

# **Patrick L. Holland**

*Professor of Chemistry*

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## **Professional Positions**

### ***Yale University***

Professor of Chemistry (2013- )

### ***University of Rochester***

Professor of Chemistry (2010-2013)

Associate Professor of Chemistry (2005-2010)

Assistant Professor of Chemistry (2000-2005)

### ***University of Minnesota*** (1997-2000)

National Institutes of Health Postdoctoral Fellow

Advisor: Prof. William B. Tolman

## **Education**

### ***University of California, Berkeley*** (1993-1997)

Ph.D. in Chemistry, September 1997

Advisors: Profs. Robert G. Bergman and Richard A. Andersen

### ***Princeton University*** (1989-1993)

A.B. *magna cum laude* (high honors) in Chemistry, June 1993

## **Awards**

Watkins Visiting Professor, Wichita State University, 2019

Xingda Lectureship, Peking University, 2017

Friedrich Wilhelm Bessel Research Award of the Humboldt Foundation, 2016

Fellow of the American Association for the Advancement of Science, 2015

Blavatnik Award for Young Scientists, 2013

Fulbright Scholar Award, 2012

ACS Rochester Section Volunteerism Award, 2010

Sloan Research Fellowship, 2003

NSF CAREER Award, 2002

NIH Postdoctoral Fellowship, University of Minnesota, 1997-1999

American Institute of Chemists Student Awardee, 1993

Phi Beta Kappa, Princeton University, 1993

## **Service to Chemistry Community**

Guest Editor of *Chemical Reviews* Special Issue "Dinitrogen: 2020"  
Editorial Board of *Chemical Science* (2019- )  
Editorial Board of *Chemical Society Reviews* (2019- )  
Co-organizer of William B. Tolman Award Symposium at National ACS Meeting, San Francisco, CA (2017)  
Chair of Inorganic Reaction Mechanisms Gordon Research Conference (2017)  
Participant in DOE N<sub>2</sub> Fixation Workshop (2016)  
Participant in NSF Nitrogen Cycle Workshop (2015)  
Vice-Chair of Inorganic Reaction Mechanisms Gordon Research Conference (2015)  
*Organometallics* Roundtable (2013)  
Member, *Inorganic Syntheses* (2013-present)  
Editorial Board of *Inorganic Chemistry* (2012-2014)  
Editorial Board of *Journal of Biological Inorganic Chemistry* (2009-2012)  
Awards Co-Chair, ACS Inorganic Division (2010-2012)  
Chair, Harrison Howe Award Committee, ACS Rochester Section (2007-2009)  
Organized symposium ("New Faces of Biomimetic Coordination Chemistry") at National ACS Meeting, Washington, DC (2009)  
Co-organized symposium ("Beta-Diketiminates: A Renaissance of Reaction Chemistries") at National ACS Meeting, Washington, DC (2005)  
Discussion leader at Gordon-Kenan Graduate Research Seminar in Bioinorganic Chemistry (2005 and 2012)  
*ad hoc* member of many panels for NIH, DOE, and NSF grant review

## **Research Interests**

Synthesis, electronic structure, geometry, and mechanisms of iron and cobalt complexes, with a particular focus on low-coordinate and high-spin complexes. Activation of small molecules, particularly alkenes, arenes, and N<sub>2</sub>. Organometallic and bioinorganic catalysis.

## **Publications**

h-index = 57. Total citations = 9,133.

### **Journal Publications from Independent Career**

158. S. M. McWilliams, D. L. J. Broere, C. J. V. Halliday, B. Q. Mercado, P. L. Holland, "Converting Arenes Into Amines Using Dinitrogen," submitted.
157. A. L. Speelman, I. Coric, C. Van Stappen, S. DeBeer, B. Q. Mercado, P. L. Holland, "Nitrogenase-Relevant Reactivity of a Synthetic Iron-Sulfur-Carbon Site," *J. Am. Chem. Soc.*, under revision.
156. G. P. Connor, B. Q. Mercado, H. M. C. Lant, J. M. Mayer, P. L. Holland, "Chemical oxidation of a coordinated PNP-pincer ligand forms unexpected Re-nitroxide complexes with reversal of nitride reactivity," *Inorg. Chem.*, under revision.
155. D. E. DeRosha, V. G. Chilkuri, C. Van Stappen, E. Bill, B. Q. Mercado, S. DeBeer, F.

- Neese, P. L. Holland, "Planar three-coordinate iron sulfide in a synthetic [4Fe-3S] cluster with biomimetic reactivity," *Nature Chem.*, in press.
154. G. P. Connor, D. Kim, A. L. Nagelski, E. O. Schmidt, T. Hass-Mitchell, J. T. Atwater, S. A. Tridenti, S. Sohn, P. L. Holland, "Implementation of an Accessible Gas Chromatography Laboratory Experiment for High School Students," *J. Chem. Ed.*, in press.
153. D. E. DeRosha, N. A. Arnet, B. Q. Mercado, P. L. Holland, "A [2Fe-1S] Complex that Affords Access to Bimetallic and Higher Nuclearity Iron-Sulfur Clusters," *Inorg. Chem.* **2019**, *58*, 8829-8834.
152. D. Kim, S. M. W. Rahaman, B. Q. Mercado, R. Poli, P. L. Holland, "Roles of Iron Complexes in Catalytic Radical Alkene Cross-Coupling: A Computational and Mechanistic Study," *J. Am. Chem. Soc.* **2019**, *141*, 7473-7485.
151. S. M. Bhutto, P. L. Holland, "Dinitrogen Activation and Functionalization using beta-Diketiminato Iron Complexes," *Eur. J. Inorg. Chem.* **2019**, 1861-1869.
150. L. Roy, M. H. Al-Afyouni, D. E. DeRosha, B. Mondal, I. M. DiMucci, K. M. Lancaster, J. Shearer, E. Bill, W. W. Brennessel, F. Neese, S. Ye, P. L. Holland, "Reduction of CO<sub>2</sub> by a Masked Two-Coordinate Cobalt(I) Complex and Characterization of a Proposed Oxodicobalt(II) Intermediate," *Chem. Sci.* **2019**, *10*, 918-929.
149. S. F. McWilliams, P. C. Bunting, V. Kathiresan, B. Q. Mercado, B. M. Hoffman, J. R. Long, P. L. Holland, "Isolation and Characterization of a High-Spin Mixed-Valent Iron Dinitrogen Complex," *Chem. Commun.* **2018**, *54*, 13339-13342.
148. S. F. McWilliams, E. Bill, G. Lukat-Rodgers, K. R. Rodgets, B. Q. Mercado, P. L. Holland, "Effects of N<sub>2</sub> Binding Mode on Iron-Based Functionalization of Dinitrogen to Form an Iron(III) Hydrazido Complex," *J. Am. Chem. Soc.* **2018**, *140*, 8586-8598.
147. K. L. Skubi, P. L. Holland, "So Close, Yet Sulfur Away: Opening the Nitrogenase Cofactor Structure Creates a Binding Site," *Biochemistry* **2018**, *57*, 3540-3541.
146. V. Pelmentschikov, L. B. Gee, H. Wang, K. C. MacLeod, S. F. McWilliams, K. L. Skubi, S. P. Cramer, P. L. Holland, "High-Frequency Fe-H Vibrations in a Bridging Hydride Complex Characterized by NRVS and DFT," *Angew. Chem.* **2018**, *57*, 9367-9371.
145. J. G. Chen, R. M. Crooks, L. C. Seefeldt, K. L. Bren, R. M. Bullock, M. Y. Darensbourg, P. L. Holland, M. J. Janik, A. K. Jones, M. G. Kanatzidis, P. King, K. M. Lancaster, S. V. Lymar, P. Pfromm, W. F. Schneider, R. R. Schrock, "Beyond fossil-fuel-driven nitrogen transformations," *Science* **2018**, *359*, 873.
144. S. J. Bonyhady, D. E. DeRosha, J. Vela, D. J. Vinyard, R. E. Cowley, B. Q. Mercado, W. W. Brennessel, P. L. Holland, "Iron and Cobalt Diazoalkane Complexes Supported by  $\beta$ -Diketiminato Ligands: A Synthetic, Spectroscopic and Computational Investigation," *Inorg. Chem.* **2018**, *57*, 5959-5972.
143. D. E. DeRosha, P. L. Holland, "Incorporating Light Atoms Into Synthetic Analogues of FeMoco," *Proc. Natl. Acad. Sci. USA* **2018**, *115*, 5054-5056.
142. D. L. J. Broere, B. Q. Mercado, J. T. Lukens, A. C. Vilbert, G. Banerjee, H. M. C. Lant, S. H. Lee, E. Bill, S. Sproules, K. M. Lancaster, P. L. Holland, "Reversible Ligand-Centered Reduction in Low-Coordinate Iron Formazanate Complexes," *Chem. Eur. J.* **2018**, *24*,

9417-9425.

