# Kara L. Bren

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## EDUCATION:

**Carleton College**, Northfield, Minnesota (1987 – 1991) B.A., Chemistry (1991)
Research: NMR investigation of dynamics of carbohydrates
Research Advisor: Prof. Lynn Buffington

**California Institute of Technology**, Pasadena, California (1991 – 1995) Ph.D., Chemistry (1996)
Thesis: Structurally Engineered Cytochromes *c* with Novel Ligand-Binding Properties
Research Advisor: Harry B. Gray

**University of Florence**, Florence, Italy (4/94 – 8/94; 4/95 – 5/95), visiting student
Research: NMR solution structures of paramagnetic heme proteins
Research Advisor: Ivano Bertini

## PROFESSIONAL EXPERIENCE:

**Professor of Chemistry**, University of Rochester, 2008 – 2018

**Associate Professor of Chemistry**, University of Rochester, 2003 – 2008

**Assistant Professor of Chemistry**, University of Rochester, 1997 – 2003

**Member of Biophysics, Structural and Computational Biology Cluster**, University of Rochester, 1998 – present

**NIH Postdoctoral Fellow**, University of California at Davis, 1996 – 1997

## AWARDS AND HONORS:

| | |
|---|---|
| Distinguished Lecturer, City University of Hong Kong | 2019 |
| KAIST Chemistry Distinguished Lectureship Award | 2018 |
| Humphrey Lecturer, University of Vermont | 2017 |
| Kavli Fellow, National Academy of Sciences | 2017 |
| Edward Peck Curtis Award for Excellence in Undergraduate Teaching | 2017 |
| Visiting Lecturer, Chemistry Promotion Center, Taiwan | 2016 |
| Visiting Scholar, Kaohsiung Medical University, Taiwan | 2016 |
| Salzberg Lecturer, City College of New York | 2014 |
| Guest Professor of Biochemistry, Lund University, Sweden | 2014 |
| American Chemical Society PROGRESS/Dreyfus Lectureship Award | 2006 |
| Alfred P. Sloan Research Fellow | 2003 – 2005 |
| Paul Saltman Memorial Lecturer | 2004 |
| National Research Service Award (NIH Post-doctoral Fellow) | 1996 – 1997 |
| Eastman/Kodak Graduate Fellow | 1992 – 1995 |
| Special Institute Fellow, Caltech | 1991 – 1992 |
| Nominated to Phi Beta Kappa | 1991 |
| Nominated to Sigma Xi | 1991 |
| Franz Exner Award for Excellence in Chemistry | 1991 |
| Technology Policy Studies Fellow (Carleton College; sponsored by Sloan Foundation) | 1990 |

## LEADERSHIP IN SCIENTIFIC FIELD:

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|---|---|
| Program Director, UR Chemistry-Biology Interface Training Program (NIH T32) | 2017 – present |
| Associate Editor, *Journal of the American Chemical Society* | 2014 – present |
| Member, Editorial Advisory Board, *Comments on Inorganic Chemistry* | 2014 – present |
| Member, Editorial Advisory Board, *Accounts of Chemical Research* | 2012 – present |
| Guest Editor, *Proceedings of the National Academy of Sciences* | 2016, 2017 |
| Member, DOE Panel on Nitrogen Activation | 2016 |
| Council Member, Society for Biological Inorganic Chemistry | 2014 – 2018 |
| ACS National Award Selection Committee | 2012 – 2015 |
| Guest Professor of Biochemistry, Lund University, Sweden | 2014 |
| Alternate Councilor, Division of Inorganic Chemistry, American Chemical Society | 2013 – 2015 |
| Member, Editorial Advisory Board, *Journal of Inorganic Biochemistry* | 2012 – 2016 |
| Chair, ACS Division of Inorganic Chemistry, Bioinorganic Subdivision | 2010 |
| Director, University of Rochester Biological Chemistry Cluster | 2010 – |
| Chair-elect, ACS Division of Inorganic Chemistry, Bioinorganic Subdivision | 2009 |
| Member, Editorial Advisory Board, *Inorganic Chemistry* | 2009 – 2012 |
| Thesis Opponent, University of Bergen, Norway | 2008 |
| Member, Editorial Advisory Board, *Journal of Biological Inorganic Chemistry* | 2007 – 2011 |
| Guest Editor, *Inorganic Chemistry* Forum on Metalloprotein Folding | 2004 |
| Invited Expert Analyst, *ChemTracts Inorganic Chemistry* | 2000 – 2009 |

