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Center for Catalysis, Department of Chemistry
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Professional preparation

University of California, Berkeley, 2007-2010, Post-Doctoral Researcher

Advisor: Jeffrey R. Long

Research Area: Design and synthesis of metal-organic frameworks for catalysis and gas storage/separation

Massachusetts Institute of Technology, 2002-2007, Ph.D., Inorganic Chemistry

Thesis Advisor: Stephen J. Lippard

Thesis Title: Dioxygen activation and substrate hydroxylation by the hydroxylase component of toluene/o-xylene monooxygenase from *Pseudomonas sporium* OX1.

Swarthmore College, 1998-2002, B.A. in Chemistry and B.A. in Biology

Advisors: Robert S. Paley and Michael R. Wedlock

Research Area: Organometallic chemistry (RSP) and resonance Raman spectroscopy (MRW)

GlaxoSmithKline Inc., Research Triangle Park, NC, 2000 & 2001, Research Intern

Supervisors: Samuel Gerritz, Philip Turnbull

Appointments

August 2022 – present	Professor, Department of Chemistry, University of Florida
August 2017 – August 2022	Associate Professor, Department of Chemistry, University of Florida
August 2010 – August 2017	Assistant Professor, Department of Chemistry, University of Florida

Selected honors and awards

University of Florida Research Foundation Professor 2020-2022
Visiting professor, Université Grenoble Alpes, Grenoble, France 2020
Visiting researcher, Commissariat à l'énergie atomique et aux énergies alternatives, Grenoble, France 2020
University Term Professor, University of Florida, 2019-2021
KAIST BK21 School of Molecular Science Lectureship Award, 2019
University Term Professor, University of Florida, 2016-2019
Fellow for Sustainability, Martin Family Society, Massachusetts Institute of Technology, 2004
Presidential Fellow, Massachusetts Institute of Technology, 2002
Phi Beta Kappa, Epsilon of Pennsylvania, Swarthmore College, 2002

Publications (Corresponding author(s) underlined)

- 33 Torres, J.F.; Oi, C.H.; Moseley, I.; El-Sakkout, N.; Knight, B.J.; Shearer, J.; García-Serres, R.; Zadrozny, J.M.; Murray, L.J. "Dinitrogen Coordination to a High Spin Diiron(I/II) Species" *Angew. Chem. Int. Ed.*, **2022**, *61*, e202202329. doi: [10.1002/anie.202202329](https://doi.org/10.1002/anie.202202329)
- 32 Hong, D.H.; Ferreira, R.B.; Catalano, V.J.; García-Serres, R.; Shearer, J.; Murray, L.J. "Access to Metal Centers and Fluxional Hydride Coordination Integral for CO₂ Insertion into [Fe₃(μ-H)₃]³⁺ Clusters" *Inorg. Chem.* **2021**, *60*, 7228–7239. doi: [10.1021/acs.inorgchem.1c00244](https://doi.org/10.1021/acs.inorgchem.1c00244)

