

# Christine K. Payne

School of Chemistry and Biochemistry  
Bioengineering Program Faculty  
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## Educational Background

1998 B.S. Chemistry University of Chicago, with Honors in Chemistry and the College  
2003 Ph. D. Chemistry University of California, Berkeley, Advisor: Charles Harris

## Employment History

2013- Associate Professor, Georgia Institute of Technology  
2007-2013 Assistant Professor, Georgia Institute of Technology  
2003-2006 Postdoctoral Fellow, Harvard University, Advisor: Xiaowei Zhuang

## Research Interests

Interactions of nanoparticles with cells for diagnostic and therapeutic applications  
Biomolecular and cellular synthesis of conducting polymers for regenerative medicine  
Development of new fluorescence microscopy methods for live cell imaging

## Professional Memberships and Service

2014 NIH Peer Review, GDD, ad hoc  
2012 NIH Peer Review, NANO, ad hoc  
2011 Participant, Innovation Brainstorm, Strategic Planning for the NIH Common Fund  
2011 Symposium Organizer, "Advanced Microscopy...Biophysical Questions," ACS Meeting, Denver  
2011-2012 Reviewer, Center for Integrated Nanotechnologies (CINT), Los Alamos National Laboratory  
2010 Chair, Biophysical Subdivision, Division of Physical Chemistry, ACS  
2009-present NSF Peer Review: DMR and Chemistry  
2009 Symposium Organizer, "Single Molecule Biophysics," OSA Annual Meeting, San Jose  
2007-present Co-Organizer, Atlanta Area Chemical Physics (AACP) Seminar Series  
2003-present Biophysical Society, member  
1999-present American Chemical Society, member

## Honors and Awards

2014 Vasser Woolley Faculty Fellowship  
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

## Research Grants

Current GT-FIRE, "Intracellular mapping of nanoparticle-induced oxidative stress," July 2015-June 2016, \$40,000 Direct, co-PI: Prof. Melissa Kemp, Biomedical Engineering  
NSF Major Research Instrumentation, "MRI: Acquisition of a super-resolution microscope," September 2013-August 2016, \$469k Total, co-PIs: M. Grover, M. Kemp, H. Lu and Y. Xia.  
Completed HERCULES Seed Grant, Emory School of Public Health, July 2014-March 2015, \$32k Direct  
NIH Director's New Innovator Award, October 2009-June 2014, \$2.3M Total/\$1.5M Direct  
DARPA Young Faculty Award, July 2011-December 2013, \$300k Total/\$175k Direct  
NIH Research Scholar Development Award, April 2007-March 2010, \$268k Total/\$250k Direct

NIH R01 with R. Dickson (PI), C. Fahrni, and M. Kemp, September 2008-July 2012

### Teaching

#### Courses

Statistical Mechanics (CHEM 6481, Graduate) Spring 07, Spring 09, Fall 10, Fall 12  
 Quantum Mechanics (CHEM 3412, Undergraduate) Spring 08, Fall 08, Fall 09, Fall 11, Spring 13, Spring 15  
 General Chemistry (CHEM 1310, Undergraduate) Spring 11, Fall 14  
 Fundamentals of Data Analysis (CHEM 2801) Fall 13, Fall 14

#### REU

Jenna Tomlinson (2008, PhD student at University of Michigan), Solaire Finkenstaedt-Quinn (2009, PhD student at University of Minnesota), Syeda Anum (2011, MD student at UMass), Ryan Lannan (2012), Quachel Bazile (2012, PhD student at University of Alabama, Birmingham), Victoria Cochran (2014, current Harvard undergrad)

#### B.S.

Former: Nicole Fay (2007-2008, postdoc at UC Berkeley), Jesse Haulk (2008), Kevin Hardin (2008-2009), Paul Park (2010), Heather Jekot (2010, MD student at MCG), Jessica Obermiller (2011), Joshua Liu (2010-2011), Kelsey Killion (2012), Jairo Zapata (2009-2012), Candace Law (2012), Son Tran (2012), Joseph Kim (2011-2012, technician at Medical Neurogenetics), Hursh Sureka (2011-2013), Patrick Chen (2012-2013, CDC), Kaitlyn Willingham (2013), Chelsea Thompson (2013, technician at Ethicon), Edward Zhang (2013-2014, ABB Robotics), Nina Mohebbi (2013-2015, current GT undergrad), Joseph Miles (2014-2015, current GPC undergrad)  
Current: Jessica Richey (CHEM, 2014-), Rohan Kadambi (CHBE, 2015-)

#### M.S.

Melinda Ogden (2009), Dipesh Khanal (2015)

