June 19, 2024 CURRICULUM VITAE

ROBERT P. HAUSINGER

University Distinguished Professor
Department of Microbiology, Genetics, & Immunology
Department of Biochemistry & Molecular Biology
567 Wilson Road
Biomedical Physical Sciences Building, Room 6193
Michigan State University
East Lansing, MI 48824-1101
(517)-884-5404

Education

Undergraduate: University of Wisconsin, BS in Chemistry and BS in Biochemistry, 1977.
Graduate: University of Minnesota, PhD in Biochemistry, 1982.

Professional Experience

1976-1977	Undergraduate Research Assistant, Dr. William Gibbons, Department of Biochemistry, University of Wisconsin.
1978-1980	Teaching Assistant in Biochemistry, University of Minnesota.
1977-1982	Graduate Student with Dr. James B. Howard, Department of Biochemistry, University of Minnesota.
1982-1984	Postdoctoral Fellow with Dr. Christopher Walsh, Departments of Chemistry and Biology, Massachusetts Institute of Technology.
1984-1989	Assistant Professor, Department of Microbiology and Department of Biochemistry, Michigan State University.
1989-1994	Associate Professor, Department of Microbiology and Department of Biochemistry, Michigan State University.
1994-2019	Professor, Department of Microbiology & Molecular Genetics and Department of Biochemistry & Molecular Biology, Michigan State University.
2019-present	University Distinguished Professor

Administrative Assignments

1997	Panel Manager of USDA Nitrogen Fixation and Metabolism panel
2003-2006	Chair-elect, Chair, and Advisor, Microbial Physiology Division K of the American Society for Microbiology
2003-2013	Associate Chair and Director of Graduate Studies, Department of Microbiology & Molecular Genetics, Michigan State University.
2007-2010	Director Quantitative Biology Program and Co-Director Quantitative Biology Initiative, Michigan State University.
2013-2015	Interim Chair, Department of Microbiology and Molecular Genetics, Michigan State University.

Honors and Awards

Cyrus P. Barnum Teaching Award, 1979, 1980.
Graduate School Fellowship, 1981.
N.I.H. Postdoctoral Fellowship, 1982-1984.
Sigma Xi Junior Faculty Award, 1995.

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College of Natural Sciences Distinguished Faculty Award, 1999, 2009
College of Natural Science Alumni Association Meritorious Faculty Award, 2000
Sigma Xi Senior Meritorious Faculty Award, 2006
5, 2009
Conselho Nacional de Desenvolvimento Científico e Tecnológico (National Council for Scientific & Technological Development, CNPq) Visiting Professorship (Brazil), 2010
Edward Teller Lectureship, UC-Davis, 2011
Elected Fellow of the American Academy of Microbiology, 2017
University Distinguished Professor, 2019
College of Natural Sciences Research Leadership Award, 2024

Society Memberships

American Society for Microbiology
American Chemical Society
Society for Biological Inorganic Chemistry

Professional Activities

1. Non-assigned teaching

Instructor at NSF-supported "Inorganic Biochemistry Summer Workshop", Athens GA, 1991.

Coordinator of a session on “Enzymes and Proteins” as part of the “Frontiers in Science Workshop” program for secondary education teachers, Division of Science and Mathematics Education, 2003

2. Grant Proposal Review Panel Member:

USDA Nitrogen Fixation and Metabolism panel, 1992, 1996, 1997.
NIH Metallobiochemistry (BMT) Study Section, 1997-2001
NIH Special Emphasis Panel for a Program Project, 2002
NIH Special Emphasis Panel, 2008
NSF Chemistry of Life Processes (CLP) Panel, 2016, 2018, 2021
NIH Macromolecular Structure and Function A (MSFA) Study Section, 2020
DOE Basic Energy Sciences Panel, 2024

3. Ad Hoc Proposal Reviewer:

US national funding agencies: National Science Foundation, National Institutes of Health (Merit program), U.S. Dept. Agriculture, U.S. Dept. Army, U.S. Dept. of Energy, U.S. Civilian Research and Development Foundation, Research Corporation for Science Advancement (Cottrell Scholar Awards), ACS Petroleum Research Fund.

Other funding agencies in the US: Brookhaven National Laboratory, Grayson Foundation, Louisiana Board of Regents, South Carolina Agriculture and Forestry Research, Stanford Synchrotron Radiation Laboratory, and various Michigan State University funding sources.

Funding agencies for other countries: Biotechnology and Biological Sciences Research Council (BBSRC, UK), European Science Foundation (Flanders), Hong Kong Research Grants Council, Israel Science Foundation, Max Planck Society Dioscuri Programme, National Sciences and Engineering Research Council of Canada, Netherlands Organization for Scientific Research (NWO) Gravitation Programme, Swiss National Science Foundation, University of Siena (Italy), UW-Milwaukee Research Growth Initiative.

4. Editorial Advisory Board Member:

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Archives of Microbiology (2001-2004)
BioMetals (2003-present)
BMC Biochemistry (2004-2019)
Journal of Bacteriology (1998-2012)
Journal of Biological Chemistry (2008-2013)
Journal of Biological Inorganic Chemistry (2000-2002)

5. Ad Hoc Manuscript Reviewer:

ACS Catalysis, *ACS Chemical Biology, ACS Omega, Amino Acids, Analytical Biochemistry, Angewandt Chemie, Applied and Environmental Microbiology, Applied Microbiology and Biotechnology, Archives of Biochemistry and Biophysics, Archives of Biochemistry and Biophysics Sinica, Archives of Microbiology, Biochemical and Biophysical Research Communications, Biochemical Journal, Biochemical Society Transactions, Biochemistry, Biochimica et Biophysica Acta, Biological Chemistry, BioMed Research International, BioMetals, Bioorganic Chemistry, BioMolecular Concepts, BioSystems, Biotechnology for Biofuels, Biotechnology Letters*, *Biotechnology and Molecular Biology Reviews, Biotechnology Progress, BMC Biochemistry, BMC Genomics, BMC Microbiology, BMC Research Notes, Canadian Journal of Microbiology, Catalysts, ChemBioChem, Chemical Physics Letters, Chemical Research in Toxicology, Chemical Reviews, Chemical Science, Chemistry—A European Journal, Chemistry Central Journal, Chemistry-Methods, Comments on Inorganic Chemistry, Communications Biology, Comprehensive Coordination Chemistry, Coordination Chemistry Reviews, Current Opinion in Chemical Biology, Environmental Microbiology, European Journal of Biochemistry, European Journal of Epidemiology, FEBS Journal, FEBS Letters, FEMS Microbiology Letters, FEMS Microbiological Reviews, Frontiers of Microbiology, Gene, Infection and Immunity, Inorganic Chemistry, Inorganica Chimica Acta, Inorganics, International Journal of Biological Macromolecules, ISME Journal, Journal of Bacteriology, Journal of Basic Microbiology, Journal of Biological Chemistry, Journal of Biological Inorganic Chemistry, Journal of Dental Research, Journal of Enzyme Inhibition, Journal of Experimental Botany, Journal of General Microbiology, Journal of Inorganic Biochemistry, Journal of Medicinal Chemistry, Journal of Membrane Biology, Journal of Molecular Biology, Journal of Molecular Catalysis, Journal of Structural Biology, Journal of the American Chemical Society, Limnology & Oceanography, mBIO, Metallomics, Microbial Drug Resistance, Microbial Pathogenesis, Microbiological and Molecular Biological Reviews, Microbiology, Molecular Genetics and Genomics, Molecular Microbiology, Molecules, Natural Products Reports, Nature, Nature Chemical Biology, Nature Communications, Nature Structural Biology, Nature Structural and Molecular Biology, New Microbes and New Infections, Oncotarget, Organic Letters, Phytochemistry, Phytochemistry Letters, Plant Physiology, Plant Science, PLoS Biology, PLoS One, PLoS Pathogens, Proceedings of the National Academy of Sciences, Protein Expression and Purification, Protein Science, Proteins: Structure, Function, and Bioinformatics, ReCUR (Honors College Undergraduate Research journal), Research in Microbiology, Science, RSC Medicinal Chemistry, Science Advances, Scientific Reports, Soil Biology and Biochemistry, Tetrahedron Letters, Toxicon, Trends in Biochemical Sciences, The Plant Journal, Virulence*

6. External Thesis Reviewer:

- M.Sc. thesis external reviewer, A. Phillips, University of the Orange Free State, South Africa, 1989.
- Ph.D. thesis external reviewer, J. Bossé, Department of Pathobiology, University of Guelph, 1999.
- Ph.D. thesis external reviewer, Yu Hang (Ivan) Fong, Chinese University of Hong Kong, 2012.

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- Ph.D. thesis external reviewer, W. Law, University of Toronto, 2024

7. External Promotion/Tenure Reviewer:

- Tenure letter, Indiana University Department of Chemistry, 1997.
- Tenure letter, Utah State University, Department of Chemistry and Biochemistry, 1997.
- Tenure letter, Bowling Green State University, Department of Biological Sciences, 1999.
- Tenure letter, Alma College, 1999.
- Promotion letter, Johns Hopkins University, Dept. Environmental Health Sciences, 2000.
- Promotion letter, Dept. Microbiology, Southern Illinois University, 2000.
- Promotion letter, Dept. Chemistry & Biochemistry, Utah State University, 2001.
- Promotion letter, Dept. Biochemistry, Univ. Missouri—Columbia, 2002.
- Promotion letter, Dept. Chemistry, M.I.T., 2003.
- Promotion letter, Dept. Biochemistry, Uniformed Services Univ. of Health Sci., 2003.
- Tenure/promotion letter, Dept. Chemistry, Auburn University, 2004
- Tenure/promotion letter, Dept. Chemistry, University of Wisconsin-Milwaukee, 2004.
- Tenure letter, Dept. Chemistry, M.I.T., 2004.
- Promotion decision, Dept. Applied Physics & Chemistry, Univ. Electro-Commun. Japan, 2005.
- Tenure/promotion letter, Dept. Biochemistry & Molec. Biol., Pennsylvania State University, 2006.
- Promotion letter, Dept. Chemistry & Biochemistry, Montana State University, 2006.
- Tenure/promotion letter, Dept. Chemistry, Univ. Toronto, 2006.
- Tenure/promotion letter, Dept. Biochemistry, University of Mississippi Medical Center, 2007.
- Tenure letter, Dept. Chemistry, Carnegie Mellon University, 2007.
- Tenure/promotion letter, Dept. Biochemistry & Molecular Biology, Wayne State University, 2007.
- Tenure/promotion letter, Dept. Chemistry, Univ. Massachusetts, Amherst, 2008.
- External hiring letter, Dept. Biochemistry & Chemistry, Worchester Polytechnic Institute, 2009
- Tenure/promotion letter, Dept. Pharmaceutical Sciences, Univ. Maryland, 2009.
- PhD. Thesis external reviewer, Shujian Cun, Chinese University of Hong Kong, 2009
- Promotion letter, Dept. Chemistry, Univ. Wisconsin—Milwaukee, 2010.
- Promotion letter, Dept. Chemistry, Georgia State Univ., 2011.
- Ph.D. thesis external reviewer, Kim Chan Chung, Dept. Chemistry, Univ. Toronto, 2011.
- Promotion letter, Dept. Chemistry, Univ. Toronto, 2011.
- Tenure/promotion letter, Dept. Chemistry, Univ. Texas – Arlington, 2013.
- Promotion letter, Dept. Microbiology and Immunology, Univ. Michigan, 2013.
- Promotion letter, Dept. Microbiology & Immunology, Univ. Maryland School of Medicine, 2013.
- Promotion letter, Dept. Chemistry & Biochemistry, Univ. Wisconsin—Milwaukee, 2013.
- Promotion letter, Dept. Biochemistry & Molecular Biology, Univ. Georgia, 2014.
- Tenure/promotion letter, Dept. Microbiology & Immunology, Univ. Maryland School of Medicine, 2015.
- Tenure letter, Dept. Chemistry, M.I.T., 2015.

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- Reappointment letter, Dept. Chemistry, Carnegie Mellon University, 2016.
- Tenure/promotion letter, Dept. Chemistry, Emory Univ., 2016.
- Tenure/promotion letter, Dept. Chemistry and Biochemistry, Auburn Univ., 2017.
- Promotion letter, Dept. Structural Biology, University at Buffalo, 2018.
- Promotion letter, Dept. Microbiology & Immunology, Univ. Maryland School of Medicine, 2018.
- Promotion letter, Dept. Chemistry, M.I.T., 2018.
- Promotion letter, Chinese University of Hong Kong, 2018.
- Evaluation letter, Colorado School of Mines, Golden, CO, 2019.
- Promotion letter, Dept. Chemistry, Carnegie Mellon Univ., 2019.
- Promotion letter, Dept. Structural Biology, University of Buffalo, 2020.
- Tenure letter, Dept. Chemistry, Carnegie Mellon Univ., 2021.
- Promotion/tenure letter, Dept. Chemistry, North Carolina State University, 2021.
- Promotion letter, Marquette University, 2022.
- Promotion letter, Rochester Institute of Technology, 2022.
- Promotion letter, UC-Riverside, 2022.
- Tenure/promotion letter, Dept. Biochemistry, Virginia Polytechnic University & State University, Blacksburg, VA, 2023.
- Tenure/promotion letter, Dept. Chemistry, Pennsylvania State University, University Park, PA, 2023.
- Tenure/promotion letter, Dept. Chemistry, Western Michigan University, Kalamazoo, MI, 2023.
- Promotion letter, School of Life Sciences, Chinese University of Hong Kong, 2024.

