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EDUCATION

- 2005 **Ph.D., Chemistry**
California Institute of Technology, Pasadena, CA
Thesis Title: *Coordination chemistry at trigonally coordinated iron platforms: chemistry related to dinitrogen reduction*
- 1999 **B.S.E. Chemical Engineering**, summa cum laude
University of Michigan, Ann Arbor, MI

EMPLOYMENT

- 2011 – 2013 **Harvard University**, Cambridge MA; Thomas D. Cabot Associate Professor, CCB
- 2007 – 2011 **Harvard University**, Cambridge MA; Assistant Professor, CCB
- 2005 – 2007 **Massachusetts Institute of Technology**, Cambridge, MA
NIH NRSA Postdoctoral Fellow
Advisor: Professor Daniel G. Nocera
- 2000 – 2005 **California Institute of Technology**, Pasadena, CA
Graduate Student
Advisor: Professor Jonas C. Peters
- 1997 – 1999 **University of Michigan**, Ann Arbor, MI
Undergraduate Student
Advisor: Professor Mark M. Banaszak-Holl
- 1999 **IBM**, Yorktown Heights, NY
Summer Undergraduate Research Assistant
Supervisor: Professor Christopher B. Murray
- 1998 **EXXON – Basic Chemicals and Intermediates Technology**, Baytown, TX
Summer Undergraduate Research Assistant
Supervisor: Dr. Michael C. Bradford
- 1997 **FORD – Sci Lab**, Dearborn, MI
Summer Undergraduate Research Assistant
Supervisor: Dr. Jane Adams

RESEARCH INTERESTS

Our lab has made progress in the fields of organometallic and polynuclear coordination chemistry, giving rise to structurally and electronically well-defined species possessing redox-flexibility that perform multi-electron transformations. Reaction chemistry is tailored through ligand design to affect metal-based properties, allowing us to elucidate both structure/function and electronic structure/function relationships. The synthesis of these materials has allowed us to understand their redox behavior and target small molecule activation pathways reminiscent of naturally occurring enzymatic function: ranging from C–H bond functionalization catalysis to small molecule activation pertinent to energy storage.

AWARDS

- 2013 - 2018 **Henry and Camille Dreyfus Teacher Scholar Award**, Harvard University

2013	National Academy of Sciences Award for Initiatives in Research in area of Catalysis
2013	National Fresenius Award , Phi Lambda Epsilon
2012 - 2017	DOE Early Career Research Program , Harvard University
2011 - 2013	George W. Merck Fellowship , Harvard University
2011 - 2014	AFOSR Young Investigator Program , Harvard University
2010 - 2014	NSF CAREER , Harvard University
2008 - 2009	Milton Fund Award , Harvard Medical School
2008 - 2010	Dreyfus Foundation Fellowship in Environmental Chemistry , Harvard University
2008	MIT Technology Review TR35
2005 - 2007	NIH NRSA Postdoctoral Fellowship , Massachusetts Institute of Technology
2005	Division of Inorganic Chemistry Young Investigator Award , ACS
2005	Herbert Newby McCoy Award , California Institute of Technology
2003	Dow Travel Fellowship , California Institute of Technology
2000 - 2004	DOD Predoctoral Fellowship , California Institute of Technology
1997 - 1999	Dean's List , School of Engineering, University of Michigan
1995 - 1999	John B. Angell Scholar , University of Michigan
1998	Dow Chemical Undergraduate Award , School of Engineering, University of Michigan

