

James E. Penner-Hahn

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Address: Department of Chemistry, University of Michigan, Ann Arbor, MI 48109.
734/764-7324. jeph@umich.edu

Education: B.S. with highest honors in Chemistry, Purdue University, West Lafayette, IN.
Ph.D. in Inorganic Chemistry, Stanford University, Stanford, CA.

Thesis: "X-ray Absorption Studies of Metalloprotein Structure: Cytochrome P-450, Horseradish Peroxidase, Plastocyanin, and Laccase." Advisor, Keith O. Hodgson.

Postdoctoral Research: (Jointly with Professors Keith O. Hodgson and Edward I. Solomon). Research Associate at Stanford Synchrotron Radiation Laboratory, February 1984 - August 1985. Polarization dependent studies of x-ray absorption near edge structure and the relation of this structure to metal-ion electronic structure.

Professional Experience

Assistant Professor, Department of Chemistry, University of Michigan, 1985-1990.

Associate Professor, Department of Chemistry, University of Michigan, 1990-1994.

Visiting Scientist, Chalmers University of Technology, Göteborg, Sweden, 1992.

Associate Faculty Member, Biophysics Research Div., Univ. of Michigan, 1991-2002.

Professor, Department of Chemistry, University of Michigan, 1994-present.

Visiting Scientist, Département de Biologie Cellulaire et Moléculaire, Centre d'Études de Saclay, 1998-1999.

Associate Vice President for Research, 2000-2002

Chair, Biophysics Research Division, 2002-2006

Associate Dean for Natural Sciences, 2006-2009

George A. Lindsay Collegiate Professor of Chemistry and Biophysics, 2009-present

Associate Dean for Budget and Planning, 2009-2017

Director of International Partnerships, College of LSA, 2017-2023

Current Research Interests

Biophysical and Physical Inorganic Chemistry. Spectroscopic investigation of metal site structure in bioinorganic systems with particular emphasis on copper and zinc enzymes. X-ray absorption and x-ray scattering studies of energy storage materials. Development of new techniques within x-ray spectroscopy, such as the use of polarization properties to study the physical basis of x-ray absorption edge structure. *In situ* study of metal speciation in biological tissue and development of methods for characterizing the cellular metallome. Ultrafast x-ray spectroscopic characterization of excited state structure.

Current Teaching Interests

Development of collaborative, inquiry based laboratory courses for introductory chemistry.
Use of networked computers for implementation of discovery based experiments in large courses. Development of teaching material to facilitate incorporation of biological examples in introductory chemistry courses.

Honors and Awards:

Phi Beta Kappa, Purdue University, 1978.
Phi Kappa Phi, Purdue University, 1978
Outstanding Chemistry Senior, Purdue University, 1979.
National Science Foundation pre-doctoral fellowship. 1979-82.
Camille and Henry Dreyfus Foundation Distinguished New Faculty Award Recipient. 1985.
US Young Investigator for the IUPAC assembly, 1988.
Alfred P. Sloan Research Fellow, 1991-1993.
University of Michigan, Faculty Recognition Award, 1994.
Fogarty Senior International Fellowship, 1998-1999.
Akron Section Award (American Chemical Society), 2000.
Farrel Lytle Award, 2003
Elected Fellow of the AAAS, 2005
UROP Outstanding Undergraduate Mentor Award, Spring 2005
Foundation Lecturer, Foundation for Inorganic Chemistry, Sydney University, 2005
Collegiate Professor, LSA, 2009

Organizations and Activities

Member, American Chemical Society. 1976-present.
Member, American Crystallographic Association. 1984-present.
Member, American Physical Society. 1986-present.
Member, Biophysical Society. 1989-present.
Member, Institute for Protein Structure and Design, University of Michigan, Ann Arbor, 1985-1995. Executive Committee, 1988-1989.
Member, Center for Catalysis and Surface Science, University of Michigan, Ann Arbor, 1986-1996.

Departmental Service

Executive committee, Department of Chemistry, University of Michigan, 1992-1995, 1999-2000.
Associate Chair for Undergraduate Affairs, Department of Chemistry, 1995-1998
Search committees in physical chemistry (3 times), inorganic chemistry, and analytical chemistry.
Committee service: Curriculum Committee, Admissions Committee, Graduate Committee, Computer Committee.
Physical Chemistry Cluster coordinator, 1994-1998, 1999-2002
Long-Range Planning Committee, 2005-6
Space Committee, 2005-6

University Service

Rackham Graduate School, Division II Board,, 1992-4, Chair 1994. Executive Board, Rackham Graduate School, University of Michigan, 1997-2000.
Senate Assembly, University of Michigan, 1999-2002.
President's Information Revolution Commission, University of Michigan, 2001-2002.
Chair, Ford Nuclear Reactor Decommissioning Team, 2000-2003
Chair, 4th Wiesner Symposium: "Braving the New World: Benefits and Challenges of the Genomic Revolution", December 7-8, 2001.
LS-CAT Management Board (board overseeing construction and operation of the State of Michigan LS-CAT beam-line at Argonne National Laboratory), 2001-2007.
Dean Search Committee, College of Literature, Science, and the Arts, 2003.
Dean's Advisory Committee on the Life Sciences Initiative, 2002-2003.
Natural Sciences Divisional Evaluation Committee, College of LS&A, 2002-2004.
Dean's Advisory Committee on Gender in the Life Sciences, 2003-2008.
Elected member of Executive Committee, College of Literature, Sciences, and the Arts, 2004-2006.
Director, Molecular Biophysics Training Grant, 2002-2007.
Executive Committee, Chemical Biology Interdepartmental Ph.D. program, 2004-2009.
Executive Committee, Office of International Programs, 2004-2008.
Executive Committee, Michigan Energy Institute, 2007-present.
Executive Committee, Shanghai-Jiaotong Joint Institute, 2007-present.
Advisory Committee, IT Rationalization, 2010-12.
Advisory Committee, Administrative Services Transformation, 2011-2017.
Chair, IT Council, 2012-2017

Other Service

Local organizing committee. Third International Conference on EXAFS. Stanford, July 1984.
Co-editor, "EXAFS and Near-Edge Structure - III", Springer-Verlag Proceedings in Physics, Volume 2 (1984).
Local organizing committee. International Conference on X-ray Instrumentation. Stanford, July, 1985.
Program committee. 5th International Conference on X-ray Absorption Fine Structure. Seattle, August, 1988.
BioSync study group to evaluate Structural Biology and Synchrotron Radiation, 1991.
Executive committee, Stanford Synchrotron Radiation Laboratory Users Organization. 1992-1994.
International XAFS Society, Executive committee, 1992-1994; Associate Chair, 1998-2000; Chair 2000-2002.
Invited U.S. Observer, International Union of Pure and Applied Chemistry, 37th General Assembly, Lisbon, Portugal, August 5-12, 1993.
NSF Instrumentation and Instrument Development Review Panel, 1993-1995.
BioSync study group to evaluate Structural Biology and Synchrotron Radiation, 1997.
Chair, Program Committee, Xth International XAFS Conference, Chicago, August 1998.
BioCAT Advisory Committee, Illinois Institute of Technology, 1995-1998, Chair 1998-2003.