- 31 Eaton, M.C.; Catalano, V.J.; Shearer, J.; Murray, L.J. "Dinitrogen Insertion and Cleavage By a Metal-Metal Bonded Tri-Cobalt(I) Cluster" *J. Am. Chem. Soc.* **2021**, *143*, 5649–5653. doi: [10.1021/jacs.1c01840](https://doi.org/10.1021/jacs.1c01840)
- 30 Buratto, W.R.; Ferreira, R.B.; Catalano, V.J.; García-Serres, R.; Murray, L.J. "Cleavage of Cluster Iron-Sulfide Bonds in Cyclophane Coordinated Fe_nS_m Complexes" *Dalton Trans.* **2021**, *50*, 816-821. doi: [10.1039/D0DT03805A](https://doi.org/10.1039/D0DT03805A)
- 29 "Synthetic Factors Governing Access to Tris(β-diketimine) Cyclophanes vs. Tripodal Tri-β-Aminoenones" Eaton, M.C.; Knight, B.J.; Brahmi, R.; Ferreira, R.B.; Catalano, V.J.; Rheingold, A.L.; Ghiviriga, I.; Murray, L.J. *J. Org. Chem.* **2020**, *85*, 13579–13588. doi: [10.1021/acs.joc.0c01708](https://doi.org/10.1021/acs.joc.0c01708)
- 28 Singh, D.; Buratto, W.R.; Torres González, J.F.; Murray, L.J. "Activation of Dinitrogen By Polynuclear Metal Complexes" *Chem. Rev.* **2020**, *120*, 5517–5581 doi: [10.1021/acs.chemrev.0c00042](https://doi.org/10.1021/acs.chemrev.0c00042)
- 27 Buratto, W.R. and Murray, L.J. "Coordination Chemistry of Iron-Dinitrogen Complexes with Relevance to Biological N₂ Fixation" Reference Module in Chemistry, Molecular Sciences and Chemical Engineering, Elsevier, 2020. doi: [10.1016/B978-0-12-409547-2.14822-X](https://doi.org/10.1016/B978-0-12-409547-2.14822-X)
- 26 Eaton, M.C.; Knight, B.J.; Catalano, V.J.; Murray, L.J. "Evaluating Metal Ion Identity on Catalytic Silylation of Dinitrogen Using a Series of Trimetallic Complexes" *Eur. J. Inorg. Chem.* **2020**, 1519-1524. doi: [10.1002/ejic.201901335](https://doi.org/10.1002/ejic.201901335)
25. Charles, F.-G.; Murray, L.J.; Giordano, C.; Spiess, B. "Vitamin B12 for the treatment of vasoplegia in cardiac surgery and liver transplantation: a narrative review of cases and potential biochemical mechanisms" *Can. J. Anaesth.* **2019**, 1-13. doi: [10.1007/s12630-019-01449-x](https://doi.org/10.1007/s12630-019-01449-x)
24. Hong, D.H.; Knight, B.J.; Catalano, V.J.; Murray, L.J. "Isolation of chloride- and hydride-bridged tri-iron and -zinc clusters in a tris(β-oxo-δ-diimine) cyclophane ligand" *Dalton Trans.* **2019**, *48*, 9570-9575. doi: [10.1039/c9dt00799g](https://doi.org/10.1039/c9dt00799g)
23. Hong, D.H. and Murray, L.J. "Carbon Dioxide Insertion into Bridging Iron Hydrides: Kinetic and Mechanistic Studies" *Eur. J. Inorg. Chem.* **2019**, 2146-2153. doi: [10.1002/ejic.201801404](https://doi.org/10.1002/ejic.201801404)
22. Ferreira, R.B. and Murray, L.J. "Cyclophanes as platforms for reactive multimetallic complexes" *Acc. Chem. Res.* **2019**, *52*, 447-455. doi: [10.1021/acs.accounts.8b00559](https://doi.org/10.1021/acs.accounts.8b00559)
21. Cook, B.J.; Di Francesco, G.N.; Ferreira, R.B.; Lukens, J.T.; Silberstein, K.E.; Keegan, B.C.; Catalano, V.J.; Lancaster, K.M.; Shearer, J.; Murray, L.J. "Chalcogen Impact on Covalency within Molecular [Cu₃(μ₃-E)]³⁺ Clusters (E = O, S, Se): A Synthetic, Spectroscopic, and Computational Study" *Inorg. Chem.* **2018**, *57*, 11382-11392. doi: [10.1021/acs.inorgchem.8b01000](https://doi.org/10.1021/acs.inorgchem.8b01000)
20. Ferreira, R.B.; Cook, B.J.; Knight, B.J.; Catalano, V.J.; García-Serres, R.; Murray, L.J. "Catalytic Silylation of Dinitrogen By a Family of Triiron Complexes" *ACS Catal.* **2018**, *8*, 7208–7212. doi: [10.1021/acscatal.8b02021](https://doi.org/10.1021/acscatal.8b02021)
19. Cook, B.J.; Di Francesco, G.N.; Kieber-Emmons, M.T.; Murray, L.J. "A Tricopper(I) Complex Competent for O-atom Transfer, C-H Bond Activation, and Multiple O₂ Activation Steps" *Inorg. Chem.* **2018**, *57*, 11361-11368. doi: [10.1021/acs.inorgchem.8b00921](https://doi.org/10.1021/acs.inorgchem.8b00921)
18. Cook, B.J.; Di Francesco, G.N.; Abboud, K.A.; Murray, L.J. "Counteractions and Solvent Influence CO₂ Reduction to Oxalate by Chalcogen-Bridged Tricopper Cyclophanates" *J. Am. Chem. Soc.* **2018**, *140*, 5696-5700. doi: [10.1021/jacs.8b02508](https://doi.org/10.1021/jacs.8b02508)
17. Ferreira, R.B. and Murray, L.J. "Group 10 and 11 transition metal-dinitrogen complexes" in *Transition Metal-Dinitrogen Complexes*. Y. Nishibayashi (Ed.). Weinheim, Germany: Wiley-VCH.
16. Anderton, K.J.; Ermert, D.M.; Quintero, P.A.; Turvey, M.W.; Fataftah, M.S.; Abboud, K.A.; Meisel, M.W.; Čižmár, E.; Murray, L.J. "Correlating Bridging Ligand with Properties of Ligand-Templated [MnⁿX₃]³⁺ Clusters (X = Br, Cl, H, MeO)" *Inorg. Chem.* **2017**, *56*, 12012-12022. doi: [10.1021/acs.inorgchem.7b02004](https://doi.org/10.1021/acs.inorgchem.7b02004)

