

Joshua D. Lawrence

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EDUCATION AND RESEARCH EXPERIENCE

Yale University, New Haven, CT

Postdoctoral Associate,

(2/03 – 7/03)

NIH Postdoctoral Fellow,

(8/03 – present)

Research: Organometallic chemistry – Catalytic transformations of alkyl C-H bonds. The scope of the alkane borylation reaction pioneered by the John F. Hartwig group was explored. Ethers, fluoroalkanes, trialkyl amines, and protected ketones were selectively functionalized at methyl positions by a diboron reagent using $\text{Cp}^*\text{Rh}(\eta^4\text{-C}_6\text{Me}_6)$ as catalyst. Multiple borylation events were observed if the substrate contained more than one methyl group. New catalysts based on Cp^*Ru were explored, and a potential intermediate in Ru-catalyzed borylation of alkanes and arenes was isolated and characterized by x-ray crystallography. Catalytic transformation of unactivated arene C-H bonds to trifluoromethyl and pentafluorophenyl groups with Ru catalysts was also significantly advanced.

Research Advisor: John F. Hartwig

University of Illinois at Urbana-Champaign (UIUC), Urbana, IL

(8/98 – 12/02)

Research: Bioinorganic chemistry – Modeling Fe-only Hydrogenase enzymes. Hydrogenase enzymes catalyze the most fundamental chemical reaction: $2\text{H}^+ + 2\text{e}^- \leftrightarrow \text{H}_2$. The foci of this project were (1) the synthesis and study of organometallic model complexes containing the proposed azadithiolate ligand, (2) the electrochemical production of H_2 from H^+ and e^- using dinuclear iron(I)-carbonyl-thiolate compounds, and (3) the synthesis of dinuclear iron(II)-thiolate compounds containing key structural features not realized in previous models.

Ph.D. Thesis title: “Structural and functional models of the iron-only hydrogenase enzymes”

Research Advisor: Thomas B. Rauchfuss

Rhodes College, Memphis, TN

(8/94 – 5/98)

B.S.-ACS in Chemistry

Research: Coordination chemistry – Variation among substituted-pyridine complexes of bis(phenanthroline)Cu(II) were investigated using spectroscopic and crystallographic techniques. Honors Thesis Title: “Synthesis, characterization, and x-ray crystallography of bis(phenanthroline) substituted-pyridine copper (II) complexes”

Research Advisor: David Y. Jeter

TEACHING EXPERIENCE

Assistant Professor of Chemistry, Centenary College of Louisiana

(Fall 2005 - Spring 2007)

Taught General Chemistry I, General Chemistry Laboratory I, General Chemistry II, General Chemistry Laboratory II, Analytical Chemistry, Analytical Chemistry Laboratory, and Instrumental Analysis (team-taught, ~1/6 of 6 credit lecture and lab course). Will teach General Chemistry I, General Chemistry II, Advanced Synthesis, Analytical Chemistry, Analytical Chemistry Laboratory, and Advanced Inorganic Chemistry in the upcoming academic year.

Joshua D. Lawrence

TEACHING EXPERIENCE (cont.)

Mentor to undergraduate research students, (Spring 2001- Summer 2004, intermittent)

Yale: Designed projects for, planned experiments for, and directly supervised two undergraduate students in the laboratory of Prof. John F. Hartwig, one of whom worked in the Science, Technology, and Research Scholars (STARS) Program. *UIUC*: Worked closely with an undergraduate student in the laboratory of Prof. Thomas B. Rauchfuss.

Teaching Assistantships, UIUC (Fall 1998 - Spring 2002, intermittent)

Adv. Inorganic Chemistry Laboratory Teaching Assistant: Set up a synthetic inorganic laboratory, planned and monitored synthetic inorganic experiments conducted by sophomore, junior, and senior chemistry majors, helped design individual projects, graded lab reports. *General Chemistry Teaching Assistant*: Designed and presented short lectures, led classroom discussions, met individually with students, wrote and graded quizzes. *Organic Chemistry Teaching Assistant for web-based course*: Directed online discussions, lead small group discussions, wrote and graded exams.

AWARDS/FELLOWSHIPS/GRANTS

Centenary College of Louisiana, Shreveport, LA

Cottrell College Science Award, Research Corporation (\$40,171) (5/06-5/08)

Mattie Allen Broyles Inaugural Year Research Chair (\$3,000) (5/05-5/06)

Yale University, New Haven, CT

NIH Kirschstein-NRSA Individual Fellowship (total award, \$39,700/year) (8/03-7/05)

University of Illinois at Urbana-Champaign, Urbana, IL

T. S. Piper Award for Graduate Research in Inorganic Chemistry (Spring 2002)

Departmental Fellowships (\$2500/year) (Fall 1998-Spring 2002)

Excellent Teacher's Assistant Rating (Spring Semester 2001)

PROFESSIONAL ORGANIZATIONS

American Chemical Society (1998-present)

Council on Undergraduate Research (2004-present)

CITATIONS

The papers listed below have been cited in over 60 separate publications *not* originating from UIUC or Yale. In addition, the work has been discussed, but not explicitly referenced, in:

“Water Splitting Goes Au Naturel,” Joe Alper, *Science* **2003**, 299, 1686-1687.