8. External Departmental Reviewer:

- External Reviewer of Dept. Chemistry, Georgia State University, 2006.
- Site visit committee, chair; UT-San Antonio Chemistry Department, 2022 (virtual)

9. Other:

- Co-convener, "*Bacterial Nickel Metabolism*" session at Amer. Soc. Microbiol. Mtg., 1987.
- Panelist, "*Molecular Biology Curriculum*", Dept. Biology, East. Mich. Univ., Ypsilanti, MI, 1992.
- Reviewer of chapter in "*Principles of Bioinorganic Chemistry*" by S. Lippard and J. Berg, University Science Books, 1992.
- Reviewer of chapter in "*Molybdenum Enzymes, Cofactors, and Model Systems*" edited by E. I. Stiefel, W. E. Newton, and D. Coucovanis, American Chemical Society, 1993.
- Test item preparer: "*Biochemistry, Cell and Molecular Biology*" subject test of GRE, Educational Testing Service, 1993, 1994.
- Sigma Xi Admissions Committee, 1994-1996, Chair, 1996.
- Chair of "*Metalloenzymes in Bioremediation*" session of Metals in Biology Gordon Research Conference, 1997.
- Reviewer of chapter in "*Encyclopedia of Catalysis*", 2000.
- Co-convener, "*Synthesis of the Active Sites of Microbial Metalloproteins*" session at Amer. Soc. Microbiol. Mtg., 2000.
- Reviewer of proposal for textbook on "*Concepts and Methods of Biochemistry: An Advanced Course*", 2002.
- Reviewer of chapters for "*Methods for General and Molecular Bacteriology*", 2002 & 2003.
- Advisory Board Member, 12th International Conference on Bioinorganic Chemistry, Ann Arbor, MI, 2003-2005.

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- Chair of "*DNA-Binding Proteins*" session of 11th Intern. Conf. Biol. Inorg. Chem., Cairns, Australia, 2003.
- Reviewer of proposal for Introductory Microbiology textbook by W. H. Freeman, 2003.
- Chair, "*Metal Cofactor Biosynthesis and Assembly*" session, 12th Internat. Conf. Biol. Inorg. Chem., Ann Arbor, MI, 2005.
- Co-Chair, "*Metalloproteins—Non-heme Iron*" session, 13th Internat. Conf. Biol. Inorg. Chem., Vienna, 2007.
- Co-Chair, "*Metalloproteins*", 14th Internat. Conf. Biol. Inorg. Chem., Nagoya, Japan, 2009.
- Chair, "*J. Inorg. Chem*." session, 6th Asian Biol. Inorg. Chem. Conf., Hong Kong, 2012.
- Review textbook proposal for CRC Press, 2017.
- MPB and MD Session co-chair, Biometals 2020 virtual conference, 7/10/2020.
- Reviewer of proposal for a book on "*Ureases: Foundations, Classes, and Applications*", 2021.
- Reviewer of proposal for a book on "*Fundamentals of Recombinant Protein Production, Purification and Characterization*", 2021.
- External mentor of Assoc. Prof. Joseph Emerson in the Mississippi State University-NIH COBRE program, 2021-2023.
- Presentation at the MSU Science Festival, 2021, 2022, 2023, and 2024.
- ASM Education Awards Selection Committee, 7/1/2019-6/30/2022 and 7/1/2022-6/30/2025 (chair).

Committee Service

University and Departmental Committees

1985-1986	Seminar Committee (MMG)
1985-1988	Preliminary Exam Committee (BMB); Chair, 1986-1987
1986-1991	Undergraduate Microbiology Club Advisor (MMG)
1987-1989	Faculty Advisory Committee (MMG)
1987-1990	Search Committee for new Chairperson (MMG)
1988-1991	Awards Committee (BMB); Chair, 1990-1991
1988-1991	Undergraduate Committee (MMG)
1989-1992	Program in Cell and Molecular Biology Executive Committee
1989-1991	Awards Committee (MMG); Chair, 1990-1991
1990-1993	Safety Committee (MMG)
1991-1993	Graduate Student Affairs Committee (Cnt for Microbial Ecology)
1991-1995	Graduate Recruiting Officer (MMG)
1991-1992	Preliminary Exam Committee (BMB)
1992-1993	Faculty Search Committee (MMG)
1992-1993	Graduate Student Recruitment Committee (BMB); Chair
1993-1994	Awards Committee (BMB)
1993-1994	Seminar Committee (BMB)
1994-1996	Faculty Advisory Committee (BMB)
1994-1995	Faculty Search Committee, Structural Biologist (BMB); Chair
1995-1997	Safety Committee (MMG); Chair, 1996
1995-1998	Undergraduate Microbiology Club Advisor (MMG)
1995-1996	Admissions Committee (Cell and Molecular Biology Program)
1996-1998	Faculty Advisory Committee (MMG); Chair (1997-8)
1996-1998	Awards Committee (BMB), Chair (1997-8)

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1997-1998	Biomedical Science Future Search Implementation Committee
1997-2001	Univ. Research Council's Misconduct/Procedural Appeals Panel
1999-2000	Seminar Committee (MMG)
1999-2001	Admissions Committee (BMB)
1999	Interim Faculty Research Infrastructure Advisory Committee
2000-2002	Awards Committee (MMG)
2001-2004	Graduate Student Judiciary Committee (BMB)
2001-2004	Graduate Program Committee (BMB)
2001-2003	Cell and Molecular Biology Executive Committee
2001-2005	Center for Structural Biology Advisory Committee
2001-2004	University Distinguished Fellowship Advisory Committee
2002-2003	Graduate Committee (MMG)
2002-2003	Chairperson Search Committee (MMG)
2003-2004	Faculty Advisory Committee, Alternate during sabbatical (BMB)
2003-2005	Biomedical Graduate Programs Task Force
2004-2007	CNS Position Management Committee
2004-2005	ad hoc Integrative Studies Planning Committee
2004-2006	Faculty Advisory Committee, Chair (BMB)
2004-2006	Faculty Search Committee, Environmental Microbiology (MMG)
2005-2013	Quantitative Biology (and Modeling) Executive Committee
2006-2007	Equipment Committee, Chair (BMB)
2007-2009	CHM Graduate Studies Committee
2007-2009	CHM MD-PhD Steering Committee
2007-2009	Graduate School PhD Completion Project Committee
2007-2009	Awards Committee (BMB)
2007-2009	Faculty Search Comm., Bioenergy/Bioproducts, Chair (MMG)
2009-2011	Comprehensive Examination Exam Committee (BMB)
2011-2013	Graduate Programs & Curric. Committee (BMB; chair 2012-2013)
2011-2013	Executive Committee (BMS gateway)
2012-2013	Faculty Search Committee, Microbial Ecology (Microbiology)
2014-2015	Biology Initiative Executive Committee
2014-2022	Mentoring committee for Yann Dufour (MMG)
2015-2020	Mentoring committee for Cecilia Martinez-Gomez (MMG, chair)
2016-2017	Faculty Search Committee, Mass Spectrometry (BMB)
2016-2018	Faculty Advisory Committee (MMG, Chair 2016-present)
2017-2019	Faculty Advisory Committee (BMB)
2017-2019	University Work-Life Office Advisory Committee
2017-2019	CryoEM Search Comm. (BMB)
2018	Worklife Office Coordinator Search committee
2018-2022	Mentoring committee for Kazem Kashefi (MMG, chair)
2018-2022	Mentoring committee for Yann Dufour (MMG)
2018	Salary Savings Committee (MMG, chair)
2019-2020	Search Committee for Chair of Chemistry
2019-2022	Awards Committee (MMG, chair)
2019-2023	Faculty Mentoring Committee (BMB)
2020	NatSci Campus Building Reopening Review Team
2020-2022	RTSF Cryo-EM Facility Advisory Board/Oversight Committee
2020-2022	Search Committee for Mass Spectrometry Director (BMB)
2021-present	Mentoring committee for Ben Orlando (BMB)
2021-present	External Advisory Committee, Resource for Quantitative Elemental Mapping for the Life Sciences (QE-Map)
2022-2023	NatSci RPT Committee
2022-2024	Faculty Advisory Committee (BMB, chair)

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2022-present	Mentoring committee for Rob Quinn (BMB)
2023	Spousal Hire Evaluation Committee (BMB, chair)
2023-present	Mentor for Charlie Hoogstraten (BMB)
2024-present	Awards Committee (BMB)

Graduate Student Guidance Committees (year of completion)

Microbiology (MMG): Robert Kelley (1985), Cheng Kao (1987), Dan Sikkema (1988), Yi-Zheng Zhang (1988), Shixing Yuan (1989), Jackie Wood (M.S., 1989), Richard Martin (1991), Andrew Black (1992), Mann Lee (1992), Todd Cotter (1992), John Kemner (1992), Il-Seon Park (1994), Joanne Chee-Sanford (1996), Greg Tatara (1996), Rob Sanford (1996), Michael Renner (1997), Jared Leadbetter (1997), Tim Sassanella (M.S., 1997), Steven Ekunwe (1998), Weije Fu (1997), Deborah Hogan (1999), Julie Dunning Hotopp (2002), Ben Griffin (2003), Fan Yang (M.S., 2007), Nicholas Flugga (M.S., 2010), Yuxin Wang (M.S., 2010), Yi Zheng (2011), Allison Spears (2012), Jerome Moulden (M.S., 2011), Eric Carter (2011), Rebecca Steidle (2015), Krista Cosert (2018), Jake Baker (2017), Daniel Parrell (2019), Natalia Porcek (2017), Huiqing Zheng (2017), Anna Huff (M.S., 2017), Nico Fernandez (2019), Taylor Dunivan (2019), Lindsay Putman (2021), Osama Alian, Kati Ford (2023), Hunter Dulay (2023), Douglas Guzior (2024), Sergio Hernandez-Ortiz, Joelis Lama-Diaz, Hazel McGuffin.

Biochemistry (BMB): Zhongru Gan (1987), Idah Sithole (1988), Cathy Wernette (1988), Dan Wilson (1988), Tracy White (1989), Chan Yong Lee (1989), Yang Feng Yang (1990), Scott Mulrooney (1990), Doug Cress (1991), Matthew Todd (1991), Saroj Mathupala (1992), Robert Meeley (1992), John Loh (1994), Mary Beth Moncrief (1996), Bernard Hummel (1997), Bin Zhang (1997), Ruth Saari (1998), Yingbin Fu (1998), Yuejun Zhen (1998), Lincong Wang (1998), Michael Washburn (1998), Otis Vacratsis (2001), Wayne Hicks (2002), Brandon Hespenheide (2002), Bryan Schmidt (2003), Wayne Riekhof (2004), Dean Shooltz (2006), Jiayan Liu (2006), Yi Wang (2006), Chetan Sukuro (2007), Bradley Olson (2008), Soledad Quiroz (2008), James Johnson (2008), Susan Achberger (M.S., 2008), Katherine Higginbotham (M.S., 2008), Jana Simmons (2010), Jian Liu (2010), Jifeng Wang (2010), Zhenwei Lu (2011), Matthew Tonero, Sean Law (2011), Jie Deng (2011), Jodi Boer (2012), Adam Cornish (2012), Fei Li (2014), Mark Farrugia (2015), Celeste Warrell (M.S., 2013), Mike Sgambelluri (2017), Elise Rivett (2021), Jingcheng Huang (2019), Gracielou Klinger (2020), Joel Rankin (2021), Caitlyn Herr (M.S., 2020), Clarisse Finders (M.S., 2018), Aiko Turmo (2023), Hannah Parks (2023), Lisa Yun (2024), Krystina Hird, Megan Gruenberg Cross (2024), Diego Granados-Villaneuva, Louisa Ellis, Nicholas Schlecht.

Chemistry (CEM): Timothy Henshaw (2004), Sanjit Sanyal (2006, M.S.), Efthalia Kalliri (2007), Meng Li (2007), Oluwateyin Olumolade (M.S., 2009), Irosha Nawarathne (2011), Getrude Dibo (M.S., 2010), Christopher John (2019), Lin Song (2020), Allison Stettler, Jorge Nevarez, Majid Jafari.

Cell and Molecular Biology (CMB): Hua Zhang (2003), Mukta Rohankhedkar (2005, M.S.), Jong Kyon Kim (2006), Sarah Santos (2007), Julie Bordowitz (2009), Danielle Nevarez-McBride (2011), Leann Buhrow (2012), Sunetra Roy (2015), Kathryn Brittain, Cody Phillips, Joel Landa.

Animal Science: Susan Fish (1990), Amina Jaber (1997).

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Pathology: Julia Frei (1989).

Crop and Soil Science: Mark Coyne (1989), Xiaoyun Qiu (2004).

Genetics: Bryce Sopher (1992), Megha Gulati (2012).

Chemical Engineering: Mingjie Jin (2012).

