

Amy E. Palmer
Curriculum Vitae

Department of Chemistry & Biochemistry
UCB 596; 3415 Colorado Ave
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EMPLOYMENT

Professor 2018 - present
Associate Professor 2012 - 2018
Assistant Professor 2005 - 2012

Department of Chemistry and Biochemistry
University of Colorado, Boulder
Member, BioFrontiers Institute
Member, Program in Neuroscience
Member, Medical Scientist Training Program

Visiting scientist, Unité des Interaction Bactéries Cellules, Pasteur Institute Jan 2013 – July 2013

EDUCATION

Ph.D., Chemistry December 2001

Stanford University

Advisor: Edward I. Solomon

Thesis title: Spectroscopic Studies of Multicopper Oxidases: Probing the Nature and Reactivity of the Different Copper Sites

M.A., Education June 2000

Stanford University

Emphasis: Curriculum Development and Teacher Education in Science

B.A., Biophysical Chemistry *cum laude* June 1994

Dartmouth College

Advisor: Karen E. Wetterhahn

Thesis title: The Effect of Ascorbate and Glutathione on the Interaction of Chromium(VI) with DNA

RESEARCH EXPERIENCE

Postdoctoral Research Fellow March 2005 – June 2005

University of California San Diego

Advisor: Roger Y. Tsien

NIH Postdoctoral Fellow March 2003 – March 2005

University of California San Diego

Advisor: Roger Y. Tsien

Postdoctoral Research Associate November 2001 – March 2003

University of California San Diego

Advisor: Roger Y. Tsien

Graduate Research Assistant September 1995 – September 2001

Stanford University

Department of Chemistry

Advisor: Edward I. Solomon

Professional Research Assistant June 1994 – July 1995

Dartmouth College

Department of Chemistry

Advisor: Karen E. Wetterhahn

Dartmouth College

Department of Chemistry

Advisor: Karen E. Wetterhahn

HONORS AND AWARDS

- 2019 College Scholar Award, CU Boulder College of Arts and Sciences
2017 Marinus Smith Award, CU Boulder
2016 Chancellor's Award for Excellence in STEM Education, CU Boulder
2016 ASSETT Faculty Development Award, CU Boulder
2015 Chair Elect: Cell Biology of Metals Gordon Research Conference
2014 NIH Director's Pioneer Award
2013 Program Project Grant Awardee – Human Frontiers Science Project
2013 Vice Chair Elect: Cell Biology of Metals Gordon Research Conference
2011 Featured in the National Institute of General Medical Sciences magazine "Findings" (Jan 2011 issue)
2010 NSF CAREER award
2010 Ed Stiefel Young Investigator Award in Biological Inorganic Chemistry
2010 Alfred P. Sloan Research Fellow
2007 Whitehall Foundation Award
2004 Pfizer Postdoctoral Poster Award, Gordon Research Conference in Bioorganic Chemistry
2004 Best poster invitational lecture, FASEB Conference on Calcium and Cell Function
2003 Ruth L. Kirschstein National Research Service Award, NIH Postdoctoral Fellowship
2000 Franklin Veatch Memorial Fellowship, Department of Chemistry, Stanford University
1998 Centennial Teaching Award, Department of Chemistry, Stanford University

PUBLICATIONS (The final author is the corresponding author; ♦ denotes co-corresponding authors)**Submitted manuscripts**

84. Slocum, J., Pamer, A.E., Jimenez, R., Intramolecular Fluorescent Protein Association in a Class of Zinc FRET Sensors Leads to Increased Dynamic Range, **submitted**
83. Sanford, L., Carpenter, M.C., Palmer, A.E., Intracellular Zn²⁺ transients modulate global gene expression in dissociated rat hippocampal neurons, **submitted**

Publications

82. Nolan, E., Gans, S., Llamas, L., Bandyopadhyay, S., Brittain, S.M., Bernasconi-Elias, P., Carter, K.P., Loureiro, J.L., Thomas, J.R., Schirle, M., Yang, Y., Guo, N., Roma, G., Schuierer, S., Beibel, M., Lindeman, A., Sigoillot, F., Chen, A., Xie, X., Ho, S., Reece-Hoyes, J., Weihofen, W., Tyskiewicz, K., Hoepfner, D., McDonald, R.I., Guthrie, N., Dogra, A., Guo, H., Shao, J., Ding, J., Canham, S., Boynton, G., George, E.L., Kang, Z., Antczak, C., Porter, J.A., Wallace, O., Tallarico, J.A., **Palmer, A.E.**, Jenkins, J.L., Jain, R.K., Bushell, S.M., Fryer, C.J., Discovery of a Zip7 Inhibitor from a Notch Pathway Screen, *Nature Chem. Bio.*, 2019 15(2):179-188, PMID: 30643281
81. Han, Y., Goldberg, J., Lippard, S.J., Palmer, A.E., Superiority of SpiroZin2 Versus FluoZin-3 for monitoring vesicular Zn²⁺ allows identification of lysosomal Zn²⁺ accumulation in lactating mammary cells, *submitted to Sci. Rep.*, 2018, 8(1):15034, PMID: 30094420
80. Manna, P., Hung, S-T; Friis, P., Mukherjee, S., Simpson, D.M., Lo, M., **Palmer, A.E.**, Jimenez, R., Directed Evolution of Excited State Lifetime and Brightness in Red Fluorescent Proteins using a Microfluidic Sorter, *Integrative Biology*, 2018, doi: 10.1039/c8ib00103k. [Epub ahead of print] PMID: 30094420
79. Braselmann, E., Wierzba, A.*, Polaski, J.T.*, Chromiński, M., Holmes, Z.E., Hung, S.-T., Batan, D., Wheeler, J. R., Parker, R., Jimenez, R., Gryko, D., Batey, R.T., **Palmer, A.E.**, A multi color riboswitch-based platform for live cell imaging of RNA in mammalian cells (* these authors contributed equally to this work); manuscript deposited in biorxiv: <https://www.biorxiv.org/content/early/2018/04/09/199240> , *Nature Chem Bio*, Oct;14(10):964-971