Member, Board of Governors, Consortium for Advanced Radiation Sources, University of Chicago, 1998-2008.
Chair, Commission on XAFS, International Union of Crystallography, 2000-2003.
Scientific Advisory Committee, Alberta Synchrotron Institute, 2001-2004.
U.S. Department of Energy BERAC Subcommittee on Biological Applications of Synchrotron Radiation, 2002.
Hamburg Outstation. External Review Panel, European Molecular Biology Laboratory, review of the EMBL, 2003.
Scientific Advisory Committee, ChemMatCARS synchrotron source, 2004-2008.
Chair, Third Midwest Metals Meeting, Ann Arbor, June 2004.
Organizing Committee, Twelfth International Conference on Biological Inorganic Chemistry, Ann Arbor, July 2005.
Chair, Scientific Advisory Committee, National Synchrotron Light Source, 2004-present.
Executive Committee, 12th International Conference on Biological Inorganic Chemistry, Ann Arbor, MI, July 31-Aug. 5, 2005.
Chair, NSLS Workshop on Chemical and Biological Applications on High-Resolution X-ray Emission Spectroscopy, May 17, 2006.
Scientific Advisory Committee, Canadian Light Source, 2007-present.
Advancing Innovation Task Force, 2006-7.

Editorial Boards Editorial Board, *Inorganic Chemistry*, 1995-7; 2000-2002.
Editorial Board, *J. Inorganic Biochemistry*, 1996-2006
Editorial Board, *J. Biol. Inorg. Chem.*, 1998-2001; 2004-2007
Editorial Board, *Proteins*, 2006-2009
Co-editor, *Journal of Synchrotron Radiation*, 1995-8.

Ph.D. Theses supervised:

Him-Tai Tsang, October, 1990. "X-ray Absorption Spectroscopic Studies of Metalloproteins: Hg-substituted Blue Copper Proteins, the MerR Metalloregulatory Protein, and Phthalate Dioxygenase."
Shengke Wang, February 1991. "Polarized X-ray Absorption Spectroscopic Studies of Iron Porphyrins and Metal Hexamines."
Geoffrey S. Waldo, October 1991. "Spectroscopic and Kinetic Characterization of *Lactobacillus Plantarum* Manganese Catalase"
Patrick G Allen, January, 1993. "New Experimental Methods for Extended X-ray Absorption Fine Structure Spectroscopy."
Kimber Clark, November, 1993. "Structural Characterization of Zinc Sites in Metalloproteins Using X-ray Absorption Spectroscopy."
Pamela J. Riggs-Gelasco, December, 1994. "Structural Characterization of the Manganese Cluster of the Oxygen Evolving Complex of Photosystem II Using X-ray Absorption Spectroscopy"
Timothy L. Stemmler, May 1996. "Kinetic and Spectroscopic Characterization of the Native and Inhibitor Bound Forms of the *Lactobacillus plantarum* Mn Catalase and Related Proteins"
David L. Tierney, September 1996. "XAS Characterization of Bacterial Superoxide Dismutase and NMR Characterization of Substrate Binding in Phthalate Dioxygenase"

Hui Huang, May 1997, "Structural Characterization of Organocopper Reagents"

Kelly A. Daly, May, 1998, "Determination of Electronic Structure and Dynamics for Transition Metal Systems Using X-ray Spectroscopy"

Eileen Yi-Iun Yu, January, 1999, "Structural Characterizations of the Manganese Cluster in the Oxygen Evolving Complex of Photosystem II Using X-Ray Absorption And X-Ray Standing Wave Measurements"

Pamela Sue Demarois, , April, 1999, "Structure and Reactivity of Manganese in Photosystem II"

Katrina Peariso, September, 2000, "Investigation of Zinc in Biological Systems Using X-ray Absorption Spectroscopy. I. EXAFS Characterization of Zinc-Dependent Alkyltransferase Proteins; II. Exploring the Role of Zinc in the Early Development of *Danio Rerio* Embryos Using X-ray Fluorescence Microprobe Imaging and Micro-XANES"

Stephanie Eden Gabelnick, August 2002, "Metalloprotein Investigations Using Capillary Electrophoresis with X-ray Fluorescence Detection"

Derek W. Yoder, October 2002, "Physical Characterization of Manganese Catalase and its Halide-Bound Forms"

Daniel Tobin, September 2003, "XAS Investigation of Zn Metalloproteins and Enzymes"

Tsu-Chien Weng, February 2004, "X-ray absorption spectroscopy studies on redox-active manganese"

Craig P. McClure, May 2004, "X-ray Absorption and X-ray Fluorescence Studies of Metalloproteins"

Rebekah A. Kelly, December 2006, "Structural, Spectroscopic, and Mechanistic Studies of Zinc Alkyl Transfer Enzymes.

Suranjana Haldar, December 2006, Determination of *in vivo* Metal Loading, Distribution, Storage and Environment in Biological Systems: Uses of X-Ray Synchrotron Light Source.

Matthew J Kidd, December 2007, Investigation of biological systems using synchrotron X-ray light sources.

Jesse D. Ward, August 2009, Application of Synchrotron Radiation to the Structure, localization, and Quantitation of Zinc in Biological Systems.

Soojeong Kim, January 2015, Electrochemical and Structural Analysis of Li-ion Battery Materials by *in-situ* X – Ray Absorption Spectroscopy

Andrew Crawford, May 2015, Methodologies in XRF Cytometry

Invited Presentations

"Near-edge and EXAFS Studies of Oriented Single Crystals", SSRL Users Group Meeting, Stanford, CA, October 21-22, 1982.

"Polarized X-ray Absorption Spectroscopy of Oriented Single Crystals", 185th ACS National Meeting, Seattle, WA, March 20-25, 1983.

"Polarization Studies of EXAFS and Edges on Single Crystals", Third International Conference on EXAFS, Stanford, CA, July 16 - Aug. 20, 1984.