#### Ph.D.

Former: William Humphries (2011, microscopy specialist at B&B Microscopes/Olympus), Candace Fleischer (2014, postdoc, Emory University)  
Current: Scott Thourson (BioE), Sabiha Runa (CHEM), Kong Wong (CHBE)

#### Postdocs

Former: Ashlee St. John Iyer (2008-2009), Don-Ricardo Miller (joint with Prof. Melissa Kemp, BME, 2009-2010), Craig Szymanski (2009-2011, postdoc at PNNL), Gerard Doorley (2010-2012, consultant), Umesh Kumar (2011-2012, research scientist, TERI, India), Steven Hira (2011-2013, postdoc with El-Sayed), Austin Cyphersmith (2012-2013, research specialist, microscopy core, UIUC), Debjyoti Bandyopadhyay (2012-2013, postdoc, ITC, India), Saheli Sarkar (2011-2014, postdoc, Northeastern), Josh Morris (2013-2014, assistant professor, Georgia Gwinnett College), Alexandra Hill (CMC regulatory manager, EMD Serono, Germany), Srikant Iyer (2013-2015, analyst, OXIDE diversity program)  
Current: NA

### Publications

39. "Cellular binding of nanoparticles disrupts the membrane potential," E.A.K. Warren and C.K. Payne, *RSC Advances*, **5**, 13660-13666 (2015).
38. "Hemoglobin-mediated synthesis of PEDOT:PSS: Enhancing conductivity through biological oxidants," J.D. Morris, D. Khanal, J.A. Richey, C.K. Payne, *Biomaterials Science*, **3**, 442-445 (2015).
37. "PEGylated nanoparticles: Protein corona and secondary structure," S. Runa, A. Hill, V.L. Cochran, C.K. Payne, *Physical Chemistry of Nanomaterials and Interfaces XIII, Proceedings of SPIE*, **91651F** (2014).
36. "A model for controlling the resting membrane potential of cells using nanoparticles," S. Mukhopadhyay, F. Zhang, E. Warren, C.K. Payne, *53<sup>rd</sup> IEEE Conference on Decision and Control* (2014).

35. "Nanoparticle-cell interactions: Molecular structure of the protein corona and cellular outcomes," C.C. Fleischer and C.K. Payne, *Accounts of Chemical Research*, **47**, 2651-2659 (2014).
34. "Impact of serum proteins on MRI contrast agents: Cellular binding and T2 relaxation," A. Hill and C.K. Payne, *RSC Advances*, **4**, 31735-31744 (2014).
33. "Secondary structure of corona proteins determines the cell surface receptors used by nanoparticles," C.C. Fleischer and C.K. Payne, *J. Phys. Chem. B*, **118**, 14017-14026 (2014).
32. "Tuning PEDOT:PSS conductivity with iron oxidants," J.D. Morris and C.K. Payne, *Organic Electronics*, **15**, 1707-1710 (2014).
31. "Lysosome transport as a function of lysosome diameter," D. Bandyopadhyay, A. Cyphersmith, J.A. Zapata, Y.J. Kim, C.K. Payne, *PLoS One*, **9**, e86847 (2014).
30. "Cellular binding of anionic nanoparticles is inhibited by serum proteins independent of nanoparticle composition," C.C. Fleischer, U. Kumar, C.K. Payne, *Biomaterials Science*, **1**, 975-982 (2013).
29. "Protein-mediated synthesis of the conducting polymer PEDOT:PSS," S.M. Hira and C.K. Payne, *Synthetic Metals*, **176**, 104-107 (2013).
28. "Membrane potential mediates the cellular binding of nanoparticles," E.H. Shin, Y. Li, U. Kumar, H.V. Sureka, X. Zhang, C.K. Payne, *Nanoscale*, **5**, 5879-5886 (2013).
27. "Conditioned media downregulates nuclear expression of Nrf2," S. Sarkar, C.K. Payne, M.L. Kemp, *Cellular and Molecular Bioengineering*, **6**, 130-137 (2013).
26. "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, 2013).
25. "Nanoparticle surface charge mediates the cellular receptors used by protein-nanoparticle complexes," C.C. Fleischer and C.K. Payne, *J. Phys. Chem. B*, **116**, 8901-8907 (2012).
24. "Imaging lysosomal enzyme activity in live cells using self-quenched substrates," W.H. Humphries and C.K. Payne, *Analytical Biochemistry*, **424**, 178-183 (2012).
23. "Nanoparticles act as protein carriers during cellular internalization," G.W. Doorley and C.K. Payne, *Chem. Commun.*, **48**, 2961-2963 (2012).
22. "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).
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  $\beta$ -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  $\eta^5\text{-CpV(CO)}_4$ ," 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  $\text{Re(CO)}_5$  radical," H. Yang, P.T. Snee, K.T. Kotz, C.K. Payne, and C.B. Harris, *J. Am. Chem. Soc.* **121**, 9227-9228 (1999).