78. Batan, D.* , Braselmann, E.* , Nguyen, D.M.T., Minson, M., Cossart, P., **Palmer A.E.**, A multi-color split-fluorescent protein approach to visualize Listeria protein secretion dynamics in infection, *Biophys. J.*, 2018, 115(2): 251-262 (*these authors contributed equally to this work), PMID: 29653838
77. Choi, S., Hu, Y.A., Corkins, M.E., **Palmer, A.E.**, and Bird, A.J., Zinc transporters belonging to the Cation Diffusion Facilitator (CDF) family have complementary roles in transporting zinc out of the cytosol, *PLoS Genetics*, 2018, 14(3):e1007262. doi: 10.1371, PMID:29529046
76. Young, A.M. and **Palmer, A.E.**, Methods to Illuminate the Role of Salmonella Effector Proteins during Infection: A Review, *Frontiers in Cellular and Infection Microbiology*, 2017, Aug 10, 7:363, doi: 10.3389/fcimb.2017.00363, PMID: 28848721
75. Carter, K.P.* , Carpenter, M.C.* , Fiedler, B.L., Jimenez, R., **Palmer, A.E.**, Critical comparison of FRET-sensor functionality in the Cytosol and Endoplasmic Reticulum and Implications for Quantification of Ions, *Anal. Chem.*, 2017, 89(17):9601-9608, PMID: 28758723 (*these authors contributed equally to this work)
74. Young, A.M., Minson, M., McQuate, S.E., **Palmer, A.E.**, Optimized Fluorescence Complementation Platform for Visualizing *Salmonella* Effector Proteins Reveals Distinctly Different Intracellular Niches in Different Cell Types, *ACS Infectious Disease*, 2017, 3(8):575-584, PMID: 28551989
73. Lauinger, L; Li, J; Shostak, A; Cemel, IA; Ha, N; Zhang, Y; Merkl, P; Obermeyer, S; Stankovic-Valentin, N; Schafmeier, T; Wever, WJ; Bowers, AA; Carter, KP; **Palmer, A.E.**; Tschochner, H; Melchior, F; Deshaies, RJ; Brunner, M; Diernfellner, A. Thiolutin is a zinc chelator that inhibits the RPN11 and other JAMM metalloproteases. *Nature Chem. Biol.*, 2017, 13(7):709-714, PMID:28459440
72. Carpenter, M.C. and **Palmer, A.E.**, Native and Engineered Sensors for Ca²⁺ and Zn²⁺, *Essays in Biochemistry*, 2017, 61(2):237-243, PMID: 28487400 (refereed review)
71. Li, J., Yakushi, T., Parlati, F., Mackinnon, A.L., Perez, C., Ma, Y., Carter, K.P., Colayco, S., Magnuson, G., Brown, B., Nguyen, K., Vasile, S., Suyama, E., Smith, L.H., Sergienko, E., Pinkerton, A.B., Chung, T.D.Y., **Palmer, A.E.**, Pass, I., Hess, S., Cohen, S.M., Deshaies, R.D., Capzimin is a potent and specific inhibitor of proteasome isopeptidase Rpn11, *Nature Chem. Bio.*, 2017, 13(5):486-493, PMID:28244987
70. Mo GC, Ross B, Hertel F, Manna P, Yang X, Greenwald E, Booth C, Plummer AM, Tenner B, Chen Z, Wang Y, Kennedy EJ, Cole PA, Fleming KG, **Palmer A**, Jimenez R, Xiao J, Dedecker P, Zhang J., Genetically-Encoded Biosensors for Visualizing Live-cell Biochemical Activity at Super-resolution, *Nature Methods*, 2017, Apr;14(4):427-434.
69. Fiedler B.L., Van Buskirk S., Carter K.P., Qin Y., Carpenter M.C., **Palmer A.E.**♦, Jimenez R.♦, Droplet Microfluidic Flow Cytometer For Sorting On Transient Cellular Responses of Genetically-Encoded Sensors, *Anal. Chem.*, 2017, Jan 3;89(1):711-719, PMID: 27959493
68. Qin, Y., Sammond, D.W., Braselmann, E., Carpenter, M.C., **Palmer, A.E.**, Development of an Optical Zn²⁺ Probe Based on a Single Fluorescent Protein, *ACS Chem. Biol.*, 2016, 11(10): 2744-2751, PMID: 27467056
67. Specht, E.A., Braselmann, E., **Palmer, A.E.**, A Critical and Comparative Review of Fluorescent Tools for Live Cell Imaging, *Annu. Rev. Physiology*, 2017, 79:93-117, PMID: 27860833 (refereed review)
66. Carpenter, M.C., Lo, M.L., **Palmer, A.E.**, Techniques for Measuring Cellular Zinc, *Arch. Biochem. Biophys.*, 2016, 611:20-29, PMID: 27580940 (refereed review)
65. Rodriguez, E.A., Campbell, R.E., Lin, J.Y., Lin, M.Z., Miyawaki, A., **Palmer, A.E.**, Shu, X., Zhang, J., Tsien, R.Y., The growing and glowing toolbox of fluorescent and photoactive proteins, *Trends in Biochem. Sci.*, 2017, 42(2):111-129, PMID: 27814948 (refereed review)
64. McQuate, S.E., Young, A.M., Silva-Herzog, E., Bunker, E., Hernandez, M., de Chaumont, F., Liu, X., Detweiler, C.S., **Palmer, A.E.**, Long-Term Live Cell Imaging Reveals New Roles for Salmonella Effector Proteins SseG and SteA, *Cell Microbiology*, 2017, 19(1), PMID: 27376507
64. Carpenter, M.C. and **Palmer, A.E.** Unraveling the mystery of the ring: Tracking heme dynamics in living cells, *Proc. Natl. Acad. Sci.*, 2016, 113(27):7296-7. (commentary piece)
63. Dean, K.M., Davis, L.M., Lubbeck, J.L., Manna, P., Friis, P., **Palmer, A.E.**♦, Jimenez, R.♦, High-speed multiparameter photophysical analyses of fluorophore libraries, *Anal. Chem*, 2015, 87(10):5026-30

62. Kim, T.J., Joo. C., Seong. J., Vafabakhsh. R., Botvinick, E.L., Berns, M.W., **Palmer, A.E.**, Wang, N., Ha, T., Jakobsson, E., Sun, J., Wang, Y., Distinct mechanisms regulating mechanical force-induced Ca^{2+} signals at the plasma membrane and the ER in human MSCs, *Elife*, 2015, 4:e04876. doi: 10.7554/eLife.04876, PMID: 25667984
61. Carter, K.P., **Palmer AE.**, Metallobiology: Zinc differently, *Nature Chem.* 2015, 7(2):96-7. doi: 10.1038/nchem.2165, PMID: 25615659 (commentary piece)
60. Park, J.G., **Palmer, A.E.**, Properties and use of genetically encoded FRET sensors for cytosolic and organelle Ca^{2+} measurements., *Cold Spring Harb Protoc.* 2015 Jan 5;2015(1), PMID: 25561625 (refereed review)
59. Park, J.G., **Palmer, A.E.**, Measuring the in situ K_d of a genetically encoded Ca^{2+} sensor, *Cold Spring Harb Protoc.* 2015 Jan 5;2015(1):pdb.prot076554. doi: 10.1101/pdb.prot076554., PMID: 25561615 (refereed review)
58. Park, J.G., **Palmer, A.E.**, Verifying the function and localization of genetically encoded Ca^{2+} sensors and converting FRET ratios to Ca^{2+} concentrations, *Cold Spring Harb Protoc.* 2015 Jan 5;2015(1):pdb.prot076547. doi: 10.1101/pdb.prot076547, PMID: 25561614 (refereed review)
57. Dean, K.M., Lubbeck, J.L., Davis, L.M., Regmi, C.K., Chapagain, P.P., Gerstman, B.S., Jimenez, R.♦, **Palmer, A.E.**♦, Microfluidics-Based Selection of Red-Fluorescent Proteins with Decreased Rates of Photobleaching, *Integrative Biology*, 2015, 7(2):263-73, PMID: 25477249
56. Farnsworth, N.L., Mead, B.E., Antunez, L.R., **Palmer, A.E.**, Bryant, S.J., Ionic osmolytes and intracellular calcium regulate tissue production in chondrocytes cultured in a 3D charged hydrogel, *Matrix Biology*, 2014, pii: S0945-053X(14)00128-0, PMID: 25128592
55. Dean, K.M., **Palmer A.E.**, Advances in fluorescence labeling strategies for dynamic cellular imaging, *Nature Chemical Biology*, 2014, 10(7): 512-23, PMID: 24937069 (refereed review)
54. Carter, K.P., Young, A.M., **Palmer, A.E.**, Fluorescent Sensors for Measuring Metal Ions in Living Systems. *Chem. Rev.*, 2014, 114(8):4564-601, PMID: 24588137 (refereed review)
53. Park J.G., **Palmer A.E.**, Quantitative measurement of Ca^{2+} and Zn^{2+} in Mammalian Cells using Genetically Encoded Fluorescent Biosensors, *Methods Mol Biol.* 2014;1071:29-47. doi: 10.1007/978-1-62703-622-1_3.
52. Stavru F., **Palmer A.E.**, Wang C, Youle RJ, Cossart P., Atypical mitochondrial fission upon bacterial infection., *Proc Natl Acad Sci U S A.* 2013, 110(40):16003-8, PMID: 24052378
51. Qin, Y., Miranda, J.G., Stoddard, C.I., Park, J.G., Dean, K.M., **Palmer, A.E.**, Direct Comparison of a Genetically Encoded Sensor and Small Molecule Indicator: Implications for Quantification of Cytosolic Zn^{2+} , *ACS Chem. Bio.*, 2013, 8(11): 2366-71, PMID: 23992616
50. Park, J.G. and **Palmer, A.E.**, Properties and use of genetically-encoded FRET sensors for cytosolic/organelle Ca^{2+} measurements, *Calcium Techniques Protocols*, Cold Springs Harbor Press, Editors: Jan B. Parys, Martin Bootman, David I. Yule, Gert Bultynck (refereed protocol)
49. **Palmer, A.E.**, Miranda, J.G., Carter, K.P., Fluorescent zinc sensors, *Metals in Cells* Volume of Encyclopedia of Inorganic and Bioinorganic Chemistry, Wiley, Editor: Valeria Culotta and Robert Scott, ISBN: 978-1-119-95323-4 (refereed review)
48. Davis L.M., Lubbeck J.L., Dean K.M., **Palmer A.E.**, Jimenez R., Microfluidic cell sorter for use in developing red fluorescent proteins with improved photostability, *Lab Chip*, 2013, 13(12):2320-7, PMID: 23636097
47. Jeong, J., Walker, J.M., Wang, F., Park, J.G., **Palmer, A.E.**, Giunta, C., Rohrbach, M., Steinmann, B., Eide, D.J., Promotion of vesicular zinc efflux by ZIP13 and its implications for spondylocheiro dysplastic Ehlers-Danlos Syndrome, *Proc. Natl. Acad. Sci.*, 2012, 109(51):E3530-8, PMID: 23213233
46. Geng, X., Huang, C., Qin, Y., McCombs, J.E., Yuan, Q., Harry, B.L., **Palmer, A.E.**, Xia, N.-S., Xue, D., Hepatitis B virus protein targets Bcl-2 proteins to increase intracellular calcium, required for virus replication and cell death induction, *Proc. Natl. Acad. Sci.*, 2012, 109(45):18471-6, PMID: 23213233