Microbiology BS/MS program: Lisa Renick (2005), Yogit Goyal

Students, Research Associates, and Visiting Scientists Supervised

High School Summer Research Students:

Jung Lee, 1985
Nelson Hsu, 1993
Lori Oosterban, 1994
Ruchi Mishra, 1995
Elizabeth Chao, 1996 (Finalist in Westinghouse Science Competition)
Daniel Kim, 2000
Merhawit Negussie, 2003

Undergraduate Students (shown in **bold** if coauthor of a published article):

Lisa Gloss, 1985-88 (Microbiology Sayer Award, Churchill Fellowship, NSF Fellowship).
Cathy Maloney, F'1985
David Rollo, Summer 1985
Aaron Vander Pool, Summer 1985
Arduth Burgess, F''85
Geoff Lewis, W'86-F'86
Bob Monticello, F'86-S'87
Steve Anderson, Summer 87-Summer '88 (Biochemistry Outstanding UG Award, NSF Fellowship).
Carrie Kane, F'87
Brent Herr, W'88
Deborah McCoy, S'90-Summer '90 (Microbiology Sayer Award)
Diane Sands, Summer '90
Young Ha, F'91
Bernard Macatangay, W'92-Summer '92
Ginger Dzuira, F'93-S'96
Montrell Seay, Summer '94
Teresa Kalinka, Summer '95
Matt Merski, F'95-Summer '99 (Biochemistry Outstanding Undergraduate Award, 1999).
Heather Everett, Summer '96
Melissa Borders, F'96-S' 98
Thomas Auchtung, Summer '97-Fall '00 (Gloss Award, 1999; DuVall Scholar Award, 2000; Gerhardt Award, 2001).
Laura Stack, Summer '98-Summer '99
Scott Dane, F'99-S'00
Serena Vanlerberg, F'99
Angie Curtis, S'00-F'00
Paul Brady, Summer, '00

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Kevin Mulrooney, Summer, ‘00-Summer ‘04
Meghan Burns, F’00
Sarah Ward, F’01-2005 (MMG Gloss Award, 2003; MMG DuVall Scholar Award, 2004; Gerhardt Award, 2005).
Greta Monterosso, Summer, 2002-2004 (BMB Undergrad Research Award, 2003; Senior Class Council Outstanding Student Award, 2004; BMB Outstanding Undergraduate Student Award, 2004).
Irfan Ahmad, F’02-S’03
Tim Egbert, Summer ‘03
Sarah Zohde, S’04-Fall ‘04
Rebecca Mowat, F’04
Kimberly Anderson, S’05-2007 (MMG Gloss Award, 2005; MMG Gerhardt Award, 2007).
Andrea Silva, F’05-Summer ‘08
Bruce Fraser, F’05-Spring ‘08 (Pfizer Scholarship, 2006; MMG Gerhardt Award, 2008).
Joyce Bower, S’06
Srikanth Aravamuthan, S’06
Melody Campbell, Summer ’06, Summer ‘07
Ben Baer, Summer ‘06
Anthony Nazione, Fall ’06
Jamey Hardesty, Fall ’06-Spring ‘07
Maryum Kahn, Fall ’06
Aaron Chester, Fall ’06-Spring ‘09
Rachel Morr, Spring ’07-Spring ‘09 (MMG Peabody Scholarship, 2008; CNS Summer Research Award; CNS Undergraduate Research Support Scholarship).
Greg Moyerbrailean, Fall ’07-Spring ‘08 (MMG Stutzenberger Scholarship, 2008)
Meghan Andrzejak, Spring ’08-Summer ‘11 (50% lab tech near end)
Brittnie DeVries, Fall ’08-summer ‘10
Michael Howard, Fall ’08-summer ‘10
Avula Umakanth, Fall’08
Christopher Towns, Fall ’08-spring ‘11
Scott Taber, Spring ’09-Fall ‘10
Stephanie DeDore, Fall ’09-summer ‘13
Scott Elsey, Summer ’10-Spring ’12 (MMG Gerhardt Award, 2012)
Matt Fountain, Summer ’10
Tejas Bhawrat, Summer ’10-4/2011
Sneha Grandhi, Summer ’11-Spring ‘12
Blair Murphy, Spring ’12-Fall ‘12
Hillary Johnson, Spring ’12-Summer ‘14
Adib Abdullah, Summer ’12-Spring ‘13
Evan Hseuh, Fall ’12-Fall ‘15
Kristen Clark, Spring ’13-Fall ‘14
Matthew Mcclellan, Fall ’13-Spring ‘14
Allison Brazeau, Spring ’14-Summer ‘14
Mario Aliaj, Fall ’14-Spring ‘15
Anastasia Ritchie, Fall ’14-Spring ‘17
Brad Doherty, Fall ’14-Spring ‘15
Ada (Lisa Gokce) Cakirlar, Fall ’14-Spring ‘17
Mike Tobar, Summer ’15-Spring ‘16
Niklas Peters, Fall ’15
Sarah Struble, Fall ’15-Spring ‘18

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Nicholas Henning, Summer ’16-Fall ‘16
Madison Perian, Summer ’16
Dhara Patel, Summer ’17-Spring ‘18
Kamren Huizenga, Spring ’17-Summer ‘17
Gokul Murali, Summer ’17-Fall ‘18
Daniel Moser, Fall ‘17
Stephanie Iorga, Spring ’18-Spring ‘20
Ricardo Aquino, Summer ’18-Spring ‘19
Abby Ortwine, Fall ’19-Spring ’20 and Spring ’21-Fall ‘21
Aishwarya Narayan, Fall ’19-Spring ’20 and Spring ’21-Spring ‘22
Yogit Goyal, Summer ’21-Spring ‘22
McKeely Kerr, Summer ’22
Grant Marquardt, Summer ‘22
Bryce Delaney, Fall ’22-present
Emma Borden, Spring ‘23
Conner Melane, Summer ’23
Chinmay Chouthai, Fall ’23-present
Abigail (Abby) Thompson, Fall ’23-present

M.S. Students:

Jackie Wood, Microbiology, 1987-1989
Mukta Rohankhedkar, Cell and Molecular Biology, 2003-2005.
Nicholas Flugga, Microbiology, 2008-2010
Celeste Warrell, Biochemistry, 2012-2013
Caitlyn Herr, 2016-2020 (deceased)

Ph.D. Students:

Scott Mulrooney, Biochemistry, 1986-1990
Matthew Todd, Biochemistry, 1986-1991 (Outstanding Biochemistry Grad Award, 1990).
Manhyung Lee, Microbiology, 1988-1992 (Microbiology DuVall Scholar Award, 1991).
Il-Seon Park, Microbiology, 1991-1994 (Microbiology DuVall Scholar Award, 1994)
Mary Beth Moncrief, Biochemistry, 1992-1996 (Outstanding Biochemistry Grad Award, 1996).
Ruth Saari, Biochemistry, 1993-1998 (Outstanding Biochemistry Grad Award, 1998).
Debbie Hogan, Microbiology, 1995-1999 (Microbiology DuVall Scholar Award, 1998).
Julie Hotopp, Microbiology, 1998-2002 (Microbiology Rudolf Hugh Fellowship winner, 2001; Marvin Hensley Endowed Fellowship, 2001).
Tim Henshaw, Chemistry, 2001-2004 (joint advisor with Joan Broderick).
Soledad Quiroz, Biochemistry, 2003-2008.
Jong Kyon Kim, Cell and Molecular Biology, 2004-2006.
Efthalia Kalliri, Chemistry, 2005-2007
Jana Simmons, Biochemistry, 2005-2010 (Outstanding Graduate Teaching Award, 2009; Sigma Xi Outstanding Graduate Student Award, 2009).
Meng Li, Chemistry, 2005-2007
Eric Carter, 2008-2011 (Rudolf Hugh Fellowship, 2009; Barnett Rosenberg Fellowship, 2010; DuVall Fellowship, 2011)
Jodi Boer Dickerson, 2008-2012 (Outstanding Graduate Student Award in BMB, 2011).

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Mark Farrugia, 2011-2015 (Outstanding Graduate Research Award in BMB, 2013; Russell B. DuVall Scholarship, 2013; Outstanding Graduate Student Award, BMB, 2015).
Joel Rankin, 2016-2021 (Dr. Richard U. and Claire M. Byerrum Endowed Fellowship, 2019; BMB Outstanding Graduate Student Award, 2020; Dissertation Completion Fellowship, 2021; Outstanding Graduate Student Research Award, 2021).
Aiko Turmo, 2019-2023. ASBMB Travel Award, 2022. Jack Throck Watson Graduate Fellowship, 2022. College of Natural Science Dissertation Completion Fellowship, 2022.
Jorge Nevarez, 2019-present.

Research Associates and Visiting Scientists:

Yves Markowicz, 1989-1990
Sang-Dal Kim, (3 months) 1990-1991
P. Richard Martin, 1991-1992
Fumiyasu Fukumori, 1991-1993
Vladimir Romanov, 9/1992-4/1996 and 7/1997-5/1998
Taha Taha, 9/1994-10/1996
Linda Michel, 11/1994-8/1996 and 8/1997-12/1997
Anatoly Slepenkin, 4/1995-5/1996
Gerard Colpas, 5/1996-6/2000
Kazuya Yamaguchi, 7/1996-9/1997
Ruth Schaller, 10/1996-4/1999
Raghavakaimal Padmakumar, 5/1997-5/1998
Aileen Soriano, 10/1997-6/2000
Ruth Saari, 9/1998-10/1999
Matthew Ryle, 10/1998-7/2003
Scott Mulrooney, 11/1999-8/2013
Kazuhito Itoh, 8/2000-5/2001
Jason Kuchar, 10/2001-5/2003
Zhenzhan Chang, 4/2002-6/2004
Piotr Grzysska, 11/2003-2/2010
Tina Müller, 7/2004-5/15/2017
Hajime Masukawa, 4/2008-3/2011
Gabriel Velazquez, 8/2008-12/2008
Lee Macomber, 3/2009-7/2015
William Kittleman, 4/2009-6/2010
Jana Simmons, 5/2011-8/2011
Benoît Desguin, 11/2013-10/2015
Salette Martinez, 5/2014-4/2017
Dongling Zhan, 6/29/2015-4/28/2016
Matthias Fellner, 12/2015-5/19/2018 (jointly mentored with Jian Hu)
Satyanarayana Lagishetty, 11/2018-12/2019 (jointly mentored with Jian Hu)
Hao Yu, 2/2019-8/2019
Mark Farrugia, 11/13/2019-11/12/2021
Santhosh Gatreddi, 12/2/2019-present (jointly mentored with Jian Hu)
Shramana Chatterjee, 2/24/2020-present (jointly mentored with Jian Hu). Winner of the BMB Outstanding Postdoctoral Scholar Award in 2024.
Joel Rankin, 9/20/2021-12/31/2022 (jointly mentored with Jian Hu)
Swati Gupta, 3/2/2022-4/31/2023
Yali Wang, 2/16/2023-present
Aiko Turmo, 6/10/2024-present

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Teaching Duties

MMG 801, “Integrated Microbial Biology”, ~21 lectures (~40%) and coordinator
BMB 805, “Protein Structure, Design, and Mechanism”, 5-6 lectures (~13%)
Every ~2 years: BMB961/MIC803/CMB800, "Metals in Biology"
Previously: BMB 960, “Recent Topics in Protein Structure and Dynamics”
Previously: BMB 101, “Frontiers in Biochemistry “
Previously: MMG 103, “Frontiers in Microbiology”
Previously: UGS 101-303, “Green Chemistry”
Previously: MMG 301, "Introductory Microbiology"
Previously: QB 827, “Problems in Quantitative Biology”
Previously: BMB 804, "Biochemical Mechanisms and Structure", 14 lectures (40%) and coordinator

Invited Seminars

03/05/87 ASM Annual Meeting, Atlanta, GA
03/10/87 Dept. Biochemistry, Ohio State University, Columbus, OH
10/20/87 Kimberley-Clarke Corp., Neenah, WI
06/17/88 Division of Inf. Dis., Dept. Medicine, Univ. Maryland, Baltimore, MD
11/09/88 Dept. Chem., Univ. Wisconsin, Milwaukee, WI
05/17/89 ASM Annual Meeting, New Orleans, LA
07/24/90 E. I. du Pont de Nemours, Wilmington, DE
10/30/90 Cell Molec. Biol. Group, Biol. Dept., Univ. Michigan, Ann Arbor, MI
07/31/91 3rd Int. Conf. of Molec. Biol. of Hydrogenase, Troia, Portugal
10/02/91 Depts. Bioch Micro & Immun, and Urology, Queen's Univ., Kingston, Canada
11/31/92 "Metals in Biology" Gordon Conference, Ventura, CA
09/07/92 5th Int. Conf. on Ni Biochem., Sudbury, Ontario
11/16/92 Dept. Biochem., Univ. Missouri, Columbia, MO
03/18/93 Dept. Bacteriol., Univ. Wisconsin, Madison, WI
03/23/93 Proctor and Gamble, Miami Valley Labs, Cincinnati, OH
04/26/93 Conf. on Biodegradation, NIEHS, Research Triangle Park, NC
12/06/93 Dept. Micro. & Immunol., Univ. Illinois, Chicago, IL
03/03/94 Dept. Med. & Biochem., Univ. Utah, Salt Lake City, UT
03/04/94 Dept. Chem. & Biochem., Utah State Univ., Logan, UT
10/11/94 Dept. Biochem., Univ. of Nebraska, Lincoln, NE
10/28/94 Workshop on Microbial Evol. & Biodeg., RIKEN, Wako, Sitama, Japan
11/01/94 Dept. Biotechnol., Univ. Tokyo, Bunkyo-ku, Japan
02/17/95 E. I. du Pont de Nemours, Wilmington, DE
03/03/95 Section of Biochem., Molec. & Cell Biol., Cornell Univ., Ithaca, NY
03/15/95 Metals in Biology Group, Univ. Michigan, Ann Arbor, MI
03/20/95 Dept. Biochem., Virg. Polytech. Inst. & State Univ., Blacksburg, VA
09/04/95 Int. Conf. Bio-Inorg. Chem., Lübeck, Germany
09/11/95 Institut für Pflanzephysiologie & Mikrobiologie, Freie Universität, Berlin, Germany
10/10/95 Dept. Biochem., Wayne State Univ., Detroit, MI
10/18/95 Dept. Chem., Texas A & M Univ., College Station, TX
11/07/95 Metalloprotein Interest Group, Univ. Minnesota, Minneapolis, MN
11/08/95 Dept. Biochem., Univ. Minnesota, Minneapolis, MN
10/01/95 Dept. Biol., Hope College, Holland, MI
02/02/96 Dept. Chemistry, Univ. South Florida, Tampa, FL
02/09/96 Dept. Microbiology, Medical College of Toledo, Toledo, OH