**Selected Invited Seminars, 2008-2015**

Physical Chemistry Seminar, University of Maryland, College Park; April 1, 2015

Materials Seminar, Indiana University, Bloomington, Indiana; February 24, 2015

Light-driven Processes for Bio-inspired Materials and Systems Workshop, Rice University, Houston, Texas; December 15, 2014.

Department of Chemistry, UC Davis, California; October 28, 2014.

Department of Chemistry, University of Minnesota, Minneapolis-St. Paul; October 16, 2014.

Department of Chemistry, Duke University, Durham, North Carolina; October 1, 2014.

Imaging in 2020, Imaging the Immune System, Jackson Hole, Wyoming; September 24, 2014.

SPIE, Physical Chemistry of Interfaces and Nanomaterials, San Diego, California; August 20, 2014.

2014 National Meeting of the American Chemical Society/Nano Probes for Biological Systems Symposium, San Francisco, California; August 11, 2014.

Centro de Investigación Coopertiva en Biomateriales (CIC biomaGUNE), San Sebastian, Spain; April 11, 2014.

Institute of Photonic Sciences (ICFO), Barcelona, Spain; April 8, 2014.

The Molecular Foundry, Lawrence Berkeley National Laboratory, Berkeley, California; March 25, 2014.

Solvation, Dynamics, and Reactivity in Complex Environments Focus Session, Division of Chemical Physics, APS, Denver, Colorado; March 6, 2014.

Department of Chemistry, University of Michigan; February 25, 2014.

Department of Chemistry, University of Puerto Rico, Río Piedras; February 3, 2014.

Biophysical Society Regional Meeting, Atlanta, Georgia; December 7, 2013.

Supramolecular Chemistry Symposium, Southeastern Regional ACS, Atlanta, Georgia; November 14, 2013.

Physical Chemistry Seminar, University of Rochester, New York; November 4, 2013.

2012 National Meeting of the American Chemical Society/Biomacromolecules Symposium, Philadelphia, Pennsylvania; August 20, 2012.

Department of Chemistry, University of Chicago; May 22, 2012.

Department of Chemistry and Biochemistry, University of California, Santa Cruz; May 14, 2012.

Translational and Molecular Imaging Institute, Mount Sinai School of Medicine, New York; March 16, 2012.

Physical Chemistry Seminar, School of Chemistry, University of California, Berkeley; March 13, 2012.

Physical Chemistry Seminar, Department of Chemistry and Biochemistry, University of California, San Diego; March 6, 2012.

Department of Chemistry, University of Southern California, Los Angeles, California; February 27, 2012.

Cardiovascular Biology Seminar, Emory School of Medicine, Atlanta, Georgia; February 13, 2012.

Physical Chemistry Seminar, University of Colorado, Boulder; January 27, 2012.

Department of Chemistry, Colorado State University, Ft. Collins, Colorado; January 26, 2012.

Department of Chemistry, University of Wisconsin, Madison; January 24, 2012.

Department of Chemistry and Biochemistry, University of California, Los Angeles; January 9, 2012.

Department of Chemistry, University of Illinois at Urbana-Champaign; November 30, 2011.

Department of Chemistry, Rice University, Houston, Texas; November 2, 2011.

Biophysics Colloquia, Cornell University, Ithaca, New York; April 27, 2011.

2011 National Meeting of the American Chemical Society, Denver, Colorado; August 29, 2011.

Department of Chemistry, New York University, New York; April 5, 2011.

Department of Chemistry, North Carolina State University, Raleigh, North Carolina; March 25, 2011.

Department of Chemistry, Duke University, Durham, North Carolina; March 22, 2011.

Single Molecule Approaches to Biology, Optical Society of America, Rochester, New York; October 27, 2010.

Functionalized Nanobiomaterials for Medical Applications, MRS Workshop, Denver, Colorado; October 6, 2010.

2010 National Meeting of the American Chemical Society, San Francisco, California; March 24, 2010.

Department of Chemistry and Biochemistry, University of Notre Dame, Notre Dame, Indiana; February 4, 2010.

Single Molecule Biophysics, Optical Society of America, San Jose, California; October 15, 2009.

Department of Physics, University of Maine, Orono; April 3, 2009.

Biochemistry Seminar, University of Colorado, Boulder; November 5, 2008.

US-North Africa Regional Workshop on Nanostructured Materials and Nanotechnology, Hammamet, Tunisia; March 18, 2008.