours)
- Fall 2016 Antibiotics: Development and Resistance (BMB 488) – undergraduate seminar course
Primary Instructor (15 hours)
- Spring 2017 Introductory Microbiology Laboratory – Inquiry-based (MICRB 202) – undergraduate laboratory course
Primary Instructor (60 hours)
- Antibiotics: Development and Resistance (BMB 488) – undergraduate seminar course
Primary Instructor (15 hours)
- Fall 2017 Antibiotics: Development and Resistance (BMB 488) – undergraduate seminar course
Primary Instructor (15 hours)

Mentoring and Training

Formal Faculty Mentoring

Mentoring team member, Tim Meredith (Assistant Professor, Biochemistry & Molecular Biology), 2015-present

Non-departmental Mentor, Scott Medina (Assistant Professor, Biomedical Engineering), 2016-present

Teaching Mentor, John Alumasa (Assistant Research Professor, Biochemistry & Molecular Biology), 2017-present

Post-Doctoral Research Fellows

Faith Harrison (Ph.D., University of Iowa) 2005-2008

Daniel Haeusser (Ph.D., Washington University) 2008-2009

Herve Nicoloff (Ph.D., Unversite Louis Pasteur) 2008-2009

John Alumasa (Ph.D., Georgetown University) 2010-present

Ayman Allam (Ph.D., University of Florida) 2013

Mynthia Cabrera (Ph.D., Georgetown University) 2017-present

Graduate Students

Primary Advisor:

Sue-Jean Hong Ph.D. awarded 2005 (Scientist Moderna Therapeutics)

Lin Cheng Ph.D. awarded 2008 (medical fellow, University of Washington)

Xin Zhou M.S. awarded 2008 (consultant, The Boston Consulting Group)

Jay Russell Ph.D. awarded 2009 (senior scientist, Merck)

Nitya Ramadoss Ph.D. awarded 2013 (postdoctoral fellow, Stanford University)

Shaima El-Mowafi Ph.D. awarded 2014 (research scientist, National Research Institute, Cairo)

Heather Feaga Ph.D. awarded 2016 (postdoctoral fellow, Columbia University)
Tyler Goralski Ph.D. in progress
Farhana Haque M.S. awarded 2017
Laura Wickham Ph.D. in progress

Graduate Student Thesis Committees: 37 students 2003-present

Graduate Student Rotation Supervisor: 31 students 2002-present

Undergraduates

Research Supervisor:

Priscilla Tee	2002-2004
Tomoyo Takagi	2002-2004
Jacob Wesley	2002-2005
Oliver Chen	2003-2004
Monica Guo	2004-2005
Anastasiya Yakhnina	2004-2007
Timothy Rogers	2005-2007
Timothy Rohrbach	2008-2009
Sharon Li	2008-2009
Elizabeth Bailey	2008
Shih-Heng Chiang	2008-2009
Rachel Criner	2009
Zafirah Zaidan	2009-2010
Benjamin Chambers	2010-2012
Hoon Chang	2010-2013
Gregory Babunovic	2012-2015
Divya Hosangadi	2012-2015
Ashley Chorath	2013-2014
Chris Rae	2013-2015
Mikisa Solomon	2013-2015
So Woon Kim	2013-2014
Alexandria Lewis	2014-2016
Samjeris Victor	2015-present
Ella Lundquist	2015
Mary Hannah Swaney	2015-present
Taryn Ryan	2015-present
Sydney Miller	2016-present
Emily Snell	2016-present
Isabel Hunsberger	2016-present
Bryn Kelly	2017-present
Kush Kumar	2017-present
Alexis Davison	2017-present
Anna Brogan	2017-present
Lindsey Engelman	2017-present
Tianna Fredericks	2017-present
Josephine Beck	2017-present
So Jung Kim	2017-present

SERVICE INFORMATION

Public Lectures, Expert Panels, Popular Science Publications

Expert panelist for screening and discussion of the movie *Resistance*, March 26, 2015.
State Theater, State College, PA

2016 Penn State Lectures on the Frontiers of Science lecturer, “New antibiotics for drug-resistant infections,” February 13, 2016. Penn State University, University Park, PA

2016 The Conversation “Why you should dispense with antibacterial soaps,” published in The Guardian and The San Francisco Examiner among other sources and read by >200,000 people.