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08/28/96 Ann. Mtg. Am. Chem. Soc., Orlando, FL
03/25/97 Biology Department, University of Indiana, Bloomington, IN
04/28/97 Symposium for Prof. August Böck, University of Munich, Munich, Germany
06/13/97 Steenbock Symposium, University of Wisconsin, Madison, WI
08/08/97 Microbial Structural Biology Symp, Penn. State Univ., State College, PA
08/23/97 Rosenberg Symposium, Michigan State University, East Lansing, MI
09/25/97 Department of Biology, Johns Hopkins University, Baltimore, MD
11/14/97 5th Chemical Congress of North America, Cancun, Mexico
11/21/97 Microbiol., Biochem., & Molec. Biol. Program, Southern Illinois Univ., Carbondale, IL
01/20/98 "Metals in Biology" Gordon Conference, Ventura, CA
06/29/98 “Nitrogen Fixation” Gordon Conference, New London, NH
09/04/98 Biology Department, Bowling Green State University, Bowling Green, OH
10/29/98 Biochemistry Dept., Alma College, Alma, MI
07/15/99 9th Internat. Conf. Biol. Inorg. Chem., Minneapolis, MN
09/23/99 Dept. Chemistry, Univ. Waterloo, Waterloo, Ontario
09/24/99 Dept. Pathobiology, Univ. Guelph, Guelph, Ontario
12/07/99 Dept. Chem. & Biochem., Univ. Maryland, College Park, MD
12/09/99 Dept. Microbiol. & Immunol., Univ. Maryland, Baltimore, MD
05/23/00 Annu. Mtg. Amer. Soc. Microbiology, Los Angeles, CA
10/26/00 Dept. Biochemistry, Univ. Buffalo, Buffalo, NY
12/05/00 Dept. Chemistry, North Dakota State University, Fargo, ND
12/06/00 Dept. Biochemistry, Univ. North Dakota, Grand Forks, ND
02/14/01 Dept. Chemistry, City University of New York, New York, NY
03/08/01 Dept. Microbiology, University of Georgia, Athens, GA
04/03/01 Society for Experimental Biology, Canterbury, England
01/11/02 Biophysics Research Institute, Medical College of Wisconsin, Milwaukee, WI
02/15/02 Dept. Biochemistry, UCLA, Los Angeles, CA
02/21/02 Dept. Chemistry, Auburn University, Auburn, AL
02/28/02 Dept. Chemistry, Carnegie Mellon University, PA
05/11/02 Midwest Metals Meeting, Chicago, IL
08/19/02 Annu. Mtg. American Chemical Society, Boston, MA
09/05/02 Dept. Microbiology, University of Illinois, Urbana, IL
09/19/02 School of Molecular Biosciences, Washington State University, Pullman, WA
07/23/03 11th Internat. Conf. Biol. Inorg. Chem., Cairns, Australia
10/08/03 Graduate School of Engineering, Kyoto University, Kyoto, Japan
10/11/03 3rd Symp. Chem. Biol. of Metal Sensors with Switching Function, Kyoto, Japan
02/06/04 Dept. Chemistry, New York University, New York, NY
03/29/04 Annu. Mtg. Amer. Chem. Soc., Anaheim, CA
06/28/04 FASEB Conference on Trace Element Metabolism, Snowmass, CO
07/11/04 FASEB Conference on Biological Methylation, Saxtons River, VT
08/29/04 EUROBIC Conference, Garmisch-Partenkirchen, Germany
09/05/04 BioMetals Conference, Garmisch-Partenkirchen, Germany
01/11/05 Biochemistry Program, Ohio State University, Columbus, OH
01/24/05 Metals in Biology, Gordon Research Conference, Ventura, CA
04/10/06 Takeda Science Foundation Oxygenase Conference, Kyoto, Japan
05/16/06 Dept. Chemistry, Dartmouth University, Hanover, NH
09/12/06 Dept. Biochem. Molec. Biol., Wayne State Univ., Detroit, MI
09/22/06 Dept. Chemistry, Georgia State Univ., Atlanta, GA
10/19/06 Dept. Chemistry, Univ. Massachusetts, Amherst, MA
01/22/07 Dept. Chemistry, Central Michigan University, Mt. Pleasant, MI
07/16/07 13th Internat. Conf. Biol. Inorg. Chem., Vienna, Austria.
10/18/07 Chemistry-Biology Interface Program, Univ. Illinois, Urbana-Champaign, IL

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10/24/07 Dept. Biochem. & Biophysics, Texas A & M Univ., College Station, TX
07/29/09 14th Internat. Conf. Biol. Inorg. Chem., Nagoya, Japan
01/15/10 Dept. Chemistry, Wayne State University, Detroit, MI
01/29/10 Dept. Chem. & Biochem., Univ. Texas—Arlington, Arlington, TX
05/21/10 Annual Meeting of the Brazilian Society for Biochemistry and Molecular Biology, Iguassu Falls, Brazil
05/24/10 Instituto de Biociencias, Universidad Federal do Rio Grande do Sul, Porto Alegre, Brazil
09/10/10 Department of Chemistry, Marquette University, Milwaukee, WI
09/17/10 Dept. Chemisty and Biochemistry, Univ. South Carolina, Columbia, SC
12/16/10 International Chemical Congress of Pacific Basin Societies (PacifiChem), Honolulu, HI
03/14/11 Edward Teller Lectureship, Dept. Applied Science, UC-Davis, Davis, CA
08/11/11 15th International Conference on Biological Inorganic Chemistry, Vancouver, BC
09/07/11 Dept. Chemistry, University of Toronto, Toronto, ON
01/24/12 Metals in Biology, Gordon Research Conference, Ventura, CA
11/05/12 6th Asian Biol. Inorg. Chem. Conf., Hong Kong, China
11/12/12 Shanghai Jiao Tong Univ., Shanghai, China
02/26/13 Codexis, Redwood City, CA
03/26/13 Dept. Biological Chemistry, Univ. Michigan, Ann Arbor, MI
11/15/13 Dept. Chemistry, Georgia State Univ., Atlanta, GA
09/18/15 Dept. Chemistry, Univ. Iowa, Iowa City, Iowa
11/05/15 Dept. Med. & Biol. Chem., Univ. Toledo, Toledo, OH
03/11/16 Dept. Chemistry, Texas A&M, College Station, TX
06/15/16 Metallocofactors, Gordon Research Conference, Easton, MA
01/07/17 25th Enzymes Mechanism Conference, St. Pete Beach, FL
03/28/17 Kaiserslautern University, Kaiserslautern, Germany
07/23/17 70th Enzymes, Coenzymes, and Metabolic Pathways Gordon Research Conference, Waterville Valley, NH
09/29/17 Dept. Chemistry, Univ. Texas, San Antonio, TX
02/13/18 Dept. Chemistry, Johns Hopkins Univ., Baltimore, MD
06/08/18 37th Summer Symposium in Molecular Biology, Pennsylvania State Univ., State College, PA
09/10/18 Dept. Chemistry, North Carolina State Univ., Raleigh, NC
09/11/18 Dept. Chemistry, Univ. North Carolina, Chapel Hill, NC
02/27/19 Institute of Plant Biology, Braunschweig University of Technology, Braunschweig, Germany
04/05/19 Molecular and Cellular Biochemistry, Indiana Univ., Bloomington, IN
04/08/19 Center for Metalloenzyme Studies, Univ. Georgia, Athens, GA
07/23/19 Society for Industrial Microbiology & Biotechnology, Washington, DC
08/16/19 19th International Conference on Biological Inorganic Chemistry, Interlaken, Switzerland
09/27/19 Dept. Chemistry, Michigan Technological University, Houghton, MI
02/03/20 Dept. Chemistry, Western Michigan Univ., Kalamazoo, MI
07/06/20 Biometals 2020 Conference, Grenoble, France (virtual)
11/09/21 Dept. Biochemistry, Univ. California—Riverside, CA (virtual)
12/09/21 Dept. Chemistry & Biochemisty, Loyola Univ., Chicago, IL (virtual)
04/04/22 ASBMB Annual Meeting, Philadelphia, PA
06/17/22 Chemical Institute of Canada Conference, Calgary, Canada
08/13/22 Dept. Chemistry, Mississippi State University, Starkville, MS
06/21/23 Karplus symposium, Dept. Biochemistry & Biophysics, Oregon State Univ. (virtual)

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07/21/23 20th International Conference on Biological Inorganic Chemistry, Adelaide, Australia.
01/16/24 *Biometals* webinar; *doi: 10.52843/cassyni.rqvgn0*.
05/14/24 NOVA School of Science and Technology (FCT NOVA), Lisbon, Portugal
05/14/24 Instituto Superior Técnico of the Univ. Lisbon (IST UL), Lisbon, Portugal
05/18/24 14th Inorganic & Bioinorganic Chemistry Conference, Lisbon, Portugal

Patents

1. Hausinger, R. P. 1998. Nucleic acids encoding mutant urease, #5,783,436; 7/21/98.
2. Hausinger, R. P. 1998. Mutant urease and method of use for determination of urea, #5,783,752; 12/8/98.

Books Published

1. Hausinger, R. P. 1993. ***Biochemistry of Nickel***, 280 p. Plenum Publishing, New York.
2. Hausinger, R. P., G. L. Eichhorn, and L. G. Marzilli. 1996. ***Mechanisms of Metallocenter Assembly***, 267 p., Advances in Inorganic Biochemistry, Vol. 11, VCH Publishers, New York.
3. Schofield, C. J. and R. P. Hausinger (Eds.). 2015. ***2-Oxoglutarate-Dependent Oxygenases***, 487 p., RSC Publishing, Royal Society of Chemistry, Cambridge, U.K., ISBN 978-1-84973-950-4

Journal and Chapter Publications

1. Hogenkamp, H. P. C., N. A. Kohlmiller, R. P. Hausinger, T. E. Walker, and N. A. Matwiyoff. 1980. Interaction of cis-diamine diaquaplatinum(II) with adenosylcobalamins. ***J. Chem. Soc. Dalton*** 1668-1673.
2. Moura, I., B. H. Huynh, R. P. Hausinger, J. LeGall, A. V. Xavier, and E. Münck. 1980. Mössbauer and EPR studies of desulforedoxin from *Desulfovibrio gigas*. ***J. Biol. Chem***. 255:2493-2498.
3. Hausinger, R. P., and J. B. Howard. 1980. Comparison of the iron proteins from the nitrogen fixation complexes of *Azotobacter vinelandii*, *Clostridium pasteurianum*, and *Klebsiella pneumoniae*. ***Proc. Natl. Acad. Sci. USA*** 77:3826-3830. PMC349719.
4. Hausinger, R. P., and J. B. Howard. 1982. The amino acid sequence of the nitrogenase iron protein from *Azotobacter vinelandii*. ***J. Biol. Chem***. 257:2483-2490.
5. Hausinger, R. P., I. Moura, J. G. G. Moura, A. V. Xavier, M. H. Santos, J. LeGall, and J. B. Howard. 1982. Amino acid sequence of the 3Fe:3S ferredoxin from the "archaebacterium" *Methanosarcina barkeri* (DSM 800). ***J. Biol. Chem***. 2578:14192-14197.
6. Kojima, N., J. A. Fox, R. P. Hausinger, L. Daniels, W. H. Orme-Johnson, and C. Walsh. 1983. Paramagnetic centers in the nickel-containing deazaflavin-reducing hydrogenase from *Methanobacterium thermoautotrophicum*. ***Proc. Natl. Acad. Sci. USA*** 80:378-382. PMC393380.
7. Hausinger, R. P., and J. B. Howard. 1983. Thiol reactivity of the nitrogenase Fe-protein from *Azotobacter vinelandii*. ***J. Biol. Chem***. 258:13486-13492.
8. Hausinger, R. P., W. H. Orme-Johnson, and C. Walsh. 1984. Nickel tetrapyrrole cofactor F430: comparison of the forms bound to methyl coenzyme M reductase and protein free in cells of *Methanobacterium thermoautotrophicum* ΔH. ***Biochemistry*** 23:801-804.

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9. Lindahl, P., N. Kojima, R. P. Hausinger, J. A. Fox, B. K. Teo, C. Walsh, and W. H. Orme-Johnson. 1984. Nickel and iron EXAFS of the F_{420}-reducing hydrogenase from *Methanobacterium thermoautotrophicum*. ***J. Am. Chem. Soc***. 106:3062-3064.

10. Hausinger, R. P., W. H. Orme-Johnson, and C. Walsh. 1985. Factor 390 chromophores: phosphodiester between AMP or GMP and methanogen factor 420. ***Biochemistry*** 24:1629-1633.

11. Howard, J. B., T. L. Deits, G. L. Anderson, M. Maroney, L. Que, and R. P. Hausinger. 1985. Mechanism and structure of the nitrogenase Fe protein, pp. 153-162. *In* P. W. Ludden and J. E. Burris (eds.), ***Nitrogen fixation and CO_2 metabolism***. Elsevier, New York.

12. Hausinger, R. P., J. Honek, and C. Walsh. 1986. Separation of flavins and flavin analogs by HPLC. **Meth. Enzymol**. 122:199-209.

13. Hausinger, R. P. 1986. Purification of a nickel-containing urease from the rumen anaerobe *Selenomonas ruminantium.* ***J. Biol. Chem***. 261:7866-7870.