141. D. L. J. Broere, B. Q. Mercado, P. L. Holland, "Selective Conversion of CO<sub>2</sub> to Isocyanate by Low-Coordinate Iron," *Angew. Chem. Int. Ed.* **2018**, *57*, 6507-6511.
140. D. L. J. Broere, B. Q. Mercado, E. Bill, K. M. Lancaster, S. Sproules, P. L. Holland, "Alkali Cation Effects on Redox-Active Formazanate Ligands in Iron Chemistry," *Inorg. Chem.* **2018**, *57*, 9580-9591.
139. D. L. J. Broere, P. L. Holland, "Boron compounds tackle dinitrogen," *Science* **2018**, *359*, 871.
138. E. Rozen, Y. Erlich, M. E. Reesbeck, P. L. Holland, C. N. Sukenik, "Functionalized Self-Assembled Monolayers Bearing Diiminate Complexes Immobilized through Covalently Anchored Ligands," *Langmuir* **2018**, *34*, 13472-13480.
137. G. P. Connor, N. Lease, A. Casuras, A. S. Goldman, P. L. Holland, J. M. Mayer, "Protonation and electrochemical reduction of rhodium- and iridium-dinitrogen complexes in organic solution," *Dalton Trans.* **2017**, *46*, 14325-14330.
136. N. A. Arnet, S. F. McWilliams, D. E. DeRoshia, B. Q. Mercado, P. L. Holland, "Synthesis and Mechanism of Formation of Hydride-Sulfide Complexes of Iron," *Inorg. Chem.* **2017**, *56*, 9185-9193.
135. M. Horitani, K. Grubel, S. F. McWilliams, B. D. Stubbert, B. Q. Mercado, Y. Yu, P. M. Gurubasavaraj, N. S. Lees, P. L. Holland, B. M. Hoffman, "ENDOR Characterization of an Iron-Alkene Complex Provides Insight into a Corresponding Organometallic Intermediate of Nitrogenase," *Chem. Sci.* **2017**, *8*, 5941-5948.
134. S. F. McWilliams, E. Brennan-Wydra, K. C. MacLeod, P. L. Holland, "Density Functional Calculations for Prediction of <sup>57</sup>Fe Mössbauer Isomer Shifts and Quadrupole Splittings in β-Diketiminato Complexes," *ACS Omega* **2017**, 2594-2606.
133. P. L. Holland, "Reaction: Opportunities for Sustainable Catalysts," *Chem* **2017**, *2*, 443-444.
132. D. L. J. Broere, I. Čorić, A. Brosnahan, P. L. Holland, "Quantitation of the THF Content in Fe[N(SiMe<sub>3</sub>)<sub>2</sub>]<sub>2</sub>·xTHF," *Inorg. Chem.* **2017**, *56*, 3140-3143.
131. J. C. Lo, D. Kim, C.-M. Pan, J. T. Edwards, Y. Yabe, J. Gui, T. Qin, S. Gutiérrez, J. Giacoboni, M. W. Smith, P. L. Holland, P. S. Baran, "Fe-Catalyzed C-C Bond Construction from Olefins via Radicals," *J. Am. Chem. Soc.* **2017**, *139*, 2484-2503.
130. D. E. DeRoshia, B. Q. Mercado, G. Lukat-Rodgers, K. R. Rodgers, P. L. Holland, "Enhancement of C-H Oxidizing Ability in Co-O<sub>2</sub> Complexes through an Isolated Heterobimetallic Oxo Intermediate," *Angew. Chem. Int. Ed.* **2017**, *56*, 3211-3215.
129. M. E. Reesbeck, K. Grubel, D. Kim, W. W. Brennessel, B. Q. Mercado, P. L. Holland, "Diazoalkanes in Low-Coordinate Iron Chemistry: Bimetallic Diazoalkyl and Alkylidene Complexes of Iron(II)," *Inorg. Chem.* **2017**, *56*, 1019-1022.
128. K. C. MacLeod, R. A. Lewis, D. E. DeRoshia, B. Q. Mercado, P. L. Holland, "C-H and C-N Activation at Redox-Active Pyridine Complexes of Iron," *Angew. Chem. Int. Ed.* **2017**, *56*, 1069-1072.
127. A. M. Speelman, P. L. Holland, "Sulfur-Supported Iron Complexes for Understanding N<sub>2</sub>

- Reduction," *Top. Organomet. Chem.*, **2017**, *60*, 197-214.
126. G. P. Connor, P. L. Holland, "Coordination chemistry insights into the role of alkali metal promoters in dinitrogen reduction," *Catalysis Today* **2017**, *286*, 21-40.
  125. Y. Liu, D. J. Vinyard, M. E. Reesbeck, T. Suzuki, K. Manakongtreecheep, P. L. Holland, G. W. Brudvig, D. Söll, "A [3Fe-4S] cluster is required for tRNA thiolation in archaea and eukaryotes," *Proc. Natl. Acad. Sci. USA* **2016**, *113*, 12703-12708.
  124. S. M. Bellows, N. A. Arnet, P. M. Gurubasavaraj, W. W. Brennessel, E. Bill, T. R. Cundari, P. L. Holland, "The Mechanism of N-N Double Bond Cleavage by an Iron(II) Hydride Complex," *J. Am. Chem. Soc.* **2016**, *138*, 12112-12123.
  123. K. C. MacLeod, F. S. Menges, S. F. McWilliams, S. M. Craig, B. Q. Mercado, M. A. Johnson, P. L. Holland, "Alkali-Controlled C-H Activation or N-C Bond Formation from N<sub>2</sub>-Derived Iron Nitrides and Imides," *J. Am. Chem. Soc.* **2016**, *138*, 11185-11191.
  122. K. C. MacLeod, S. F. McWilliams, B. Q. Mercado, P. L. Holland, "Stepwise N-H Bond Formation From N<sub>2</sub>-Derived Iron Nitride, Imide and Amide Intermediates to Ammonia," *Chem. Sci.* **2016**, *7*, 5736-5746.
  121. I. Čorić, P. L. Holland, "Insight into the FeMoco of nitrogenase from synthetic iron complexes with sulfur, carbon, and hydride ligands," *J. Am. Chem. Soc.* **2016**, *138*, *138*, 7200-7211.
  120. S. M. Bellows, W. W. Brennessel, P. L. Holland, "Effects of Ligand Halogenation on the Electron Localization, Geometry and Spin State of Low-Coordinate  $\beta$ -Diketimate Iron Complexes," *Eur. J. Inorg. Chem.* **2016**, 3344-3355.
  119. S. F. McWilliams, K. R. Rodgers, G. Lukat-Rodgers, B. Q. Mercado, K. Grubel, P. L. Holland, "Alkali Metal Variation and Twisting of the FeNNFe Core in Bridging Diiron Dinitrogen Complexes," *Inorg. Chem.* **2016**, *55*, 2960-2968.
  118. C. Chen, M. Hecht, A. Kavara, W. W. Brennessel, B. Q. Mercado, D. J. Weix, P. L. Holland, "Rapid, Regioconvergent, Solvent-Free Alkene Hydrosilylation with a Cobalt Catalyst," *J. Am. Chem. Soc.* **2015**, *137*, 13244-13247.
  117. N. A. Arnet, T. R. Dugan, F. S. Menges, B. Q. Mercado, W. W. Brennessel, E. Bill, M. A. Johnson, P. L. Holland, "Synthesis, Characterization, and Nitrogenase-Relevant Reactions of an Iron Sulfide Complex with a Bridging Hydride," *J. Am. Chem. Soc.* **2015**, *137*, 13220-13223.
  116. I. Čorić, B. Q. Mercado, E. Bill, D. J. Vinyard, P. L. Holland, "Binding of dinitrogen to an iron-sulfur-carbon site," *Nature* **2015**, *526*, 96-99.
  115. C. Chen, S. M. Bellows, P. L. Holland, "Tuning Steric and Electronic Effects in Transition-Metal  $\beta$ -Diketimate Complexes," *Dalton Trans.* **2015**, *44*, 16654-16670.
  114. S. F. McWilliams, P. L. Holland, "Dinitrogen Binding and Cleavage by Multinuclear Iron Complexes," *Acc. Chem. Res.* **2015**, *48*, 2059-2065.
  113. M. H. Al-Afyouni, E. Bill, D. E. DeRoshia, W. W. Brennessel, P. L. Holland, "Spin Isomers and Ligand Isomerization in a Three-Coordinate Cobalt(I) Carbonyl Complex," *J. Am. Chem. Soc.* **2015**, *137*, 10689-10699.