"Single Crystal X-ray Absorption Spectroscopy of Plastocyanin", Workshop on New Methods in X-ray Absorption, Scattering, and Diffraction, Bristol, England, Aug. 5-6, 1984.

"X-Ray Absorption Near Edge Structure: A New Tool for Studying Metal-Ion Electronic Structure", University of Michigan (Inorganic Seminar), October 14, 1985.

"X-Ray Absorption Near Edge Structure: A New Tool for Studying Metal-Ion Electronic Structure", Northern Illinois University, March 4, 1986.

"EXAFS and XANES Studies of High-Valent Metal-oxo Porphyrins Relevant to Horseradish Peroxidase", International Conference on Biophysics and Synchrotron Radiation, Frascati, Italy, July 14-16, 1986.

"X-Ray Absorption Near Edge Structure", University of Michigan (Physical Chemistry Seminar), Fall, 1986.

"Proposal for a University of Michigan Beam Line", Annual Users Meeting of the Advanced Photon Source, Argonne, Illinois, November 13-14, 1986.

"Chemical Forms of Sulfur in Heavy Petroleum as Revealed by XANES: Preliminary Results", Chevron Oil Field Research Corporation, La Habra, California, January 23, 1987.

"EXAFS Spectroscopy: Basic Principles and Applications to Inorganic Structure", GMI, Flint, Michigan, May 26, 1987.

"X-ray Absorption Spectroscopic Investigations of the Iron Sites in *P. Cepacia* Phthalate Oxygenase", International Conference on Bioinorganic Chemistry, Noordwijkerhout, The Netherlands, July 6-10, 1987.

"Use of X-ray Absorption Spectroscopy for Characterizing Metal Clusters in Proteins: Possibilities and Limitations", National ACS Meeting, New Orleans, August 30-Sept 4, 1987.

"X-ray Absorption Spectroscopy of Mixed Valence Mn Complexes and the Photosynthetic Oxygen Evolving System", Symposium on Frontiers of Biomedical Science, Philadelphia, April 15, 1988.

"X-ray Absorption Spectroscopy of Phthalate Dioxygenase", Symposium on Synchrotron Radiation in Structural Biology, Brookhaven National Laboratory, May 22-25, 1988.

"X-ray Absorption Spectroscopy of the Mn in the Photosynthetic Oxygen Evolving Complex", Gordon Conference on Physico-Chemical Methods in Photosynthesis, July 4-8, 1988.

"X-ray Absorption Spectroscopy of Mn in Biological Molecules", 5th International Conference of X-ray Absorption Fine Structure, Seattle, August 22-26, 1988.

"Structural Characterization of the Fe sites in Phthalate Dioxygenase", Oregon Graduate Center, Portland, August 29, 1988.

"Use of X-ray Absorption Spectroscopy for Characterizing Metal Clusters in Proteins: Possibilities and Limitations", Biophysics, University of Michigan, September 26, 1988.

"The role of Polarized Measurements in X-ray Absorption Spectroscopy. Elucidation of Near Edge Structure and Applications to Chemical Systems". Workshop on Chemical Applications of Synchrotron Radiation, Argonne National Laboratory, October 3-4, 1988.

"Structural Characterization of the Fe sites in Phthalate Dioxygenase", Purdue University, West Lafayette, November 17, 1988.

"X-ray Absorption Spectroscopy: A New Tool for Elucidation of Metal-Ion Electronic Structure", Franklin & Marshall College, November 18, 1988.

"Potentials and Limitations of X-ray Absorption Spectroscopy", Molecular Biophysics Faculty Seminar, University of Michigan, January 19, 1989.

"Structural Characterization of the Fe sites in Phthalate Dioxygenase", North Carolina State University, Department of Biochemistry, February 9, 1989.

"Experience of an EXAFS User with Array Detectors", Workshop on X-ray Absorption Fine Structure and Array Detectors, Brookhaven National Laboratory, May 17, 1989.

- "Structural Properties of the Mn Site(s) in the Photosynthetic Oxygen Evolving Complex", American Society for Photobiology, Boston, July 3-7, 1989.
- "Structural Characterization of the Mn Sites in the Photosynthetic Oxygen Evolving Complex", Chemistry Division, Argonne National Laboratory, June 27, 1989.
- "Structural Characterization of the Iron Sites in Phthalate Dioxygenase Using X-ray Absorption Spectroscopy", Los Alamos National Laboratory, Los Alamos, New Mexico, October 6, 1989.
- "Sulfur Speciation in Heavy Petroleums Using X-ray Absorption Near Edge Structure", Chevron Oil Field Research Company, La Habra, California, October 13, 1989.
- "Structural Characterization of the Manganese Sites in the Photosynthetic Oxygen Evolving Complex Using X-ray Absorption Spectroscopy", 1989 Conference on the Structure and Function of Photochemical Reaction Centers, University of Chicago, December 3-4, 1989.
- "Structural Characterization of the Manganese Sites in the Photosynthetic Oxygen Evolving Complex Using X-ray Absorption Spectroscopy", Parke-Davis Pharmaceutical Research Division, Ann Arbor, Michigan, December 5, 1989.
- "Structural Characterization of the Fe Sites in *Pseudomonas Cepacia* Phthalate Dioxygenase", International Chemical Congress of Pacific Basin Societies, Honolulu, Hawaii, December 17-22, 1989.
- "Comparison of the Mn Sites in the Photosynthetic Oxygen Evolving Complex and the *L. Plantarum* Mn Catalase", Gordon Research Conference on Metals in Biology, Ventura, California, January 22-26, 1990.
- "Structural Characterization of the Mn Sites in the Photosynthetic Oxygen Evolving Complex", Chalmers Technological University, Göteborg, Sweden, February 4, 1990.
- "Structural Characterization of the Mn Sites in the Photosynthetic Oxygen Evolving Complex", Lund University, Lund, Sweden, February 6, 1990.
- "Applications of X-ray Absorption Spectroscopy to the Characterization of Metalloproteins: Potential and Limitations", Biophysical Society, Baltimore, February 18-22, 1990.
- "X-ray Absorption Spectroscopy of the Mn Sites in the Photosynthetic Oxygen Evolving Complex", Biophysical Society, Baltimore, February 18-22, 1990.
- "Structural Characterization of the Hg Sites in MerR", UCLA Colloquium on The Inorganic Chemistry/Molecular Biology Interface, Taos, NM February 24-March 1, 1990.
- "Characterization of the Mn Sites in Mn Redox Proteins: Recent Studies of the Photosynthetic Oxygen Evolving Complex and the Mn Catalase", Emory University, March 5, 1990.
- "Characterization of the Mn Sites in Mn Redox Proteins: Recent Studies of the Photosynthetic Oxygen Evolving Complex and the Mn Catalase", University of Georgia, March 6, 1990.
- "Characterization of the Mn Sites in Mn Redox Proteins: Recent Studies of the Photosynthetic Oxygen Evolving Complex and the Mn Catalase", University of South Carolina, March 7, 1990.
- "Structural Characterization of the Mn Sites in Mn Redox Enzymes: Studies of the Photosynthetic Oxygen Evolving Complex and Mn Catalase", Third International Conference on Biophysics and Synchrotron Radiation, Stanford, Ca., July 2-6, 1990.
- "Polarized X-ray Absorption Spectroscopy of Biological Molecules", Sixth International Conference on X-ray Absorption Fine Structure, York, UK, August 5-11, 1990.
- Invited Lecturer, workshop of Bioinorganic Chemistry: "Structural Characterization of the Mn Sites in Mn Redox Enzymes", and "X-ray Absorption Spectroscopy in Bioinorganic Chemistry", Indian Institute of Technology, Madras, India, Dec 9-15, 1990.