14. Hausinger, R. P. 1987. Nickel utilization by microorganisms. ***Microbiol. Rev***. 51:22-42. PMC373090.

15. Todd, M. J., and R. P. Hausinger. 1987. Purification and characterization of the nickel-containing multicomponent urease from *Klebsiella aerogenes*. ***J. Biol. Chem***. 262:5963-5967.

16. Gloss, L. M., and R. P. Hausinger. 1987. Reduction potential characterization of methanogen factor 390. ***FEMS Microbiol. Lett***. 48:143-145.

17. Frei, J. L., K. T. Cavanagh, R. A. Fisher, R. P. Hausinger, M. DuPuis, E. J. S. Rathke, and M. Z. Jones. 1988. Partial purification of goat kidney beta-mannosidase. ***Biochem. J***. 249:871-875. PMC1148787.

18. Brietenbach, J. M., and R. P. Hausinger. 1988. *Proteus mirabilis* urease. Partial purification and inhibition by boric acid and boronic acids. ***Biochem. J.*** 250:917-920. PMC1148943.

19. Simpson, D. A., R. P. Hausinger, and M. H. Mulks. 1988. Purification, characterization, and comparison of the IgA1 proteases of *Neisseria gonorrhoeae*. ***J. Bacteriol***. 170:1866-1873. PMC211043.

20. Wackett, L. P., J. F. Honek, T. P. Begley, S. L. Shames, E. C. Niederhoffer, R. P. Hausinger, W. H. Orme-Johnson, and C. T. Walsh. 1988. Methyl-S-coenzyme M reductase: a nickel-dependent enzyme catalyzing the terminal redox step in methane biogenesis, pp. 249-274. *In* J. R. Lancaster, Jr. (ed.), ***Bioinorganic chemistry of nickel***. VCH Publishers, Deerfield Beach, FL.

21. Mulrooney, S. B., M. J. Lynch, H. L. T. Mobley, and R. P. Hausinger. 1988. Purification, characterization, and genetic organization of recombinant *Providencia stuartii* urease expressed in *Escherichia coli.* ***J. Bacteriol***. 170:2202-2207. PMC211107.

22. Gloss, L. M., and R. P. Hausinger. 1988. Methanogen factor 390 formation: species distribution, reversibility, and effects of non-oxidative stress*.* ***BioFactors*** 1:237-240.

23. Mobley, H. L. T., and R. P. Hausinger. 1989. Microbial ureases: significance, regulation, and molecular characterization. ***Microbiol. Rev***. 53:85-108. PMC372718.

24. Mulrooney, S. B., H. S. Pankratz, and R. P. Hausinger. 1989. Regulation of gene expression and cellular localization of cloned *Klebsiella aerogenes* (*K. pneumoniae*) urease. ***J. Gen. Microbiol***. 135:1769-1776.

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25. Todd, M. J., and R. P. Hausinger. 1989. Competitive inhibitors of *Klebsiella aerogenes* urease. Mechanisms of interaction with the nickel active site. ***J. Biol. Chem***. 264:15835-15842.

26. Hausinger, R. P. 1990. Mechanisms of metal ion incorporation into metalloproteins. ***BioFactors*** 2:179-184.

27. Lee, M. H., S. B. Mulrooney, and R. P. Hausinger. 1990. Purification, characterization, and in vivo reconstitution of *Klebsiella aerogenes* urease apoenzyme. ***J. Bacteriol***. 172:4427-4431. PMC213271.

28. Mulrooney, S. B., and R. P. Hausinger. 1990. Sequence of the *Klebsiella aerogenes* urease genes and evidence for accessory proteins facilitating nickel incorporation. ***J. Bacteriol***. 172:5837-5843. PMC526901.

29. Todd, M. J., and R. P. Hausinger. 1991. Reactivity of the essential thiol of *Klebsiella aerogenes* urease. Effect of pH and ligands on thiol modification. ***J. Biol. Chem***. 266:10260-10267.

30. Todd, M. J., and R. P. Hausinger. 1991. Identification of the essential cysteine residue in *Klebsiella aerogenes* urease. ***J. Biol. Chem***. 266:24327-24331.

31. Hausinger, R. P. 1992. Biological utilization of nickel, 21-36. *In* Nieboer, E., and J. O. Nriagu (eds.), ***Nickel and Human Health: Current Perspectives***. John Wiley & Sons, New York.

32. McCoy, D. D., A. Cetin, and R. P. Hausinger. 1992. Characterization of urease from *Sporosarcina ureae*. ***Arch. Microbiol***. 157:411-416.

33. Lee, M. H., S. B. Mulrooney, M. J. Renner, Y. Markowicz, and R. P. Hausinger. 1992. Sequence of *ureD* and demonstration that four accessory genes (*ureD*, *ureE*, *ureF*, and *ureG*) are involved in nickel metallocenter biosynthesis. ***J. Bacteriol***. 174:4324-4330. PMC206216.

34. Jabri, E., M. H. Lee, R. P. Hausinger, and P. A. Karplus. 1992. Preliminary crystallographic studies of urease from jack bean and from *Klebsiella aerogenes*. ***J. Molec. Biol***. 227:934-937.

35. Martin, P. R., and R. P. Hausinger. 1992. Site-directed mutagenesis of the active site cysteine in *Klebsiella aerogenes* urease. ***J. Biol. Chem***. 267:20024-20027.

36. Park, I.-S., and R. P. Hausinger. 1993. Diethylpyrocarbonate reactivity of *Klebsiella aerogenes* urease: effect of pH and active site ligands on the rate of inactivation. ***J. Prot. Chem***. 12:51-56.

37. Day, E. P., J. Peterson, M. S. Sendova, M. J. Todd, and R. P. Hausinger. 1993. Saturation magnetization of ureases from *Klebsiella aerogenes* and jack bean: no evidence for coupling between the two active site nickel ions in the native enzyme. ***Inorg. Chem***. 32:634-638.

38. Fukumori, F., and R. P. Hausinger. 1993. *Alcaligenes eutrophus* JMP134 "2,4-dichlorophenoxyacetate monooxygenase" is an α-ketoglutarate-dependent dioxygenase. ***J. Bacteriol***. 175:2083-2086. PMC204309.

39. Park, I.-S., and R. P. Hausinger. 1993. Site-directed mutagenesis of *Klebsiella aerogenes* urease: identification of histidine residues that appear to function in nickel ligation, substrate binding, and catalysis. ***Protein Sci***. 2:1034-1041. PMC2142404.

40. Lee, M. H., H. S. Pankratz, S. Wang, R. A. Scott, M. G. Finnegan, M. K. Johnson, J. A. Ippolito, D. W. Christianson, and R. P. Hausinger. 1993. Purification and characterization

of *Klebsiella aerogenes* UreE protein: a nickel-binding protein that functions in urease metallocenter assembly. ***Protein Sci.*** 2:1042-1052. PMC2142396.

41. Fukumori, F., and R. P. Hausinger. 1993. Purification and characterization of 2,4-dichlorophenoxyacetate/α-ketoglutarate dioxygenase. ***J. Biol. Chem***. 268:24311-24317.

42. Wang, S., M. H. Lee, R. P. Hausinger, P. A. Clark, D. E. Wilcox, and R. A. Scott. 1994. Structure of the dinuclear active site of urease. X-ray absorption spectroscopy of native and 2-mercaptoethanol-inhibited bacterial and plant enzymes. ***Inorg. Chem***. 33:1589-1593.

43. Park, I.-S., M. B. Carr, and R. P. Hausinger. 1994. *In vitro* activation of urease apoprotein and role of UreD as a chaperone required for nickel metallocenter assembly. ***Proc. Natl. Acad. Sci. USA*** 91:3233-3237. PMC43550.

44. Romanov, V., and R. P. Hausinger. 1994. *Pseudomonas aeruginosa* 142 uses a three-component *ortho*-halobenzoate 1,2-dioxygenase for metabolism of 2,4-dichloro- and 2-chlorobenzoate. ***J. Bacteriol***. 176:3368-3374. PMC205509.

45. Hausinger, R. P. 1994. Nickel enzymes in microbes. ***Sci. Total Environ***. 148:157-166.

46. Kim, S. D., and R. P. Hausinger. 1994. Genetic organization of the recombinant *Bacillus pasteurii* urease genes expressed in *Escherichia coli*. ***J. Microbiol. Biotech***. 4:108-112.

47. Hausinger, R. P. 1994. Metalloregulation, 2220-2228. *In* R. B. King (ed.), ***Encyclopedia of Inorganic Chemistry***. Wiley, New York.

48. Park, I.-S., and R. P. Hausinger. 1995. Requirement of carbon dioxide for in vitro assembly of the urease nickel metallocenter. ***Science*** 267:1156-1158. PMC2142404.

49. Park, I.-S., and R. P. Hausinger. 1995. Evidence for the presence of urease apoprotein complexes containing UreD, UreF, and UreG in cells that are competent for in vivo enzyme activation. ***J. Bacteriol***. 177:1947-1951. PMC176834.

50. Hausinger, R. P., and F. Fukumori. 1995. Characterization of the first enzyme in 2,4-dichlorophenoxyacetic acid metabolism. ***Environ. Health Persp***. 103 (suppl. 5):37-39. PMC1519297.

51. Jabri, E., M. B. Carr, R. P. Hausinger, and P. A. Karplus. 1995. The crystal structure of urease from *Klebsiella aerogenes.* ***Science*** 268:998-1004.

52. Mobley, H. L. T., M. D. Island, and R. P. Hausinger. 1995. Molecular biology of microbial ureases. ***Microbiol. Rev***. 59:451-480. PMC239369.

53. Moncrief, M. B. C., L. G. Holm, E. Jabri, P. A. Karplus, and R. P. Hausinger. 1995. Urease activity in the crystalline state. ***Protein Sci***. 4:2234-2236. PMC2143000.

54. Hausinger, R. P. 1996. General principles and mechanisms of metallocenter assembly, 1-18. *In* Hausinger, R. P., G. L. Eichhorn, and L. G. Marzilli (eds.), ***Mechanisms of Metallocenter Assembly***, Advances in Inorganic Biochemistry. VCH Publishers, New York.

55. Moncrief, M. B. C., and R. P. Hausinger. 1996. Nickel incorporation into urease, 151-171. *In* Hausinger, R. P., G. L. Eichhorn, and L. G. Marzilli (eds.), ***Mechanisms of Metallocenter Assembly***, Advances in Inorganic Biochemistry. VCH Publishers, New York.

56. Park, I.-S., and R. P. Hausinger. 1996. Metal ion interactions with urease and UreD-urease apoproteins. ***Biochemistry*** 35:5345-5352.

57. Romanov, V., and R. P. Hausinger. 1996. NADPH-dependent reductive *ortho*-dehalogenation of 2,4-dichlorobenzoic acid in *Corynebacterium sepedonicum* KZ-4 and

coryneform bacterium strain NTB-1 via 2,4-dichlorobenzoyl coenzyme A. ***J. Bacteriol***. 178:2656-2661. PMC177992.

58. Suwa, Y., A. D. Wright, F. Fukumori, K. A. Nummy, R. P. Hausinger, W. E. Holben, and L. J. Forney. 1996. Characterization of a chromosomally encoded 2,4-dichlorophenoxyacetic acid (2,4-D)/α-ketoglutarate dioxygenase from *Burkholderia* sp. strain RASC. ***Appl. Environ. Microbiol***. 62:2464-2469. PMC168028.

59. Park, I.-S., L. O. Michel, M. A. Pearson, E. Jabri, P. A. Karplus, S. Wang, J. Dong, R. A. Scott, B. P. Koehler, M. K. Johnson, R. P. Hausinger. 1996. Characterization of the mononickel metallocenter in H134A mutant urease. ***J. Biol. Chem.*** 271:18632-18637.

60. Brayman, T G., and R. P. Hausinger. 1996. Purification, characterization, and functional analysis of a truncated *Klebsiella aerogenes* UreE urease accessory protein lacking the histidine-rich carboxyl terminus. ***J. Bacteriol***. 178:5410-5416. PMC178359.

61. Moncrief, M. B. C., and R. P. Hausinger. 1996. Purification and activation properties of UreD-UreF-urease apoprotein. ***J. Bacteriol***. 178:5417-5421. PMC178360.

62. Sassanella, T. M., F. Fukumori, M. Bagdasarian, and R. P. Hausinger. 1997. Use of 4-nitrophenoxyacetic acid for the detection and quantification of 2,4-dichlorophenoxyacetic acid (2,4-D)/α-ketoglutarate dioxygenase activity in 2,4-D-degrading microorganisms. ***Appl. Environ. Microbiol***. 63:1189-1191. PMC1389142.

63. Whiting, A. K., L. Que, Jr., R. E. Saari, R. P. Hausinger, M. A. Fredrick, and J. McCracken. 1997. Metal coordination environment of a Cu(II)-substituted α-keto acid-dependent dioxygenase that degrades the herbicide 2,4-D. ***J. Am. Chem. Soc***. 119:3413-3414.

64. Hogan, D. A., D. H. Buckley, C. H. Nakatsu, T. M. Schmidt, and R. P. Hausinger. 1997. Distribution of *tfdA* in soil isolates that do not degrade 2,4-dichlorophenoxyacetic acid (2,4-D). ***Microbial Ecol.*** 34:90-96.

65. Hausinger, R. P. 1997. Metallocenter assembly in nickel-containing enzymes. ***J. Biol. Inorg. Chem***. 2:279-286.

66. Moncrief, M. B. C., and R. P. Hausinger. 1997. Characterization of UreG, identification of a UreD-UreF-UreG complex, and evidence that a functional nucleotide-binding site in UreG may be required for *in vivo* metallocenter assembly in *Klebsiella aerogenes* urease. ***J. Bacteriol***. 179:4081-4086. PMC179225.