15. Patil, B.S.; Hessel, V.; Seefeldt, L.C.; Dean, D.R.; Hoffman, B.M.; Cook, B.J.; Murray, L.J. "Nitrogen Fixation" *Ullmann Encyclopedia of Industrial Chemistry* **2017**, in press. doi: [10.1002/14356007.a17_471.pub2](https://doi.org/10.1002/14356007.a17_471.pub2)
14. Anderton, K.J.; Knight, B.J.; Rheingold, A.L.; Abboud, K.A.; García-Serres, R.; Murray, L.J. "Reactivity of hydride bridges in a high-spin $[\text{Fe}_3(\mu\text{-H})_3]^{3+}$ cluster: reversible H_2/CO exchange and Fe-H/B-F bond metathesis" *Chem. Sci.* **2017**, *8*, 4123-4129. doi: [10.1039/c6sc05583d](https://doi.org/10.1039/c6sc05583d)
13. Ermert, D.M.; Gordon, J.B.; Abboud, K.A.; Murray, L.J. "Synthesis of Trinuclear Tin(II), Germanium(II), and Aluminum(III) Cyclophane Complexes" *Organometallics* **2016**, *35*, 3651-3657. doi: [10.1021/acs.organomet.6b00354](https://doi.org/10.1021/acs.organomet.6b00354)
12. Ermert, D.M.; Murray, L.J. "Insights into small molecule activation by multinuclear first-row transition metal cyclophanates" *Dalton Trans.* **2016**, *45*, 14499-14507. doi: [10.1039/c6dt01857b](https://doi.org/10.1039/c6dt01857b)
11. Lee, Y.; Abboud, K. A.; García-Serres, R.; Murray, L. J. "A three-coordinate Fe(II) center within a $[\text{3Fe}-(\mu_3\text{-S})]$ cluster that provides an accessible coordination site" *Chem. Commun.* **2016**, *52*, 9295-9298. doi: [10.1039/c6cc04671a](https://doi.org/10.1039/c6cc04671a)
10. Lee, Y.; Rang, I.-E.; Abboud, K. A.; García-Serres, R.; Shearer, J.; Murray, L. J. "A $[\text{3Fe-3S}]^{3+}$ cluster with exclusively μ -sulfide donors" *Chem. Commun.* **2016**, *52*, 1174-1177. doi: [10.1039/c5cc07813j](https://doi.org/10.1039/c5cc07813j)
9. Lee, Y.; Anderton, K. J.; Sloane, F. T.; Ermert, D. M.; Abboud, K. A.; García-Serres, R.; Murray, L. J. "Reactivity of Hydride Bridges in High-Spin $[\text{3M-3}(\mu\text{-H})]$ Clusters (M = Fe, Co)" *J. Am. Chem. Soc.* **2015**, *137*, 10610-10617. doi: [10.1021/jacs.5b05204](https://doi.org/10.1021/jacs.5b05204)
8. Ermert, D. M.; Gordon, J. B.; Abboud, K. A.; Murray, L. J. "Nitride-bridged triiron complex and its relevance to dinitrogen activation" *Inorg. Chem.* **2015**, *54*, 9282-9289. doi: [10.1021/acs.inorgchem.5b00825](https://doi.org/10.1021/acs.inorgchem.5b00825)
7. Ermert, D. M.; Ghiviriga, I.; Catalano, V. J.; Shearer, J.; Murray, L. J. "An Air and Water Tolerant Zinc Hydride Cluster That Reacts Selectively With CO_2 " *Angew. Chem. Int. Ed.* **2015**, *54*, 7047-7050. doi: [10.1002/anie.201501539](https://doi.org/10.1002/anie.201501539)
6. Guillet, G. L.; Gordon, J. B.; Di Francesco, G. N.; Calkins, M. W.; Čižmár, E.; Abboud, K. A.; Meisel, M. W.; García-Serres, R.; Murray, L. J. "A Family of Tri- and Dimetallic Pyridine Dicarboxamide Cryptates: Unusual *O,N,O*-Coordination and Facile Access to Secondary Coordination Sphere Hydrogen Bonding Interactions" *Inorg. Chem.* **2015**, *54*, 2691-2704. doi: [10.1021/ic502873d](https://doi.org/10.1021/ic502873d)
5. Lee, Y.; Sloane, F. T.; Blondin, G.; Abboud, K. A.; García-Serres, R.; Murray, L. J. "Dinitrogen Activation Upon Reduction of a Triiron(II) Complex" *Angew. Chem. Int. Ed.* **2015**, *54*, 1499-1503. doi: [10.1002/anie.201409676](https://doi.org/10.1002/anie.201409676)
4. Murray, L. J.; Weare, W. W.; Shearer, J.; Mitchell, A. D.; Abboud, K. A. "Isolation of a (Dinitrogen)Tricopper(I) Complex" *J. Am. Chem. Soc.* **2014**, *136*, 13502-13505. doi: [10.1021/ja506445d](https://doi.org/10.1021/ja506445d)
3. Di Francesco, G. N.; Gaillard, A.; Ghiviriga, I.; Abboud, K. A.; Murray, L. J. "Modeling Biological Copper Clusters: Synthesis of a Tricopper Complex, and Its Chloride- and Sulfide-Bridged Congeners" *Inorg. Chem.* **2014**, *53*, 4647-4654. doi: [10.1021/ic500333p](https://doi.org/10.1021/ic500333p)
2. Guillet, G. L.; Sloane, F. T.; Ermert, D. M.; Calkins, M. W.; Peprah, M. K.; Knowles, E. S.; Čižmár, E.; Abboud, K. A.; Meisel, M. W.; Murray, L. J. "Preorganized assembly of three iron(II) or manganese(II) β -diketiminato complexes using a cyclophane ligand" *Chem. Commun.* **2013**, *49*, 6635-6637. doi: [10.1039/C3CC43395A](https://doi.org/10.1039/C3CC43395A)
1. Guillet, G. L.; Sloane, F. T.; Dumont, M. F.; Abboud, K. A.; Murray, L. J. "Synthesis and characterization of a tris(2-hydroxyphenyl)methane-based cryptand and its triiron(III) complex" *Dalton Trans.* **2012**, *41*, 7866-7869. doi: [10.1039/c2dt30312d](https://doi.org/10.1039/c2dt30312d)

Manuscripts accepted, submitted, or in preparation

2. Torres-González, J.F.; Catalano, V.J.; García-Serres, R.; Murray, L.J. "Dinitrogen Homolysis to Bridging Nitrides Mediated By a Triiron Complex" *manuscript in preparation*.
1. Singh, D.; Knight, B.J.; Rheingold, A.L.; Catalano, V.J.; García-Serres, R.; Murray, L.J. "Reductive CO Homocoupling By a Diiron Complex" *manuscript in preparation*.

Prior publications (Ph.D. and Postdoctoral research)