PEER-REVIEWED PUBLICATIONS

1. Hennessy, E. T.; *Liu, R. Y.**; Iovan, D. A.; *Duncan, R. A.**; Betley, T. A. "Iron-catalyzed intermolecular *N*-group transfer with olefin substrates." *Submitted*.
2. Sazama, G. T.; Betley, T. A. "Multiple, disparate redox pathways exhibited by a tris(pyrrolido)ethane iron complex." *Inorg. Chem.* (in press).
3. Powers, T. M.; *Gu, N. X.**; Fout, A. R.; *Baldwin, A. M.**; Hernández Sánchez, R.; Alfonso, D. M.; Chen, Y.-C.; Zheng, S.-L.; Betley, T. A. "Synthesis of open-shell, bimetallic Mn/Fe trinuclear clusters." *J. Am. Chem. Soc.* **2013**, *135*, 14448-14458.
4. Powers, T. M.; Betley, T. A. "Testing the polynuclear hypothesis: multi-electron reduction of small molecules by triiron reaction sites." *J. Am. Chem. Soc.* **2013**, *135*, 12289-12296.
5. Lin, B.; Fout, A. R.; Sazama, G. T.; Raad, D. R.; Betley, T. A.; "Two- and three-electron oxidative group- and atom-transfer to a tricobalt complex to form μ^3 -imido and nitrido complexes." *Submitted*.
6. Hennessy, E. T.; Betley, T. A. "Complex *N*-heterocycle synthesis via iron-catalyzed, direct C–H bond amination." *Science* **2013**, *340*, 591-595.
7. Eames, E. V.; Hernández Sánchez, R.; Betley, T. A.; "Metal atom lability in polynuclear complexes." *Inorg. Chem.* **2013**, *52*, 5006-5012.
8. King, E. R.; Sazama, G. T.; Betley, T. A. "Co(III) imidos exhibiting spin crossover and C–H bond activation." *J. Am. Chem. Soc.* **2012**, *134*, 17858-17861.
9. Fout, A. R.; *Xiao, D. J.**; Zhao, Q.; Harris, T. D.; King, E. R.; Eames, E. V.; Zheng, S.-L.; Betley, T. A.; "Trigonal Mn₃ and Co₃ clusters supported by weak-field ligands: a structural, spectroscopic, magnetic, and computational investigation into the correlation of molecular and electronic structure." *Inorg. Chem.* **2012**, *51*, 10290-10299.
10. Eames, E. V.; Betley, T. A.; "Site-isolated redox reactivity in a trinuclear iron complex." *Inorg. Chem.* **2012**, *51*, 10274-10278.
11. Eames, E. V.; Harris, T. D.; Betley, T. A.; "Modulation of magnetic behavior via ligand-field effects in the trigonal clusters (^{Ph}L)Fe₃L₃ (L* = thf, py, PMe₂Ph)." *Chem. Sci.* **2012**, *3*, 407-415.
12. Fout, A. R.; Zhao, Q.; *Xiao, D. J.**; Betley, T. A. "Oxidative atom-transfer to a trimanganese complex to form Mn₆(μ^0 -E) (E = O, N) clusters featuring interstitial oxide and nitride functionalities." *J. Am. Chem. Soc.* **2011**, *133*, 16750-16753.
13. Harris, T. D., Betley, T. A. "Multi-site reactivity: reduction of six equivalents of nitrite to give an Fe₆(NO)₆ cluster with a dramatically expanded octahedral core." *J. Am. Chem. Soc.* **2011**, *133*, 13852-13855.