45. Miranda, J.G., Weaver, A.L., Qin, Y., Park, J.G., Stoddard, C.I., Lin, M.Z., **Palmer, A.E.**, New alternately colored FRET sensors for simultaneous monitoring of Zn²⁺ in multiple cellular locations, *PLoS One*, 2012, 7(11):e49371, PMID: 23173058
44. Park, J.G., Qin, Y., Galati, D.F., **Palmer, A.E.**, New sensors for quantitative measurement of mitochondrial Zn²⁺, *ACS Chem. Bio*, 2012, 7(10):1636-40, PMID: 22850482
43. Dean, K.M., Qin, Y., **Palmer, A.E.**, Visualizing metal ions in cells: an overview of analytical techniques, approaches, and probes, *Biochim. Biophys. Acta*, 2012, 1823(9):1406-15, PMID: 22521452 (refereed review)
42. West, D.C., Qin, Y., Peterson, Q.P., Thomas, D.L., Palchadhuri, R., Morrison, K.C., Lucas, P.L., **Palmer, A.E.**, Fan, T.M., Hergenrother, P.J., Differential Effects of ProCaspase-3 Activating Compounds in Cancer Cell Death, *Molecular Pharmaceutics*, 2012, 9(5):1425-34, PMID: 22486564
41. Lubbeck, J.L., Dean, K.M., Ma, H., **Palmer, A.E.**♦, Jimenez, R.♦, Microfluidic flow cytometer for quantifying reversible and irreversible photobleaching of fluorescent proteins in cells, *Anal. Chem.*, 2012, 84(9):3929-37, PMID: 22424298
40. Ma, H., Gibson, E.A., Dittmer, P.J., Jimenez, R.♦, **Palmer, A.E.**♦, High-throughput Examination of Fluorescence Resonance Energy-Detected Metal-ion Responses in Mammalian Cells, *J. Am. Chem. Soc.*, 2012, 134(5):2488-91, PMID: 22260720

recommended as being of special significance by Faculty of 1000

Publications prior to submission of tenure package Fall 2011

39. Dean, K.M., Lubbeck, J.L., Binder, J. Schwall, L.R., Jimenez, R.♦, **Palmer A.E.**♦, Analysis of Red-Fluorescent Proteins Provides Insight into Dark-State Conversion and Photodegradation, *Biophysical Journal*, 2011, 101: 961-969, PMID: 21843488
38. Qin, Y., Dittmer, P.D., Park, J.G., Jansen, K.B., **Palmer A.E.**, Steady state and dynamic measurements of endoplasmic reticulum and Golgi Zn²⁺ using genetically encoded sensors, *Proc. Natl. Acad. Sci. U S A*, 2011, 108(18):7351-6. PMID: 21502528
37. **Palmer, A.E.***, Qin, Y., Park, J.G., McCombs, J.E., Design and application of genetically encoded biosensors, *Trends in Biotechnology*, 2011, 29(3):144-52. PMID: 21251723 (* denotes corresponding author, refereed review)
36. Perocchi, F., Gohil, V.M., Girgis, H.S., Bao, X.R., McCombs, J.E., **Palmer, A.E.**, Mootha, V.K., *MICU1* encodes a mitochondrial EF hand protein required for Ca²⁺ uptake, *Nature*, 2010, 467(7313):291-6., PMID: 20693986
35. Ravier M.A., Cheng-Xue R., **Palmer A.E.**, Henquin J.C., Gilon P., Subplasmalemmal Ca(2+) measurements in mouse pancreatic beta cells support the existence of an amplifying effect of glucose on insulin secretion, *Diabetologia*, 2010, 53(9):1947-57. PMID: 20461354
34. McCombs, J.E., Gibson, E.A., **Palmer, A.E.**, Using a genetically targeted sensor to investigate the role of presenilin-1 in ER Ca²⁺ levels and dynamics, *Molecular Biosystems*, 2010, 6(9):1640-9. PMID: 20379593
33. Ong, D.S., Mu, T.W., **Palmer, A.E.**, Kelly, J.W., Endoplasmic Reticulum Ca²⁺ Increases Enhance Glucocerebrosidase Folding, Trafficking and Function, *Nature Chemical Biology*, 2010, 6(6):424-32., PMID: 20453863
32. VanEngelenburg, S.B., and **Palmer, A.E.**, General method for live-cell imaging of Type-III Secretion reveals effector dynamics and spatial segregation of three *Salmonella* effectors, *Nature Methods*, 2010, 7(4): 325-30, PMID: 20228815
* This work was highlighted in *Nature Structural and Molecular Biology*, 17, 397 (2010)
31. VanEngelenburg, S.B., Nahreini, T, and **Palmer, A.E.**, FACS-based selection of tandem tetracysteine peptides with improved ReAsH brightness in live-cells, *ChemBioChem*, 2010, 11(4): 489-493, PMID: 20099291
30. **Palmer, A.E.** and Dittmer, P.J., SNAP-shots of hydrogen peroxide in cells, *Chem. Biol.*, 2010, 17(4): 318-9, PMID: 20416502 (commentary piece)

29. **Palmer A.E.**, Franz, K.J. Introduction to "Cellular metal homeostasis and trafficking", *Chem. Rev.* 2009, 109 (10): 4533-4535, PMID: 19778037 (commentary piece)
28. **Palmer, A.E.**, Expanding the repertoire of fluorescent calcium indicators, *ACS Chemical Biology*, 2009, 4(3): 157-159, PMID: 19298092 (commentary piece)
27. Dittmer, P.J., Miranda, J.G., Gorski, J.A., **Palmer, A.E.**, Genetically encoded sensors elucidate spatial distribution of zinc, *J. Biol. Chem.*, 2009, 284(24): 16289-97, PMID: 19363034
26. Schafer, D., Gibson, E.A., Salim, E.A., **Palmer, A.E.**, Jimenez, R., and Squier, J., Optically integrated microfluidic cell counter fabricated by femtosecond laser ablation and anodic bonding, *Optics Express*, 2009, 17(8): 6068, PMID: 19365429
25. Astori, S., Wallace, D.J., Borgloh, S.M.z.A., Yang, Y., Bausen, M., Kugler, S., **Palmer, A.E.**, Tsien, R.Y., Sprengel, R., Kerr, J.N.D., Denk, W., and Hasan, M.T. Detection of Single Action Potentials in vitro and in vivo with a Genetically-encoded Activity Sensor, D3cpv., *Nature Methods*, 2008, 5(9): 797-804, PMID: 19160514
24. VanEngelenburg, S.B. and **Palmer, A.E.**, Quantification of Real-Time *Salmonella* effector Type-Three Secretion Kinetics Using the Small Molecule Fluorophore FIAsh, *Chem. Biol.*, 2008, 15(6): 619-628, PMID: 18559272
23. McCombs, J.E. and **Palmer, A.E.**, Measuring calcium dynamics in living cells with Genetically Encodable Calcium Indicators, *Methods*, 2008, 46(3): 152-159, PMID: 18848629 (refereed review)
22. VanEngelenburg, S.B. and **Palmer, A.E.**, Fluorescent sensors of protein function, *Current Opinion Chemical Biol.*, 2008, 12(1): 60-65, PMID: 18282482 (refereed review)
21. **Palmer, A.E.**, Dittmer, P., McCombs, J.E., Genetically encoded sensors for calcium and zinc, in Small Animal Whole-Body Optical Imaging Based on Genetically Engineered Probes, edited by A. P. Savitsky, R. E. Campbell, R. M. Hoffman, Proceedings of SPIE Vol 6868 (SPIE, Bellingham, WA, 2008), 6868-07 (non-refereed review)
20. **Palmer, A.E.*** and Tsien, R.Y. Measuring Calcium Signaling Using Genetically Targetable Fluorescent Indicators, *Nature Protocols*, 2006, 1(2): 1-9, PMID: 17406387 (*denotes corresponding author, refereed protocol)