- "Structural Characterization of the Mn Sites in Mn Redox Enzymes: X-ray Absorption Spectroscopy in Bioinorganic Chemistry", Rochester University, January 8, 1991.
- "Potentials and Limitations of X-ray Absorption Spectroscopy", Symposium on Macromolecular Structure Determination, American Chemical Society Meeting, Atlanta, April 14-20, 1991.
- "Polarized X-ray Absorption Spectroscopy of Biological Molecules", Sixth International Conference on X-ray Absorption Fine Structure, York, UK, August 5-11, 1990.
- "Polarized X-ray Absorption Spectroscopy of Biological Molecules", Symposium on Synchrotron Radiation, American Crystallographic Association, Toledo, July 22-26, 1991.
- "Potential and Limitations of X-ray Absorption Spectroscopy," Catalysis & Surface Science Colloquium, University of Michigan, September 27, 1991.
- "Chemical Applications of Synchrotron Radiation", Seminar Series (3 seminars) in Mexico City, January 10-12, 1992.
- "Structural Characterization of the Fe Sites in Phthalate Dioxygenase", Institut für Physik, Medizinische Universität zu Lübeck, Germany, January 26, 1992.
- "X-ray Absorption Spectroscopy of Cu Proteins", Symposium on Cu Proteins, Chalmers University of Technology, Göteborg, Sweden, June 12, 1992.
- "Chemical Applications of X-ray Absorption Spectroscopy", Institut für Anorganische Chemie der Universität, Frankfurt Am Main, Germany, July 9, 1992.
- "Structural Characterization of Organocuprate Complexes in Solution", Department of Chemistry, Marburg University, Marburg, Germany, July 8, 1992.
- "Applications of Polarized XAFS in Structural Biology", Fourth International Conference of Biophysics and Synchrotron Radiation, Tsukuba, Japan, September 1-5, 1992.
- "Structural Characterization of the Metal Sites in Mn Redox Proteins: Mn catalase and the Oxygen Evolving Complex", The Ohio State University, October 12, 1992.
- "X-Ray Absorption Spectroscopy of the Mn Site in the Photosynthetic Oxygen Evolving Complex: Characterization of Reduced Derivatives", SSRL users organization Annual Meeting, Stanford, California, October 22-23, 1992.
- "Structural Characterization of the Metal Sites in Mn Redox Proteins: Mn catalase and the Oxygen Evolving Complex", University of Michigan, Enzyme Discussion Group, February 3, 1993.
- "Polarized X-ray Absorption Fine Structure", Department of Chemistry, University of Buffalo, March 19, 1993.
- "X-Ray Absorption Fine Structure Spectroscopy of Biological Molecules", ACS National Meeting, Denver, March 28-April 2, 1993.
- "X-Ray Absorption Spectroscopy of the Mn Site in the Oxygen Evolving Complex: Characterization of Reduced Derivatives", ACS National Meeting, Denver, March 28-April 2, 1993.
- "X-Ray Absorption Spectroscopy of the Mn Site in the Photosynthetic Oxygen Evolving Complex: Characterization of Reduced Derivatives", American Society for Photobiology, Chicago, June 26-30, 1993.
- "Polarized XAFS? Why not just use crystallography?" Workshop on Chemical Applications of XAFS, Stanford, California, July 7-8, 1993.
- "XAFS in Chemistry and Biology: Potential and Limitations". Workshop on Chemical Applications of XAFS, Stanford, California, July 7-8, 1993.

"Applications of X-ray Absorption Spectroscopy to Inorganic Chemistry: Potential and Limitations", Debye Institute, Department of Metal-Mediated Organic Synthesis", August 4, 1993.

"Structural Characterization of the Metal Sites in Mn Redox Proteins: Mn catalase and the Oxygen Evolving Complex", North Carolina State University, November 10, 1993.

"X-ray Absorption Spectroscopy of Metalloproteins", Oakland University, December 8, 1993

"Structural Characterization of the Mn sites in the Photosynthetic Oxygen Evolving Complex", Louisiana State University, March 11, 1994

"Graduate School in Chemistry. Why you should go. Why you shouldn't go.", Dow Foundation program for fellowship students, Midland, Michigan, April 7, 1994

"Structural Characterization Of The Mn Ligand Environment In Mn Catalase", American Chemical Society Meeting, Washington, D.C., August 22-28, 1994.

"Characterization of the Mn Sites in Manganese Redox Proteins: Mn Catalase and the Photosynthetic Oxygen Evolving Complex", Eighth International Conference on X-ray Absorption Fine Structure, Berlin, August 27-Sept. 5, 1994

"X-Ray Absorption Spectroscopy of Crystals. Why Not Just Use Crystallography?", Argonne National Laboratory, November 2, 1994

"Overview of X-ray Spectroscopy of Photosystem II", ESF Conference on Oxygen Evolution, Gif sur Yvette, France, November 5-10, 1994.

"Characterization of the Mn Sites in Manganese Redox Proteins: Mn Catalase and the Photosynthetic Oxygen Evolving Complex", University of Western Ontario, London, Canada, November 23, 1994.

"Structural Characterization of the Mn Site in the Photosynthetic Oxygen Evolving Complex", Ohio State University, December 15, 1994.