14. Sazama, G. T.; Betley, T. A. "Reductive coupling of CO templated by iron bound to the tris(pyrrolide)ethane scaffold." *Organometallics*, **2011**, *30*, 4315-4319.
15. Scharf, A. B.; Betley, T. A. "Electronic perturbations of iron dipyrinato complexes via ligand β -halogenation and meso-fluoroarylation." *Inorg. Chem.* **2011**, *50*, 6837-6845.
16. Harris, T. David; Zhao, Q.; Hernández Sánchez, R.; Betley, T. A. "Expanded redox accessibility via ligand substitution in the octahedral clusters Fe_6Br_6 cluster." *Chem. Commun.* **2011**, *47*, 6344-6347.
17. Zhao, Q.; Harris, T. D.; Betley, T. A.; "[$(^{\text{H}}\text{L})_2\text{Fe}_6(\text{NCMe})_m$] $^{n+}$ ($m = 0, 2, 4, 6$; $n = -1, 0, 1, 2, 3, 4, 6$): An electron-transfer series featuring octahedral Fe_6 clusters supported by a hexaamide ligand platform." *J. Am. Chem. Soc.* **2011**, *133*, 8293-8306.
18. King, E. R.; Hennessy, E. T.; Betley, T. A.; "Catalytic C-H bond amination from high-spin iron imido complexes." *J. Am. Chem. Soc.* **2011**, *133*, 4917-4923.
19. Powers, T. M.; Fout, A. R.; Zheng, S.-L.; Betley, T. A.; "Oxidative group transfer to a triiron complex, formation of a nucleophilic $[\text{Fe}_3(\mu^3\text{-N})]^-$." *J. Am. Chem. Soc.* **2011**, *133*, 336-338.
20. Zhao, Q.; Betley, T. A.; "Synthesis and redox properties of tri-iron complexes featuring strong M-M interactions." *Angew. Chem. Int. Edit.* **2011**, *50*, 709-712.
21. Sazama, G. T.; Betley, T. A.; "Ligand-centered redox activity: redox properties of 3d transition metal ions ligated by the weak-field tris(pyrrolyl)ethane trianion." *Inorg. Chem.* **2010**, *49*, 2512-2524.
22. King, E. R.; Betley, T. A.; "Unusual electronic structure of first row transition metal complexes featuring redox-active dipyrromethane ligands." *J. Am. Chem. Soc.* **2009**, *131*, 14374-14380.
23. King, E. R.; Betley, T. A.; "C-H bond amination from a ferrous dipyrromethene complex." *Inorg. Chem.* **2009**, *48*, 2361-2163.
24. Eremin, K.; Stenger, J.; Huang, J.-F.; Aspuru-Guzik, A.; Betley, T. A.; Vogt, L.; Kassal, I.; Speakman, S.; Kandekar, N. "Examination of pigments on Thai manuscripts: the first identification of copper citrate." *J. Raman. Spec.* **2008**, *39*, 1057-1065.

* Denotes undergraduate author.

Previous Publications

25. Betley, T. A.; Wu, Q.; Van Voorhis, T.; Nocera, D. G. "Electronic design criteria for O-O bond formation via metal oxo complexes." (Special Oxygen Forum Issue) *Inorg. Chem.* **2008**, *47*, 1849-1861.
26. Betley, T. A.; Surendranath, Y.; Childress, M. V.; Alliger, G. E.; Fu, R.; Cummins, C. C.; Nocera, D. G. "A ligand field chemistry of oxygen generation by the oxygen-evolving complex and synthetic active sites." *Phil. Trans. R. Soc. B.* **2008**, *363*, 1293-1303.
27. Betley, T. A.; Qian, B. A.; Peters, J. C. "Group VIII coordination chemistry of a pincer-type bis(8-quinolinyl)amido ligand." *Inorg. Chem.* **2008**, *47*, 11570-11582.
28. Rhode, J.-U.; Que, L., Jr.; Betley, T. A.; Peters, J. C. "XAS characterization of a nitridoiron(IV) complex with a very short Fe-N bond." *Inorg. Chem.* **2007**, *46*, 5720-5726.
29. Hendrich, M. P.; Gunderson, W.; Mehn, M. M.; Betley, T. A.; Lu, C. C.; Behan, R. K.; Green, M. T.; Peters, J. C. "On the feasibility of N_2 fixation via a single site $\text{Fe}^{\text{I}}/\text{Fe}^{\text{IV}}$ cycle - spectroscopic studies of $\text{Fe}^{\text{I}}(\text{N}_2)\text{Fe}^{\text{I}}$, $\text{Fe}^{\text{IV}}\equiv\text{N}$, and related species." *Proc. Natl. Acad. Sci. U.S.A.* **2006**, *103*, 17107-17112.
30. MacBeth, C. E.; Thomas, J. C.; Betley, T. A.; Peters, J. C. "The coordination chemistry of '[BP₃]NiX' platforms: targeting low-valent nickel sources as promising candidates to $\text{L}_3\text{Ni}=\text{E}$ and $\text{L}_3\text{Ni}\equiv\text{E}$ linkages." *Inorg. Chem.* **2004**, *43*, 4645-4662.
31. Betley, T. A.; Peters, J. C. "A tetrahedrally coordinated $\text{L}_3\text{Fe-N}_x$ platform that accommodates terminal nitride ($\text{Fe}^{\text{IV}}\equiv\text{N}$) and dinitrogen ($\text{Fe}^{\text{I}}-\text{N}_2$) ligands." *J. Am. Chem. Soc.* **2004**, *126*, 6252-6253.