13. Bloch, E. D.; Queen, W. L.; Hudson, M. R.; Mason, J. A.; Xiao, D. J.; Murray, L. J.; Flacau, R.; Brown, C. M.; Long, J. R. "Hydrogen Storage and Selective, Reversible O₂ Adsorption in a Metal-Organic Framework with Open Chromium(II) Sites" *Angew. Chem. Int. Ed* **2016**, *55*, 8605-8609. doi: 10.1002/anie.201602950
12. Sumida, K.; Stuck, D.; Mino, L.; Chai, J.-D.; Bloch, E. D.; Zavorotynska, O.; Murray, L. J.; Dincă, M.; Chavan, S.; Bordiga, S.; Head-Gordon, M.; Long, J. R. "Impact of Metal and Anion Substitutions on the Hydrogen Storage Properties of M-BTT Metal-Organic Frameworks" *J. Am. Chem. Soc.* **2013**, *135*, 1083-1091. doi: 10.1021/ja310173e
11. Queen, W. L.; Bloch, E. D.; Brown, C. M.; Hudson, M. R.; Mason, J. A.; Murray, L. J.; Ramirez-Cuesta, A. J.; Peterson, V. K.; Long, J. R. "Hydrogen adsorption in the metal-organic frameworks Fe₂(dobdc) and Fe₂(O₂)(dobdc)" *Dalton Trans.* **2012**, *41*, 4180-4187. doi: 10.1039/c2dt12138g
10. Bloch, E. D.; Murray, L. J.; Queen, W. L.; Chavan, S.; Maximoff, S. N.; Bigi, J. P.; Krishna, R.; Peterson, V. K.; Grandjean, F.; Long, G. J.; Smit, B.; Bordiga, S.; Brown, C. M.; Long, J. R. "Selective Binding of O₂ over N₂ in a Redox-Active Metal-Organic Framework with Open Iron(II) Coordination Sites" *J. Am. Chem. Soc.* **2011**, *133*, 14814-14822. doi: 10.1021/ja205976v
9. Sumida, K.; Her, J.-H.; Dincă, M.; Murray, L. J.; Schloss, J. M.; Pierce, C. J.; Thompson, B. A.; FitzGerald, S. A.; Brown, C. M.; Long, J. R. "Neutron Scattering and Spectroscopic Studies of Hydrogen Adsorption in Cr₃(BTC)₂-A Metal-Organic Framework with Exposed Cr²⁺ Sites" *J. Phys. Chem. C* **2011**, *115*, 8414-8421. doi: 10.1021/jp200638n
8. Murray, L. J.; Dincă, M.; Yano, J.; Chavan, S.; Bordiga, S.; Brown, C. M.; Long, J. R. "Highly-Selective and Reversible O₂ Binding in Cr₃(1,3,5-benzenetricarboxylate)₂" *J. Am. Chem. Soc.* **2010**, *132*, 7856-7857. doi: 10.1021/ja1027925
7. Murray, L. J.; Dincă, M.; Long, J. R. "Hydrogen Storage in Metal-Organic Frameworks" *Chem. Soc. Rev.* **2009**, *38*, 1294-1314. doi: 10.1039/b802256a
6. Murray, L. J.; García-Serres, R.; McCormick, M. S.; Davydov, R.; Naik, S. G.; Kim, S.-H.; Hoffman, B. M.; Huynh, B. H.; Lippard, S. J. "Dioxygen Activation at Non-Heme Diiron Centers: Oxidation of a Proximal Residue in the I100W Variant of Toluene/*o*-Xylene Monooxygenase Hydroxylase" *Biochemistry* **2007**, *46*, 14795-14809. doi: 10.1021/bi7017128.
5. Murray, L. J.; Naik, S. G.; Ortillo, D. O.; García-Serres, R.; Lee, J. K.; Huynh, B. H.; Lippard, S. J. "Characterization of the Arene-Oxidizing Intermediate in ToMOH as a Diiron(III) Species" *J. Am. Chem. Soc.* **2007**, *129*, 14500-14510. doi: 10.1021/ja076121h
4. Murray, L. J.; Lippard, S. J. "Substrate Trafficking and Dioxygen Activation in Bacterial Multicomponent Monooxygenases" *Acc. Chem. Res.* **2007**, *40*, 466-474. doi: 10.1021/ar600040e
3. Newcomb, M.; Lansakara-P., D. S. P.; Kim, H.-Y.; Chandrasena, R. E. P.; Lippard, S. J.; Beauvais, L. G.; Murray, L. J.; Izzo, V.; Hollenberg, P. F.; Coon, M. J. "Products from Enzyme-Catalyzed Oxidations of Norcarenes" *J. Org. Chem.* **2007**, *72*, 1128-1133. doi: 10.1021/jo061865j

2. Newcomb, M.; Chandrasena, R. E. P.; Lansakara-P., D. S. P.; Kim, H.-Y.; Lippard, S. J.; Beauvais, L. G.; Murray, L. J.; Izzo, V.; Hollenberg, P. F.; Coon, M. J. "Desaturase Reactions Complicate the Use of Norcarane as a Mechanistic Probe. Unraveling the Mixture of Twenty-Plus Products Formed in Enzyme-Catalyzed Oxidations of Norcarane" *J. Org. Chem.* **2007**, *72*, 1121-1127. doi: 10.1021/jo061864r
1. Murray, L. J.; García-Serres, R.; Naik, S.; Huynh, B. H.; Lippard, S. J. "Dioxygen Activation at Non-Heme Diiron Centers: Characterization of Intermediates in a Mutant Form of Toluene/o-Xylene Monooxygenase Hydroxylase" *J. Am. Chem. Soc.* **2006**, *128*, 7458-7459. doi: 10.1021/ja062762l

Invited presentations

Departmental or Divisional Seminars:

50. "Bond-Making and -Breaking Effected By Polynuclear Metal Complexes" Arcane Seminar, Université Grenoble Alpes, Grenoble, France. April 11, 2022
49. "A Tale of Bond Making And Breaking By Weak-Field Ligated Polynuclear Metal Compounds" Department of Chemistry and Biochemistry, The Ohio State University, Columbus, OH. February 02, 2022
48. "A Tale of Bond Making And Breaking By Weak-Field Ligated Polynuclear Metal Compounds" Department of Chemistry, Cornell University, Ithaca, NY. Oct 25, 2021
47. "Weak-field ligated polynuclear homometallic complexes + electrons + small molecules = ..." Harvard-MIT Inorganic Chemistry Colloquium, Massachusetts Institute of Technology & Harvard University, Cambridge, MA. Apr 14, 2021
46. "Carbon Dioxide and Dinitrogen Reduction By Polynuclear Metal Compounds" Department of Chemistry, North Carolina State University, Raleigh, NC. April 7, 2021
45. "Activation of Carbon Oxygenates and Dinitrogen Using Polynuclear Metal Compounds" Department of Chemistry, Indiana University, Bloomington. April 4, 2021
44. "Designed Polynuclear Metal Compounds For the Activation of Small Molecules" Department of Chemistry, University of Cambridge, Cambridge, United Kingdom. Feb 28, 2020.
43. "Cooperative Small Molecule Activation" School of Chemistry, University College Dublin, Dublin, Ireland. Feb 26, 2020.
42. "Reduction of CO_x molecules using polynuclear metal compounds" Équipe INAC-SyMMES, Université Grenoble Alpes and CEA and CNRS, Grenoble, France. Feb 18, 2020.
41. "Bond Scission and Formation Facilitated by Polynuclear Metal Complexes" UniSysCat Colloquium, Humboldt Universität zu Berlin, Berlin-Adlershof, Germany. Feb 5, 2020.
40. "Small Molecule Transformations at Polynuclear Metal Complexes" Department of Chemistry, University of Minnesota, Minneapolis, MN. Sept 10, 2019.
39. "Small molecule activation by multimetallic cyclophane complexes" Diversity In Chemistry Initiative (DICI) Guest Speaker, Division of Chemistry and Chemical Engineering, California Institute of Technology, Pasadena, CA. Mar 1, 2019
38. "Harnessing metal-ion redox cooperativity for small molecule activation" Department of Chemistry, Seoul National University, Seoul 08826, South Korea. Feb 22, 2019
37. "Harnessing metal-ion redox cooperativity for small molecule activation" Center for Biomimetic Chemistry, Ewha Womens University, Seoul 120750, South Korea. Feb 21, 2019
36. "Harnessing metal-ion redox cooperativity for small molecule activation" Department of Chemistry, Pohang University of Science and Technology, Pohang 37673, South Korea. Feb 20, 2019
35. "Activation of small molecules by polynuclear iron and copper complexes" Department of Chemistry, Rutgers

University - Newark, Newark, NJ. Feb 14, 2019

34. "Metals, macrocycles, and small molecules: A tale of bond breaking and making" Department of Chemistry and Biochemistry, Florida International University, Miami, FL. Nov 16, 2018
33. "Multimetallic cyclophanates: unravelling redox cooperativity with small molecule activation" Department of Chemistry, University of Rochester, Rochester, NY. Nov 2, 2018
32. "Understanding how metal ions cooperate to activate small molecules" Department of Chemistry and Biochemistry, Montana State University, Bozeman, MT. Sept 1, 2017
31. "Understanding cooperativity through the activation of strong bonds by multimetallic compounds" Department of Chemistry, Western Washington University, Bellingham, WA. Apr 27, 2017
30. "Behind the veil of redox cooperativity: trimetallic complexes and the activation of strong bonds" Department of Chemistry, University of Utah, Salt Lake City, UT. Oct 19, 2016
29. "Behind the veil of redox cooperativity: trimetallic complexes and the activation of strong bonds" Department of Chemistry & Physics, Florida Gulf Coast University, Fort Meyers, FL. Sept 23, 2016
28. "Behind the veil of redox cooperativity: trimetallic complexes and the activation of strong bonds" Department of Chemistry, University of Florida, Gainesville, FL. Sept 21, 2016
27. "Exploring the chemistry of trimetallic cyclophane complexes" Department of Chemistry, Northwestern University, Evanston, IL. May 13, 2016
26. "Exploring the chemistry of trimetallic cyclophane complexes" Department of Chemistry, Marquette University, Milwaukee, WI. May 12, 2016
25. "Exploring the chemistry of trimetallic cyclophane complexes" Department of Chemistry, University of Wisconsin-Madison, Madison, WI. May 11, 2016
24. "Exploring the chemistry of trimetallic cyclophane complexes" Department of Chemistry, University of California, Berkeley, Berkeley, CA. Apr 22, 2016
23. "Exploring the chemistry of trimetallic cyclophane complexes" Department of Chemistry, University of California, Davis, Davis, CA. Apr 21, 2016
22. "Exploring the chemistry of trimetallic cyclophane complexes" Department of Chemistry, Massachusetts Institute of Technology, Cambridge, MA. Apr 6, 2016
21. "Exploring the chemistry of trimetallic cyclophane complexes" Department of Chemistry, Yale University, New Haven, CT. Feb 29, 2016
20. "Exploring the chemistry of trimetallic cyclophane complexes" Department of Chemistry, Indiana University, Bloomington, IN. Feb 26, 2016
19. "Selective binding and activation of small molecules by trimetallic cyclophane complexes" Department of Chemistry, Stanford University, Palo Alto, CA. Feb 4, 2016
18. "Selective binding and activation of small molecules by trimetallic cyclophane complexes" Department of Chemistry, Pomona College, Claremont, CA. Feb 2, 2016
17. "Selective binding and activation of small molecules by trimetallic cyclophane complexes" Department of Chemistry, University of California, Santa Barbara, Santa Barbara, CA. Feb 1, 2016
16. "Selective binding and activation of small molecules by trimetallic cyclophane complexes" Department of Chemistry, University of California, Irvine, Irvine, CA. Jan 21, 2016
15. "Cyclophane-supported trimetallic complexes: N₂ cleavage, CO₂ reduction, O₂ activation, & O-atom transfer" Department of Chemistry, Auburn University, Auburn, AL. Nov 5, 2015
14. "Multimetallic macrobicyclic complexes" Department of Chemistry & Chemical Biology, Harvard University, Cambridge, MA. Oct 20, 2015