112. M. E. Reesbeck, M. M. Rodriguez, W. W. Brennessel, B. Q. Mercado, D. J. Vinyard, P. L. Holland, "Oxidized and Reduced [2Fe-2S] Clusters from an Iron(I) Synthon," *J. Biol. Inorg. Chem.* **2015**, *20*, 875-883.
111. P. L. Holland, "Distinctive Reaction Pathways at Base Metals in High-Spin Organometallic Catalysts," *Acc. Chem. Res.* **2015**, *48*, 1696-1702.
110. S. J. Bonyhady, J. M. Goldberg, N. Wedgwood, T. R. Dugan, A. G. Eklund, W. W. Brennessel, P. L. Holland, "Electronic structure and N-N cleavage reactivity of a redox-active cobalt diazoalkane complex," *Inorg. Chem.* **2015**, *54*, 5148-5150.
109. A. Das, Z. Han, W. W. Brennessel, P. L. Holland, R. Eisenberg, "Nickel Complexes for Robust Light-Driven and Electrocatalytic Hydrogen Production from Water," *ACS Catal.* **2015**, *5*, 1397-1406.
108. K. Grubel, W. W. Brennessel, B. Q. Mercado, P. L. Holland, "Alkali Metal Control over N–N Cleavage in Iron Complexes," *J. Am. Chem. Soc.* **2014**, *136*, 16807-16816.
107. T. E. Machonkin, M. D. Boshart, J. A. Schofield, M. R. Rodriguez, K. Grubel, D. Rokhsana, W. W. Brennessel, P. L. Holland, "Structural and Spectroscopic Characterization of Iron(II), Cobalt(II), and Nickel(II) *ortho*-Dihalophenolate Complexes: Insights into Metal-Halogen Secondary Bonding," *Inorg. Chem.* **2014**, *53*, 9837-9848.
106. R. A. Lewis, K. C. MacLeod, B. Q. Mercado, P. L. Holland, "Geometric and redox flexibility of pyridine as a redox-active ligand that can reversibly accept one or two electrons," *Chem. Commun.* **2014**, *50*, 11114-11117.
105. K. C. MacLeod, D. J. Vinyard, P. L. Holland, "A Multi-Iron System Capable of Rapid N<sub>2</sub> Formation and N<sub>2</sub> Cleavage," *J. Am. Chem. Soc.* **2014**, *136*, 10226-10229.
104. J. A. Gladysz, R. B. Bedford, M. Fujita, F. P. Gabbai, K. I. Goldberg, P. L. Holland, J. L. Kiplinger, M. J. Krische, J. Louie, C. C. Lu, J. R. Norton, M. A. Petrukhina, T. Ren, S. S. Stahl, T. D. Tilley, C. E. Webster, M. C. White and G. T. Whiteker, "Organometallics Roundtable 2013-2014," *Organometallics* **2014**, *33*, 1505-1527.
103. T. R. Dugan, E. Bill, K. C. MacLeod, W. W. Brennessel, P. L. Holland, "Synthesis, Spectroscopy and Hydrogen/Deuterium Exchange in High-Spin Iron(II) Hydride Complexes," *Inorg. Chem.* **2014**, *53*, 2370-2380.
102. C. Chen, T. R. Dugan, W. W. Brennessel, D. J. Weix, P. L. Holland, "Z-Selective Alkene Isomerization by High-Spin Cobalt(II) Complexes," *J. Am. Chem. Soc.* **2014**, *136*, 945-955.
101. K. P. Chiang, S. M. Bellows, W. W. Brennessel, P. L. Holland, "Multimetallic cooperativity in activation of dinitrogen at iron-potassium sites," *Chem. Sci.* **2014**, *5*, 267-274.
100. W. Yao, P. M. Gurubasavaraj, P. L. Holland, "All-Ferrous Iron-Sulfur Clusters," *Struct. Bonding* **2014**, *160*, 1-37.
99. R. E. Cowley, M. R. Golder, N. A. Eckert, M. Al-Afyouni, P. L. Holland, "Mechanism of Catalytic Nitrene Transfer from Iron(I)–Isocyanide Complexes," *Organometallics* **2013**, *32*, 5289-5298.
98. S. M. Bellows, T. R. Cundari, P. L. Holland, "Spin Crossover during  $\beta$ -Hydride Elimination in High-Spin Iron(II)- and Cobalt(II)-Alkyl Complexes," *Organometallics*

- 2013**, 32, 4741-4751.
97. Z. Han, L. Shen, W. W. Brennessel, P. L. Holland, R. Eisenberg, "Nickel Pyridylthiolate Complexes for the Photocatalytic Production of Hydrogen from Aqueous Solutions in Noble-Metal-Free Systems," *J. Am. Chem. Soc.* **2013**, 135, 14659-14669.
  96. C. J. Pollock, K. Grubel, P. L. Holland, S. DeBeer, "Experimentally Quantifying Small Molecule Bond Activation Using Valence-to-Core X-ray Emission Spectroscopy," *J. Am. Chem. Soc.* **2013**, 135, 11803-11808.
  95. T. R. Dugan, K. C. MacLeod, W. W. Brennessel, P. L. Holland, "Cobalt-Magnesium and Iron-Magnesium Complexes with Weakened Dinitrogen Bridges," *Eur. J. Inorg. Chem.* **2013**, 3891-3897.
  94. B. D. Stubbert, J. Vela, W. W. Brennessel, P. L. Holland, "A Sulfide-Bridged Diiron(II) Complex with an N<sub>2</sub>H<sub>4</sub> Ligand," *Z. Anorg. Allg. Chem.* **2013**, 639, 1351-1355.
  93. R. M. Davydov, M. P. McLaughlin, E. Bill, B. M. Hoffman, P. L. Holland, "Generation of High-Spin Iron(I) in a Protein Environment Using Cryoreduction," *Inorg. Chem.* **2013**, 52, 7323-7325.
  92. K. C. MacLeod, P. L. Holland, "Recent Developments in Homogeneous Dinitrogen Reduction by Molybdenum and Iron," *Nature Chem.* **2013**, 5, 559-565. (Invited Perspective)
  91. Z. Chen, C. R. K. Glasson, P. L. Holland, T. J. Meyer, "Electrogenerated polypyridyl ruthenium hydride and ligand activation for water reduction to hydrogen and acetone to iso-propanol," *Phys. Chem. Chem. Phys.* **2013**, 15, 9503-9507.
  90. P. Chandrasekaran, K. P. Chiang, D. Nordlund, U. Bergmann, P. L. Holland, S. DeBeer, "On the Sensitivity of X-ray Core Spectroscopy to Changes in Metal Ligation: A Systematic Study of High-Spin Ferrous Complexes," *Inorg. Chem.* **2013**, 52, 6286-6298.
  89. T. R. Dugan, E. Bill, K. C. MacLeod, G. J. Christian, R. E. Cowley, W. W. Brennessel, S. Ye, F. Neese, P. L. Holland, "Reversible C-C Bond Formation Between Redox-Active Pyridine Ligands in Iron Complexes," *J. Am. Chem. Soc.* **2012**, 134, 20352-20364.
  88. M. P. McLaughlin, M. Retegan, E. Bill, T. M. Payne, H. S. Shafaat, S. Peña, J. Sudhamsu, A. E. Ensign, B. R. Crane, F. Neese, P. L. Holland, "Azurin as a protein scaffold for a low-coordinate non-heme iron site with a small-molecule binding pocket," *J. Am. Chem. Soc.* **2012**, 134, 19746-19757.
  87. B. L. Edelbach, B. M. Pharoah, S. M. Bellows, P. R. Thayer, C. N. Fennie, R. E. Cowley, P. L. Holland, "An Expedient Synthesis of 2,4,6-Tris(trifluoromethyl)aniline," *Synthesis* **2012**, 44, 3595-3597.
  86. Z. Han, F. Qiu, R. Eisenberg, P. L. Holland, T. D. Krauss, "Robust Photogeneration of H<sub>2</sub> in Water Using Semiconductor Nanocrystals and a Nickel Catalyst," *Science* **2012**, 338, 1321-1324.
  85. C. R. K. Glasson, W. Song, D. L. Ashford, A. Vannucci, Z. Chen, J. J. Concepcion, P. L. Holland, T. J. Meyer, "Self-Assembled Bilayers on Indium-Tin Oxide (SAB-ITO) Electrodes: A Design for Chromophore-Catalyst Photoanodes," *Inorg. Chem.* **2012**, 51, 8637-8639.