67. Pearson, M. A., L. O. Michel, R. P. Hausinger, and P. A. Karplus. 1997. Structures of Cys319 variants and acetohydroxamate-inhibited *Klebsiella aerogenes* urease. ***Biochemistry*** 36:8164-8172.

68. Taha, T. S. M., T. G. Brayman, P. A. Karplus, and R. P. Hausinger. 1997. Urease nickel metallocenter: structure and assembly, 391-413. *In* Winkelmann, G., and G. J. Carrano (eds.), ***Transition Metals in Microbial Metabolism***. Harwood Academic Publishers, Amsterdam.

69. Hausinger, R. P., F. Fukumori, D. A. Hogan, T. M. Sassanella, Y. Kamagata, H. Takami, and R. E. Saari. 1997. Biochemistry of 2,4-D degradation: evolutionary implications, 35-51. *In* Horikoshi, K., M. Fukuda, and T. Kudo (eds.), ***Microbial Diversity and Genetics of Biodegradation***. Japan Scientific Societies Press, Tokyo.

70. Nakatsu, C. H., F. Fukumori, R. R. Fulthorpe, R. P. Hausinger, W. E. Holben, Y. Kamagata, R. Korona, R. E. Lenski, O. V. Maltseva, V. Grace Matheson, C. McGowan, Y. Suwa, J. M. Tiedje, N. L. Tonso, E. M. Top, A. D. Wright, and L. J. Forney. 1997. Genetic diversity of 2,4-dichlorophenoxyacetic acid (2,4-D) catabolic genes, 197-206. *In* Horikoshi, K., M. Fukuda, and T. Kudo (eds.), ***Microbial Diversity and Genetics of Biodegradation***. Japan Scientific Societies Press, Tokyo.

Bayer EX1073
Bayer v. Corteva - IPR2023-01038

71. Karplus, P. A., M. Pearson, and R. P. Hausinger. 1997. 70 years of crystalline urease: what have we learned? ***Accts. Chem. Res***. 30:330-337.

72. Yamaguchi, K., and R. P. Hausinger. 1997. Substitution of the urease active site carbamate by dithiocarbamate and vanadate. ***Biochemistry*** 36:15118-15122.

73. Saari, R. E., and R. P. Hausinger. 1998. Ascorbic acid-dependent turnover and reactivation of 2,4-dichlorophenoxyacetic acid/α-ketoglutarate dioxygenase using thiophenoxyacetic acid. ***Biochemistry*** 37:3035-3042.

74. Colpas, G. J., T. G. Brayman, J. McCracken, M. A. Pressler, G. T. Babcock, L. J. Ming, C. M. Colangelo, R. A. Scott, and R. P. Hausinger. 1998. Spectroscopic characterization of metal binding by *Klebsiella aerogenes* UreE urease accessory protein. ***J. Biol. Inorg. Chem***. 3:150-160.

75. Pearson, M. A., R. A. Schaller, L. O. Michel, P. A. Karplus, and R. P. Hausinger. 1998. Chemical rescue of *Klebsiella aerogenes* urease variants lacking the carbamylated-lysine nickel ligand. ***Biochemistry*** 37:6214-6220.

76. Cosper, N. J., C. V. M. Stalhanske, R. E. Saari, R. P. Hausinger, and R. A. Scott. 1999. X-ray absorption spectroscopic analysis of Fe(II) and Cu(II) forms of an herbicide-degrading α-ketoglutarate dioxygenase*.* ***J. Biol. Inorg. Chem*.** 4:122-129.

77. Romanov, V., M. T. Merski, and R. P. Hausinger. 1999. Assays for allantoinase. ***Anal. Biochem***. 268:49-53.

78. Saari, R. E., D. A. Hogan, and R. P. Hausinger. 1999. Stereospecific degradation of the phenoxypropionate herbicide dichlorprop*.* ***J. Molec. Catalysis*** 6:421-428.

79. Colpas, G. J., T. G. Brayman, L.-J. Ming, and R. P. Hausinger. 1999 Identification of metal-binding residues in *Klebsiella aerogenes* urease nickel metallochaperone, UreE. ***Biochemistry*** 38:4078-4088.

80. Yamaguchi, K., N. J. Cosper, C. Stalhanske, R. A. Scott, M. A. Pearson, P. A. Karplus, and R. P. Hausinger. 1999. Characterization of metal-substituted *Klebsiella aerogenes* urease. ***J. Biol. Inorg. Chem***. 4:468-477.

81. Hogan, D. A., T. A. Auchtung, and R. P. Hausinger. 1999. Cloning and characterization of a sulfonate/α-ketoglutarate dioxygenase from *Saccharomyces cerevisiae*. ***J. Bacteriol***. 181:5876-5879. PMC94115.

82. Soriano, A., and R. P. Hausinger. 1999. GTP-dependent activation of urease apoprotein in complex with the UreD, UreF, and UreG accessory proteins. ***Proc. Natl. Acad. Sci. USA*** 96:11140-11144. PMC18000.

83. Ryle, M. J., R. Padmakumar, and R. P. Hausinger. 1999. Stopped-flow kinetic analysis of *Escherichia coli* taurine/α-ketoglutarate dioxygenase: interactions with α-ketoglutarate, taurine, and oxygen. ***Biochemistry*** 38:15278-15286.

84. Hegg, E. L., A. K. Whiting, R. E. Saari, J. McCracken, R. P. Hausinger, and L. Que, Jr. 1999. The herbicide-degrading α-keto acid-dependent enzyme TfdA: metal coordination environment and mechanistic insights. ***Biochemistry*** 38:16714-16726.

85. Hausinger, R. P., and P. A. Karplus. 1999. Use of urea-based fertilizers to stimulate plant growth. **NRI Research Highlights**. U. S. Dept. Agric.

86. Todd, M. J., and R. P. Hausinger. 2000. Fluoride inhibition of *Klebsiella aerogenes* urease: mechanistic implications of a pseudo-uncompetitive, slow-binding inhibitor. ***Biochemistry*** 39:5389-5396.

Bayer EX1073
Bayer v. Corteva - IPR2023-01038

87. Colpas, G. J., and R. P. Hausinger. 2000. *In vivo* and *in vitro* kinetics of metal transfer by the *Klebsiella aerogenes* urease nickel metallochaperone, UreE. ***J. Biol. Chem***. 275:10731-10737.

88. Hogan, D. A., S. Smith, E. Saari, J. McCracken, and R. P. Hausinger. 2000. Site-directed mutagenesis of 2,4-dichlorophenoxyacetic acid/α-ketoglutarate dioxygenase. Identification of residues involved in metallocenter formation and substrate binding. ***J. Biol. Chem***. 275:12400-12409.

89. Pearson, M. A., I.-S. Park, R. A. Schaller, L. O. Michel, P. A. Karplus, and R. P. Hausinger. 2000. Kinetic and structural characterization of urease active site variants. ***Biochemistry*** 39:8575-8584.

90. Soriano, A., G. J. Colpas, R. P. Hausinger. 2000. UreE stimulation of GTP-dependent urease activation in the UreD-UreF-UreG-urease apoprotein complex. ***Biochemistry*** 39:12435-12440.

91. Hausinger, R. P., and P. A. Karplus. 2001. Urease, p. 867-879. *In* Wieghardt, K., R. Huber, T. L. Poulos, and A. Messerschmidt (Eds.), ***Handbook of Metalloproteins***. John Wiley & Sons, Ltd.

92. Hausinger, R. P., G. J. Colpas, and A. Soriano. 2001. Urease: a paradigm for protein-assisted metallocenter assembly. ***ASM News*** 67:78-84.

93. Dunning Hotopp, J. C., and R. P. Hausinger. 2001. Alternative substrates for 2,4-dichlorophenoxyacetate hydroxylase. ***J. Molec. Catalysis*** 15:155-163.

94. Ho, R. Y. N., M. P. Mehn, E. L. Hegg, A. Liu, M. J. Ryle, R. P. Hausinger, and L. Que, Jr. 2001. Resonance Raman studies of the iron(II)-α-keto acid chromophore in model and enzyme complexes. ***J. Am. Chem. Soc***. 123:5022-5029.

95. Liu, A., R. Y. N. Ho, L. Que, Jr., M J. Ryle, B. S. Phinney, and R. P. Hausinger. 2001. Alternative reactivity of an α-ketoglutarate-dependent iron(II) oxygenase: enzyme self-hydroxylation. ***J. Am Chem. Soc***. 123:5126-5127.

96. Mulrooney, S. B., T. Zakharian, R. A. Schaller, and R. P. Hausinger. 2001. Dual effects of ionic strength on *Klebsiella aerogenes* urease: pH dependent activation and inhibition. ***Arch. Biochem. Biophys***. 394:280-282.

97. Song, H. K., S. B. Mulrooney, R. Huber, and R. P. Hausinger. 2001. Crystal structure of *Klebsiella aerogenes* UreE, a nickel-binding metallochaperone for urease activation. ***J. Biol. Chem***. 276:49359-49364. **Recommended by Faculty of 1000**.

98. Blakeley, R. L., W. E. Cooley, R. P. Hausinger. 2002. Nickel. *In* ***Encyclopedia of Science & Technology***, 9th Edition, McGraw-Hill, Inc. 11:730-734.

99. Ryle, M. J., and R. P. Hausinger. 2002. Non-heme iron oxygenases. ***Curr. Opin. Chem. Biol***. 6:193-201.

100. Elkins, J. M., M. J. Ryle, I. J. Clifton, J. S. Lloyd, J. C. Dunning Hotopp, N. I. Burzlaff, J. E. Baldwin, R. P. Hausinger, and P. L. Roach. 2002. X-ray crystal structure of *Escherichia coli* taurine/α-ketoglutarate dioxygenase complexed to ferrous iron and substrates. ***Biochemistry*** 41:5185-5192.

101. Itoh, K., R. Kanda, Y. Sumita, H. Kim, Y. Kamagata, K. Suyama, H. Yamamoto, R. P. Hausinger, and J. M. Tiedje. 2002. *tfdA*-like genes in 2,4-D-degrading bacteria belonging to the *Bradyrhizobium-Agromonas-Nitrobacter-Afipia* cluster in α-*Proteobacteria*. ***Appl. Environ. Microbiol***. 68:3449-3454. PMC126798.

Bayer EX1073
Bayer v. Corteva - IPR2023-01038

102. Dunning Hotopp, J. C., and R. P. Hausinger. 2002. Probing the 2,4-dichlorophenoxyacetate/α-ketoglutarate dioxygenase substrate binding site by site-directed mutagenesis and mechanism-based inactivation. ***Biochemistry*** 41:9787-9794.

103. Trewick, S. C., T. F. Henshaw, R. P. Hausinger, T. Lindahl, and B. Sedgwick. 2002. Oxidative demethylation by *Escherichia coli* AlkB directly reverts DNA base damage. ***Nature*** 419:174-178. **Recommended by Faculty of 1000**.

104. Dunning Hotopp, J. C., T. A. Auchtung, D. A. Hogan, and R. P. Hausinger. 2003. Intrinsic tryptophan fluorescence as a probe of metal and α-ketoglutarate binding to TfdA, a mononuclear non-heme iron oxygenase. ***J. Inorg. Biochem***. 93:66-70.

105. Mulrooney, S. B., and R. P. Hausinger. 2003. Metal ion dependence of recombinant *Escherichia coli* allantoinase. ***J. Bacteriol***., 185:126-134. PMC141845.

106. Ryle, M. J., A. Liu, R. B. Muthukumaran, R. Y. N. Ho, K. D. Koehntop, J. McCracken, L. Que, Jr., and R. P. Hausinger. 2003. O_2- and α-ketoglutarate-dependent tyrosyl radical formation in TauD, an α-keto acid-dependent non-heme iron dioxygenase. ***Biochemistry*** 42:1854-1862.

107. Mulrooney, S. B., and R. P. Hausinger. 2003. Nickel uptake and utilization by microorganisms. ***FEMS Microbiol. Rev***. 27:239-261.

108. Ryle, M. J., K. D. Koehntop, A. Liu, L. Que, Jr., and R. P. Hausinger. 2003. Interconversion of two oxidized forms of taurine/α-ketoglutarate dioxygenase, a non-heme iron hydroxylase: evidence for bicarbonate binding. ***Proc. Natl. Acad. Sci. USA*** 100:3790-3795. PMC153000.

109. Hausinger, R. P. 2003. Ni and CO: more surprises. ***Nature Struct. Biol*.** 10:234-236.

110. Kuchar, J., and R. P. Hausinger. 2004. Biosynthesis of Metal Sites. ***Chem. Rev***. 104:509-526.

111. Henshaw, T. F., M. Feig, and R. P. Hausinger. 2004. Aberrant activity of the DNA repair enzyme AlkB. ***J. Inorg. Biochem****.* 98:856-861.

112. Proshlyakov, D. A., T. F. Henshaw, G. R. Monterosso, M. J. Ryle, and R. P. Hausinger. 2004. Direct detection of oxygen intermediates in the non-heme Fe enzyme taurine/α-ketoglutarate dioxygenase. ***J. Am. Chem. Soc****.* 126:1022-1023. **Recommended by Faculty of 1000**.

113. Hausinger, R. P. 2004. Fe(II)/α-ketoglutarate-dependent hydroxylases and related enzymes. ***Crit. Rev. Biochem. Molec. Biol****.* 39:21-68.

114. Chang, Z., J. Kuchar, and R. P. Hausinger. 2004. Chemical cross-linking and mass spectrometric identification of sites of interaction for UreD, UreF, and urease. ***J. Biol. Chem***. 279:15305-15313.