College and University Committees

Member, BMB Department Head Search Committee (2007-2008)

Member, University AD14 Review Committee of College of Science Dean (2008-2009)

Member College of Science Preprofessional Evaluation Committee (2009-present)

Member, Penn State MD/Ph.D. Steering Committee (2010-2017)

Member, Automated Biological Calorimetry Facility Advisory Committee (2011-2014)

Member, College of Science Sabbatical Leave Committee (2012)

Member, Paul Berg Award Selection Committee (2012)

Member, Center for Excellence in Science Education (2012-present)

Member, Undergraduate Education Advisory Committee (2012-2013)

Penn State Faculty Senate (2013-present)

Member, Senate Committee on Faculty Affairs (2013-2015)

Member, Senate Committee on Curricular Affairs (2015-present)

Curricular Representative, College of Science (2015-present)

Member, University Committee on Assessment of Learning (2016-present)

Department Committees

Member, Marker Lecture Selection Committee (2002-2004)

Chair, Marker Lecture Selection Committee (2004-2005)

Participant, BMB Strategic Plan Committee (2004)

Member, BMB Faculty Search Committee (2004)

Member, BMMB Graduate Affairs Committee (2005-2009)

Member, IBIOS Candidacy Exam Committee (2006-2007)

Chair, BMB Honors and Awards Committee (2008-2009)

Member, BMB Promotion and Tenure Committee (2009-2010)

Member, BMB Instructional Faculty Evaluation Committee (2009-2011)

Member, BMMB Candidacy Committee (2010-2011)

Member, BMB Undergraduate Affairs Committee (2012-2015; 2017-present)

Member, BMB Undergraduate Program Assessment Committee (2013-2015)
Member, BMB Peer Teaching Evaluation Committee (2014-2017)
Chair, BMB Junior Faculty Mentoring Committee (2015-2017)
Organizer, BMB Junior Faculty Grant Application Review Panel (2015-2017)
Chair, BMB Peer Teaching Evaluation Committee (2017-present)

Professional Meeting Organization

Organizer, Microbiologists at Penn State (MAPS) 2004 –2006, 2012-2013
Symposium Convener, “Diverse Mechanisms Regulating Translation.” American Society for Microbiology General Meeting, New Orleans, LA
May 24, 2004
Conference Organizer, 2nd Caulobacter Meeting, Vancouver, BC, Canada
July 10-12, 2005
Symposium Convener, “Microbial Translation – What You See Is Not Always What You Get.” American Society for Microbiology General Meeting General Meeting, Orlando, FL – May 21, 2006
Session Chair, “Cell and Developmental Biology.” Molecular Genetics of Bacteria and Phage Meeting, Madison, WI – August 10, 2007
Session Chair, “Protein Dynamics.” Stalked Bacteria and Relatives: From Genes to Structure (EMBO Conference), Marburg, Germany, April 2, 2014.
Session Chair, “Translation.” Molecular Genetics of Bacteria and Phage Meeting, Madison, WI – August 9, 2017

Grant and Journal Review

Ad hoc member, NIH CSR Tropical Medicine and Parasitology Special Emphasis Panel (ZRG1 TMP 02): 2003
Ad hoc reviewer, Cooperative Grants Program, U.S. Civilian Research & Development Foundation: 2003
Ad hoc reviewer, NSF MCB: 2004, 2007-2010
Ad hoc reviewer, DTRA: 2008-2010
Ad hoc reviewer, Swiss National Science Foundation: 2008, 2011
Ad hoc reviewer, The Wellcome Trust/DBT India Alliance: 2010
Ad hoc reviewer, Israel Science Foundation: 2012
Ad hoc reviewer, Cottrell College Science Award: 2014
Temporary Member, NIH CSR AREA Special Emphasis Panel: 2014-2016
Temporary Member, NIH CSR Prokaryotic Molecular and Cell Biology Study Section: 2015
Member, NIH Site Visit Review Panel, National Cancer Institute, 2015
Temporary Member, NIH CSR Special Emphasis Panel: 2016
Ad hoc manuscript review for: Nature, Cell, PNAS, Molecular Cell, Journal of Bacteriology, Molecular Microbiology, Nucleic Acids Research, Journal of Molecular Biology, Microbiology, FEMS Microbiology Letters, Genes to Cells, PLoS ONE,

Molecular Biology and Evolution, FEBS Letters, RNA Biology, IUBMB Life, Future Medicinal Chemistry, WIREs RNA, Plasmid, Trends in Genetics, PLoS Biology, Frontiers in Microbiology, PLoS Genetics, Nature Chemical Biology, Cell Reports, eLife, Scientific Reports