

Christine K. Payne

Chemistry and Biochemistry
Georgia Institute of Technology
Atlanta, GA 30332-0400

Phone: (404) 385-3125
Fax: (404) 385-6057
christine.payne@chemistry.gatech.edu

Educational Background

1998 B.S. Chemistry University of Chicago
2003 Ph. D. Chemistry University of California, Berkeley

Advisor: Charles Harris

Employment History

2007- Assistant Professor, Georgia Institute of Technology
2003-2006 Postdoctoral Fellow, Harvard University, Advisor: Xiaowei Zhuang
1998-2000 Graduate Teaching Assistant, University of California, Berkeley

Research Interests

Kinetics and mechanisms of intracellular chemical reactions
Interactions of nanoparticles with living cells
Development of new fluorescence microscopy methods

Professional Memberships and Service

2012 NIH Peer Review, NANO, ad hoc
2011 Symposium Organizer, "Advanced Microscopy...Biophysical Questions," ACS Meeting, Denver
2011 Participant, Innovation Brainstorm, Strategic planning session for NIH Common Fund
2010 Chair, Biophysical Subdivision, Division of Physical Chemistry, ACS
2009- NIH Peer Review, DMR, Biomaterials
2009 Symposium Organizer, "Single Molecule Biophysics," OSA Annual Meeting, San Jose
2007- Co-Organizer, Atlanta Area Chemical Physics (AACP) Seminar Series
2003- Biophysical Society, member
1999- American Chemical Society, member

Honors and Awards

2011 DARPA Young Faculty Award
2009 NIH Director's New Innovator Award
2008 ACS PROGRESS-Dreyfus Lectureship Award
2007-2010 Research Scholar Development Award; NIH
2004-2006 Ruth L. Kirschstein National Research Service Award; NIH Postdoctoral Fellowship
1998 B.S. with Honors in the College and in Chemistry, University of Chicago

Research Grants

Current NIH Director's New Innovator Award, October 2009-September 2014, \$2.3M Total/\$1.5M Direct
NIH R01 with R. Dickson (P.I.), C. Fahrni, and M. Kemp, September 2008-July 2012
DARPA Young Faculty Award, July 2011-June 2013, \$300K Total/\$175K Direct

Completed NIH Research Scholar Development Award, April 2007-March 2010, \$268K Total/\$250K Direct

Teaching

Courses Statistical Mechanics (CHEM 6481, Graduate) Spring 07 & 09, Fall 10
Quantum Mechanics (CHEM 3412, Undergraduate) Spring 08, Fall 08, Fall 09 & Fall 11
General Chemistry (CHEM 1310, Undergraduate) Spring 11

REU	Jenna Tomlinson (2008, now a Ph.D. student at University of Michigan), Solaire Finkenstaedt-Quinn (2009, now a Ph.D. student at University of Minnesota), Syeda Anum (2011, senior at Northeastern University), Ryan Lannan (2012), Quachel Bazile (2012)
B.S.	Former: Nicole Fay (2007-2008, now a Ph.D. student at UC Berkeley), Jesse Haulk (2008), Kevin Hardin (2008-2009), Paul Park (2010), Heather Jekot (2010, now a medical student at MCG), Jessica Obermiller (2011), Joshua Liu (2010-2011), Jairo Zapata (2009-2011), Patrick Chen (2012), Kelsey Killion (2012) Current: Hursh Sureka (ChemE), Joseph Kim (Biochem), Candace Law (BME), Son Tran (ISyE)
M.S.	Melinda Ogden (2007-2009)
Ph.D.	Former: William Humphries (Ph.D. Fall 2011) Current: Candace Fleischer
Postdocs	Former: Ashlee St. John Iyer (2008-2009), Don-Ricardo Miller (joint with Prof. Melissa Kemp, BME, 2009-2010), Craig Szymanski (2009-2011), Gerard Doorley (2010-2012) Current: Steven Hira, Umesh Kumar, Saheli Sarkar (joint with Prof. Melissa Kemp, BME), Debjyoti Bandyopadhyay