## REVIEWING AND ADVISORY ACTIVITIES (SELECTED):

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|---|---|
| Member, Advisory Board, Merck KGaA | 2017 |
| Examination Board, PhD Thesis, University of Naples (Italy) | 2017 |
| Reviewer, DOE EFRC Programs | 2016, 2018 |
| Panel Reviewer, NSF-CHE (multiple times) | 2008 – 2018 |
| Member, NIH Fellowship Panel | 2015 |
| Member, External Committee, Johns Hopkins Chemistry Department Evaluation | 2015 |
| Member, NSF CAREER Panel, NSF-CHE | 2015 |
| Member, NIH Macromolecular Structure and Function A Study Section (MSFA) | 2005 – 2008 |
| Member, DOE Review Panel on Basic Research for Hydrogen Fuel Initiative | 2005 |
| Ad hoc Member, NIH Physical Biochemistry Special Emphasis Panel | 2004 |
| Ad hoc Member, NIH Metallobiochemistry Study Section (twice) | 2003 |
| Ad hoc Member, NIH Biochemistry Study Section | 2003 |
| Ad hoc Member, NIH Biochemistry Special Emphasis Panel | 2003 |

## LEADERSHIP ACTIVITIES IN SCIENTIFIC MEETINGS (SELECTED):

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|---|---|
| Chair-Elect, Chair; Metals in Biology Gordon Research Conference | 2020, 2021 |
| Organizer, Symposium on Solar Fuels, ACS National Meeting, Boston | 2018 |
| Discussion Leader, Bioinorganic Chemistry Graduate Research Seminar | 2018 |
| Organizer, Power Hour on Women in Science, Metals in Biology Gordon Conference | 2018 |
| Session Chair, Metals in Biology Gordon Research Conference | 2015, 2017 |
| Session Organizer and Chair, Tetrapyrroles Gordon Research Conference | 2016 |
| Member, International Organizing Committee, The Girona Seminar | 2016 – 2018 |
| Organizer, Symposium on Heme Modification, Uptake and Transport, ACS National Meeting, Anaheim, CA | 2011 |
| Co-organizer, Tenth Annual Upstate New York NMR Symposium, Rochester, NY | 2008 |
| Session Moderator, Protein Structure and Folding, Graduate Research Seminar on Bioinorganic Chemistry, Ventura, CA | 2006 |
| Moderator, Bioinorganic Oral Session, National Meeting of the ACS, Anaheim, CA | 2004 |
| Session Organizer and Moderator, Bioinorganic Chemistry Oral Session, Northeast Regional Meeting of the ACS, Rochester, NY | 2004 |
| Session Moderator, Residual Structures in Unfolded Proteins, Gordon Research Conference on Protein Folding Dynamics, Ventura, CA | 2002 |
| Co-organizer, Third Annual Upstate New York NMR Symposium, Rochester, NY | 2001 |

**PROFESSIONAL AFFILIATIONS:**

American Association for the Advancement of Science
American Chemical Society (Inorganic, Biological, and Physical subdivisions)
National Academy of Sciences Kavli Fellow
New York Academy of Science
Phi Beta Kappa
Sigma Xi
Iota Sigma Pi
Society for Biological Inorganic Chemistry

**CURRENT FUNDING:**

"Training Grant in the Chemistry-Biology Interface," National Institutes of Health, T32-GM118283, Role: PI/PD

"SusChEM: Artificial Hydrogenases," NSF CHE-1708256, Role: PI

"Biocatalysts for $NO_x$ Reduction," Pump Primer II, University of Rochester, Role: PI

“SISGR: Modular Nanoscale and Biomimetic Assemblies for Photocatalytic Hydrogen Generation,” Department of Energy, DE-FG02-09ER16121, Role: PI.