13. "Cyclophane-supported trimetallic complexes: N₂ cleavage, CO₂ reduction, O₂ activation, & O-atom transfer" Department of Chemistry, Boston University, Boston, MA. Oct 19, 2015
12. "Cyclophane-supported trimetallic complexes: N₂ cleavage, CO₂ reduction, O₂ activation, & O-atom transfer" Department of Chemistry, Brown University, Providence, RI. Oct 16, 2015
11. "Cyclophane-supported trimetallic complexes: N₂ cleavage, CO₂ reduction, O₂ activation, & O-atom transfer" Department of Chemistry, University of Pennsylvania, Philadelphia, PA. Oct 14, 2015
10. "Cyclophane-supported trimetallic complexes: N₂ cleavage, CO₂ reduction, O₂ activation, & O-atom transfer" Department of Chemistry, Johns Hopkins University, Baltimore, MD. Oct 13, 2015
9. "Properties and small molecule reactivity of trinuclear base metal cyclophane complexes" Department of Chemistry & Biomolecular Sciences, University of Ottawa, Ottawa, ON, Canada. Sept 25, 2015
8. "Unusual structure types and reactivities of trinuclear base metal cyclophane complexes" Department of Chemistry, University of Toronto, Toronto, ON, Canada. Sept 23, 2015
7. "Unusual structure types and reactivities of trinuclear base metal cyclophane complexes" Department of Chemistry, The Pennsylvania State University, State College, PA. Apr 28, 2015
6. "All wrapped up: multimetallic assemblies within macrobicyclic ligands" Department of Chemistry, University of North Carolina - Chapel Hill, Chapel Hill, NC. Feb 6, 2015
5. "All wrapped up: multimetallic assemblies within macrobicyclic ligands" Department of Chemistry, North Carolina State University, Raleigh, NC. Feb 5, 2015
4. "All wrapped up: multimetallic assemblies within macrobicyclic ligands" Department of Chemistry & Biochemistry, Georgia Institute of Technology, Atlanta, GA. Feb 3, 2015
3. "All wrapped up: multimetallic assemblies within macrobicyclic ligands" Department of Chemistry, University of Georgia, Athens, GA. Feb 2, 2015
2. "All wrapped up: multimetallic assemblies within macrobicyclic ligands" Department of Chemistry, University of Nevada, Reno, Reno, NV. Nov 21, 2014
1. "All wrapped up: multimetallic assemblies within macrobicyclic ligands" Department of Chemistry, University of North Florida, Jacksonville, FL. Nov 7, 2014

Conferences & meetings

18. nanoGe Conference on Recent Advances on Nitrogen Activation and Conversion (N2X), March 31 - April 1, 2021. Title: Dinitrogen Activation By Homotrinary Metal Compounds. *Invited talk*.
17. Global Inorganic Discussion Weekdays, August 10, 2020. Title: Reduction of carbon dioxide using polynuclear metal compounds. *Invited talk*.
16. "Coordination Chemistry: Synthesis, Characterization and Application" Symposium, Southeast Regional Meeting of the American Chemical Society, Savannah, GA, October 22, 2019. Title: Dinitrogen coordination and activation by weak-field ligated multimetallic complexes. *Invited talk*.
15. Symposium in honor of the Pure Chemistry Award Recipient, Danna Freedman, ACS National Meeting, San Diego, CA, August 27, 2019. Title: Let's get together! Making C-C bonds between small molecules at multimetallic centers. *Invited talk*.
14. Symposium in honor of F. Albert Cotton Award Recipient, Jeffrey R. Long, ACS National Meeting, Orlando, FL March 31-April 4, 2019. Title: Engineering multimetallic compounds to activate small molecules. *Invited talk*.
13. KAIST-BK21 School of Molecular Science Symposium, Department of Chemistry, Korea Advanced Institute of Science and Technology, Daejeon 31414, South Korea. February 18, 2019. Title: Harnessing metal-ion redox cooperativity for small molecule activation. *Award lecture*.
12. "Many Colors of Copper" Symposium, ACS National Meeting, Washington, D.C. August 20-24, 2017. Title: Tale

of bonding and reactivity by tricopper cyclophanates. *Invited talk*

11. Gordon Research Conference: Metals in Biology, Four Points Sheraton / Holiday Inn Express, Ventura, CA, January 22-27, 2017. Title: Understanding How Metal Ions Cooperate to Activate Dinitrogen. *Invited talk*
10. 42nd International Conference on Coordination Chemistry, Brest, France, July 3-8, 2016. Title: N₂ activation by triiron complexes. *Invited talk*
9. Telluride Workshop: Activation of Small Molecules, Telluride, CO, June 21-25, 2016. Title: Reactivity of ligand-encapsulated (multi)metal complexes. *Invited talk*
8. Gordon Research Conference: Metallocofactors, Stonehill College, Easton, MA, June 12-17, 2016. Title: Binding and activation of small molecules by triiron complexes. *Invited talk*
7. Fusion Conference: Small Molecule Activation, Cancún, Mexico, May 20-23, 2016. Title: Synthesis and reactivity of trimetallic complexes. *Invited talk*
6. "Metal-Oxygen Oxidants in Synthesis & Biology: Beyond Metal-Oxo Species" Symposium, ACS National Meeting, San Diego, CA. March 15-16, 2016. Title: Dioxygen activation by a tricopper-dinitrogen complex. *Invited talk*
5. "The Inorganic Chemistry of Neurobiology, Immunology and Bioenergy: New Faces" Symposium, ACS National Meeting, San Francisco, CA. August 11-12, 2014. Title: Small molecule activation by trinuclear cyclophane complexes. *Invited talk*
4. Gordon Research Conference: Inorganic Chemistry, University of New England, Biddeford, ME, June 8-13, 2014. Title: Dinitrogen and trinuclear cyclophane complexes. *Invited talk*
3. Florida Section ACS Annual Meeting and Exposition, Innisbrook, FL, May 8-10, 2014. Title: Modeling metal clusters in enzymes through rational design. *Invited talk*
2. Florida Section ACS Annual Meeting and Exposition, Innisbrook, FL, May 9-11, 2013. Title: Designed control of multimetallic complexes using macrobicyclic ligands. *Invited talk*
1. "Catalysis Science: The Next Generation" Symposium, ACS National Meeting, Dallas, TX March 16-20, 2013. Title: A macrobicyclic approach for harnessing redox cooperativity in multimetallic assemblies. *Invited talk*