84. R. E. Cowley, P. L. Holland, "Ligand Effects on Hydrogen Atom Transfer from Hydrocarbons to Three-Coordinate Iron Imides," *Inorg. Chem.* **2012**, *51*, 8352-8361.
83. T. M. Figg, P. L. Holland, T. R. Cundari, "Cooperativity Between Low-Valent Iron and Potassium Promoters in Dinitrogen Fixation," *Inorg. Chem.* **2012**, *51*, 7546-7550.
82. M. M. Rodriguez, B. D. Stubbert, C. C. Scarborough, W. W. Brennessel, E. Bill, P. L. Holland, "Isolation and Characterization of Stable Iron(I)-Sulfide Complexes," *Angew. Chem. Int. Ed.* **2012**, *51*, 8246-8250. (Chosen as a "Hot Paper")
81. W. R. McNamara, Z. Han, C.-J. Yin, W. W. Brennessel, P. L. Holland, R. Eisenberg, "Cobalt-Dithiolene Complexes for the Photocatalytic and Electrocatalytic Reduction of Protons in Aqueous Solutions," *Proc. Natl. Acad. Sci. USA* **2012**, *109*, 15594-15599.
80. K. P. Chiang, C. C. Scarborough, M. Horitani, N. S. Lees, K. Ding, T. R. Dugan, W. W. Brennessel, E. Bill, B. M. Hoffman, P. L. Holland, "Characterization of the Fe-H Bond in a Three-Coordinate Terminal Hydride Complex of Iron(I)," *Angew. Chem. Int. Ed.* **2012**, *51*, 3658-3662. (Chosen as a "Hot Paper")
79. K. Grubel, P. L. Holland, "New iron-sulfur clusters help hydrogenases tolerate oxygen," *Angew. Chem. Int. Ed.* **2012**, *51*, 3308-3310. (Highlight)
78. T. R. Dugan, J. M. Goldberg, W. W. Brennessel, P. L. Holland, "Low-Coordinate Cobalt Fluoride Complexes: Synthesis, Reactions, and Production from C-F Activation Reactions," *Organometallics* **2012**, *31*, 1349-1360. (Special Issue on Fluorine in Organometallic Chemistry)
77. Z. Han, W. R. McNamara, M.-S. Eum, P. L. Holland, R. Eisenberg, "A Nickel-Thiolate Catalyst for the Long-Lived Photocatalytic Production of Hydrogen in a Noble-Metal-Free System," *Angew. Chem. Int. Ed.* **2012**, *51*, 1667-1670. (Chosen as a "Hot Paper")
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3. P. L. Holland, R. A. Andersen, R. G. Bergman, J. Huang, S. P. Nolan, "Monomeric Cyclopentadienylnickel Methoxo and Amido Complexes: Synthesis, Characterization, Reactivity, and Use for Exploring the Relationship Between H-X and M-X Bond Energies," *J. Am. Chem. Soc.* **1997**, *119*, 12800-12814.
2. P. L. Holland, M. E. Smith, R. A. Andersen, R. G. Bergman, "X-ray Crystal Structures of Cp\*Ni(PEt<sub>3</sub>)X. Understanding Distortions and Trans Influences in Cyclopentadienyl Complexes," *J. Am. Chem. Soc.* **1997**, *119*, 12815-12823.
1. P. L. Holland, R. A. Andersen, R. G. Bergman, "Synthesis, Characterization, and Reactivity of Dimeric Amidonickel Complexes," *J. Am. Chem. Soc.* **1996**, *118*, 1092-1104.

### Patents

3. C. Chen, D. J. Weix, P. L. Holland, "Diketiminato Cobalt Catalysts and Methods for Alkene Hydrosilylation," U.S. Provisional Patent Application 62/204,149, **2015**.
2. P. L. Holland, D. J. Weix, C. Chen, T. R. Dugan, "Z-Selective Alkene Isomerization by High-Spin Cobalt(II) Complexes," U.S. Provisional Patent Application 61/985,761, **2014**.
1. T. D. Krauss, R. Eisenberg, P. L. Holland, F. Qiu, Z. Han, "Methods for Producing Hydrogen Using Nanoparticle Catalyst Mixtures," PCT/US2013/068480, US Application 61/722,374, **2013**.

### Funding

#### Current Research Funding

- "Tandem Catalytic C-H Activation and N<sub>2</sub> Activation Using Iron Complexes"  
Basic Energy Sciences, Department of Energy  
PI: Patrick Holland  
9/19-8/22
- "Mechanistically guided improvement in radical alkene coupling by base metal catalysts"  
National Institutes of Health, R01 GM-129081, \$1,164,862  
PI: Patrick Holland  
4/19-4/23
- "Low-Coordinate Synthetic Models for Nitrogenase Activity"  
National Institutes of Health, R01 GM-065313, \$1,303,066  
PI: Patrick Holland  
8/18-7/22
- "INFEWS: Evaluating the Prospects of Electrochemical Nitrogen Reduction Using Pincer Catalysts"  
National Science Foundation, CHE-1665137, \$300,000

PIs: Patrick Holland, James Mayer (collaboration with Alex Miller and Alan Goldman)  
9/17-8/20

- "RUI: The Sources of Substrate Specificity in Hydroquinone Dioxygenases"  
National Science Foundation, CHE-1506458, \$97,870 subcontract  
PI: Timothy Machonkin  
9/15-9/19

### **Past Research Funding**

- "SusChem: Catalytic Alkene Transformations Using High-Spin Cobalt Complexes"  
National Science Foundation, CHE-1465017, \$500,000  
PI: Patrick Holland  
9/15-1/19
- "Low-Coordinate Synthetic Models for Nitrogenase Activity"  
National Institutes of Health, R01 GM-065313, \$1,988,802  
PI: Patrick Holland  
9/14-7/18
- "Enabling Nitrogen Reduction Catalysis through Surface Immobilization"  
United States-Israel Binational Science Foundation, 2009541, \$164,000 total  
co-PIs: Chaim Sukenik (Bar Ilan University) and Patrick Holland  
10/11-9/15
- "Low-Coordinate Synthetic Models for Nitrogenase Activity"  
National Institutes of Health, R01 GM065313, \$1,211,567  
PI: Patrick Holland  
6/10-9/14
- "Modular Nanoscale and Biomimetic Assemblies for Photocatalytic Hydrogen Generation"  
Department of Energy, DE-FG02-09ER16121, \$880,000  
co-PIs: Kara Bren, Richard Eisenberg, Patrick Holland, Todd Krauss  
9/12-6/13 (left group)
- "RUI: The Sources of Substrate Specificity in Hydroquinone Dioxygenases"  
National Science Foundation, CHE-0951999, \$25,778 subcontract  
PI: Timothy Machonkin  
4/10-4/13
- "Nitrene Transfer Reactions with Iron Complexes"  
National Science Foundation, CHE-0911314, \$430,000  
PI: Patrick Holland, co-PI: Brian Edlbach (Monroe Community College)  
8/09-6/13
- "High-Spin Cobalt Hydrides for Catalysis"  
Department of Energy, DE-FG-02-09ER16089, \$670,000  
PI: Patrick Holland  
9/09-6/13
- "Modular Nanoscale and Biomimetic Assemblies for Photocatalytic Hydrogen Generation"  
Department of Energy, DE-FG02-09ER16121, \$1,680,000  
co-PIs: Kara Bren, Richard Eisenberg, Patrick Holland, Todd Krauss