"Structural Characterization of the Mn Site in the Photosynthetic Oxygen Evolving Complex", Gordon Conference on Metals in Biology, Ventura, California, January 23-27, 1995

"Structural Characterization of the Mn Site in the Photosynthetic Oxygen Evolving Complex", University of Nebraska, January 31, 1995.

"Structural Characterization of the Mn Site in the Photosynthetic Oxygen Evolving Complex", University of Virginia, February 13, 1995.

"Graduate School in Chemistry. Why you should go. Why you shouldn't go.", Dow Foundation program for fellowship students, Midland, Michigan, April 7, 1995

"X-Ray Absorption Spectroscopy of Crystals (Why Not Just Use Crystallography?)", 1995 Kilpatrick Lecture, Illinois Institute of Technology, April 25, 1995.

"Structural Characterization Of The Mn Cluster In PSII Using X-Ray Absorption Spectroscopy", International Congress on Photosynthesis, Montpellier, France, August 20-25, 1995.

"Polarized X-ray Absorption Spectroscopy", Fifth International Conference on Biophysics and Synchrotron Radiation, Grenoble, France, August 21-25, 1995.

"X-Ray Absorption Spectroscopy Of The Mn Site In The Photosynthetic Oxygen Evolving Complex", University of Texas, El Paso, April 26, 1996.

"X-Ray Absorption Spectroscopy Of The Mn Site In The Photosynthetic Oxygen Evolving Complex", University of Houston, April 29, 1996.

"Structural Characterization Of The Mn Cluster In Photosystem II Using X-Ray Absorption Spectroscopy", Great Lakes Regional ACS Meeting, Illinois State University, May 22, 1996.

"Mn-catalase and the OEC in Photosynthesis", Oxygen Intermediates in Non-Heme Metallobiochemistry, Minneapolis, MN, June 23-27, 1996.

"Structural Studies of Mn Enzymes", International Union of Crystallography, Seattle, August 8-17, 1996.

"Oxidation State Of The Mn In The Photosynthetic Oxygen Evolving Complex", ESF Conference on Biophysics of Photosynthesis, Sitges, Spain, October 5-10, 1996.

"X-Ray Absorption Spectroscopy Of Mn Enzymes", ACS National Meeting, San Francisco, April 13-17, 1997.

"Structural Characterization of Organometallic Reagents: The Role of X-ray Absorption in Understanding Organic Reactivity", Workshop on Biological and Chemical Applications of EXAFS Spectroscopy, NSLS, May 21, 1997.

"Metal Containing Enzymes", St. Thomas College, November 20, 1997.

"Characterization of the Mn cluster in the photosynthetic oxygen evolving complex", Departmental Colloquium, University of Cincinnati, April 10, 1998.

"Zn Speciation during zebrafish development", Workshop on Biological and Chemical Applications of Synchrotron Radiation, NSLS, May 17, 1998

"X-Ray Absorption Spectroscopy Of Mn Enzymes", Sixth International Conference on Biophysics and Synchrotron Radiation, Chicago, August 4-8, 1998.

"X-ray Absorption Spectroscopy in the Era of Synchrotron-based crystallography. Is it obsolete?", Sixth International Conference on Biophysics and Synchrotron Radiation, Chicago, August 4-8, 1998.

"X-ray Absorption Spectroscopy in Coordination Chemistry. Application to Mn Enzymes", International Conference on Coordination Chemistry, Florence, August 30-September 4, 1998.

"Structural Characterization of the Mn cluster in Photosynthetic Oxygen Evolution", Centre d'Etude Atomique, Saclay, France, September 21, 1998.

"Structural Characterization of the Mn cluster in Photosynthetic Oxygen Evolution", Institut de Chimie Moleculaire et Organique, Université de Paris, Sud, Orsay, October 7, 1998.

"Spectroscopically Quiet" Metals: Zinc in Biological Systems", Workshop on Biological Applications of X-ray Absorption Spectroscopy, Grenoble, France, February 15-16, 1999.

"Characterization of "Spectroscopically Quiet" Metals: Zinc in Biological Systems", Workshop on XAFS, DESY, Hamburg, Germany, June 16-20, 1999.

"Structural Characterization of the Mn Cluster in the Photosynthetic Oxygen Evolving Complex", Max Planck Institut für Strahlenchemie, Mülheim, Germany, June 30, 1999.

"X-Ray Absorption Spectroscopy of Crystals (Why Not Just Use X-ray Diffraction?)", Institut für Angewandte Physik, Heinrich-Heine-Universität, Düsseldorf, Germany, July 1, 1999.

"Structural Characterization of the Mn Cluster in the Photosynthetic Oxygen Evolving Complex", Lehrstuhl für Biochemie der Pflanzen, Ruhr-Universität, Bochum, Germany, July 2, 1999.

"New Roles for Zinc in Biology: Zinc catalyzed alkyl-transfer chemistry", Centre d'Etude Atomique, Saclay, France, July 12, 1999.

"Polarized X-ray Absorption Fine Structure", Synchrotron Radiation Satellite of the International Union of Crystallography Meeting, Daresbury, England, August 1-4, 1999.

"Structural Characterization of the Mn Cluster in the Photosynthetic Oxygen Evolving Complex", Miami University, September 16, 1999

“The role for x-ray absorption spectroscopy in the era of structural genomics”, NRC Workshop on Biological Applications of Synchrotron Radiation, Saskatoon, October 21-23, 1999.

“Characterization of "Spectroscopically Quiet" Metals: Zinc in Biological Systems”, Clark University, February 21, 2000.

“Characterization of "Spectroscopically Quiet" Metals: Zinc in Biological Systems”, Worcester Polytechnic Institute, February 23, 2000.

“Characterization of "Spectroscopically Quiet" Metals: Zinc in Biological Systems”, University of Massachusetts, February 24, 2000.

"Structural Characterization of the Mn Cluster in the Photosynthetic Oxygen Evolving Complex", Brown University, February 25, 2000.

“Characterization of "Spectroscopically Quiet" Metals: Zinc in Biological Systems”, European Synchrotron Radiation Facility, June 20, 2000.

“Polarized X-Ray Absorption Spectroscopy of Iron Porphyrins”, First International Conference on Porphyrins and Phthalocyanines, Dijon, France, June 25 – 30, 2000.

“Zn catalyzed alkyl-transfer reactions: A new class of biological Zn sites", BioXAS Conference, Orsay, France, July 3-4, 2000.

“XAFS studies of Zn containing alkyl transfer enzymes”, 11th International XAFS Conference, Aki, Japan, July 26-31, 2000.