115. Hausinger, R. P. 2004. Metabolic versatility of prokaryotes for urea decomposition. ***J. Bacteriol****.* 186:2520-2522. PMC387778.

116. Mulrooney, S. B., and R. P. Hausinger. 2005. Metallocenter biosynthesis and assembly. ***Encyclopedia of Inorganic Chemistry***, 2nd Edition. R. B. King, Ed., John Wiley & Sons, Chichester, UK, pp.3144-3152.

117. Grzyska, P. K., M. J. Ryle, G. R. Monterosso, J. Liu, D. P. Ballou, and R. P. Hausinger. 2005. Steady-state and transient kinetic analyses of taurine/α-ketoglutarate dioxygenase: effects of oxygen concentration, alternative sulfonates, and active site variants on the Fe(IV)-oxo intermediate. ***Biochemistry*** 44:3845-3855.

Bayer EX1073
Bayer v. Corteva - IPR2023-01038

118. Mulrooney, S. B., S. K. Ward, and R. P. Hausinger. 2005. Purification and properties of the *Klebsiella aerogenes* UreE metal-binding domain, a functional metallochaperone of urease. ***J. Bacteriol***. 187:3581-3585. PMC1112008.

119. Kim, J. K., S. B. Mulrooney, and R. P. Hausinger. 2005. Biosynthesis of active *Bacillus subtilis* urease in the absence of known urease accessory proteins. ***J. Bacteriol***. 187: 7150-7154. PMC1251626.

120. Kalliri, E., P. K. Grzyska, and R. P. Hausinger. 2005. Kinetic and spectroscopic investigation of Co^{II}, Ni^{II}, and *N*-oxalylglycine inhibition of the Fe^{II}/α-ketoglutarate dioxygenase, TauD. ***Biochem. Biophys. Res. Commun.*** 338:191-197.

121. Rohankhedkar, M., S. B. Mulrooney, W. J. Wedemeyer, and R. P. Hausinger. 2006. The AidB component of the *Escherichia coli* adaptive response to alkylating agents is a flavin-containing, DNA-binding protein. ***J. Bacteriol***. 188:223-230. PMC1317588.

122. Koehntop, K. D., S. Marimanikkuppam, M. J. Ryle, R. P. Hausinger, and L. Que, Jr. 2006. Self-hydroxylation of taurine/α-ketoglutarate dioxygenase. Evidence for more than one oxygen activation mechanism. ***J. Biol. Inorg. Chem***. 11:63-72.

123. Zhang, L., S. B. Mulrooney, A. F. K. Leung, Y. Zeng, B. B. C. Ko, R. P. Hausinger, and H. Sun. 2006. Inhibition of urease by bismuth(III): Implications for the mechanism of action of bismuth drugs. ***BioMetals*** 19:503-511.

124. Luo, L., M. B. Pappalardi, P. J. Tummino, R. A. Copeland, M. E. Fraser, P. K. Grzyska, and R. P. Hausinger. 2006. An assay for Fe(II)/2-oxoglutarate-dependent dioxygenases by enzyme-coupled detection of succinate formation. ***Anal. Biochem***. 353:69-74.

125. Müller, T. A., M. I. Zavodszky, M. Feig, L. A. Kuhn, and R. P. Hausinger. 2006. Structural basis for the enantiospecificities of R- and S-specific phenoxypropionate/α-ketoglutarate dioxygenases. ***Protein Sci***. 15:1356-1368. PMC2242530.

126. Kim, J. K., S. B. Mulrooney, and R. P. Hausinger. 2006. The UreEF fusion protein provides a soluble and functional form of the UreE urease accessory protein. ***J. Bacteriol***. 188:8413-8420. PMC1698248.

127. Hausinger, R. P. 2007. New insights into acetone metabolism. ***J. Bacteriol***. 189:671-673. PMC1797323.

128. Quiroz, S., J. K. Kim, S. B. Mulrooney, and R. P. Hausinger. 2007. Chaperones of nickel metabolism. *In* ***Nickel and Its Surprising Impact in Nature***, Vol. 2 of Metal Ions in Life Sciences (ed. Sigel, A, H. Sigel, R. K. O. Sigel) John Wiley & Sons, Ltd., Chichester, UK, pp. 519-544.

129. Hausinger, R. P. and D. B. Zamble. 2007. Microbial physiology of nickel and cobalt. *In* ***Molecular Microbiology of Heavy Metals*** (ed. Nies, D. H. and S. Silver) Springer, Heidelberg, Germany, pp. 287-320.

130. Hausinger, R. P., and A. T. Phillips. 2007. Enzyme activity. *In* ***Methods in General and Molecular Microbiology*** (ed. C. A. Reddy), American Society for Microbiology, Washington, DC, pp. 504-526.

131. Montero-Morán, G. M., M. Li, E. Rendòn-Huerta, F. Jourdan, D. J. Lowe, A. W. Stumpff-Kane, M. Feig, C. Scazzocchio, and R. P. Hausinger. 2007. Purification and characterization of the Fe^{II}- and α-ketoglutarate-dependent xanthine hydroxylase from *Aspergillus nidulans*. ***Biochemistry*** 46:5293-5304. PMC2525507.

132. Yu, Z., P.-A. Genest, B. ter Riet, K. Sweeney, C. DiPaolo, R. Kieft, E. Christodoulou, A. Perrakis, J. M. Simmons, R. P. Hausinger, H. G. A. M. van Luenen, D. J. Rigden, R. Sabatini, and P. Borst. 2007. The protein that binds to DNA base J in trypanosomatids has features of a thymidine hydroxylase. ***Nucl. Acids Res***. 35:2107-2115. PMC1874643.

Bayer EX1073
Bayer v. Corteva - IPR2023-01038

133. Grzyska, P. K., T. A. Müller, M. G. Campbell, and R. P. Hausinger. 2007. Metal ligand substitution and evidence for quinone formation in taurine/α-ketoglutarate dioxygenase. ***J. Inorg. Biochem****.* 101:797-808.

134. Muthukumaran, R. B., P. K. Grzyska, R. P. Hausinger, and J. McCracken. 2007. Probing the Fe-substrate orientation for taurine/α-ketoglutarate dioxygenase using deuterium ESEEM spectroscopy. ***Biochemistry*** 46:5951-5959.

135. Grossoehme, N. E., S. B. Mulrooney, R. P. Hausinger, and D. E. Wilcox. 2007. Thermodynamics of Ni^{2+}, Cu^{2+}, and Zn^{2+} binding to the urease metallochaperone UreE. ***Biochemistry*** 46:10506-10516.

136. Grzyska, P. K., and R. P. Hausinger. 2007. Cr^{II} reactivity of taurine/α-ketoglutarate dioxygenase. ***Inorg. Chem****.* 46:10087-10092. PMC2596585.

137. Li, M., T. A. Müller, B. A. Fraser, and R. P. Hausinger. 2008. Characterization of active site variants of xanthine hydroxylase from *Aspergillus nidulans*. ***Arch. Biochem. Biophys.*** 470:44-53. PMC2258140.

138. Kalliri, E., S. B. Mulrooney, and R. P. Hausinger. 2008. Identification of *Escherichia coli* YgaF as L-2-hydroxylglutarate oxidase. ***J. Bacteriol****.* 190:3793-3798. PMC2395033.

139. Simmons, J. M., T. A. Müller, and R. P. Hausinger. 2008. Fe^{II}/α-ketoglutarate hydroxylases involved in nucleobase, nucleoside, nucleotide, and chromatin metabolism. ***Dalton Trans***. 5132-5142. PMC2907160.

140. Quiroz-Valenzuela, S., S. C. K. Sukuru, R. P. Hausinger, L. A. Kuhn, and W. T. Heller. 2008. The structure of urease activation complexes examined by flexibility analysis, mutagenesis, and small-angle x-ray scattering. ***Arch. Biochem. Biophys***. 480:51-57. PMC2614477.

141. Carter, E. L., N. Flugga, J. L. Boer, S. B. Mulrooney, and R. P. Hausinger. 2009. Interplay of metal ions and urease. ***Metallomics*** 1:207-221. PMC2745169.

142. Grzyska, P. K., R. P. Hausinger, and D. A. Proshlyakov. 2010. Metal and substrate binding to an Fe(II) dioxygenase resolved by UV spectroscopy with global regression analysis. ***Anal. Biochem***. 399:64-71. PMC2823959. *doi: 10.1016/j.ab.2009.11.022*,

143. Simmons, J. M., D. J. Koslowsky, and R. P. Hausinger. 2010. *Trypanosoma brucei brucei*: Thymine 7-hydroxylase-like proteins. ***Exp. Parasitol***. 124:453-458. PMC2824036. *doi: 10.1016/j.exppara.2009.11.012*.

144. Müller, T. A., K. Meek, and R. P. Hausinger. 2010. Human AlkB homologue 1 (ABH1) exhibits DNA lyase activity at abasic sites. ***DNA Repair*** 9:58-65. PMC2818486. *doi: 10.1016/j.dnarep.2009.10.011*.

145. Grzyska, P. K., E. H. Appelman, R. P. Hausinger, and D. A. Proshlyakov. 2010. Insight into the mechanism of an iron dioxygenase by resolution of steps following the Fe(IV)=O species. ***Proc. Natl. Acad. Sci. USA*** 107:3982-3987. PMC2840172. *doi: 10.1073/pnas.0911565107*.

146. Carter, E. L., and R. P. Hausinger. 2010. Characterization of *Klebsiella aerogenes* urease accessory protein UreD in fusion with the maltose binding protein. ***J. Bacteriol***. 192:2294-2304. PMC2863474. *doi: 10.1128/JB.01426-09*.

147. Boer, J. L., S. Quiroz-Valenzuela, K. L. Anderson, and R. P. Hausinger. 2010. Mutagenesis of *Klebsiella aerogenes* UreG to probe nickel binding and interactions with other urease-related proteins. ***Biochemistry*** 49:4859-4869. PMC 2912431. *doi: 10.1012/bi1004987*.

Bayer EX1073
Bayer v. Corteva - IPR2023-01038

148. Lam, R., V. Romanov, K. Johns, K. Battaile, J. Wu-Brown, J. L. Guthrie, R. P. Hausinger, E. Pai, and N. Y. Chirgadze. 2010. Structure of a truncated urease accessory protein UreF from *Helicobacter pylori*. ***Proteins*** 78:2839-2848. PMC2978904. *doi: 10.1002/prot.22802*.

149. Masukawa, H., K. Inoue, H. Sakurai, C. P. Wolk, and R. P. Hausinger. 2010. Site-directed mutagenesis of *Anabaena* sp. PCC 7120 nitrogenase active site to increase photobiological hydrogen production. ***Appl. Environ. Microbiol***. 76:6741-6750. PMC2953041. *doi: 10.1128/AEM.01056-10*.

150. Proshlyakov, D. A., and R. P. Hausinger. 2011. Transient iron species in the catalytic mechanism of the archetypal α-ketoglutarate-dependent dioxygenase, TauD. *In* ***Iron-Containing Enzymes: Versatile Catalysts of Hydroxylation Reactions in Nature*** (Eds., de Visser, S. and D. Kumar). Royal Society of Chemistry, Cambridge, U.K., pp. 67-87.

151. Mulrooney, S. B., M. J. Howard, and R. P. Hausinger. 2011. The *Escherichia coli* alkylation response protein AidB is a redox partner of flavodoxin and binds RNA and acyl carrier protein. ***Arch. Biochem. Biophys***. 513:81-86. PMC3166795. *doi: 10.1016/j.abb.2011.07.004*.

152. Carter, E. L., D. E. Tronrud, S. R. Taber, P. A. Karplus, and R. P. Hausinger. 2011. Iron-containing urease in a pathogenic bacterium. ***Proc. Natl. Acad. Sci. USA*** 108:13095-13099. PMC3156221. *doi: 10.1073/pnas.1106915108*, **Recommended by Faculty of 1000**.

153. Macomber, L, and R. P. Hausinger. 2011. Mechanisms of nickel toxicity in microorganisms. ***Metallomics*** 3:1153-1162. PMC4130172. *doi: 10.1039/c1mt00063b*.

154. Carter, E. L., J. L. Boer, M. A. Farrugia, N. Flugga, C. L. Towns, and R. P. Hausinger. 2011. Function of UreB in *Klebsiella aerogenes* urease. ***Biochemistry*** 50:9296-9308. PMC3202645. *doi: 10.1021/bi2011064*.

155. Macomber, L., S. P. Elsey, and R. P. Hausinger. 2011. Fructose-1,6-bisphosphate aldolase (class II) is the primary site of nickel toxicity in *Escherichia coli*. ***Mol. Microbiol***. 82:1291-1300. PMC3225726. *doi: 10.1111/j.1365-2958.2011.07891.x*.

156. Carter, E. L., D. A. Proshlyakov, and R. P. Hausinger. 2012. Apoprotein isolation and activation, and vibrational structure of the *Helicobacter mustelae* iron urease. ***J. Inorg. Biochem***. 111:195-202. PM C3314087. *doi: 10.1016/j.jinorgbio.2011.10.016*.

157. Boer, J. L., and R. P. Hausinger. 2012. *Klebsiella aerogenes* UreF: Identification of the UreG binding site and role in enhancing fidelity of urease activation. ***Biochemistry*** 51:2298-2308. PMC3314087. *doi: 10.1021/bi3000897*.

158. Simmons, J. M., D. J. Koslowsky, and R. P. Hausinger. 2012. Characterization of a *Trypanosoma brucei* AlkB homolog capable of repairing alkylated DNA. ***Exp.Parasitol***. 131:92-100. PMC3340446. *doi: 10.1016/j.exppara.2012.03.011*.