- 9/09-9/12
- “Characterization of Catalytic Imide Group Transfer Reactions with Iron Catalysts”  
Petroleum Research Fund, 44942-AC, \$80,000  
PI: Patrick Holland  
9/06-9/08
- “Low-Coordinate Synthetic Models for Nitrogenase Activity”  
National Institutes of Health, R01 GM065313, \$1,073,394  
PI: Patrick Holland  
4/04-3/10
- “Synthetic Models of the Catalytic Nickel-Copper Site of Acetyl Coenzyme A”  
Petroleum Research Fund, 38275-G, \$35,000  
PI: Patrick Holland  
9/02-8/05
- “CAREER: Reactive Low-Coordinate Compounds of the Late Transition Metals”  
National Science Foundation, CHE-0134658, \$495,000  
PI: Patrick Holland  
1/02-12/06

### **Equipment, Education**

- "MRI: Development of a Hybrid Mass Spectrometry Platform with Mass-Selective Optical Spectroscopy of Cryogenic Ions"  
National Science Foundation, CHE-1828190  
7/18
- “CRIF: Acquisition of A Matrix-Assisted Laser Desorption/Ionization Time of Flight (MALDI-TOF) Mass Spectrometer”  
National Science Foundation, CHE-0840410, \$279,643  
8/09
- “GAANN: Graduate Assistance in Chemistry”  
Department of Education, P200A060048, \$540,000  
8/06-8/09
- “CRIF: Purchase of a Gas Chromatograph-Mass Spectrometer”  
National Science Foundation, CHE-0443581, \$104,174  
2/05
- “CRIF: Upgrade of an X-ray Diffractometer”  
National Science Foundation, CHE-0342508, \$121,750  
2/04

### **Invited Lectures at Universities & Colleges**

Hamilton College (Clinton, NY) – January 2001  
 Trinity College (Hartford, CT) – February 2001  
 West Chester University (West Chester, PA) – September 2001  
 Nazareth College (Pittsford, NY) – January 2002

SUNY Buffalo (Buffalo, NY) – February 2002  
Carnegie Mellon University (Pittsburgh, PA) – April 2002  
University of West Virginia (Morgantown, WV) – September 2002  
SUNY Fredonia (Fredonia, NY) – September 2002  
Colgate University (Hamilton, NY) – October 2002  
Rochester Institute of Technology (Rochester, NY) – October 2002  
SUNY Brockport (Brockport, NY) – November 2002  
Purdue University (West Lafayette, IN) – February 2003  
Rose-Hulman Institute of Technology (Terre Haute, IN) – February 2003  
Indiana University (Bloomington, IN) – February 2003  
University of Minnesota (Minneapolis, MN) – September 2003  
St. John's University and College of St. Benedict (St. Cloud, MN) – September 2003  
Yale University (New Haven, CT) – September 2003  
Alfred University (Alfred, NY) – September 2003  
Princeton University (Princeton, NJ) – October 2003  
Notre Dame University (Notre Dame, IN) – October 2003  
University of California-Berkeley (Berkeley, CA) – October 2003  
Utah University (Salt Lake City, UT) – October 2003  
Utah State University (Logan, UT) – October 2003  
Fordham University (New York, NY) – December 2003  
University of Chicago (Chicago, IL) – January 2004  
University of Guelph (Guelph, ON) – March 2004  
Syracuse University (Syracuse, NY) – March 2004  
University of California-San Diego (La Jolla, CA) – April 2004  
University of California-Irvine (Irvine, CA) – May 2004  
California Institute of Technology (Pasadena, CA) – May 2004  
University of Southern California (Los Angeles, CA) – May 2004  
University of California-Riverside (Riverside, CA) – May 2004  
James Madison University (Harrisonburg, VA) – July 2004  
University of Rochester (Rochester, NY) – September 2004  
Northwestern University (Evanston, IL) – October 2004  
Messiah College (Grantham, PA) – October 2004  
Haverford College (Haverford, PA) – October 2004  
Boston University (Boston, MA) – November 2004  
Brandeis University (Waltham, MA) – November 2004  
University of Toronto-Mississauga (Mississauga, ON) - November 2004  
Massachusetts Institute of Technology (Cambridge, MA) - January 2005  
University of North Carolina (Chapel Hill, NC) - January 2005  
North Carolina State University (Raleigh, NC) - January 2005  
University of Akron (Akron, OH) - January 2005  
University of Delaware (Newark, DE) - March 2005  
University of Seattle (Seattle, WA) - May 2005  
University of British Columbia (Vancouver, BC) - May 2005

University of Washington (Seattle, WA) - May 2005  
Miami University (Oxford, OH) - October 2005  
University of Cincinnati (Cincinnati, OH) - October 2005  
Bucknell University (Lewisburg, PA) - October 2005  
Juniata College (Huntingdon, PA) - October 2005  
Dickinson College (Carlisle, PA) - October 2005  
University of North Texas (Denton, TX) - January 2006  
University of North Carolina (Charlotte, NC) - February 2006  
Duke University (Durham, NC) - February 2006  
University of Albany (Albany, NY) - March 2006  
University of Wisconsin (Madison, WI) - April 2006  
University of Illinois (Urbana-Champaign, IL) - April 2006  
University of Florida (Gainesville, FL) - April 2006  
Max Planck Institute for Bioinorganic Chemistry (Mülheim, Germany) - September 2006  
Ithaca College (Ithaca, NY) - October 2006  
University of Victoria (Victoria, BC) - October 2006  
Simon Fraser University (Vancouver, BC) - October 2006  
SUNY Cortland (Cortland, NY) - November 2006  
McGill University (Montreal, QC) - November 2006  
Monroe Community College (Rochester, NY) - December 2006  
Gustavus Adolphus College (St. Peter, MN) - February 2007  
Duquesne University (Pittsburgh, PA) - October 2007  
Tsukuba University (Tsukuba, Japan) - November 2007  
Osaka University (Osaka, Japan) - November 2007  
Osaka City University (Osaka, Japan) - November 2007  
Buffalo State College (Buffalo, NY) - November 2007  
Dartmouth College (Hanover, NH) - May 2008  
University of Pennsylvania (Philadelphia, PA) - September 2008  
SUNY Geneseo (Geneseo, NY) - September 2008  
SUNY New Paltz (New Paltz, NY) - September 2008  
Johns Hopkins University (Baltimore, MD) - October 2008  
Georgetown University (Washington, DC) - October 2008  
Brock University (St. Catharines, ON) - October 2008  
University of Toronto (Toronto, ON) - November 2008  
Bloomsburg University (Bloomsburg, PA) - November 2008  
New Mexico State University (Las Cruces, NM) - November 2008  
University of Texas (Austin, TX) - May 2009  
University of Montreal (Montreal, QC) - September 2009  
University of Oregon (Eugene, OR) - October 2009  
Columbia University (New York, NY) - November 2009  
Pennsylvania State Erie (Erie, PA) - November 2009  
West Chester University (West Chester, PA) - November 2009  
York University (Toronto, ON) - December 2009