“Biological Water Oxidation: Characterization of the Mn Cluster in the Photosynthetic Oxygen Evolving Complex”, Kalamazoo College, October 19, 2000.

“Life at the Interface of Biology and Inorganic Chemistry. Frontiers in Bioinorganic Chemistry”, Akron Section Award Address, Nov. 15, 2000.

“Characterization of "Spectroscopically Quiet" Metals: Zinc in Biological Systems”, International Symposium on Advances in Bioinorganic Chemistry, Mumbai, India, November 20-24, 2000.

“Biological Water Oxidation: Characterization of the Mn Cluster in the Photosynthetic Oxygen Evolving Complex”, IIT Bombay, Mumbai, India, Nov. 25, 2000.

“Biological Water Oxidation: Characterization of the Mn Cluster in the Photosynthetic Oxygen Evolving Complex”, IIT Madras, Chennai India, Nov 27, 2000.

“Molecular Oxygen Evolution in Photosynthesis”, University of Hyderabad, Hyderabad, India, Nov. 28, 2000.

“Biological Water Oxidation: Characterization of the Mn Cluster in the Photosynthetic Oxygen Evolving Complex”, IIT Delhi, New Delhi, India, Nov. 30, 2000.

“Non-crystallographic Structure Determination: The Role for XAS in the Era of Structural Genomics”, Workshop on Structural Molecular Biology At SESAME, Nicosia, Cyprus, December 6-7, 2000.

“Spectroscopically Challenged Metal: Characterization of the Role of Zn in Biology” Wayne State University, December 19, 2000.

“Zn catalyzed alkyl-transfer reactions: A new class of biological Zn sites", Boston University, February 12, 2001

“Structural Characterization of the Mn cluster in the Photosynthetic Oxygen Evolving Complex Using X-ray Absorption” Bowling Green State University, February 14, 2001

“Characterization of Spectroscopically Quiet Metals: Zinc in Biological Systems”, NSLS Users Meeting, Upton, NY, May 22, 2001.

- “X-ray Absorption Spectroscopy of Zinc Sites in Proteins. When is a Tetrathiolate not a Tetrathiolate?”, Workshop on Advanced Methods of EXAFS Data Modeling, National Synchrotron Light Source, May 23, 2001.
- “Spectroscopically Challenged Metals: Structural Characterization of Zn sites in Biology”, College of Charleston, October 11, 2001
- “Radiation Damage Of Redox-Sensitive Transition Metal Ions”, Workshop on Radiation Damage in X-ray Crystallography, Argonne National Laboratory, December 1-2, 2001.
- “Spectroscopically Challenged Metals: Structural Characterization of Zn sites in Biology”, Department of Biochemistry, University of Alberta, December 19, 2001.
- “Zn promoted alkyl transfer enzymes”, Metals in Biology Gordon Research Conference, January 20-25, 2002.
- “Characterization of "Spectroscopically Quiet" Metals: Zinc in Biological Systems”, Department of Chemistry, Yale University, February 12, 2002.
- “Structural characterization of Zn sites in non-crystalline proteins. The role of x-ray absorption for studies of spectroscopically challenged metals”, Zinc Signals 2002, April 11-13, 2002 Grand Cayman, BWI
- “Characterization of "Spectroscopically Quiet" Metals: Zinc in Biological Systems”, Department of Chemistry, University of Firenze, Italy, May 6, 2002.
- “Characterization of "Spectroscopically Quiet" Metals: Zinc in Biological Systems”, Midwest Metals Meeting, Chicago, May 10-12, 2002
- “Applications of x-ray absorption spectroscopy to inorganic and bioinorganic chemistry”, ACS National Meeting, Boston, August 18-22, 2002.
- “X-ray Absorption Spectroscopy at a Third Generation Synchrotron: Towards a new paradigm for XAFS”, Workshop on Structural Biology Applications at PETRA III, Hamburg, Germany, September 12-13, 2002.
- “Biological EXAFS at 3rd generation sources: Is brighter better?” Stanford Synchrotron Radiation Laboratory Users Meeting, October 7-8, 2002
- “Characterization of "Spectroscopically Quiet" Metals: Zinc in Biological Systems”, Department of Chemistry, University of New Mexico, January 24, 2003.
- “Characterization of ‘Spectroscopically Quiet’ Metals: Zinc in Biological Systems”, Oakland University, February 12, 2003.
- “Characterization of ‘Spectroscopically Quiet’ Metals: Zinc in Biological Systems”, Beijing Synchrotron Radiation Facility, Chinese Academy of Sciences, Beijing, February 24, 2003.
- “Characterization of ‘Spectroscopically Challenged’ Metals: Zinc in Biological Systems”, Willamette University, Willamette, OR, April 17, 2003.
- “Biological Applications of EXAFS and XANES. Examples from the Zn Enzymes”, Workshop on Biological Applications of Synchrotron Radiation, Baton Rouge, LA, June 2-6, 2003.
- “ ‘Spectroscopically quiet’ metals: Zinc in biological systems”, EMBO Practical Workshop on Biological EXAFS, Hamburg, Germany, June 17-22, 2003
- “XAS at 3rd generation synchrotrons: challenges and limitations” ”, EMBO Practical Workshop on Biological EXAFS, Hamburg, Germany, June 17-22, 2003
- “Characterization of Spectroscopically Silent Metals: The Role of Zn in Biology”, Plenary Talk, Twelfth International Conference on XAFS, Lund, Sweden, June 22-27, 2003.
- “On the prospects for high - throughput XAS studies using third – generation synchrotron sources”, Second BioXAS Study Weekend: Genomics and BioXAS, Orsay, France, June 29-30, 2003.