Invited Seminars, 2007-2012

- "Imaging chemical reactions inside living cells," Department of Chemistry, University of Chicago; May 22, 2012.
- "Imaging dynamic events inside living cells," Department of Chemistry and Biochemistry, University of California, Santa Cruz; May 14, 2012.
- "Probing nanoparticle-cell interactions with fluorescence microscopy and single particle tracking," Translational and Molecular Imaging Institute, Mount Sinai School of Medicine, New York; March 16, 2012.
- "Imaging chemical reactions inside living cells," Physical Chemistry Seminar, School of Chemistry, University of California, Berkeley; March 13, 2012.
- "Imaging nanoparticle-cell interactions," Physical Chemistry Seminar, Department of Chemistry and Biochemistry, University of California, San Diego; March 6, 2012.
- "Imaging chemical reactions inside living cells," Department of Chemistry, University of Southern California, Los Angeles, California; February 27, 2012.
- "Using fluorescence microscopy to image chemical reactions inside living cells," Cardiovascular Biology Seminar, Division of Cardiology, Emory School of Medicine, Atlanta, Georgia; February 13, 2012.
- "Imaging nanoparticle-cell interactions," Atlanta Area Chemical Physics Seminar, Department of Chemistry, Emory University, Atlanta, Georgia; February 6, 2012.
- "Imaging chemical reactions inside living cells," Physical Chemistry Seminar, Department of Chemistry and Biochemistry, University of Colorado, Boulder; January 27, 2012.
- "Imaging chemical reactions inside living cells," Department of Chemistry, Colorado State University, Ft. Collins, Colorado; January 26, 2012.

"Imaging chemical reactions inside living cells," Department of Chemistry, University of Wisconsin, Madison; January 24, 2012.

"Imaging chemical reactions inside living cells," Department of Chemistry and Biochemistry, University of California, Los Angeles; January 9, 2012.

"Imaging chemical reactions inside living cells," Department of Chemistry, University of Illinois at Urbana-Champaign; November 30, 2011.

"Imaging nanoparticle-cell interactions," Department of Chemistry, Rice University, Houston, Texas; November 2, 2011.

"Imaging chemical reactions inside living cells: Two-color single particle tracking of the enzymatic degradation of low-density lipoprotein (LDL)," 2011 National Meeting of the American Chemical Society, Denver, Colorado; August 29, 2011.

"Imaging chemical reactions inside living cells," Biophysics Colloquia, Cornell University, Ithaca, New York; April 27, 2011.

"Imaging chemical reactions inside living cells," Department of Chemistry, New York University, New York; April 5, 2011.

"Imaging nanoparticle-cell interactions," Department of Chemistry, North Carolina State University, Raleigh, North Carolina; March 25, 2011.

"Imaging chemical reactions inside living cells," Department of Chemistry, Duke University, Durham, North Carolina; March 22, 2011.

"Imaging chemical reactions inside living cells," Department of Chemistry, Georgia Southern University, Statesboro, Georgia; November 12, 2010.

"Imaging dynamic events inside living cells: Intracellular degradation of LDL," Single Molecule Approaches to Biology, Optical Society of America, Rochester, New York; October 27, 2010.

"Imaging nanoparticles in living cells: Unraveling interactions at the nano-bio interface," Functionalized Nanobiomaterials for Medical Applications, MRS Workshop, Denver, Colorado; October 6, 2010.

"Kinetics and mechanism of intracellular reactions: Probing the degradation of LDL," 2010 National Meeting of the American Chemical Society, San Francisco, California; March 24, 2010.

"Imaging dynamic events in live cells," Department of Chemistry and Biochemistry, University of Notre Dame, Notre Dame, Indiana; February 4, 2010.

"Imaging dynamic events in live cells," Department of Chemistry, Spelman College, Atlanta, Georgia; January 28, 2010.

"Imaging dynamic events in live cells," IBB Breakfast Club, Georgia Tech; January 19, 2010.

"Intracellular delivery of quantum dots for live cell imaging," NanoFANS, Nanotechnology Research Center, Georgia Tech; November 18, 2009.

"Imaging dynamic events inside living cells," Department of Chemistry and Biochemistry, Bowdoin College, Brunswick, Maine; November 6, 2009.

"Non-scanning two-photon microscopy for imaging in live cells," Single Molecule Biophysics, Optical Society of America, San Jose, California; October 15, 2009.

"Cytosolic delivery of quantum dots for live cell imaging," Structural Biology and Molecular Biophysics Symposium, Georgia Tech; July 24, 2009.

"Imaging reaction dynamics in living cells," College of Arts and Sciences Seminar, Valdosta State University, Valdosta, Georgia; April 23, 2009.

"Imaging intracellular dynamics," Department of Physics, University of Maine, Orono; April 3, 2000.