32. Peters, J. C.; Thomas, J. C.; Thomas, C. M.; Betley, T. A. *Issues Relevant to C–H Activation at Platinum(II): Comparative Studies between Cationic, Zwitterionic, and Neutral Platinum(II) Compounds in Benzene Solution. Activation and Functionalization of C–H Bonds*, Karen Goldberg and Alan Goldman, eds.; ACS Symposium Series No. 885; **2004**; Chapter 20.
33. Betley, T. A.; Peters, J. C. “Dinitrogen chemistry from trigonally coordinated iron and cobalt platforms.” *J. Am. Chem. Soc.* **2003**, *125*, 10782-10783.
34. Betley, T. A.; Peters, J. C. “The strong-field tripodal phosphine donor, [PhB(CH₂P^tPr₂)₃]⁻, provides access to electronically and coordinatively unsaturated transition metal complexes.” *Inorg. Chem.* **2003**, *42*, 5074-5084.
35. Betley, T. A.; Peters, J. C. “Zwitterionic relatives to the classic [(P-P)Rh(sol_v)₂]⁺ ions: neutral catalysts active for H–E bond additions to olefins (E = C, Si, B).” *Angew. Chem. Int. Edit.* **2003**, *42*, 2385-2389.
36. Brown, S. D.; Betley, T. A.; Peters, J. C. “A low-spin d⁵ iron imide: nitrene capture by low-coordinate iron(I) provides the 4-coordinate Fe(III) complex [PhB(CH₂PPh₂)₃]Fe≡N-*p*-Tolyl.” *J. Am. Chem. Soc.* **2003**, *125*, 322-323.
37. Jenkins, D. M.; Di Bilio, A. J.; Allen, M. J.; Betley, T. A.; Peters, J. C. “Elucidation of a low spin cobalt(II) system in a distorted tetrahedral geometry.” *J. Am. Chem. Soc.* **2002**, *124*, 15336-15350.
38. Betley, T. A.; Peters, J. C. “Synthesis of the (dialkylamino)borate, [Ph₂B(CH₂NMe₂)₂]⁻, affords access to *N*-chelated rhodium(I) zwitterions.” *Inorg. Chem.* **2002**, *41*, 6541-6543.
39. Jenkins, D. M.; Betley, T. A.; Peters, J. C. “Oxidative group transfer to Co(I) affords a terminal Co(III) imido complex.” *J. Am. Chem. Soc.* **2002**, *124*, 11238-11239.
40. Betley, T. A.; Hessler, J. A.; Mecke, A.; Holl, M. M. B.; Orr, B. G.; Uppuluri, S.; Tomalia, D. A.; Baker, J. R. “Tapping mode atomic force microscopy investigation of poly(amidoamine) core-shell tecto(dendrimers) using carbon nanoprobles.” *Langmuir* **2002**, *18*, 3127-3133.
41. Betley, T. A.; Holl, M. M. B.; Orr, B. G.; Swanson, D. R.; Tomalia, D. A.; Baker, J. R. “Tapping mode atomic force microscopy investigation of poly(amidoamine) dendrimers: effects of substrate and pH on dendrimer deformation.” *Langmuir* **2001**, *17*, 2768-2773.
42. Murray, C. B.; Sun, S. H.; Doyle, H.; Betley, T. A. “Monodisperse 3d transition-metal (Co, Ni, Fe) nanoparticles and their assembly into nanoparticle superlattices.” *MRS Bulletin* **2001**, *26*, 985-991.
43. Murray, C. B.; Sun, S. H.; Doyle, H.; Betley, T. A. “Colloidal synthesis of nanocrystals and nanocrystal superlattices.” *IBM Journal of Research and Development* **2001**, *45*, 47-56.

AWARDED RESEARCH SUPPORT

2013 - 2018	Henry and Camille Dreyfus Teacher Scholar Award
2012 - 2013	SunCatalytix
2012 - 2017	DOE Early Career Research Program
2011 - 2013	George W. Merck Fellowship
2011 - 2016	NIH NIGMS (R01)
2010 - 2013	AFOSR Young Investigator Program
2010 - 2015	NSF CAREER
2009 - 2012	NSF MRSEC
2008 - 2010	ACS PRF
2008 - 2009	Milton Fund Award
2008 - 2010	Dreyfus Foundation Fellowship in Environmental Chemistry