Publications from graduate and postdoctoral work

19. Xu, C., Xu, W., **Palmer, A.E.**, and Reed, J.C., Bcl-1 regulates Endoplasmic reticulum Ca²⁺ downstream of Bcl-2-family proteins, *J. Biol. Chem.*, 2008, 283(17): 11477-11484
18. **Palmer, A.E.**, Giacomello, M., Kortemme, T., Hires, S. A., Lev-Ram, V., Baker, D., Tsien R. Y., Ca²⁺ indicators based on computationally-redesigned calmodulin-peptide pairs, *Chemistry and Biology*, 2006, 13: 521-530
17. Duman, J.G., Chen, L., **Palmer A.E.**, Hille, B., Contributions of intracellular compartments to calcium dynamics: Implicating an acidic store, *Traffic*, 2006, 7: 859-872
16. Qunitanar, L. Yoon, J., Aznar, C.P., **Palmer, A.E.**, Andersson, K.K., Britt, R.D., Solomon, E.I. Spectroscopic and electronic structure studies of the trinuclear Cu cluster active site of the multicopper oxidase laccase: nature of its coordination unsaturation, *J. Am. Chem. Soc.*, 2005, 127(40):13832-13845
15. **Palmer, A.E.**, Jin, C, Reed, J.C., Tsien, R.Y., Bcl-2 mediated alterations in endoplasmic reticulum Ca²⁺ analyzed with an improved genetically encoded fluorescent sensor, *Proc. Natl. Acad. Sci.*, 2004, 101:50, 17404-17409

This work was highlighted in the following journals:

BioTechniques, 2005, 38:1, p1; *Nature Reviews Molecular Cell Biology*, 2005, 6, p92

14. Shaner, N.C., Campbell, R.E., Steinbach, P.A., Giepmans, B.N.G., **Palmer, A.E.**, Tsien, R.Y. Improved monomeric red, orange, and yellow fluorescent proteins derived from *Discoma* red fluorescent protein, *Nature Biotechnology*, 2004, 22, 1567-1572

13. Andersson, K.K., Schmidt, P.P., Katterle, B., Strand, K., **Palmer, A.E.**, Lee, S.-K., Solomon, E.I., Graslund, A., Barra, A.-L. Examples of high frequency EPR studies in bioinorganic chemistry, *J. Biol. Inorg. Chem.*, 2003, 8, 235-247
12. **Palmer, A.E.**, Szilagyi, R.K., Cherry, J.R., Jones, A., Xu, F., Solomon, E.I. Spectroscopic characterization of the Leu₅₁₃His variant of fungal laccase: effect of increased axial ligand interaction on the geometric and electronic structure of the Type 1 Cu site *Inorg. Chem.*, 2003, 42, 4006-4017
11. Campbell, R.E., Tour, O., **Palmer, A.E.**, Steinbach, P.A., Baird, G. S., Zacharias, D.A., Tsien, R.Y. A Monomeric Red Fluorescent Protein *Proc. Natl. Acad. Sci.*, 2002, 99, 7877-7882
10. **Palmer, A.E.**, Quintanar, L., Severance, S., Wang, T.-P., Kosman, D. J., and Solomon, E.I. Spectroscopic characterization and O₂ reactivity of the trinuclear Cu cluster of mutants of the multicopper oxidase Fet3p, *Biochemistry*, 2002, 41, 6438-6448
9. **Palmer, A.E.**, Lee, S.K., Solomon E. I. Decay of the Peroxide Intermediate in Laccase: Reductive Cleavage of the O-O Bond. *J. Am. Chem. Soc.* 2001, 123, 6591-6599
8. Solomon, E.I., Chen, P., Lee, S.K., Metz, M., **Palmer, A.E.**, Oxygen binding, activation, and reduction to water by Cu proteins, *Angew. Chemie Int. Ed.*, 2001, 40:24, 4570-4590 (refereed review)
7. Machonkin, T.E., Quintanar, L., **Palmer, A.E.**, Hassett, R.F., Severance, S., Kosman, D.J., Solomon, E.I. Spectroscopic Characterization of FET3p, a new member of the multicopper oxidase family. *J. Am. Chem. Soc.*, 2001, 123, 5507-5517
6. **Palmer, A.E.**, Randall, D.W., Xu, F., Solomon, E.I. Spectroscopic studies and electronic structure description of the high potential type 1 copper site in fungal laccase: Insight into the effect of the axial ligand. *J. Am. Chem. Soc.* 1999, 121, 7138-7149
5. Xu, F., **Palmer, A.E.**, Yaver, D.S., Berka, R.M., Gambetta, G.A., Brown, S.H., Solomon, E.I. Targeted Mutations in a *Trametes villosa* laccase: axial perturbations of the T1 copper. *J. Biol.Chem.* 1999, 274, 12372-12375
4. Wilcox, D.E., Bennett, L.L., Cox, E.H., Halebian, G., Hill, B.T., Kowack, E.P., Liu, X., Merkel, J.S., **Palmer, A.E.**, Posewitz, M.C., Roy, J.F., Wetterhahn, K.E. Interaction of Metallothionein with Carcinogenic Metals Ni(II), Cr(VI), and As(III). In: *Metallothionein IV*. Ed: Klassen, C.D. 1999, Birkhauser: Basel, p 585-594
3. Solomon, E.I., **Palmer, A.E.**, Sundaram, U.M., Machonkin, T.E. Spectroscopic Studies of O₂ Intermediates in Copper Proteins: Electronic Structure Contributions to Function in Bioinorganic Chemistry. In: *Spectroscopic Methods in Bioinorganic Chemistry*. Eds: Solomon, E.I. and Hodgson, K.O. 1998, ACS: Washington, D.C., p 423-452 (refereed review)
2. Xu, F., Berka, R.M., Wahleithner, J.A., Nelson, B.A., Shuster, J.R., Brown, S.H., **Palmer, A.E.**, Solomon, E.I. Site directed mutations in fungal laccase: effect on redox potential, activity, and pH profile. *Biochemical J.* 1998, **334**, 63-70
1. Bobilya, D. J., D'Amour, K., **Palmer, A.**, Skeffington, C., Therrien, N., Tibaduiza, E. C. Isolation and cultivation of porcine brain capillary endothelial cells as an in vitro model of the blood-brain barrier. *Methods in Cell Science* 1995, **17**, 25-32

PATENTS

U.S. Application No. 13/360,706, Title: *Optically Integrated Microfluidic Cytometer For High Throughput Screening Of Photophysical Properties of Cells or Particles*, Filed: 01/28/2012, CU TTO File No. CU2607B-US1, Inventors: Amy E. Palmer, Ralph Jimenez, Kevin M. Dean, Jennifer L. Lubbeck, Lloyd Davis.

INVITED TALKS

2019 Seminar speaker: UT Austin (Chemistry), UT Dallas (Chemistry), Notre Dame (Chemistry and Biochemistry, IMPACT lecture), Johns Hopkins University (Biophysics)

Conference presentations (invited talks): Janelia Research Campus, Gordon Research Conference on Cell Biology of Metals, International Society of Zinc Biology