"Imaging reaction dynamics in living cells," Natural Science Seminar, New College of Florida, Sarasota, Florida; December 5, 2008.

"Pyrenebutyrate-mediated delivery of quantum dots to living cells," Southeastern Regional Meeting of the ACS, Nashville, Tennessee; November 14, 2008.

"Pyrenebutyrate-mediated delivery of quantum dots to living cells," Department of Chemistry and Biochemistry, University of Colorado, Boulder; November 5, 2008.

"Directed delivery of nanomaterials within living cells," US-North Africa Regional Workshop on Nanostructured Materials and Nanotechnology, Hammamet, Tunisia; March 18, 2008.

"Imaging reaction dynamics in living cells," Department of Chemistry and Biochemistry, San Diego State University, California; February 1, 2008.

"Role of diffusion in vesicle-mediated transport: Fluorescence correlation spectroscopy for quantitative cellular imaging," Department of Chemistry, University of Alabama, Huntsville; April 20, 2007.

Publications (* indicates Georgia Tech publication)

26.* "Nanoparticle surface charge mediates the cellular receptors used by protein-nanoparticle complexes," C.C. Fleischer and C.K. Payne, *J. Phys. Chem. B*, **accepted**, (2012).

25.* "Imaging lysosomal enzyme activity in live cells using self-quenched substrates," W.H. Humphries and C.K. Payne, *Analytical Biochemistry*, **424**, 178-183 (2012).

24.* "Nanoparticles act as protein carriers during cellular internalization," G.W. Doorley and C.K. Payne, *Chem. Commun.*, **48**, 2961-2963 (2012).

- 23.* "Fluorescent coumarin thiols measure biological redox couples," K.G. Reddie, W.H. Humphries, C.P. Bain, M.L. Kemp, C.K. Payne, N. Murthy, *Org. Lett.*, **14**, 680-683 (2012).
- 22.* "Imaging intracellular quantum dots: Fluorescence microscopy and transmission electron microscopy," C.J. Szymanski, H. Yi, J.T. Liu, E.R. Wright, C.K. Payne, in *Nanobiotechnology Protocols*, Eds. S.J. Rosenthal and D.W. Wright (Humana Press, New York, 2012), in press.
- 21.* "Endo-lysosomal vesicles positive for Rab7 and LAMP1 are terminal vesicles for the transport of dextran," W.H. Humphries, C.J. Szymanski, C.K. Payne, *PLoS One*, **6**, e26626 (2011).
- 20.* "Single particle tracking as a method to resolve differences in highly colocalized proteins," C.J. Szymanski, W.H. Humphries IV, C.K. Payne, *Analyst*, **136**, 3527-3533 (2011). Featured in "Emerging Investigators" edition.
- 19.* "Cellular binding of nanoparticles in the presence of serum proteins," G.W. Doorley and C.K. Payne, *Chem. Commun.*, **47**, 466-468 (2011). Featured in "Emerging Investigators" edition.
- 18.* "Intracellular degradation of low-density lipoprotein probed with two-color fluorescence microscopy," W.H. Humphries IV, N.C. Fay, C.K. Payne, *Integrative Biology*, **2**, 536-544 (2010).
- 17.* "Pyrenebutyrate leads to cellular binding, not intracellular delivery, of polyarginine quantum dots," A.E. Jablonski, T. Kawakami, A.Y. Ting, C.K. Payne, *J. Phys. Chem. Lett.*, **1**, 1312-1315 (2010).
- x.* "Pyrenebutyrate-mediated delivery of quantum dots across the plasma membrane of living cells," A.E. Jablonski, W.H. Humphries IV, C.K. Payne, *J. Phys. Chem. B*, **113**, 405-408 (2009). Withdrawn. The conclusions drawn from the data in this manuscript were incorrect. A full discussion can be found in Publication #17.
- 16.* "Imaging gene delivery with fluorescence microscopy," C.K. Payne, *Nanomedicine*, **2**, 847-860 (2007).
- 15.* "Cellular binding, motion, and internalization of synthetic gene delivery polymers," G.T. Hess, W.H. Humphries IV, N.C. Fay, and C.K. Payne, *Biochim. Biophys. Acta, Mol. Cell Res.*, **1773**, 1583-1588 (2007).
14. "Internalization and trafficking of cell surface proteoglycans and proteoglycan-binding ligands," C.K. Payne, S.A. Jones, C. Chen, and X. Zhuang, *Traffic*, **8**, 389-401 (2007).
13. "Photo-induced β -hydrogen elimination and radical formation with $\text{CpW}(\text{CO})_3(\text{CH}_2\text{CH}_3)$: Ultrafast IR and DFT studies," E.A. Glascoe, M.F. Kling, J.E. Shanoski, R.A. DiStasio Jr., C.K. Payne, B.V. Mork, T.D. Tilley, and C.B. Harris, *Organometallics*, **26**, 1424-1432 (2007).
12. "Temperature-dependent UV-Vis spectral changes in hydrogen- and deuterium-bonded photosynthetic reaction centers of *Rhodobacter sphaeroides*," A.E. Ostafin, J.A. Popova, C.K. Payne, H. Mizukami, J.R. Norris, *Photosynthetica*, **44**, 433-438 (2006).
11. "Nanophotonic light sources for fluorescence spectroscopy and cellular imaging," O. Hayden and C.K. Payne, *Ang. Chem. Int. Ed.*, **44**, 1395-1398 (2005).
10. "Ultrafast infrared mechanistic studies of the interaction of 1-hexyne with Group 6 hexacarbonyl complexes," J.E. Shanoski, C.K. Payne, M.F. Kling, E.A. Glascoe, and C.B. Harris, *Organometallics*, **24**, 1852-1859 (2005).