- “Zinc catalyzed alkyl-transfer enzymes”, Eleventh International Conference on Bioinorganic Chemistry, Cairns, Australia, July 19-23, 2003.
- “Experimental Techniques in x-ray absorption spectroscopy”, Summer Workshop on Structural Molecular Biology, Stanford University, September 15-17, 2003.
- “Applications of synchrotron Radiation to Inorganic Chemistry”, Department of Chemistry, University of Science and Technology, Hefei, China, October 20, 2003.
- “Characterization of Spectroscopically Silent Metals: The Role of Zn in Biology”, National Synchrotron Radiation Laboratory, Hefei, China, October 22, 2003.
- “Characterization of Spectroscopically Silent Metals: The Role of Zn in Biology”, Department of Chemistry, Yonsei University, Seoul Korea, February 27, 2004.
- “Characterization of Spectroscopically Silent Metals: The Role of Zn in Biology”, Department of Chemistry, Notre Dame University, April 15, 2004.
- “Zinc-containing alkyl-transfer enzymes - a new class of biological Zn sites”, 87th Canadian Chemistry Conference, London, Ontario Canada, May 29-June 1, 2004.
- “X-ray Absorption Spectroscopy as a probe of Zn electronic structure”, Symposium on “Bridging Technologies for Structural Biology”, Pacific Northwest National Laboratory. June 14-16, 2004.
- “Zn promoted alkyl transfer enzymes: A New Role for Zn in Biology”, Inorganic Chemistry Gordon Conference, July 18-23, 2004.
- “Non-crystallographic Structure Determination: A Tutorial on the Strengths and Limitations of X-ray Absorption Spectroscopy” Northwestern University, Distinguished Lectures in Inorganic Chemistry, August 4, 2004
- “Zn Promoted Alkyl Transfer Enzymes: A New Role for Zn in Biology” Northwestern University, Distinguished Lectures in Inorganic Chemistry, August 5, 2004
- “Spatially and Temporally Resolved X-ray Absorption Spectroscopy Using Third-generation Synchrotron Sources”, Northwestern University, Distinguished Lectures in Inorganic Chemistry, August 6, 2004.
- “Spectroscopically Challenged Metals: Characterization of Zn Sites in Biology”, Wayne State University, September 9, 2004.
- “Biological X-ray Spectroscopy at a Third Generation Synchrotron Source”, Symposium on Structural Biology at Crossroads: From Biological Molecules to Biological Systems, EMBL, Hamburg, September 15-18, 2004.
- “Characterization of Spectroscopically Quiet Sites: Zinc in Bioinorganic Chemistry”, University of North Texas, Nov. 12, 2004.
- “Characterization of Spectroscopically Quiet Sites: Zinc in Bioinorganic Chemistry”, Pune University, Pune, India, Nov. 26, 2004.
- “Characterization of Spectroscopically Quiet Sites: Zinc in Bioinorganic Chemistry”, IIT Delhi, Delhi, India, Nov. 30, 2005.
- “Characterization of ‘Spectroscopically Challenged’ Metals: Zinc in Biological Systems”, Second Asian Biological Inorganic Chemistry Conference, December 5-10, 2004, Goa, India.
- “Characterization of ‘Spectroscopically Challenged’ Metals: Zinc in Biological Systems”, Concordia University, January 7, 2005.
- “Characterization of ‘Spectroscopically Challenged’ Metals: Zinc in Biological Systems”, Nanjing University, March 2, 2005.

- “Metal Distributions in the Hippocampus”, APS Workshop on High Resolution X-ray analysis in Biological Systems: New Opportunities, Argonne, IL, March 21, 2005.
- “Characterization of ‘Spectroscopically Challenged’ Metals: Zinc in Biological Systems”, *Frontiers in Bio-Metals*, University of Saskatchewan, May 11, 2005.
- “X-ray Absorption Spectroscopy at the Advanced Photon Source”, EMBO training course on BioXAS on metalloproteins and organism tissue, Hamburg, Germany, June 14-19, 2005.
- “Structural Characterization of Zn sites in Biology”, EMBO training course on BioXAS on metalloproteins and organism tissue, Hamburg, Germany, June 14-19, 2005.
- “Zinc-promoted Alkyl Transfer Enzymes”, Department of Molecular & Microbial Biosciences, Sydney University, Sydney, Australia, August 19, 2005
- “Inorganic Physiology: Spatially resolved x-ray absorption spectroscopy of intact biological samples”, Melbourne University, Melbourne, Australia, August 25, 2005.
- “Biological X-ray Spectroscopy at a Third Generation Synchrotron Source”, Monash University, Melbourne, Australia, August 26, 2005.
- “Inorganic Physiology: Spatially resolved x-ray absorption spectroscopy of intact biological samples”, University of Queensland, Brisbane, Australia, September 8, 2005.
- “Biological X-ray Spectroscopy at a Third Generation Synchrotron Source”, Australian National University, Canberra, Australia, September 14, 2005.
- “How We Think: The Role Of Metal Ions In The Brain”, Department of Chemistry, Sydney University, Sydney, Australia, September 16, 2005.
- “Zinc promoted alkyl transfer enzymes: A new role for Zn in Biology”, Plenary lecture, MaxLab Users’ Meeting, Lund, Sweden, September 29-30, 2005.
- “Inorganic Physiology: Transition metal distribution and speciation in biological tissue”, State Key Laboratory for Coordination Chemistry, Nanjing University, Nanjing, China, February 28, 2006.
- “High resolution x-ray emission as a probe of Zn electronic structure”, Solomon Award Symposium, ACS National Meeting, Atlanta, March 26-30, 2006.
- “High-Resolution X-Ray Emission as a Probe of Zn Electronic Structure in Biological Systems”, NSLS Workshop on Chemical and Biological Applications of High-Resolution X-ray Spectroscopy, May 17, 2006.
- “Metal imaging in tissue and in single cells”, Gordon Research Conference on Environmental Biological Inorganic Chemistry, June 18-22, 2006.
- “Inorganic Physiology: Distribution and Speciation of Metal Ions in Biological Systems”, 69th IHEP Innovation Forum, Institute of High Energy Physics, Beijing, China, Oct. 27, 2006.
- “Inorganic Physiology: Distribution and Speciation of Metal Ions in Biological Systems”, Third Asian Society for Biological Inorganic Chemistry, Nanjing, China, Oct. 30-Nov. 3, 2007.
- “Beyond Crystallography – High Resolution X-ray Absorption and X-ray Emission Spectroscopy of Metalloproteins”, ESRF Workshop on Spectroscopy around Biological Crystallography, Grenoble, France, February 6-8, 2007.
- “Practical Aspects of X-ray Absorption”, SSRL Winter School on XAS, Stanford University, March 13-16, 2007
- “Characterization of ‘Spectroscopically Challenged’ Metals: Zinc in Biological Systems”, SSRL Winter School on XAS, Stanford University, March 13-16, 2007.
- “Inorganic physiology: distribution and speciation of metal ions in biological systems”, First CanBIC Conference, Georgian Bay, May 22-25, 2007.