Marquette University (Milwaukee, WI) - January 2010  
University of Wyoming (Laramie, WY) - September 2010  
Colorado State University (Fort Collins, CO) - September 2010  
Northwestern University (Evanston, IL) - October 2010  
LeMoyne College (Syracuse, NY) - October 2010  
Pennsylvania State University (University Park, PA) - October 2010  
University of North Carolina (Chapel Hill, NC) - January 2011  
East Carolina University (Greenville, NC) - February 2011  
University of North Carolina (Charlotte, NC) - March 2011  
Temple University (Philadelphia, PA) - March 2011  
Virginia Polytechnic Institute (Blacksburg, VA) - April 2011  
Yale University (New Haven, CT) - September 2011  
Ithaca College (Ithaca, NY) - September 2011  
University of Illinois (Chicago, IL) - September 2011  
University of Oklahoma (Norman, OK) - October 2011  
University of Kansas (Lawrence, KS) - October 2011  
Princeton University (Princeton, NJ) - November 2011  
University of Illinois (Urbana-Champaign, IL) - December 2011  
University of Miami (Coral Gables, FL) - December 2011  
Weizmann Institute (Rehovot, Israel) - January 2012  
Bar Ilan University (Ramat Gan, Israel) - January 2012  
University of Wisconsin (Madison, WI) - January 2012  
University of Göttingen (Göttingen, Germany) - April 2012  
University of Münster (Münster, Germany) - April 2012  
Max-Planck-Institut für Kohlenforschung (Mülheim, Germany) - April 2012  
University of Kiel (Kiel, Germany) - May 2012  
Humboldt University - Berlin (Berlin, Germany) - May 2012  
ETH (Zürich, Switzerland) - May 2012  
University of Basel (Basel, Switzerland) - May 2012  
Friedrich Alexander University - Erlangen-Nürnberg (Erlangen, Germany) - June 2012  
SUNY Potsdam (Potsdam, NY) - October 2012  
University of Toledo (Toledo, OH) - November 2012  
University of Georgia (Athens, GA) - January 2013  
North Carolina State University (Raleigh, NC) - February 2013  
University of Tennessee (Knoxville, TN) - February 2013  
Valparaiso University (Valparaiso, IN) - April 2013  
Brandeis University (Boston, MA) - January 2014  
Carleton College (Northfield, MN) - January 2014  
University of West Virginia (Morgantown, WV) - February 2014  
Shanghai Institute of Organic Chemistry (Shanghai, China) - March 2014  
Fudan University (Shanghai, China) - March 2014  
Brown University (Providence, RI) - May 2014  
Tufts University (Medford, MA) - September 2014

College of the Holy Cross (Worcester, MA) - October 2014  
Swarthmore College (Swarthmore, PA) - October 2014  
University of California (Santa Barbara, CA) - October 2014  
University of Southern California (Los Angeles, CA) - October 2014  
University of California (Irvine, CA) - October 2014  
University of Missouri (St. Louis, MO) - December 2014  
Wayne State University (Detroit, MI) - February 2015  
University of New Mexico (Albuquerque, NM) - February 2015  
Whitman College (Walla Walla, WA) - March 2015  
University of Washington (Seattle, WA) - March 2015  
Indiana University (Bloomington, IN) - April 2015  
University of Houston (Houston, TX) - October 2015  
Emory University (Atlanta, GA) - October 2015  
Georgia Tech University (Atlanta, GA) - October 2015  
Georgetown University (Washington, DC) - February 2016  
Ursinus College (Collegeville, PA) - April 2016  
University of Pennsylvania (Philadelphia, PA) - September 2016  
Iowa State University (Ames, IA) - October 2016  
University of Göttingen (Göttingen, Germany) - January 2017  
Laboratoire de Chimie de Coordination (Toulouse, France) - January 2017  
Universitat de Girona (Girona, Spain) - February 2017  
Institut Català d'Investigació Química (Tarragona, Spain) - February 2017  
Friedrich-Alexander-Universität (Erlangen-Nuremberg, Germany) - February 2017  
Peking University (Beijing, China) - April 2017  
Philips-Universität Marburg (Marburg, Germany) - May 2017  
TU Braunschweig (Braunschweig, Germany) - May 2017  
HU Berlin (Berlin, Germany) - May 2017  
TU München (Munich, Germany) - May 2017  
Uppsala University (Uppsala, Sweden) - May 2017  
University of Regensburg (Regensburg, Germany) - May 2017  
Max Planck Institute for Chemical Energy Conversion (Mülheim/Ruhr, Germany) - June 2017  
University of Amsterdam (Amsterdam, Netherlands) - June 2017  
Aix Marseille Université (Marseille, France) - June 2017  
Rutgers University (New Brunswick, NJ) - September 2017  
University of California (San Diego, CA) - October 2017  
Scripps Research Institute (La Jolla, CA) - October 2017  
University of Oklahoma (Norman, OK) - October 2017  
University of California (Berkeley, CA) - January 2018  
Massachusetts Institute of Technology (Cambridge, MA) - April 2018  
Northwestern University (Evanston, IL) - May 2018  
Simon Fraser University (Vancouver, BC) - October 2018  
University of Victoria (Victoria, BC) - October 2018  
Cornell University (Ithaca, NY) - December 2018

Indiana University (Bloomington, IN) - January 2019  
University of Michigan (Ann Arbor, MI) - February 2019  
University of Notre Dame (Notre Dame, IN) - February 2019  
Calvin College (Grand Rapids, MI) - February 2019  
Hope College (Holland, MI) - February 2019  
Wichita State University (Wichita, KS) - March 2019  
McGill University (Montreal, ON) - March 2019  
Indiana University Purdue University at Indianapolis (Indianapolis, IN) - April 2019  
Rutgers University - Newark (Newark, NJ) - May 2019  
University of Chicago (Chicago, IL) - May 2019  
University of Kassel (Kassel, Germany) - June 2019  
University of Utrecht (Utrecht, Netherlands) - June 2019  
James Madison University (Harrisonburg, VA) - June 2019  
University of Freiburg (Freiburg, Germany) - August 2019  
Brown University (Providence, RI) - September 2019  
University of Utah (Salt Lake City, UT) - October 2019  
University of Alberta (Edmonton, AB) - March 2020  
University of Calgary (Calgary, AB) - March 2020

#### **Lectures at Meetings/Conferences (Invited)**

Bergman Symposium (Berkeley, CA) – June 2002  
Nitrogen Fixation Gordon Conference (New London, NH) – June 2002  
International Conference on Coordination Chemistry (Heidelberg, Germany) – July 2002  
Metals in Biology Gordon Conference (Ventura, CA) – February 2003  
Eisenberg/Jones Symposium, National ACS Meeting (New Orleans, LA) – March 2003  
Symposium on Non-Heme Iron in Biology, National ACS Meeting (Anaheim, CA) – March 2004  
Nitrogen Fixation Gordon Conference (New London, NH) – June 2004  
Organometallic Chemistry Gordon Conference (Newport, RI) – July 2004  
European Biological Inorganic Chemistry Conference (EUROBIC 7) (Garmisch-Partenkirchen, Germany) - August 2004  
Inorganic Reaction Mechanisms Gordon Conference (Ventura, CA) - February 2005  
Pacifichem (Honolulu, HI) - December 2005  
Rochester Section ACS Dinner (Rochester, NY) - January 2006  
Wieghardt Symposium, National ACS Meeting (Atlanta, GA) - March 2006  
Iron-Sulfur Enzymes Gordon Conference (New London, NH) - June 2006  
Inorganic Chemistry Gordon Conference (Newport, RI) - July 2006  
International Workshop on Bioinorganic and Organometallic Perspectives in Activation of Small Molecules (Nagoya, Japan) - November 2007  
Que Symposium, National ACS Meeting (New Orleans, LA) - April 2008  
Symposium on Integration of Research and Education at the Frontiers of Inorganic Chemistry, National ACS Meeting (New Orleans, LA) - April 2008

Symposium on Organometallic Chemistry of the Group 15 Elements, Northeast Regional ACS Meeting (Burlington, VT) - June 2008

Symposium on Activation of Dinitrogen, National ACS Meeting (Philadelphia, PA) - August 2008

Metals in Biology Gordon Conference (Ventura, CA) - January 2009

International Conference on Biological Inorganic Chemistry, ICBIC (Nagoya, Japan) - July 2009