- 2018 Conference presentation (invited talk). ASBMB Symposium on Metals in Biology (San Diego CA); Janelia Farm Research Conference on Fluorescent Proteins and Sensors; Helmholtz Pioneer Campus Conference (Venice, Italy); Current Trends in Biomedicine Workshop: Contribution of Bacterial Injection Systems to Human Disease (Baeza, Spain)
Plenary Speaker. 53rd Congreso Mexicano de Quimica
Instructor. Ecole de Physique Des Houches winter school: Fluorescence Markers for Advanced Microscopy
Seminar. Cinvestav Research Institute, Mexico
Poster. NIH High Risk High Reward Research Symposium
- 2017 Seminar speaker. University of Illinois Urbana-Champaign (Chemistry-Biology Interface Program student-invited speaker); University of Arizona (Chemistry)
Conference Presentation (invited talk). Biophysical Society National Meeting (New Orleans); Pittcon National Meeting (Chicago, Illinois); Janelia Farm Research Conference on Frontiers in Imaging Science; Biophysical Society meeting on Single Cell Biophysics (Taipei, Taiwan); MIT Neurotechnology Symposium
Invited Workshop Participant. Chan Zuckerberg Initiative: Microscopy Workshop
- 2016 Conference Presentations (invited talk). Winter-quantitative Biology Conference (Honolulu, HI); National ACS meeting (San Diego CA); Janelia Farm Research Conference. Fluorescent Proteins and Sensors
Seminar speaker. Indiana University (Chemistry); University of Minnesota (Chemistry-Biology Interface Symposium)
- 2015 Seminar speaker. Northwestern University's Chemistry of Life Processes Institute; Georgia Tech (Chemistry); Institut Pasteur (Paris, France); Ecole Normale Supérieure; Caltech (Department of Chemistry and Chemical Engineering); Washington University St. Louis School of Medicine (Department of Developmental Biology)
Conference Presentations (invited talk). Mosbacher Kolloquium: Metals in Biology – Cellular Functions and Disease; German Society for Biochemistry and Molecular Biology; Pacificchem, "Genetically encoded sensors for monitoring the spatial distribution of zinc in living cells"; Pacificchem, "Directed evolution via multiparameter microfluidic screening to identify new red fluorescent proteins with longer lifetimes and higher photostability"; EMBL Conference "Seeing is Believing Imaging the Processes of Life", October 2015, Talk chosen for oral presentation "Directed evolution via multiparameter microfluidic screening to identify new red fluorescent proteins with longer lifetimes and higher photostability"
Keynote Speaker. NY Academy of Sciences Symposium on "Visualizing Second Messengers"
- 2014 Conference Presentation: Janelia Farm Research Conference on Fluorescent Proteins and Sensors; International Society of Zinc Biology, Asilomar, CA
Seminar. University of Colorado Anschutz Medical Campus, Program in Structural Biology and Biochemistry
Seminar. University of Denver, Department of Biology
Public talk. University Women's Club, University of Colorado
- 2013 Seminar. MIT: Chemistry
Seminar. UMass: Department of Microbiology and Physiology
Seminar. Novartis (Boston)
Seminar. Max Planck Institute for Biophysical Chemistry and University of Göttingen
Conference Presentation: Cell Biology of Metals GRC
- 2012 Conference Presentation: International Society for Zinc Biology Meeting (Australia)
Seminar. UCSF (jointly sponsored CCB/iPQB Seminar Series)
Seminar. Arizona State University (Chemistry and Biochemistry and Biodesign Institute)
Seminar. UT Southwestern: Biochemistry
Seminar. UC – Denver: Pharmacology

Seminar. Stanford University (Chemistry)

Seminar. Pasteur Institute, Paris, France

Seminar. Carleton College (Chemistry and Biochemistry)

Conference Presentation. FASEB Trace Elements in Biology and Medicine

Plenary lecture: Institute of Metals in Biology in Grenoble (France): Metal Homeostasis Workshop

Conference Presentation. EMBO Conference Series: Chemical Biology 2012

Conference Presentation: Janelia Farm Research Conference on Fluorescent Proteins and Sensors.

- 2011
- Conference Presentation (invited). American Chemical Society National Meeting, Denver: Symposium on "Advanced Microscopy Techniques for Biophysical Questions" (Physical Division)
- Conference Presentation (contributed talk). American Chemical Society National Meeting, Denver: "Group break-out activities: Encouraging student engagement in first semester Physical Chemistry"
- Conference Presentation. Metals in Biology Gordon Conference (Stiefel lecture): *Live cell imaging of zinc distribution and dynamics in normal and disease states*
- Seminar. Cornell University (Biophysics Program): *Development of probes for live cell imaging*
- Seminar. Princeton University (Lewis Sigler Institute for Genomics): *Developing probes for live cell imaging of cell signaling and host pathogen interactions*
- Seminar. Duke University (Department of Chemistry): *Developing fluorescent proteins for imaging metal homeostasis in living cells*
- Seminar. University of Wisconsin Madison (Department of Chemistry): *Developing fluorescent probes for metal ions and host-pathogen interactions*
- Seminar. University of Chicago (Department of Chemistry): *Developing fluorescent proteins for imaging metal homeostasis in living cells*
- Keynote Speaker. Dartmouth College: 20th anniversary Women In Science Project Research Symposium: *Spying on cells: Seeing is believing*
- Conference Presentation. American Society of Microbiology National Meeting, plenary speaker in "New Ways to See": *New Tools for Live Cell Imaging of Type III Secretion.*
- Conference Presentation. Gordon Research Conference: Cell biology of Metals: *Monitoring the distribution and dynamics of cellular zinc*
- 2010
- Seminar. University of Illinois at Chicago (Dept of Chemistry): *Dissecting host-pathogen interactions in real time: New fluorescent tools for imaging Type-III Secretion*
- Conference Presentation. FASEB Conference: Calcium and Cell Function: *Developing fluorescent sensors for calcium and metal ions*
- Conference Presentation. FASEB Conference: Trace Elements (unable to attend so Postdoctoral Associate Yan Qin gave the presentation in my place)
- Conference Presentation. American Chemical Society National Meeting, Boston: *Genetically targeted sensors to illuminate the distribution and dynamics or organelle transport of zinc in living cells*
- Conference Presentation. INSERM International Workshop (France): Imaging Host-Pathogen Interactions: *Live cell imaging of Type III Secretion*
- 2009
- Conference Presentation. Bioorganic Chemistry Gordon Research Conference: *Fluorescent tools for real-time imaging of Salmonella invasion*
- Conference Presentation. Metals in Cell Biology Gordon Research Conference: *Genetically targeted zinc sensors for monitoring the spatial distribution of zinc in live cells*
- Conference Presentation. Janelia Farms Research Conference: Fluorescent Proteins and Biosensors: *Microfluidic platform for optimization of FRET sensors and fluorescent proteins*
- Conference Presentation. American Society for Cell Biology National Meeting: Minisymposium on Host Pathogen Interactions: *Dissecting host-pathogen interactions in real time: New tools for imaging Type-III secretion*

- 2008 Conference Presentation. SPIE Photonics West: *Genetically encoded sensors for calcium and zinc*
Conference Presentation. American Society for Cell Biology National Meeting: Minisymposium on Imaging & Sensors: *Genetically encoded sensors illuminate cellular distribution of zinc*
- 2007 Seminar. University of Colorado at Boulder Program in Neuroscience: *Calcium biosensors to illuminate cellular perturbations in Alzheimer's disease models*
Seminar. Biotech Symposium, University of Colorado
Conference Presentation. Janelia Farms Research Conference: Fluorescent Proteins and Biosensors: *Genetically encoded sensors for calcium and zinc*
Seminar. Butcher Symposium, University of Colorado: *Fluorescent tools for live cell imaging: what can we learn?*
- 2006 Seminar. University of Colorado at Denver Health Sciences Center: *Development of genetically encoded sensors for calcium and zinc and applications in live cell imaging*
Seminar. University of Colorado at Denver Health Sciences Center: *Development of biosensors for calcium and zinc and applications in live cell imaging*

GRANT SUPPORT

Pending support

NIH R01 GM133184: Riboglow: a robust multi-color riboswitch-based platform for imaging RNA in living cells, Pending Council Review
 Grant duration: 4/01/2019 – 3/31/2023, Role Co-PI (with Rob Batey)

Current support:

NIH DP1 award DP1GM114863
 NIH Director's Pioneer Award: Regulation of cell signaling by transition metal dynamics
 Grant duration: 9/1/2014 – 8/31/2019
 Role: PI

ALSAM Therapeutic Innovation Grant
 Mapping molecular signatures of prostate cancer progression
 Grant duration: 1/1/2019 – 12/31/2021
 Role: Co-PI (with Professor Raj Argawal)

Completed support:

NIH R01 award GM084027-06
 Genetically encoded sensors shed light on zinc homeostasis
 Grant duration: 9/1/2013 – 5/31/2018
 Role: PI

NIH R01 award GM105997
 Technologies to Define and Map Novel Interorganelle Macromolecular Interactions
 Grant Duration: 8/1/2013 – 04/30/2018
 PI: Natalie Ahn
 Co-PIs: Amy Palmer, Vladislav Verkhusha (Albert Einstein M.C.)