“Methodology for EXAFS data analysis”, BioXAS Practical Course on metalloproteins and organism tissue, EMBL-Hamburg, July 11-16, 2007

“Recent Advances in Zn XAS”, BioXAS Practical Course on metalloproteins and organism tissue, EMBL-Hamburg, July 11-16, 2007

“Inorganic Physiology: Distribution and Speciation of Metal Ions in Yeast”, 13th International Conference on Biological Inorganic Chemistry, Vienna, July 16-20, 2007

“Redox activity of biomimetic Mn complexes: Results from time-resolved x-ray absorption spectroscopy”, BioXAS Study Weekend, Paris, August 9-11, 2007

“Radiation Damage of Redox-Sensitive Transition Metal Ions”, 9th International Conference on Biology and Synchrotron Radiation, August 13-17, 2007, Manchester, England.

“Time-resolved X-ray Absorption Spectroscopy”, Workshop on Advanced X-ray Method, Stanford Synchrotron Radiation Laboratory, October 15-18, 2008

“Inorganic Physiology: Distribution and Speciation of Metal Ions in Biological Systems”, University of Calgary, June 12, 2009.

“Inorganic Physiology: Distribution and Speciation of Metal Ions in Yeast”, Gordon Conference on Cell Biology of Metals: Metal Metabolism and Disease, August 9-14, 2009

“Biological X-ray Spectroscopy”, School on Advanced Biological Inorganic Chemistry, TATA Institute for Fundamental Research, Mumbai, India, Nov. 2-3, 2009

“Inorganic Physiology: Distribution and Speciation of Metal Ions in Biological Systems”, Symposium on Advanced Biological Inorganic Chemistry, Mumbai, India, Nov. 2-3, 2009

“Inorganic Physiology: Distribution and Speciation of Metal Ions in Yeast”, Plenary speaker at the EUROBIIC, June 19-27, 2010, Thessaloniki, Greece.

“Inorganic Physiology: Distribution and Speciation of Metal Ions in Biological Systems”, XRM2010, August 13-14, 2010, Chicago.

“Inorganic Physiology: Distribution and Speciation of Metal Ions in Biological Systems”, University of Saskatoon, November 17, 2010.

“Inorganic Physiology: Distribution and Speciation of Metal Ions in Biological Systems”, Beijing Normal University, July 27, 2013.

“Inorganic Physiology: Distribution and Speciation of Metal Ions in Biological Systems”, Beijing Normal University, December 28, 2013.

“Advanced x-ray spectroscopy” (4 lecture series), Harbin Institute of Technology, January 2014, 2013.

“Inorganic Physiology: Distribution and Speciation of Metal Ions in Biological Systems”, ACS National Meeting, San Diego, March 12-16, 2016.

“Inorganic Physiology: Distribution and Speciation of Metal Ions in Biological Systems”, Keynote lecture, Symposium on Advanced Biological, January 7-11, 2017.

“Inorganic Physiology: Distribution and Speciation of Metal Ions in Biological Systems”, Indian Institute of Science, Education and Research - Kolkata, January 12, 2017.

“Structural Evolution of Cobalamin Excited States: Femtosecond Dynamics using X-ray Free Electron Lasers”, Osaka University, December 4, 2018.

“Structural Evolution of Reactive Species: From energy storage to energy redistribution”, Nanjing University, July 5, 2019.

“Structural Evolution of Reactive Species: femtosecond dynamics of cobalamins”, University of Science and Technology of China, Hefei, China, July 16, 2019.

“Inorganic Physiology: Distribution and Speciation of Metal Ions in Biological Systems”, Habib University, Karachi, Pakistan, December 3, 2019.

Peer-Reviewed Publications

1. J.E. Hahn, T. Nimry, W.R. Robinson, D.J. Salmon and R.A. Walton, "Crystal and Molecular Structure of the Complex [1,2-bis(diphenylphosphino)ethane] (diethylphenylphosphine) triisothiocyanatorhenium(III) and the Electrochemistry of Isothiocyanato derivatives of Rhenium(III) and Rhenium (IV)" *J. Chem. Soc., Dalton Trans.* (1978) 1232-1236.
2. J.H. Dawson, L.A. Andersson, I.M. Davis and J.E. Hahn, "Spectroscopic Investigation of the Active Site Structure of Cytochrome P-450 with X-ray Absorption Spectroscopy" *Biochemistry, Biophysics, and Regulation of Cytochrome P-450*, J.A. Gustafsson, *et al.* (Eds.) Elsevier, 1980.
3. S. Chen, J.E. Hahn, C.E. Rice and W.R. Robinson, "The Effects of Titanium or Chromium Doping on the Crystal Structure of Vanadium Sesquioxide (V_2O_3)" *J. Solid State Chem.* **44** (1982) 192-200.
4. M.F. Perutz, S.S. Hasnain, P.J. Duke, J. Sessler and J.E. Hahn, "Stereochemistry of Iron in Deoxyhaemoglobin", *Nature*, **295** (1982) 535-538.
5. R.A. Scott, J.E. Hahn, S. Doniach, H.C. Freeman and K.O. Hodgson, "Polarized X-ray Absorption Spectra of Oriented Plastocyanin Single Crystals. Investigation of the Methionine-Copper Coordination", *J. Am. Chem. Soc.*, **104** (1982) 5364-5369.
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8. J.E. Hahn, R.A. Scott, K.O. Hodgson, S. Doniach, S.R. Desjardins and E.I. Solomon, "Observation of an Electric Quadrupole Transition in the X-ray Absorption Spectrum of a Cu(II) Complex", *Chem. Phys. Lett.*, **88** (1982) 595-598.
9. J.H. Dawson, L.A. Andersson, K.O. Hodgson and J.E. Hahn, "The Active Site Structure of Cytochrome P-450 as Determined by Extended X-ray Absorption Fine Structure", *Cytochrome P-450: Biochemistry, Biophysics, and Environmental Implications*, E. Heitman, *et al.* (Eds.), Elsevier, 1982.
10. J.F. Wishart, C. Ceccarelli, R.L. Lintvedt, Jeremy M. Berg, D.P. Foley, T. Frey, J.E. Hahn, K.O. Hodgson and R.M. Weis, "Synthesis, Structure, and Magnetism of a New Type of p-Molecular Complex Containing Copper(II) Complexes and Benzene: Bis-[2,2-dimethyl-7-(phenylimino)-3,5,7-octanetrionato]dicopper(II)-Benzene and Bis-[2,2-dimethyl-7-((4-nitrophenyl)imino)-3,5,7-octanetrionato] dicopper(II)-Bis(benzene)", *Inorg. Chem.*, **22** (1983) 1667-1671.
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12. J.E. Hahn and K.O. Hodgson, "Polarized X-ray Absorption Spectroscopy", *Inorganic Chemistry: Toward the 21st Century*, M.H. Chisholm (Ed.), ACS Symposium Series, **211** (1983) 431-444.
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