**PUBLICATIONS:**

Complete List: https://scholar.google.com/citations?user=eqCI1VQAAAAJ&hl=en

2015 and later:

1. Methionine Ligand Lability of Homologous Monoheme Cytochromes *c*, Benjamin D. Levin, Kelly A. Walsh, Kristal K. Sullivan, Kara L. Bren, and Sean J. Elliott, *Inorg. Chem.* **2015**, *54*, 38-46. DOI: 10.1021/ic501186h
2. Effects of Protein Structure on Iron-Polypeptide Vibrational Dynamic Coupling in Cytochrome *c*, Mary Grace I. Galinato, Sarah E. J. Bowman, Jesse G. Kleingardner, Sherri Martin, Jiyong Zhao, Wolfgang Sturhahn, E. Ercan Alp, Kara L. Bren, and Nicolai Lehnert, *Biochemistry* **2015**, *64*, 1064-1076. DOI: 10.1021/bi501430z
3. Multidisciplinary Approaches to Solar Hydrogen, Kara L. Bren, *J. Royal Soc. Interface* **2015**, *5*, 1-12. ID: 20140091. DOI: 10.1098/rsfs.2014.0091
4. Biological Significance and Applications of Heme *c* Proteins and Peptides, Jesse G. Kleingardner and Kara L. Bren, *Acc. Chem. Res.* **2015**, *48*, 1845-1852. DOI: 10.1021/acs.accounts.5b00106
5. Discovery of the Magnetic Behavior of Hemoglobin: A Beginning of Bioinorganic Chemistry, Kara L. Bren, Richard Eisenberg and Harry B. Gray, *Proc. Natl. Acad. Sci. U.S.A.* **2015**, *112*, 13123-13127. DOI: 10.1073/pnas.1515704112
6. NMR Analysis of Spin States and Spin Densities, in *Spin States in Biochemistry and Inorganic Chemistry: Influence on Structure and Reactivity.* Kara L. Bren, Edited by M. Swart and M. Costas, John Wiley & Sons, Ltd, Chichester, United Kingdom (2016). DOI: 10.1002/9781118898277.ch16
7. Semisynthetic and Biomolecular Hydrogen Evolution Catalysts. Banu Kandemir, Saikat Chakraborty, Yixing Guo, and Kara L. Bren, *Inorg. Chem.* **2016**, *55,* 467-477. DOI: 10.1021/acs.inorgchem.5b02054 *Research Article in Forum on Small Molecule Activation: From Biological Principles to Energy Applications.*
8. Hydrogen Evolution from Water under Aerobic Conditions Catalyzed by a Cobalt-ATCUN Metallopeptide. Banu Kandemir, Lenore Kubie, Yixing Guo, Brian Sheldon, and Kara L. Bren, *Inorg. Chem.* **2016**, *55*, 1355-1357. DOI: 10.1021/acs.inorgchem.5b02157. Featured on journal cover and selected as ACS Editors' Choice.

9. Going with the Electron Flow: Effects of Heme Electronic Structure on Electron Transfer, Kara L. Bren, *Isr. J. Chem.* **2016,** *56*, 693-704. DOI: 10.1002/ijch.201600021. Special Issue in Celebration of Harry Gray's 80th Birthday.
10. Extracellular Electron Transfer on Sticky Paper Electrodes: Carbon Paste Paper Anode for Microbial Fuel Cells, Peter Lamberg and Kara L. Bren, *ACS Energy Lett.* **2016**, *1*, 895-898. DOI: 10.1021/acsenergylett.6b00435
11. Efficient and Flexible Preparation of Biosynthetic Microperoxidases, Erin C. Kleingardner, Wesley B. Asher, and Kara L. Bren, *Biochemistry* **2017**, *56*, 143-148. DOI: 10.1021/acs.biochem.6b00915
12. Photoinduced Charge Separation in Single-Walled Carbon Nanotube/Protein Integrated Systems, Lenore Kubie, Amanda R. Amori, Saikat Chakraborty, Kara L. Bren, and Todd D. Krauss, *Nanoscale Horiz.*, **2017**, *2*, 163-166. DOI: 10.1039/C6NH00172F. *Featured in Royal Society of Chemistry Collection "Celebrating Excellence in Research: 100 Women of Materials Science."*
13. Locked and Loaded for Apoptosis, Kara L. Bren and Emma L. Raven, *Science* **2017**, *356*, 1236. DOI: 10.1126/science.aan5587
14. Covalent Bonding of Heme to Protein Prevents Heme Capture by Nontypeable *Haemophilus influenzae*, Valerie Sgheiza, Bethany Novick, Sarah Stanton, Jeanetta Pierce, Breanne Kalmeta, Melody Frink, Kyle Grimaldi, Kara L. Bren, and Lea Vacca Michel, *FEBS Open Bio* **2017**, 7, 1778–1783. DOI: 10.1002/2211-5463.12324
15. Engineered Biomolecular Catalysts, Kara L. Bren. *J. Am. Chem. Soc.* **2017**, *139*, 14331–14334. DOI: 10.1021/jacs.7b09896
16. Beyond Fossil Fuel-Driven Nitrogen Transformations, Jinguang G. Chen, Richard M. Crooks, Lance Seefeldt, Kara L. Bren, R. Morris Bullock, Marcetta Y. Darensbourg, Patrick L. Holland, Brian Hoffman, Michael J. Janik, Anne K. Jones, Mercouri Kanatzidis, Paul King, Kyle M. Lancaster, Sergei Lymar, Peter Pfromm, William F. Schneider, Richard R. Schrock, *Science* **2018**, *360*, eaar6611. DOI: 10.1126/science.aar6611
17. Carbene Capture in a Myoglobin Mutant, Emily H. Edwards and Kara L. Bren, *Nat. Catal.*, **2018**, *1*, 565-566. DOI: 10.1038/s41929-018-0129-y
18. Influence of Heme *c* Attachment on Heme Conformation and Potential, Jesse G. Kleingardner, Benjamin D. Levin, Giorgio Zoppellaro, K. Kristoffer Andersson, Sean J. Elliott, and Kara L. Bren, *J. Biol. Inorg. Chem.,* **2018**, in press. DOI: 10.1007/s00775-018-1603-3**.** *Included in the special issue "Alison Butler: Papers in Celebration of her 2018 ACS Alfred Bader Award in Bioorganic or bioinorganic Chemistry."*
19. Hydrogen Evolution from Water Catalyzed by Cobalt-Mimochrome VI*a, a Synthetic Mini-Protein. Vincenzo Firpo‡, Jennifer M. Le‡, Vincenzo Pavone, Angela Lombardi, and Kara L. Bren (‡contributed equally), *Chem. Sci.,* **2018**, in press. DOI: 10.1039/C8SC01948G