NSF MRI 1429782: MRI: Development of an Advanced Bio-Imaging Instrument: Enabling 3D quantitative multi-functional sensing at the nanoscale.
 Award duration: 8/15/2014 – 7/31/2017 (no cost extension until 7/31/2018)
 PI: Rafael Piestun
 Co-PI: Amy Palmer

Human Frontiers Science Program "Investigating the role of secreted RNAs in bacterial virulence"

Award duration: 12/1/2013 – 11/30/16 (no cost extension until 5/31/17)
PI: Pascale Cossart (Institute Pasteur)
Co-PIs: Amy Palmer (University of Colorado Boulder), Rotem Sorek (Weizmann Institute, Israel)

Butcher award (University of Colorado)
Developing a Platform for *in vivo* Imaging of Chronic Bacterial Infection
PI: Corrie Detweiler
Co-PI: Amy Palmer

NSF CAREER: MCB-0950411
CAREER: Live Cell Imaging of Salmonella effector proteins
Grant duration: 09/01/2010 – 8/31/2015
Role: PI

NIH R21 "A Platform to Study Tenocyte Mechanotransduction"
PI: Stephanie Bryant (Chemical and Biological Engineering) 85%
Co-PI: Amy Palmer 15%

NIH R01 award GM083849
Microfluidics-based selection for Optimization of Red Fluorescent Proteins
Grant duration: 7/1/2008 – 6/30/2012 (no cost extension to 6/30/2013)
Role: PI (Co-PI: Professor Ralph Jimenez)

Alfred P. Sloan Foundation Research
Award duration: 10/1/2010 – 09/30/2012 (no cost extension 09/30/2013)
Role: PI

3 R01 GM084027-01S1
Diversity supplement to "Genetically encoded sensors shed light on zinc homeostasis"
Grant duration: 12/1/2008 – 2/28/2010
Role: PI

3 R01 GM084027-02S1
Administrative Supplement to "Genetically encoded sensors shed light on zinc homeostasis"
Grant duration: 9/30/09 – 2/28/2010
Role: PI

CU-NIST Seed Grant
Development of a Novel Platform for high Throughput Screening of Fluorescent Biosensors
Grant duration: June 1, 2006 – May 31, 2007
Role: PI (Co-PI: Professor Ralph Jimenez)

ACS IRG by the University of Colorado Cancer Center
Live Cell Imaging of Zinc to Examine the Role of Zinc Homeostasis in Prostate Cancer
Grant duration: July 1, 2006 – June 30, 2007 (1 year no cost extension to June 30, 2008)
Role: PI

Whitehall Foundation Award
Development of genetically encoded fluorescent sensors to examine neuronal Zn²⁺ dynamics
Grant duration: March 1, 2007 – Feb 28, 2008
Role: PI

CU Innovative Seed Grant Program
Development of novel technologies for real-time studies of microbial biofilms

Grant duration: 7/1/07 – 6/30/08 (no cost extension until 6/30/09)

Role: PI

Butcher grant

Calcium Sensors – Probes to Elucidate Mechanisms of Neurodegeneration

Grant duration: 7/1/2008 – 6/30/2010

Role: Co-PI (PI: Professor Kevin Jones)

NIH R01 award GM083849-02S1

Competitive revision to: Microfluidics-based Selections for Optimization of Red Fluorescent Proteins

Grant duration: 10/1/2009 – 9/30/2011 (no cost extension to 8/30/12)

Role: PI: Palmer; Co-PI Jimenez; Co-PI Pardi)

Butcher Award (University of Colorado)

Revolutionizing the way we look at cells: Inventing organelle biosensors by harnessing the power of proteomics and live cell imaging

Role: Co-PI with Professor Natalie Ahn

STEM EDUCATION ACTIVITIES

1. Classroom teaching

Fall 2005 Advanced General Biochemistry I (CHEM 5771); 5 credits
 Scientific Ethics (CHEM 5761); 1 credit

Spring 2006 Advanced Topics in Signal Transduction and Cell Cycle Regulation (CHEM 5801); 3 credits;
 taught 2 lectures

Fall 2006 Advanced General Biochemistry I (CHEM 5771); 5 credits
 Scientific Ethics (CHEM 5761); 1 credit

Fall 2006 Advances in Molecular Biophysics (CHEM 5661); 3 credits; taught 2 lectures

Fall 2007 Physical Chemistry with Biological Applications (CHEM 4411/5411); 3 credits

Fall 2007 Chemical Biology (CHEM 5341); 3 credits, taught 1 lecture

Spring 2008 Advanced Topics in Signal Transduction and Cell Cycle Regulation (CHEM 5801); 3 credits;
 taught 2 lectures

Fall 2008 Physical Chemistry with Biological Applications (CHEM 4411/5411); 3 credits

Fall 2008 Advances in Molecular Biophysics (CHEM 5661); 3 credits, taught 2 lectures

Fall 2009 Physical Chemistry with Biological Applications (CHEM 4411/5411); 3 credits

Fall 2010 Physical Chemistry with Biological Applications (CHEM 4411/5411); 3 credits

Fall 2010 Advances in Molecular Biophysics (CHEM 5661); 3 credits, taught 2 lectures

Fall 2011 Physical Chemistry with Biological Applications (CHEM 4411/5411); 3 credits

Spring 2012 Advanced Topics in Signal Transduction and Cell Cycle Regulation (CHEM 5801); 3 credits;
 taught 2 lectures

Spring 2014 General Chemistry for Majors (CHEM 1271); 5 credits

Fall 2014 Advances in Molecular Biophysics (CHEM 5661); 3 credits, taught 2 lectures

Spring 2015 General Chemistry for Majors (CHEM 1271); 5 credits

Spring 2016 Advanced Topics in Signaling and Cell Cycle Regulation (CHEM 5801); 3 credits

Fall 2016 Foundations in Chemistry (CHEM 1400); 4 credits

Fall 2017 Foundations in Chemistry (CHEM 1400); 4 credits

Fall 2018 Foundations in Chemistry (CHEM 1400); 4 credits

2. Innovations in Undergraduate Course Transformation

A. Course Transformation in Physical Chemistry:

Over the course of 4 years (2007 – 2011) I transformed the course structure, pedagogy, and curriculum of an upper-division Physical Chemistry class (CHEM 4411/5411). I defined what students should learn, evaluated what students were actually learning using a pre/post concept survey, and transformed the learning

environment by developing group break-out sessions, hands-on tutorials, and Clicker questions to engage students as active learners. These reforms were sustained and adopted by faculty that taught the class after me. Moreover, other faculty in the Department have started to employ “break-out” group work in their courses.

Key activities:

- Reorganized the class into learning modules and developed specific learning goals for each module to explicitly define what students need to know and be able to do.
- Created 22 Group “Break out” activities for Physical Chemistry. During each class period, students work on these activities for 15-20 min in groups of 4-6. Activities are designed to engage students and challenge them to explore fundamental concepts in Physical Chemistry as well as enhance their problem solving skills.
- Integrated undergraduate Learning Assistants (LAs) into the course. The LA Program at the University of Colorado is designed to encourage undergraduate science majors to pursue a career in teaching and to assist with course reform. I mentored 1 LA in Fall 2009, 3 LAs in Fall 2010, and 2 LAs in Fall 2011.
- Revised and utilized a pre/post chemistry concept inventory to measure learning gains in an effort to evaluate how classroom reforms impacted student learning.
- Used the Colorado Learning Attitudes about Science Survey (CLASS-Chem) instrument each year since 2007 to measure how students’ attitudes and perceptions about chemistry change over the course of the semester and use this information to improve the course.
- Received an NSF CAREER award to support and sustain these reforms, our group work was highlighted in a video produced by the Science Education Initiative (<http://STEMvideos.colorado.edu>), and I presented my course model at the National ACS meeting

B. Course transformation in General Chemistry for Majors:

In 2014, when I began teaching general chemistry to Chem and Biochem majors it became immediately apparent that the curriculum, pedagogy, structure, and underlying philosophy that motivated the course were outdated. While I lobbied the Dept to change Introductory Chemistry for majors, I developed 4 new recitations, 2 new labs, and 6 in-class activities for Majors General Chemistry-II (CHEM1271).

Once the Department adopted major curriculum reform, I developed a new **Foundations of Chemistry** course (CHEM 1400), which I launched in the Fall of 2016. The goals of this new course are to improve critical thinking and reasoning, emphasize core concepts in chemistry, and foster a sense of community and identity as a chemistry and/or biochemistry major. The curriculum and design were motivated by research on teaching and learning that indicates students develop deeper understandings and higher level critical thinking skills when they are actively engaged, challenged to construct explanations, and taught to explain their reasoning.

Key activities:

- Developed 44 in-class group activities to engage students in solving problems, analyzing data, constructing explanations, and examining mechanisms
- Developed 15 new activities for recitation periods
- Posted 40 videos and associated video quizzes online to prepare students for each class period
- Integrated tablet-based activities (use of simulations, free-response learning catalytics) into the classroom
- Introduced a collaborative research project and end of semester poster session
- Restructured the curriculum to focus on core concepts and developed learning goals for each of the 7 units
- Integrated 4 Learning Assistants into the classroom

- Currently evaluating curriculum reforms using pre/post critical thinking assessment test (CAT), concept inventories, and CLASS instrument for measuring attitudes

3. Curriculum reform

In 2014-15 I spearheaded a Department effort to redesign the first two years of our curriculum for Chem and Biochem majors. We developed a proposal to restructure our curriculum, promote collaboration between courses, and create 5 new classes in an effort to adopt innovations in STEM education, emphasize critical thinking and integrate more advanced material at an earlier stage. The proposal was approved by the College of Arts and Sciences and we are launched new introductory courses in the 2016-2017 AY.