Patents

3. Veige, A. S.; Del Castillo, T.; Murray, L. J.; Yang, X.; Powers, A. R. "Method for linking two or more metals for photo and electronic materials" US Patent 8,889,879, issued Nov 18, 2014
2. Murray, L. J.; Guillet, G. L.; Di Francesco, G. N.; Gordon, J. G. "Multimetallic assembly, methods of making multimetallic assembly, methods of oxidizing water, methods of o-atom transfer catalysts, and methods of carbon dioxide reduction" U.S. Patent 9,233,364, issued January 12, 2016
1. Long, J. R. *et al.* "Gas separations with redox-active metal-organic frameworks" Application No. 13/593,914

Grants, contracts, and other external funding

Current:

3. Title: Multimetallic CO₂ reduction and C–C bond formation
Agency: Department of Energy, Basic Energy Sciences, Catalysis Program (DE-SC0022174)
Principal Investigator: Leslie J. Murray
Amount: \$500,000 (09/2021–08/2024)
2. Title: Dimetallic CO Homocoupling and Functionalization
Agency: National Science Foundation, CAS-MNPP Program (CHE-2102098)
Principal Investigator: Leslie J. Murray

Amount: \$475,000 (09/2021–08/2024)

1. Title: Ligand effects on reactivity of hydride-decorated and reduced multi-iron compounds (*active*)
Agency: National Institutes of Health, General Medical Sciences (R01-GM123241)
Principal Investigator: Leslie J. Murray
Amount: \$1,432,022 (04/2017–01/2023)

Completed:

1. Title: Dinitrogen Activation by Designed Trinuclear Clusters
Agency: National Science Foundation (CHE-1464876)
Principal Investigator: Leslie J. Murray
Award: \$390,000
2. Supplemental Award to CHE-1464876 for purchase of a small footprint FTIR
Agency: National Science Foundation (CHE-1650652)
Principal Investigator: Leslie J. Murray
Award: \$24,976
3. Title: Designing Multifunctional Complexes for Chemical Catalysis
Agency: American Chemical Society, Petroleum Research Fund (52704-DN13)
Principal Investigator: Leslie J. Murray
Award: \$100,000
4. Title: Acquisition of an FTIR Spectrometer for Biochemical and Materials Research and Education
Agency: National Science Foundation (CRIF: Departmental Multi-User Instrumentation, CHE-1048604)
Principal Investigator: Daniel R. Talham
Co-PIs: A. Angerhofer, L. McElwee-White, J. C. Nino, A. S. Veige, L. J. Murray, and A. Katrizky
Award: \$219,272

Collaborators (last 48 months)

International:

Vincent Maurel (CEA, Grenoble, France)

Ricardo García-Serres (Université Grenoble Alpes, France)

Jean-Marie Mouesca (Université Grenoble Alpes, France)

Domestic:

Alexander Angerhofer (U of Florida)

Vincent J. Catalano (U of Nevada, Reno)

Samantha MacMillan (Cornell University)

Kyle M. Lancaster (Cornell University)

Jason Shearer (Trinity College, San Antonio)

Students Supervised

Current Graduate Students

<i>Student</i>	<i>Start Date</i>	<i>Dissertation Topic</i>
Subhadeep Bera	8/18	<i>n</i> Fe- <i>m</i> X/ <i>z</i> S cluster chemistry
William Buratto	8/17	FeS cluster reactivity with small molecules
Arijeet Ghude	4/21	Dinitrogen activation by triiron compounds
Titto Sunil John	4/21	Iron cluster reactivity towards CO _x species

Maria Victoria Lorenzo Ocampo	8/18	Bond making/breaking with tri-M complexes
Juan Felipe Torres González	8/17	Iron nitride cluster reactivity

Previous Graduate Students

<i>Student</i>	<i>Degree</i>	<i>Graduation Date</i>	<i>Thesis Title</i>	<i>Current position</i>
Gianna Di Francesco	Ph.D.	8/15	A Series of Tricopper Macrobicyclic Complexes: Reactivity and Tunability via Simple Modifications	Process Engineer, Intel Corporation
David Ermert	Ph.D.	8/16	Inroads Into Biologically Inspired Small Molecule Activation: Synthesis And Reactivity Of Templated Trinuclear Clusters	Scientist III, Entegris Inc.
Ricardo Ferreira	Ph.D.	8/18	Triiron Complexes for the Study of Nitrogen Fixation	Process Engineer, Intel Corporation
Amrita Mullick	Ph.D.	8/15	Application of Metal Organic Frameworks and <i>N</i> -Heterocyclic Carbene Metal Complexes	Harbor Electronics
Yousoon Lee	Ph.D.	8/15	Functional Model Complexes for Iron-Molybdenum Cofactor: Reduction of N ₂ and CO ₂ and Synthesis of Iron-Sulfur Clusters	Product Manager, ACME Bioscience
Devender Singh	Ph.D.	5/22	Synthesis of Diiron Clusters Decorated by Hydride, Sulfide, and Carbonyl Bridges: Their Application in Small Molecule Activation	Process Engineer, Intel Corporation
Vibhuti Chandhok	M.S.	8/19	Chalcogen Bridged Tricopper Cyclophanates for Carbon Dioxide Fixation and Utilization	-
Jeong Ah Lee	M.S.	5/15	Synthesis and Characterization of Tri-Cobalt(II) and -Iron (II) Complexes and Their Potential Application For N ₂ Activation	-
Alyssa Mitchell	M.S.	5/16	Probing the Copper-Chalcogen Interactions of Multimetallic Clusters	Analytical Specialist, Gopher Resources

Current Undergraduate Students

<i>Student</i>	<i>Start Date</i>	<i>Major & Expected Graduation</i>	<i>Mentor</i>
Taylor Stephens	02/22	B.S. Chemistry & Mathematics	J. Torres González
Ian Walsh	01/22	B.S. Chemical Engineering	W. Buratto