**PATENTS:**

1. Method and System for Purifying And Quantitating Proteins Using Heme Fusion Tags, PCT Patent Application No. PCT/US11/22982, United States Patent # 8,815,533, 8 August 2014.
2. Methods for Producing Hydrogen Using Nanoparticle-Catalyst Mixtures, United States Patent #10,047,443, 14 August 2018
3. Integrated Nanotechnological and Biological Systems for Efficient Solar Hydrogen Production, US Provisional Patent Application Number 61/932,430, filed with the U.S. Patent and Trademark Receiving Office on January 28, 2014.

**INVITED LECTURES (since 2015):**

**2015:** Gordon Research Conference, Ventura, CA (session moderator, session introduction)
Texas Woman's University (colloquium)
Massachusetts Institute of Technology/Harvard University Joint Inorganic Seminar
American Chemical Society National Meeting, Denver, Colorado (2 talks)
Canadian Biological Inorganic Chemistry Conference, Parry Sound, Ontario

Northeast Regional Meeting of the American Chemical Society, Ithaca, NY (keynote speaker)
Telluride Science Research Center Meeting on Hydrogenase Mimics, Telluride, CO
International Conference on Biological Inorganic Chemistry, Beijing, China
IUPAC Congress, Busan, Korea (keynote speaker)
ChemComm Symposium, UNIST, Ulsan, Korea
ChemComm Symposium, Seoul, Korea
Texas Woman's University (Distinguished Lecturer)
Millersville University
Pacifichem

**2016:** Sustainability Seminar Series, University of Rochester
COST Action Meeting on Spin States in Inorganic Chemistry, Prague, Czech Republic
The Girona Seminar on Transition Metal Reactivity by Design, Girona, Spain (plenary lecturer)
Penn State Bioinorganic Workshop
DOE Solar Photochemistry Meeting, Gathersburg, MD
Chemistry and Biology of Tetrapyrroles Gordon Research Conference
EUROBIC, Budapest, Hungary
Metals in Biochemistry Symposium, NERM, Binghamton University
University of Arizona
Biocatalysis Symposium, SERMACS, Columbia, SC
International Symposium on Catalysis and Fine Chemicals (C&FC 2016), Taipei, Taiwan, 10-14 November 2016 (Keynote lecturer)
Taiwan Biological Inorganic Chemistry Symposium 2016 (TBICS 2016), Kaohsiung, Taiwan, 15 November 2016
National Tsing Hua University, Hsinchu City, Taiwan, 16 November 2016.
University of Illinois, Urbana-Champaign