4. Mentoring and research advisor for undergraduate students

- Since 2005 I have mentored and served as the primary research advisor for 33 undergraduates, including 17 women, and 7 under-represented minorities. 15 of these students wrote and received Undergraduate research awards to support their research.
- Faculty mentor for the SMART (Sumer Multi-cultural Access to Research Training) Program at CU since 2007.

5. Additional STEM education activities

- Advisory Board for TRESTLE (Transforming Education, Supporting Teaching and Learning Excellence) Project at CU Boulder, 2016-present
- Recipient of Chancellor's Faculty Award (CU Center for STEM Learning) 2016 for "Transforming Chemistry through Collaboration and Community" project to change the culture in the General Chemistry for majors course
- Recipient of ASSETT (Arts & Sciences Support of Education Through Technology, CU) 2016 Development Award to introduce tablets for group activities in the General Chemistry for majors course
- Mentored a graduate student (Anna Curtis) on a Discipline-Based Education Research project to assess whether incorporation of case studies into the General Chemistry curriculum influences critical thinking skills, Spring 2015 through Fall 2017
- 1 of 16 Invited participants at a 2-day workshop on Science Learning and Assessment by the Gordon and Betty Moore Foundation, led by Bruce Alberts, 2014
- Participant in graduate training programs: Signaling and Cell Cycle Regulation (2005 – present), Molecular Biophysics (2005 – present), Creative Methods in Molecular Biology (2005 – 2012), Pharmaceutical Biotechnology (2012 – 2016), and Interdisciplinary Quantitative Biology (IQ-Biology, 2012 – present). I attend monthly Super Groups and serve as a mentor for numerous students in these programs.
- 3-day Faculty Teaching Excellence Program (FTEP) workshop on "How to create Learning Goals" (Spring of 2006)
- 1-day ASSETT workshop on "How to FLIP a classroom" (May 2015)

Postdoctoral associates supervised

Name	Years	Current position
Emily A. Gibson	2008-2009	Assistant Professor, Bioengineering, CU-Denver
Hairong Ma	2009-2012	Research Assistant Professor, Texas Tech University Health Sciences Center
Yan Qin	2009-2016	Assistant Professor, Biological Sciences, University of Denver, NIH K99 recipient
Elizabeth Specht	2014 - 2016	Senior Scientist, The Good Food Institute
Eugenia Silva-Herzog	2015 - 2016	MPH Program, Georgetown University

Esther Braselmann	2014 - present	Postdoctoral Associate, NIH K99 recipient
Molly Carpenter	2015 - present	Postdoctoral Associate
Maria Lo	2015 - present	Postdoctoral Associate
Jian Wei Tay	2016 - 2018	Postdoctoral Associate
Evan Pratt	2017 – present	Postdoctoral Associate
Colin Rathbun	2018 – present	Postdoctoral Associate, NIH F32 recipient

Principal Dissertation/Thesis Advisor (graduate level)

18 students total

Name	Years/Degree	Current position
Schuyler B. Van Engelenburg	2005 – 2010 / PhD	Assistant Professor University of Denver
Philip J. Dittmer	2004 – 2010 / PhD	Postdoc, UC Denver Anschutz Medical Campus with Mark Del'Acqua
Janet E. McCombs	2005 – 2010 / PhD	Scientist, Biotechnology Industry
David Wren	2005 – 2008 / M.A.	Assistant Professor of Teaching and Director of Chemistry Center, Wake Forrest University
Jose G. Miranda	2006 – 2012 / PhD	NIH F31 Predoctoral Fellowship recipient; Postdoc, UC Denver Anschutz Medical Campus with Richard Benninger
Kevin Dean	2007 – 2013 / PhD	Postdoc, UT Southwestern with Gaudenz Danuser
Sarah McQuate	2010 – 2014 / PhD	NIH F31 Predoctoral Fellowship recipient; Santa Cruz science communication program
J. Genevieve Park	2010 – 2014 / PhD	Surgery Resident Wake Forest Medical Center
Jennette DeKoekoek	2011 – 2012/M.A.	
Alexandra M. Young	2011 – 2017 / PhD	Postdoc, Fred Hutch Cancer Institute
Kyle P. Carter	2012 – 2017 / PhD	Postdoc, Stanford University
Eldon Chou	2012 – 2014 / M.A.	Employed by GE Life sciences
Yu Han	2013 – 2018 / PhD	Postdoc, UC Denver Anschutz Medical Campus
Lynn Sanford	2014 – present	
Michael Minson	2014 – present	
Kelsie Anson	2016 – present	NSF GRF recipient 2017
Lara Janiszewski	2016 – present	NSF GRF recipient 2017
Leah Damon	2017 – present	

Member of Graduate Dissertation/Thesis Committee (other than principal advisor)

2006	3 students	Chris Downey, Aaron Heib, Lisa Brassel
2007	1 student	Chung-Tien Lee (MCDB)
2009	4 students	Kyle Landgraf, Idalis Villeneuve (Chemical and Biological Engineering), Rachel Mooney (Chemical and Biological Engineering), Colby Stoddard
2011	3 students	Martha Hosotani (Physics), Ryan Takeshita (MCDB), Cole DeForest (Chemical and Biological Engineering)
2012	7 students	Andrew Garst, Tyson Vonderfecht, Nikki Bishop (Chemical and Biological Engineering), Jonathon Friedman (MCDB), Amber English (MCDB), Douglas Chapnick, Jamee Bresee
2013	7 students	Michelle Turco, Jennifer Lubbeck (Physical Chemistry), Becca Blair, Leslie Morton, Laura Johnson, Travis Lund
2014	4 students	Yemin Xu (Biochemistry/Chemical and Biological Engineering), Anthony Barsic (Electrical, Computer and Energy Engineering), Christina Sandoval, Amber English (MCDB)
2015	5 students	Chun Yang (Biochemistry/Chemical and Biological Engineering), Jennifer Gifford, Conggang Zhang, Ashley Rowland (MCDB), Jessica Podell, Noah Kastelowitz

2016	4 students	Isaac Godfroy (Chemical and Biological Engineering), Hanzeng Li (MCDB), Luke Amer (Chemical and Biological Engineering), Jacob Polaski
2017	9 students	Tianjing Hu, Erik Bunker, Alex Hopkins, Dave Protter, Russell Perkins (Chem), Abigail Horn, Prem Manna (Chem), Brett Fiedler (Chem, Co-mentor), Ben Allen
2018	7 students	Aaron Aziz (Chemical and Biological Engineering), Peter Otoupal (Chemical and Biological Engineering), Abigail Horn, Melissa Phillips (MCDB), Marc-Andre Leblanc, Anna Curtis (Chem), Joseph Plaks (Chemical and Biological Engineering),
Current	14 students	Abigail Reens (MCDB), Giancarlo Bruni (MCDB, Co-mentor), Elina Ly, Joe Villaneuva (MCDB), Doug Peters (MCDB), Deanna Lananger (MCDB), Nicholas Hill (Biochem), Samantha Allen (Chem), Rob Albrisch (Biochem), Zach Wilson (MCDB), Graycen Wheeler, Suzannah Miller, Kristen Eller (Chemical and Biological Engineering), Johnny Striepen (MCDB)

Rotation Advisor for Graduate Students

2005-2006	J'Aime Manion, Jessica Hattle, Janet McCombs, David Wren, Schuyler VanEngelenburg, Andrea Edwards
2006-2007	Andrew Garst, Jesus Hernandez, Carol Manhart, Jose Miranda
2007-2008	Kevin Dean, Mike Sfregola (MCDB), Katarina Jensen
2008-2009	Mikal Sherman
2009-2010	Andrew Dalby, John Zinder, Chun Yang
2010-2011	Steven Jones, Danielle Pfaff, Alexandra Young
2011-2012	Marissa McKercher, Eldon Chou, Sabrina Hunt, Eric Bunker, Kyle Carter
2012-2013	David Protter, Neil Lloyd, Katherine Palma (IQ-Biology), Justine Debelius, Leighanna Hinojosa
2013-2014	Lynn Sanford, Amanda Burnett, Michael Minson, Charli Fant, Zacharia Holmes
2014-2015	Van Tra, Meagan Nakamoto, Justin Moser
2015-2016	Roman Iwasaki, Lara Janiszewski, Nick Hill
2016-2017	Suzannah Miller, Jenna Rimel, Ignacio Tripoli (IQ-Biology), Leah Damon,
2017-2018	Humza Ashraf, Dieu My Nguyen (IQ-Biology), Claire Armstrong, Giulia Corbet, Jeffre Allen
2018-2019	Erin Richards, Kate DaPron (MCDB), Calvin Voong