Previous Undergraduate Students

<i>Student</i>	<i>Tenure</i>	<i>Degree</i>	<i>Current Position</i>
Collin Oi	09/20-08/22	B.S. Chemistry (Honors)	Graduate Student, UW-Madison
Alexander Dawson	02/21-01/22	B.S. Comp. Sci. & Chem.	-

Mary Eaton	12/15-6/21	B.S. Biochemistry, 2021	Graduate student, Cornell University
Kevin Anderton	01/12-05/16	B.S. Chemistry, 2016	Graduate student, Harvard University
Amberle Pritchard	11/14-12/15	B.S. Chemistry, 2016	-
Jesse Gordon	01/12-05/15	B.S. Chemistry, 2015	Postdoctoral Researcher, Harvard University
Natalie Gaughan	01/12-05/13	B.S. Chemistry, 2015	-
Forrest Sloane	01/11-05/14	B.S. Chem. Eng., 2014	Systems Engineer, Albermarle Corporation
Jonathan Samuelson	11/10-05/12	B.S. Chemistry, 2012	B.S. Chemical Engineering student, USF

Previous Visiting Students

<i>Student</i>	<i>Tenure</i>	<i>Description</i>	<i>Current Position</i>
Louis Mazaud	04-08/15	M.S. student Université Pierre et Marie Curie	Graduate student, Chemistry, École Polytechnique
Robin Brahmi	01-06/15	M.S. student Université de Strasbourg	Master Green Cap Program, INP-ENSIACET, Toulouse
Aleth Gaillard	04-08/12	Magistère student, École Normale Supérieure de Cachan	Graduate student w/ Alex Shalek, Chemistry, Massachusetts Institute of Technology

Current Postdoctoral Associates

<i>Researcher</i>	<i>Start Date</i>	<i>Ph.D. Advisor</i>	<i>Research Project</i>
Brad Musselman	08/22	Nicolai Lehnert (U Michigan)	CO ₂ reduction

Previous Postdoctoral Associates

<i>Researcher</i>	<i>Tenure</i>	<i>Current Position</i>
Brian Cook	9/16-11/18	Process Engineer, Intel Corporation
Gianna Di Francesco	9/15-02/16	Process Engineer, Intel Corporation
Peng-Chen Duan	08/18-10/20	Henan University
Gary Guillet	11/10-06/13	Associate Professor, Georgia Southern University (2013)
Dae Ho Hong	8/17-10/19	Research Scientist, LG Corporation
Brian Knight	04/16-06/18	Postdoctoral Researcher, Smith Group, FSU

Undergraduate Students Awards and Recognition

Kevin Anderton

Barry Goldwater Scholarship Program 2015, Honorable Mention

UC Berkeley Amgen Scholars Program, 2015

University of Florida University Scholars Program, 2015

Jesse Gordon

University of Florida University Scholars Program, 2014

NSF iREU Program in France, 2014

Forrest Sloane

UF College of Engineering, Undergraduate Honors Thesis, Summa cum Laude, 2014

University of Florida University Scholars Program, 2013

University of Florida University Scholars Program, 2012

Jonathan Samuelson

University of Florida University Scholars Program, 2011

UF Student Committees (Not as Chair)

<i>Degree</i>	<i>Current</i>	<i>Previous</i>	<i>Total</i>
Ph.D.	37	24	61
M.S.	0	3	3

Courses Taught

<i>Course No.</i>	<i>Course Title</i>	<i>UG/G</i>
CHM 2046	General Chemistry II	UG
CHM 3610	Inorganic Chemistry	UG
CHM 3610L	Inorganic Chemistry Laboratory	UG
CHM 6620	Advanced Inorganic Chemistry	G
CHM 6621	Inorganic Reactions and Mechanisms	G
CHM 6690	Inorganic Chemistry Seminar	G

Service to Profession

Reviewer: Scholarly Journals

Angewandte Chemie, Australian Journal of Chemistry, Catalysis Science & Technology, Chemical Communications, Chemical Reviews, Chemical Society Reviews, Chemical Science, Chemistry – An Asian Journal, Chemistry - A European Journal, Comprehensive Coordination Chemistry, Coordination Chemistry Reviews, Dalton Transactions, European Journal of Inorganic Chemistry, Inorganic Chemistry, Inorganica Chimica Acta, Journal of the American Chemical Society, Journal of Cluster Science, Organometallics, Polyhedron, Proceedings of the National Academy of Sciences (USA), Supramolecular Chemistry, The Chemical Record

Reviewer: Grant Proposals

Natural Sciences and Engineering Research Council (Canada)

National Science Foundation (USA)

American Chemical Society – Petroleum Research Fund (USA)

Department of Energy, Office of Science, Basic Energy Sciences, Catalysis (USA)

Reviewer: Fellowship Applications

Department of Energy, Office of Science, Graduate Fellowship Program

Governance:

Florida Section of the American Chemical Society: Immediate Past-Chair (2014), Chair (2013), Chair-Elect (2012), Chair-Elect Designate (2011), Councilor (2017-present)

University and Departmental Governance and Service

University and College:

Senator, University Faculty Senate, 2019-2022

Faculty Mentor, University Scholars Program, 2011-2015

Faculty Mentor, University Minority Mentor Program, 2013

Member, College of Liberal Arts & Sciences Faculty Council, 2011-2013

Departmental:

Member, Undergraduate Curriculum & Lab Committee, 2012-present

Member, Graduate Standards Committee, 2012-present

Member, Organizing Committee, Chem-a-thon Event, 2012-present

Faculty Outreach Advisor, Undergraduate Chemistry Club, 2011-present

Member, Spectroscopy Services Committee, 2010-present

Member, Graduate Selections & Recruiting Committee, 2010-2015

Memberships:

Center for Catalysis, University of Florida, 2010-present

Florida Center for Heterocyclic Compounds, University of Florida, 2017-present

American Chemical Society, 2007-present

Society for Biological Inorganic Chemistry, 2010-2012