Iron-Sulfur Enzymes Gordon Conference (New London, NH) - June 2010

Symposium on Ligand Design, National ACS Meeting (Boston, MA) - August 2010

Wieghardt Retirement Symposium (Mülheim, Germany) - November 2010

Pacifichem (Honolulu, HI) - December 2010

Metal Hydrides Workshop (Oxford, England) - March 2012

Fulbright Berlin Conference (Berlin, Germany) - March 2012

Iron Symposium (Regensburg, Germany) - June 2012

Inorganic Chemistry Gordon Conference (Biddeford, ME) - June 2012

Andersen Symposium (Berkeley, CA) – October 2012

Inorganic Reaction Mechanisms Gordon Conference (Galveston, TX) - March 2013

Symposium on Hydrogen Production, Storage, and Utilization, National ACS Meeting (New Orleans, LA) - April 2013

International Conference on Biological Inorganic Chemistry, ICBIC (Grenoble, France) - July 2013

Symposium on Base Metal Catalysis, National ACS Meeting (Indianapolis, IN) - September 2013

Werner Nobel Centenary Symposium, National ACS Meeting (Indianapolis, IN) - September 2013

New York ACS Section: Frontiers of Inorganic and Organometallic Chemistry (New York, NY) - September 2013

Fusion Conference on Molecules and Materials for Artificial Photosynthesis (Cancun, Mexico) - February 2014

Canadian Chemistry Conference (Vancouver, BC) - June 2014

Rigaku Symposium (New Haven, CT) - June 2014

Fusion Conference on Small Molecule Activation (Chicago, IL) - July 2014

Western Canadian Undergraduate Chemistry Conference (Kelowna, BC) - May 2015

National ACS Meeting (Boston, MA) - August 2015

International Conference on Nitrogen Fixation (Monterey, CA) - October 2015

Pacifichem (Honolulu, HI) - December 2015

National ACS Meeting (San Diego, CA) - March 2016

Metallocofactors Gordon Conference (Easton, MA) - June 2016

Telluride Conference on Small Molecule Activation (Telluride, CO) - June 2016

International Conference on Coordination Chemistry (Brest, France) - July 2016

National ACS Meeting (Philadelphia, PA) - August 2016

SABIC Frontiers in Inorganic Chemistry (Kolkata, India) - January 2017

ECOST: Control over Spin States in Technology and Biochemistry (Lisbon, Portugal) - March 2017

National ACS Meeting (San Francisco, CA) - April 2017  
 Boston Regional Inorganic Colloquium (Boston, MA) - February 2018  
 National ACS Meeting (New Orleans, LA) - March 2018  
 Blavatnik Science Symposium (New York, NY) - June 2018  
 National ACS Meeting (Orlando, FL) - March 2019  
 Canadian Chemistry Conference (Quebec, QC) - June 2019  
 International Conference on Biological Inorganic Chemistry (Interlaken, Switzerland) - August 2019  
 European Colloquium on Inorganic Reaction Mechanisms (Toulouse, France) - July 2020

### **Lectures at Meetings/Conferences (Contributed)**

National ACS Meeting (Chicago, IL) - August 2001  
 Inorganic Discussion Weekend (Waterloo, ON) - October 2001  
 National ACS Meeting (Boston, MA) - August 2002  
 Organometallic Chemistry Gordon Conference (Newport, RI) - July 2003  
 National ACS Meeting (New York, NY) - September 2003  
 NSF Inorganic Workshop (Sedona, AZ) - June 2004  
 Northeast Regional ACS Meeting (Rochester, NY) - November 2004  
 Beta-Diketiminates Symposium, National ACS Meeting (Washington, DC) - August 2005  
 International Meeting of the IMBG (Autrans, France) - September 2006  
 International Conference on Biological Inorganic Chemistry, ICBIC (Vienna, Austria) - July 2007  
 International Conference on Biological Inorganic Chemistry, ICBIC (Vancouver, Canada) - August 2011  
 National ACS Meeting (San Francisco, CA) - August 2014  
 EuCheMS Inorganic Chemistry Conference (Copenhagen, Denmark) – July 2017

### **Research Trainees**

#### **Doctoral**

<b>Name</b>	<b>Degree/Year</b>	<b>Most Recent Known Position</b>
Nathan Eckert	Ph.D. 2005	Pilot Plant Manager, Shepherd Chemical Co., Cincinnati, OH
Javier Vela	Ph.D. 2005	Professor, Iowa State U., Ames, IA
Ying Yu	Ph.D. 2007	Master's program in Information Systems
Keying Ding	Ph.D. 2009	Assistant Professor, Middle Tennessee State Univ.
Sara Rocks	Ph.D. 2009	Assistant Professor, Utah Valley U., Orem, UT
Matthew McLaughlin	Ph.D. 2011	Principal Process Engineer, GlobalFoundries
Ryan Cowley	Ph.D. 2011	Research Chemist, ThermoFisher, Sunnyvale, CA
Karen Chiang	Ph.D. 2011	Lecturer, U. San Diego, San Diego, CA
Thomas Dugan	Ph.D. 2012	Sr. Research Chemist, Evonik, Allentown, PA



Meghan (Clark) Rodriguez	Ph.D. 2012	Adjunct Professor, Monroe Community College, Rochester, NY
Zhiji Han	Ph.D. 2014	Professor, Sun Yat-Sen Univ.
Sarina Bellows	Ph.D. 2014	Thermo Fisher Scientific, Rochester, NY
Chi Chen	Ph.D. 2016	Catalytic Innovations, Adamsville, RI
Megan Reesbeck	Ph.D. 2016	Horace Mann School, New York, NY
Nicholas Arnet	Ph.D. 2016	Postdoctoral, Texas A&M (M. Darensbourg)
Sean McWilliams	Ph.D. 2019	Postdoctoral, UNC (Dempsey)
Daniel DeRosha	Ph.D. 2019	Postdoctoral, Columbia (Owen)
Gannon Connor	current student	Expected completion 2020
Daniel Kim	current student	Expected completion 2020
Dongyoung Kim	current student	Expected completion 2020
Samuel Bhutto	current student	Expected completion 2022
Alexandra Nagelski	current student	Expected completion 2022
Jeremy Weber	current student	Expected completion 2022
Conner Wilson	current student	Expected completion 2022
Nan Xie	current student	Expected completion 2023
Jessica Armstrong	current student	Expected completion 2023
Reagan Hooper	current student	Expected completion 2023

### Master's

Name	Degree/Year	Most Recent Known Position
Elizabeth Gregory	M.S. 2004	Assistant Director of EH&S, SUNY Brockport
Travis Hebden	M.S. 2005	Engineer, Intel Corp., Portland, OR
Liwei Zhu	M.S. 2007	Senior Associate, Discover Financial Services, Chicago, IL
Tawana Robinson	M.S. 2008	Baylor Genome Sequencing Center, Waco, TX
Wenwen Yao	M.S. 2011	Ph.D. student in environmental engineering, Worcester Polytechnic Inst.
Malik Al-Afyouni	M.S. 2013	Analytical Chemist, Eastman Chemical, Akron, OH
Anna Brosnahan	M.S. 2016	Analyst, Dean & Co., Vienna, VA

### Postdoctoral

Name	Time in Group	Most Recent Known Position
Jeremy Smith	2000-2003	Professor, Indiana U.
Savariraj Kingsley	2002-2003	Scientist, ChemRoutes Corp., Edmonton, Canada
Wilda Vargas-Gregory	2004-2005	Adjunct Professor, POPAC Nursing School, Mayaguez, PR
Jérôme Elhaïk	2005-2006	Free-lance translator, France
Azwana Sadique	2004-2007	Adjunct faculty, Monroe Community College, Rochester, NY
Bryan Stubbert	2006-2007	Senior Chemist, Dow Corp., Midland, MI