“Can We Exploit Hydrogenases?” *Chem. Eng. News* **2002**, 80, 35-39.

“Bugs Offer Power Tips,” Phillip Ball, *Nature Science Update*, **September 23, 2001**.

“C-H-Aktivierung immer effektiver (C-H Activation becomes more effective),” Ullrich Jahn *Nachrichten aus der Chemie*, 53, **March 2005**.

Joshua D. Lawrence

PUBLICATIONS AND PRESENTATIONS

“Photochemical and Thermal Borylation of Alkanes,” Hartwig, J. F.; Lawrence, J. D. In *Handbook of C-H Transformations*; Dyker, G., Ed.; Wiley-VCH: Weinheim, **2005**, pp 605.

“Regiospecific Functionalization of Methyl C-H Bonds of Alkyl Groups in Reagents with Heteroatom Functionality,” Lawrence, J. D.; Takahashi, M.; Kawamura, K.; Bae, C.; Hartwig, J. F. *J. Am. Chem. Soc.* **2004**, *126*, 15334 - 15335.

"New Class of Diiron Dithiolates Related to the Fe-Only Hydrogenase Active Site: Synthesis and Characterization of $[\text{Fe}_2(\text{SR})_2(\text{CNMe})_7]^{2+}$," Lawrence, J. D.; Rauchfuss, T. B.; Wilson, S. R. *Inorg. Chem.* **2002**, *41*, 6193-6195.

“Bimetallic Carbonyl Thiolates as Functional Models for Fe-only Hydrogenases,” Gloaguen, F.; Lawrence, J. D.; Rauchfuss, T. B. *Inorg. Chem.* **2002**, *41*, 6573-6582.

“Synthetic and Structural Studies on $[\text{Fe}_2(\text{SR})_2(\text{CN})_x(\text{CO})_{6-x}]^{x-}$ as Active Site Models for Fe-Only Hydrogenases,” Gloaguen, F.; Lawrence, J. D.; Schmidt, M.; Wilson, S. R.; Rauchfuss, T. B. *J. Am. Chem. Soc.* **2001**, *123*, 12518-12527.

“Biomimetic Hydrogen Evolution Catalyzed by an Iron Carbonyl Thiolate,” Gloaguen, F.; Lawrence, J. D.; Rauchfuss, T. B. *J. Am. Chem. Soc.* **2001**, *123*, 9476-9477.

“Beyond Fe-only Hydrogenases: N-Functionalized 2-Aza-1,3-dithiolates $\text{Fe}_2[(\text{SCH}_2)_2\text{NR}](\text{CO})_x$ ($x = 5, 6$),” Lawrence, J. D.; Li, H.; Rauchfuss, T. B. *Chem. Commun.* **2001**, 1482-1483.

“Diiron Azadithiolates as Models for the Iron-Only Hydrogenase Active Site: Synthesis, Structure, and Stereoelectronics,” Lawrence, J. D.; Li, H.; Rauchfuss, T. B.; Bénard, M.; Rohmer, M.-M. *Angew. Chem. Int. Ed. Engl.* **2001**, *40*, 1768-1771.

“Selective functionalization of primary alkane C-H bonds in the presence of remote functional groups,” Lawrence, J.D.; Takahashi, M.; Bae, C.; Hartwig, J. F. 228th ACS National Meeting, Philadelphia, PA, August 22-26, 2004. (oral)

"Models of the Oxidized Active States of the Fe-only Hydrogenase Enzymes," Lawrence, J. D.; Linck, R. C.; Reynolds, M. A.; Rauchfuss, T. B. 224th ACS National Meeting, Boston, MA, August 18-22, 2002. (poster)

“Chelating Azadithiolate Ligands Inspired by Fe-only Hydrogenases,” Lawrence, J. D.; Li, H.; Rauchfuss, T. B. 222nd ACS National Meeting, Chicago, IL, August 26-30, 2001. (poster)

“Mechanistic and Electrochemical Investigation of Fe-only Hydrogenase Models: Why does Nature Choose Two Cyanides?” Lawrence, J. D.; Gloaguen, F.; Rauchfuss, T. B. 222nd ACS National Meeting, Chicago, IL, August 26-30, 2001. (poster)

“Structural Models of the Binuclear Site in the Fe-only Hydrogenases,” Lawrence, J. D.; Schmidt, M.; Rauchfuss, T. B. 6th International Conference on the Molecular Biology of Hydrogenases, Potsdam, Germany, August 5-10, 2000. (poster)