Undergraduate students (33 students total, 9 honors students, 7 under-represented minorities)

Name	Year	Honors Thesis	Research Program	Post-grad position
Ashley Pratt	2006 - 2007	B.A. MCDB & Biochemistry, <i>magna cum laude</i>	UROP Fall 2005	PhD program, The Scripps Research Institute
Stephanie Lange	2006	B. A. Biochemistry, <i>cum laude</i>	Independent research	
Jue Cao	2007	B. A. Biochemistry, <i>magna cum laude</i>	Independent research	Medical school, Drexell University
Weng Si Au Yeung	2007 - 2008		HHMI independent research	PhD program, Northwestern University
Jessica L. Weiss	2007 - 2008		HHMI independent research	
Joseph Stech	2007 - 2008		Independent research	
Weston Blakeslee	2009		Independent research	PhD program, CU-Denver
Jennifer Binder	2010	B.A. Chemistry, <i>magna cum laude</i>	Independent research	PhD program, Arizona State U.
Caitlin Stoddard	2009-2010	B.A. Biochemistry, <i>summa cum laude</i>	BURST, HHMI independent research	PhD program, UCSF
Linda Nguyen	2010-2011	B.A. Chemistry, <i>magna cum laude</i>	BURST, Independent research	Dental School
Amanda Weaver	2010-2012		BURST, HHMI Independent research	

Zachary Dunlap	2011		BURST	
Alyssa Wiener	2011-2012	B.A. Biochemistry, <i>summa cum laude</i>	HHMI, Independent research	Medical school, University of Chicago
Elizabeth Hutton	Summer 2011		Volunteer from Integrated Science Program at Princeton University	
Madeline Lebin	2012-2015		UROP, HHMI	Teach for America
Katherine T Anderson	2012-2013		Independent research	
Cloe Pogoda	2012-2013		Independent research	PhD program, CU-Boulder
Jordan Gringauz	2013 - 2016		UROP	Research Assistant
Brian Wood	2014 - 2016		Independent research	
Zachary Maschmann	2014 - 2015		Independent research	PhD program, Cornell U.
Yeabsira Desta	2015-2016		BURST	
Natalie Robertson	2015-present		HHMI	
Dilara Batan	2015-2016	B.A. Biochemistry, <i>summa cum laude</i>	UROP, HHMI	PhD program, CU Boulder
Grant Huckels	2016-2017			
Hannah McMullen	2016-2017	B.A. MCDB, <i>summa cum laude</i>	UROP	M.D. Columbia
Abdur Khan	2017-present		BSI Scholar	
Justin Tapper	2017 - present		BSI Scholar	

Non-CU students participating in a summer research program

Kendra Vann	2007		SMART	
Stephanie Morales	2008		SMART	PhD program, Baylor School of Medicine
Anabel Gonzales-Gil	2009		SMART	PhD program, Johns Hopkins U.
Amandla Roque-Atilano	2010		SMART	PhD program, UC Denver Anschutz Medical Campus
Isola Brown	2011		SMART	PhD program, Michigan State
Jamal Bryant	2012		SMART	PhD Program, Vanderbilt
Mateo Hernandez	2014, 2015		SMART	
Angela Cannata	2018		SMART	

High School Students

Conner Brown	2009-2010	Boulder High School	Independent Research	
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Abbreviations: BURST, Bioscience Undergraduate Research Skills and Training; SMART, Summer Multicultural Access to Research Training

Member of Undergraduate Honors Thesis Committee (other than Principal Advisor)

Katherine Weinell (MCDB, 2006)
 Brian Cristiano (Biochemistry 2008)
 Susan Anduaga (MCDB 2009)
 Nicholas Taylor (Chemistry 2009)
 Jake Lebin (Biochemistry 2010)
 Casey Hughes (MCDB 2011)
 Krista Donohue (Chemical and Biological Engineering 2011)
 Patrick Chitwood (MCDB 2012)
 Jared Di Benedetto (MCDB 2012)

Michael Pham (Chemistry 2012)
Patrick Chitwood (MCDB 2012)
Katelyn Cook (MCDB 2016)
Annika Gustavson (MCDB 2018)
Isaac Heinz (Geology 2018)

SERVICE ACTIVITIES

National

Editorial Board Member

2017 – present, *Biophysical Journal*
2015 – present, *Journal of Biological Inorganic Chemistry*

Grant Review Panels

2018 NIH DP2 Panel
2017 NIH DP2 Panel
2015 – 2017 NIH Special Emphasis Panels
2014 NSF CAREER Panel, Chemistry of Life Processes Program
2010-2014 NIH MSFA Study Section, standing member
2009 NIH MSFA Study Section, ad hoc reviewer, 2 cycles
2008 NIH MI Study Section, ad hoc reviewer
2008 – present: mail reviews for NSF, NSERC, Alzheimer's Association

Advisory Committees

2017 HHMI Janelia Research Campus, GENIE project
2015 American Chemical Society, National search for Editor-in-Chief of new ACS Journal
2015 HHMI Janelia Research Campus, GENIE project

Conference organization

2018 ASBMB, Organize "Metals in Biology" Session
2017 American Chemical Society National Meeting (August), Organize Bioinorganic Chemistry Symposium
2015 Chair, Gordon Research Conference Cell Biology of Metals
2013 Vice Chair, Gordon Research Conference Cell Biology of Metals
2010 American Chemical Society National Meeting (April), 3-day symposium for Physical Division on "Metals in Biology"

Other

2005 – present: Journal reviewer, e.g. *Nature*, *Science*, *Nature Methods*, *Nature Chemical Biology*, *Nature Chemistry*, *Nature Communications*, *Chemical Reviews*, *JACS*, *Angewandte Chemie*, *Chemistry and Biology*, *ACS Chemical Biology*, etc.; typically review 10-15 papers per year
2008 – 2009: Guest Editor *Chemical Reviews* "Cellular Metal Trafficking and Regulation" thematic issue

University level

2017 – 2018: Foundations of Excellence committee: Learning Dimension
2012 – present: Faculty Director, BioFrontiers Advanced Imaging Core Facility
2012 – present: Advisory Board, BioFrontiers Advanced Imaging Core Facility
2016 – present: Advisory Board for TRESTLE (Transforming Education, Supporting Teaching and Learning Excellence) Project at CU Boulder
2007 – present: NIH Biophysics Training Grant Steering Committee, alternating years
2013 – 2014: Executive Leadership Program
2007 – 2015: Colorado Clinical and Translational Sciences Institute (CCTSI) Grant Review Board
2008 – 2010: CU Innovative Seed Grant Reviewer for Vice Chancellor's Office

Department/Institute Level

Leadership

2018 – present Associate Chair of Undergraduate Affairs, Biochemistry
2016 – present BioFrontiers Executive committee
2005 – present BioFrontiers Council
2013 – 2015 Department Executive Committee

Faculty Search Committees

2013 – 2014 Chair, Biochemistry Search Committee (Sabrina Spencer)
2011 – 2012 Member, Biochemistry Search Committee (Senior hire: Roy Parker)
2007 – 2008 Member, BioFrontiers Search Committee (Biophysics Search)
2006 – 2007 Member, Organic Chemistry Search Committee

Curriculum

Shared Undergraduate Instruction Committee (2017 – 2018 Co-Chair, 2018 – 2019, Member)
Biochemistry Curriculum committee (2016 – 2018)
General Chemistry Curriculum committee (2014 – 2018)
Department-wide Curriculum committee (2016 – 2017)
Biochemistry PhD Committee (2005 – 2007)

Other

2009 – 2012 Graduate recruiting
2010 – 2012 Diversity committee

Community Outreach

- Talks to Science Research Seminar Class, Fairview High School (2016, 2017, 2018)
- CU Wizards Show (2017, 2019)
- Participated in a day of workshops and panels at Dartmouth College (20th anniversary Women In Science Project Symposium)
- Science Fair Judge, Mesa Elementary School, Boulder CO (2011, 2012, 2015)
- Profiled in “Findings” NIH Magazine

PROFESSIONAL AFFILIATIONS

1994 – present Member, American Chemical Society
2005 – present Member, Biophysical Society
2008 – present Member, American Society for Cell Biology
2004 – 2005 Member, Society for Neuroscience
2014 – present Member, International Society for Zinc Biology
2015 – present Member, Society for Biological Inorganic Chemistry