Benjamin Dible	2006-2009, 2010	Patent Analyst, Sanofi, Bridgewater, NJ
Aydin Kavara	2010-2011	Research Scientist, Jordi Labs, Kalamazoo, MI
P. M. Gurubasavaraj	2010-2011	Assistant Professor, Rani Chennamma University, India
William McNamara	2010-2012	Associate Professor, William & Mary College, Williamsburg, VA
Katarzyna Grubel	2011-2014	Scientist, Pacific Northwest National Laboratory, Richland, WA
Simon Bonyhady	2013-2015	Chemist, Chemtura Corp., Naugatuck, CT
Richard Lewis	2013-2015	Technical Reviewer, FDA, Washington, DC
Cory MacLeod	2012-2016	Senior Chemist, Chemtura Corp., Naugatuck, CT
Ilija Coric	2013-2016	Group Leader, Univ. Zürich
Daniel Broere	2016-2018	Assistant Professor, U. of Utrecht
Amy Speelman	2016-2019	Currently in group
Kazimer Skubi	2017-	Currently in group
Majed Fataftah	2019-	Starting in summer 2019

### Undergraduate Theses

<b>Name</b>	<b>Degree/Year</b>	<b>Most Recent Known Position</b>
Emily Bones	B.S. 2001	Education Resource Associate, American Assoc. of Chem. Teachers (American Chem. Soc.), Washington, DC
Lanyn Perez	B.S. 2002	Graduate student, U. Maryland (Biology)
Nicole Ketterer	B.S. 2003	Research Scientist, Chevron, Richmond, CA
Travis Hebden	B.S. 2004	Engineer, Intel, Portland, OR
Benjamin Gilston	B.S. 2005	Postdoctoral, Vanderbilt (Chemistry, W. Chazin)
Pamela Barrett	B.S. 2006	Postdoctoral, U. Washington (Civil and Environmental Engineering)
Amanda Mack	B.S. 2008	Teaching Fellow, Phillips Academy, Andover, MA
Matthew Golder	B.S. 2010	Postdoctoral, MIT (Chemistry, J. Johnson); soon to be Assistant Professor, U. Washington, Seattle, WA
Ethan Kaplan	B.A. 2010	Associate, PricewaterhouseCoopers, New York, NY
Jonathan Goldberg	B.S. 2012	Postdoc, Princeton Univ. (J. Groves)
Maxwell Hecht	B.S. 2013	Chemist, Jordi Labs, Mansfield, MA
Emma Brennan-Wydra	B.S. 2015	Unknown
Bechir-Auguste Pierre	B.S. 2015	Consultant, Bain & Company
David Minoli	B.S. 2016	Chemistry Teacher, Los Angeles

Emily Silva	B.S. 2017	Teacher in WorldTeach, Ecuador
Mackenzie Adelberg	B.S. 2017	Unknown
Kuan Jiang	B.S. 2019	Teach for America

**Course Teaching at Rochester (rating out of 5 in parentheses; NA = not available)**

Chemistry 131 ("General Chemistry"): 2012 (3.4)  
 Chemistry 211 ("Inorganic Chemistry"): 2002 (NA), 2003 (3.6), 2004 (4.0)  
 Chemistry 234 ("Advanced Synthetic Techniques"): 2007 (4.0), 2008 (4.9), 2009 (4.5), 2010 (4.5)  
 Chemistry 411 ("Advanced Inorganic Chemistry"): 2000 (NA), 2001 (NA), 2002 (NA), 2003 (NA), 2004 (NA)  
 Chemistry 412 ("Inorganic Spectroscopy"): 2002 (3.7), 2003 (4.1), 2004 (4.3)  
 Chemistry 414 ("Bioinorganic Chemistry"): 2005 (4.7), 2006 (4.7), 2007 (4.4), 2008 (4.1), 2009 (4.6)  
 Chemistry 415 ("Group Theory"): 2010 (5.0)  
 Chemistry 421 ("Basic Organometallic Chemistry"): 2011 (4.5), 2012 (4.5)  
 Chemistry 422 ("Advanced Organometallic Chemistry"): 2012 (3.9)  
 Chemistry 424 ("Inorganic Spectroscopy"): 2010 (4.8)

**Course Teaching at Yale (rating out of 5 in parentheses)**

Chemistry 457/557 ("Modern Coordination Chemistry"): 2013 (NA), 2014 (4.5)  
 Chemistry 554 ("Bioinorganic Chemistry"): 2015 (4.2), 2018 (3.5), 2019  
 Chemistry 161 ("General Chemistry I"): 2015 (2.8), 2016 (2.9), 2017 (3.0), 2018 (2.8)  
 - initiated use of active learning strategies to move beyond the traditional lecture format  
 - enrollment has gone from 211 (in 2015) to 305 (in 2018)  
 Chemistry 555 ("Inorganic Mechanisms"): 2016 (3.8)  
 Chemistry 550 ("Physical Methods in Inorganic Chemistry"): 2019 (4.3)

**Other Pedagogy:**

- Short course on Organometallic Chemistry (Eastman Kodak Co.): 2002
- created website for sharing group exercises on inorganic chemistry
- invited talk in national symposium for VIPeR (Virtual Inorganic Pedagogical Electronic Resource), April 2008.
- B. A. Reisner, J. L. Stewart, B. S. Williams, L. A. Goj, P. L. Holland, H. J. Eppley, A. R. Johnson, "Virtual Inorganic Pedagogical Electronic Resource Learning Objects in Organometallic Chemistry," *J. Chem. Educ.* **2012**, *89*, 185-187.
- leader for presentation on "Writing Effective Workshop Problems" at Rochester Cluster of Leadership in Education, January 2013.

- National Academies Education Short Course, May 2015.
- led faculty discussion on active learning methods in large classes, Yale Center for Teaching & Learning, April 2016.
- Yale Center for Teaching and Learning Faculty Forum "How Faculty are Using Technology to Meet Pedagogical Goals," October 2017.
- Panelist for "How to Make Your Fellowship Application Stand Out," Graduate Writing Lab at Yale, April 2018.

### **Highlights of Departmental Service**

- UR: Headed redesign of departmental Web page (2002)
- UR: Faculty supervisor for crystallography facility (2003-2013)
  - in charge of hiring new crystallographer on two occasions
  - wrote equipment grant for upgrade of detector
- UR: Chair of Graduate Studies (2005-2008)
  - established system for feedback to all TAs
  - initiated regular town-hall meetings with students
  - established "First-Year Graduate Seminar" for ethics and acculturation, expanded grad student orientation to include more TA training
  - changed graduate student fellowship system to be merit-based
  - added students to departmental committees for greater empowerment
- UR: Chair of Synthesis/Catalysis Mechanism Research Cluster (2009-2012)
  - organized annual retreat of synthetic groups
  - organized regular meetings of faculty to discuss research synergies
- Yale: Director of Graduate Studies (2015-2016)
  - initiated town-hall meetings of students and established student committee for feedback
  - initiated student Joint Safety Team, overhauled department safety training to be hands-on
  - initiated student surveys to assess, improve departmental climate
  - organized full-department meetings to discuss sexual harassment prevention (highlighted: Wang, L.; Widener, A. "Confronting sexual harassment in chemistry," *Chem. Eng. News* **2017**, 95 (37), 28-37).
  - after my official role ended, continued to informally support these efforts
- Yale: Director of Graduate Student Climate & Diversity (2018-present)
  - new position focuses on supporting student climate, mental health, diversity, and training experiences for our graduate students
  - advise student Climate & Diversity Committee and student Professional Development Network
  - coordinate recruiting at conferences/fairs for underrepresented minorities
  - interface with university-level diversity and wellness resources

### **Other University Service - Yale**

- Chemical Safety Committee (2014-2016)
  - organized visit of William Tolman for seminar describing safety culture and Joint Safety Teams between students, faculty, EHS; this initiative resulted in formation of a JST group at Yale Chemistry, which is now completely student-run
  - brought in new model for chemical safety training with "Safety Day," which features rotating stations with student-led training on different aspects of safety.
- University-Wide Committee on Sexual Misconduct (2016-present)
  - departmental Title IX representative
  - panelist on cases involving student or faculty misconduct
- Fellow of Ezra Stiles College (2014-present)
  - advisor to undergraduate students
  - participant in events that bring together science and humanities
- Interviews with *Yale Daily News* (student newspaper)
  - I have been interviewed several times for perspectives on teaching (large general chemistry course), research, and departmental innovations.