**2017:** SABIC, Kolkata, India (Keynote lecturer)
Metals in Biology Gordon Research Conference (Session Moderator)
Sustainability in Electrocatalytic Fuel and Chemical Production Symposium, American Chemical Society National Meeting, San Francisco, CA
Spectroscopic Elucidation of Metalloenzyme Mechanism, American Chemical Society National Meeting, San Francisco, CA
Division of Inorganic Chemistry Symposium, American Chemical Society National Meeting, San Francisco, CA
Georgian Bay Conference on Bioinorganic Chemistry, Parry Sound, Ontario, Canada
DOE Annual Merit Review Meeting, Washington, DC
Kavli Frontiers of Science Korean-American Symposium, Irvine, CA
Binghamton University, Binghamton, NY
University of Wisconsin, Madison, WI
Humphrey Symposium Speaker, University of Vermont
Merck KGaA, Darmstadt, Germany
Biophysics Retreat, University of Rochester
Barnard College, New York, NY
University of California, Irvine
DGIST Global Innovation Festival (DGIF), Daegu, Korea
DIGST-EWHA Bioinorganic Symposium, Seoul, Korea

**2018:** Emory University
Metals in Biology Gordon Research Conference, Ventura, CA
Gordon Research Seminar on Bioinorganic Chemistry
Symposium on Nitrogen Unfixation, ACS National Meeting, New Orleans, LA
Dalton Meeting, Coventry, UK
Penn State Bioinorganic Workshop
Ewha Woman’s University, Seoul, Korea
Women in Science Symposium, KAIST, Daejeon, Korea
KAIST Lectureship, Daejeon, Korea

The 4th International Inorganic Chemistry Symposium, KAIST, Daejeon, Korea
International Conference on Porphyrins and Phthalocyanines, Munich, Germany
American Chemical Society National Meeting, Boston, MA
Redox Films for Energy Conversion Workshop, Marseille, France
University at Buffalo
Clemson University
University of Texas at San Antonio
Nazareth College, Rochester, NY
Phelps Colloquium, University of Rochester
9th Asian Biological Inorganic Chemistry Conference (AsBIC), Singapore (Keynote)

**2019:** North Carolina State University
Gordon Research Conference on Inorganic Reaction Mechanisms (Discussion leader)
City College of New York Advanced Science Research Center
Texas A&M University
Georgian Bay Conference on Bioinorganic Chemistry, Parry Sound, Ontario, Canada
City University of Hong Kong
Latin American Symposium on Coordination and Organometallic Chemistry, Cartagena, Columbia

## PLENARY, KEYNOTE, AWARD, AND NAMED LECTURES:

**2007:** ACS PROGRESS/Dreyfus Lecture, Department of Chemistry, Purdue University
**2010:** Keynote, American Chemical Society Rochester Section Meeting, Geneva, NY
**2014:** Salzberg Lecture, City College of New York, New York, NY
**2015:** Keynote, Northeast Regional Meeting of the American Chemical Society, Ithaca, NY
Keynote, IUPAC Congress, Busan, Korea
Keynote, Texas Woman's University
**2016:** Plenary, The Girona Seminar on Transition Metal Reactivity by Design, Girona, Spain
Keynote, Catalysis & Fine Chemicals, Taipei, Taiwan
**2017**: Keynote, Symposium for Advanced Biological Inorganic Chemistry, Kolkata, India
Humphrey Lecturer, University of Vermont
Keynote, DGIST Global Innovation Festival, Korea
**2018:** Plenary, Dalton 2018, Coventry, UK
KAIST Lectureship Award, Daejeon, Korea
Keynote, AsBIC, Singapore
**2019:** Distinguished Lecturer, City University of Hong Kong

## COURSES TAUGHT:

Advanced Inorganic Chemistry I (graduate level) (CHM 411)
Advanced Inorganic Chemistry II (graduate level; physical inorganic chemistry) (CHM 412)
Biochemistry (Lecturer on NMR of biomolecules) (IND 408)
Biochemistry (Undergraduate and graduate level) (CHM 250/450)
Bioinorganic Chemistry (graduate level) (CHM 414)
Chemical Concepts, Systems, and Practices II (CHM 132)
Inorganic Chemistry (undergraduate level) (CHM 211)
Principles of Chemistry (lab) (CHM 105L)
Methods in Structural Biology (Lecturer on NMR of proteins) (CHM 402/BPH 411)
Nuclear Magnetic Resonance Spectroscopy (CHM 422)
Physical Methods in Inorganic Chemistry (CHM 424)
Group Theory (CHM 415)