9. "Ultrafast UV pump/IR probe studies of C-H activation in linear, cyclic, and aryl hydrocarbons," M.C. Asplund, P.T. Snee, J.S. Yeston, M.J. Wilkens, C.K. Payne, H. Yang, K.T. Kotz, H. Frei, R.G. Bergman, and C.B. Harris, *J. Am. Chem. Soc.* **124**, 10605-10612 (2002).
8. "Intramolecular rearrangements on ultrafast timescales: Femtosecond infrared studies of ring slip in $(\eta^1\text{-C}_5\text{Cl}_5)\text{Mn}(\text{CO})_5$," C.K. Payne, P.T. Snee, H. Yang, K.T. Kotz, L.L. Schafer, T.D. Tilley, and C.B. Harris, *J. Am. Chem. Soc.* **123**, 7425-7426 (2001).
7. "Dynamics of photosubstitution reactions of $\text{Fe}(\text{CO})_5$: An ultrafast infrared study of high spin reactivity," P.T. Snee, C.K. Payne, S.D. Mebane, K.T. Kotz, and C.B. Harris, *J. Am. Chem. Soc.* **123**, 6909-6915 (2001).
6. "Femtosecond infrared study of the dynamics of solvation and solvent caging," H. Yang, P.T. Snee, K.T. Kotz, C.K. Payne, and C.B. Harris, *J. Am. Chem. Soc.* **123**, 4204-4210 (2001).
5. "Triplet organometallic reactivity under ambient conditions: An ultrafast UV pump/IR probe study," P.T. Snee, C.K. Payne, K.T. Kotz, H. Yang, and C.B. Harris, *J. Am. Chem. Soc.* **123**, 2255-2264 (2001).
4. "Ultrafast infrared studies of ligand rearrangement at coordinatively saturated transition metal centers," K.T. Kotz, H. Yang, P.T. Snee, C.K. Payne, and C.B. Harris, in *Ultrafast Phenomena XII*, Eds. T. Elsaesser, S. Mukamel, M.M. Murnane, and N.F. Scherer (Springer-Verlag, Berlin Heidelberg, 2000) p. 636.
3. "Femtosecond infrared studies of ligand rearrangement reactions: silyl hydride products from Group 6 carbonyls," K.T. Kotz, H. Yang, P.T. Snee, C.K. Payne, and C.B. Harris, *J. Organomet. Chem.* **596**, 183-192 (2000).
2. "Ultrafast infrared studies of the reaction mechanism of silicon-hydrogen bond activation by $\eta^5\text{-CpV}(\text{CO})_4$," P.T. Snee, H. Yang, K.T. Kotz, C.K. Payne, and C.B. Harris, *J. Phys. Chem. A* **103**, 10426-10432 (1999).
1. "Femtosecond infrared studies of a prototypical one-electron oxidative-addition reaction: Chlorine atom abstraction by the $\text{Re}(\text{CO})_5$ radical," H. Yang, P.T. Snee, K.T. Kotz, C.K. Payne, and C.B. Harris, *J. Am. Chem. Soc.* **121**, 9227-9228 (1999).