159. Masukawa, H., M. Kitashima, K. Inoue, H. Sakurai, and R. P. Hausinger. 2012. Genetic engineering of cyanobacteria to enhance biohydrogen production from sunlight and water. ***AMBIO*** 41 (Supp. 2):169-173. PMC3357757. *doi: 10.1007/s13280-012-0275-4*.

160. Boer, J. L., and R. P. Hausinger. 2013. Ni-binding sites in proteins. *In* ***Encyclopedia of Metalloproteins*** (Ed. Kretsinger, R. H., E. A. Permyakov, and V. N. Uversky), Springer, New York, NY, pp. 1528-1534.

161. Mulrooney, S. B., and R. P. Hausinger. 2013. Metallocenter biosynthesis and assembly. *In* ***Encyclopedia of Inorganic and Biological Chemistry*** (Ed. Scott, R. A.), John Wiley & Sons, Ltd, West Sussex, UK.

Bayer EX1073
Bayer v. Corteva - IPR2023-01038

162. Farrugia, M. A., L. Macomber, and R. P. Hausinger. 2013. Biosynthesis of the urease metallocenter. ***J. Biol. Chem***. 288:13178-13185. PMC3650357. *doi: 10.1074/jbc.R112.446526*.

163. Müller, T. A., M. M. Andrzejak, and R. P. Hausinger. 2013. A covalent protein-DNA 5'-product adduct is generated following AP-lyase activity of human AlkB homolog 1 (ALKBH1). ***Biochem. J.*** 452:509-518. PMC4126167. *doi: 10.1042/BJ20121908*.

164. Farrugia, M. A., L. Han, Y. Zhong, J. L. Boer, B. T. Ruotolo, and R. P. Hausinger. 2013. Analysis of a soluble $(UreD:UreF:UreG)_2$ accessory protein complex and its interactions with *Klebsiella aerogenes* urease by mass spectrometry. ***J. Am Soc. Mass Spectrom***. 24:1328-1337. PMC3788043. *doi: 10.1007/s13361-013-0677-y*.

165. Müller, T. A., K. Yu, R. P. Hausinger, and K. D. Meek. 2013. ALKBH1 is dispensable for abasic site cleavage during base excision repair and class switch recombination. ***PLoS One*** 8:e67403. PMC3692455. *doi: 10.1371/journal.pone.0067403*.

166. Casey, T. M., P. K. Grzyska, R. P. Hausinger, and J. McCracken. 2013. Measuring the orientation of taurine in the active site of the non-heme Fe(II)/α-ketoglutarate dependent taurine hydroxylase (TauD) using electron spin echo envelope modulation (ESEEM) spectroscopy. ***J. Phys. Chem. B*** 117:10384-10394. PMC3854568. *doi: 10.1021/jp404743d*.

167. Boer, J. L., Scott B. Mulrooney, and R. P. Hausinger. 2014. Nickel-dependent metalloenzymes. ***Arch. Biochem. Biophys***. 544:142-152. PMC3946514. *doi: 10.1016/j.abb.2013.09.002*.

168. Masukawa, H., H. Sakurai, R. P. Hausinger, and K. Inoue. 2014. Sustained photobiological hydrogen production in the presence of N_2 by nitrogenase mutants of the heterocyst-forming cyanobacterium *Anabaena*. ***Int. J. Hydrogen Energy.*** 39:19444-19451. *doi: 10.1016/j.ijhydene.2014.09.090*.

169. Yu, H., R. P. Hausinger, H.-Z. Tang, and P. Xu. 2014. Mechanism of the 6-hydroxy-3-succinoyl-pyridine 3-monooxygenase flavoprotein from *Pseudomonas putida* S16. ***J. Biol. Chem.*** 289:29158-29170. PMC4200269. *doi: 10.1074/jbc.M114.558049*.

170. Silvestrov, P., T. A. Müller, K. N. Clark, R. P. Hausinger, and G. A. Cisneros. 2014. Homology modeling, molecular dynamics, and site-directed mutagenesis study of AlkB human homolog 1 (ALKBH1). ***J. Molec. Graph. Mod.*** 54:123-130. PMC4268226. *doi: 10.1016/j.jmgm.2014.10.013*.

171. Macomber, L., M. S. Minkara, R. P. Hausinger, and K. M. Merz, Jr. 2015. Reduction of urease activity by interaction with the flap covering the active site. ***J. Chem. Inf. & Model.*** 55:354-361. PMC4491936. *doi: 10.1021/ci5005621*.

172. Hausinger, R. P. 2015. Biochemical diversity of 2-oxoglutarate-dependent oxygenases. *In* ***2-Oxoglutarate-Dependent Oxygenases*** (Eds. Schofield, C. J., and R. P. Hausinger), RSC Publishing, Royal Society of Chemisty, Cambridge, U.K., pp.1-58.

173. Müller, T. A., and R. P. Hausinger. 2015. AlkB catalyzed DNA/RNA repair and related topics. *In* ***2-Oxoglutarate-Dependent Oxygenases*** (Eds. Schofield, C. J., and R. P. Hausinger), RSC Publishing, Royal Society of Chemisty, Cambridge, U.K., pp.246-262.

174. Henderson, K. L., T. A. Müller, R. P. Hausinger, and J. P. Emerson. 2015. Calorimetric assessment of Fe^{2+} binding to α-ketoglutarate/taurine dioxygenase: Ironing out the energetics of metal coordination by the 2-His-1-carboxylate facial triad. ***Inorg. Chem***. 54:2278-2283. P MC5453723.*doi: 10.1021/ic502881q*.

175. Desguin, B., T. Zhang, P. Soumillion, P. Hols, J. Hu, and R. P. Hausinger. 2015. A tethered organometallic pincer complex with a nickel-carbon bond in lactate racemase.

Bayer EX1073
Bayer v. Corteva - IPR2023-01038

Science 349:66-69. PMID 21638974. *doi: 10.1126/science.aab2272*, **Recommended by Faculty of 1000**.

176. Martinez, S., and R. P. Hausinger. 2015. Catalytic mechanisms of Fe(II)- and 2-oxoglutarate-dependent oxygenases. ***J. Biol. Chem.*** 290:20702-20711. PMC4543632. *doi: 10.1074/jbc.R115.648691*.

177. Farrugia, M. A., B. Wang, M. Feig, and R. P. Hausinger. 2015. Mutational and computational evidence that a nickel-transfer tunnel in UreD is used for activation of *Klebsiella aerogenes* urease. ***Biochemistry*** 54:6392-6401. PMC5453724. *doi: 10.1021/acs.biochem.5b00942*.

178. Macomber, L., and R. P. Hausinger. 2016. Nickel toxicity, regulation, and resistance in bacteria. *In* ***Stress and Environmental Regulation of Gene Expression and Adaptation in Bacteria*** (Ed. De Bruijn, F. J.), Wiley-Blackwell Publishers, Hoboken, NJ, pp. 1133-1144.

179. Desguin, B., P. Soumillion, P. Hols, and R. P. Hausinger. 2016. Nickel-pincer cofactor biosynthesis involves LarB-catalyzed pyridinium carboxylation and LarE-dependent sacrificial sulfur insertion. ***Proc. Natl. Acad. Sci. USA*** 113:5598-5603. PMC4878509. *doi: 10.1073/pnas.1600486113*, **Recommended by Faculty of 1000**.

180. Martinez, S., and R. P. Hausinger. 2016. Biochemical and spectroscopic characterization of the non-heme Fe(II)- and 2-oxoglutarate-dependent ethylene-forming enzyme from *Pseudomonas syringae* pv. *phasiolicola* PK2. ***Biochemistry*** 55:5989-5999. PMC5444383. *doi: 10.1021/acs.biochem.6b00890*.

181. Desguin, B., P. Soumillion, P. Hols, J. Hu, and R. P. Hausinger. 2017. Lactate racemase and its niacin-derived, covalently-tethered, nickel cofactor. *In* ***The Biological Chemistry of Nickel*** (Eds. Zamble, D., M. Rowinska-Zyrek, and H..Kozlowski), Royal Society of Chemistry, Cambridge, U.K., pp. 220-236.

182. Proshlyakov, D. A., J. McCracken, and R. P. Hausinger. 2017. Spectroscopic analyses of 2-oxoglutarate-dependent oxygenases: TauD as a case study. ***J. Biol. Inorg. Chem***. 22:367-379. PMC5352539. *doi: 10.1007/s00775-016-1406-3*.

183. Martin-Diaconescu, V., C. Joseph, J. L. Boer, S. B. Mulrooney, R. P. Hausinger, and M. J. Maroney. 2017. Non-thiolate ligation of nickel by nucleotide-free UreG of *Klebsiella aerogenes*. ***J. Biol. Inorg. Chem***., 22:497-503. PMC5444947. *doi: 10.1007/s00775-016-1429-9*.

184. Masukawa, H; H. Sakurai, R. P. Hausinger, K. Inoue. 2017. Increased heterocyst frequency by *patN* disruption in *Anabaena* leads to enhanced photobiological hydrogen production at high light intensity and high cell density. ***Appl. Microbiol. Biotechnol***. 101:2177-2188. PMID 28064366. *doi: 10.1007/s00253-016-8078-3*.

185. Henderson, K. L., M. Li, S. Martinez, E. A. Lewis, R. P. Hausinger, and J. P. Emerson. 2017. Global stability of an α-ketoglutarate-dependent dioxygenase (TauD) and its related complexes. ***Biochim. Biophys. Acta*** 1861:987-994. PMC5453726. *doi: 10.1016/j.bbagen.2017.02.018*.

186. Walker, A. R., P. Silvestrov, T. A. Müller, R. H. Podolski, G. Dyson, R. P. Hausinger, and G. A. Cisneros. 2017. ALKBH7 variant related to prostate cancer exhibits altered substrate binding. ***PLoS Comput. Biol***. 13:e1005345. PMC5322872. *doi: 10.1371/journal.pcbi.1005345*.

187. Müller, T. A., M. Tobar, M. N. Perian, and R. P. Hausinger. 2017. Biochemical characterization of AP lyase and m^6A demethylase activities of human AlkB homologue 1 (ALKBH1). ***Biochemistry*** 56:1899-1910. PMC5444387. *doi: 10.1021/acs.biochem.7b00060*,

Bayer EX1073
Bayer v. Corteva - IPR2023-01038

188. Fellner, M., J. A. Rankin, J. Hu, and R. P. Hausinger. 2017. Lactate racemase. *In* ***Encyclopedia of Inorganic and Bioinorganic Chemistry*** (Ed. R. A. Scott), John Wiley & Sons, Ltd., Chichester, U.K., *doi: 10.1002/9781119951438.eibc2508*.

189. Hausinger, R. P. 2017. Urease activation. *In* ***Metalloprotein Active Site Assembly*** (Eds. Johnson, M. K., and R. A. Scott), Wiley & Sons, Ltd., West Sussex, U.K., pp. 251-260. *DOI: 10.1002/9781119951438.eibc2483*.

190. Martinez, S., M. Fellner, C. Q Herr, A. Ritchie, J. Hu, and R. P. Hausinger. 2017. Structures and mechanisms of the non-heme Fe(II)- and 2-oxoglutarate-dependent ethylene-forming enzyme: Substrate binding creates a twist. ***J. Am. Chem. Soc.***, 139:11980-11988. PMC5566630. *doi: 10.1021/jacs.7b06186*.

191. Fellner, M., B. Desguin, R. P. Hausinger, and J. Hu. 2017. Structural insights into the catalytic mechanism of a sacrificial sulfur insertase of the N-type ATP pyrophosphatase family, LarE. ***Proc. Natl. Acad. Sci. USA***, 114:9074-9079. PMC5576804. *doi: 10.1073/pnas.1704967114*.

192. Desguin, B., P. Soumillion, R. P. Hausinger, and P. Hols. 2017. Unexpected complexity in the lactate racemization system of lactic acid bacteria. ***FEMS Microbiol. Rev.***, 41:S71-S83. PMID 28830089. *doi: 10.1093/femsre/fux021*.

193. Müller, T. A., S. L. Struble, K. Meek, and R. P. Hausinger. 2018. Characterization of human AlkB homolog 1 produced in mammalian cells and demonstration of mitochondrial dysfunction in ALKBH1-deficient cells. ***Biochem. Biophys. Res. Commun.*** 495:98-103. PMC5576804. *doi: 10.1016/j.bbrc.2017.10.158*.

194. Rankin, J. A., R. C. Mauban, M. Fellner, B. Desguin, J. McCracken, J. Hu, S. A. Varganov, and R. P. Hausinger. 2018. Lactate racemase nickel-pincer cofactor operates by a proton-coupled hydride transfer mechanism. ***Biochemistry*** 57:3244-3251. Identified as being of special significance in its field by F1000. PMID 29489337. *doi: 10.1021/acs.biochem.8b00100*,

195. Eschweiler, J. D., M. A. Farrugia, S. M. Dixit, R. P. Hausinger, and B. T. Ruotolo. 2018. A structural model of the urease activation complex derived from ion mobility-mass spectrometry and integrative modeling. ***Structure*** 26:599-606. PMC5884726. *doi: 10.1016/j.str.2018.03.001*.

196. Herr, C. Q, and R. P. Hausinger. 2018. Amazing diversity in biochemical roles of Fe(II)/2-oxoglutarate oxygenases. ***Trends Biochem. Sci.*** 32:517-532. PMC6014900. *doi: 10.1016/j.tibs.2018.04.002*.

197. Li, M., K. L. Henderson, S. Martinez, R. P. Hausinger, and J. P. Emerson. 2018. The Irving-Williams series and the 2-His-1-carboxylate triad: A thermodynamic study of M^{n2+}, F^{e2+}, and C^{o2+} binding to taurine/α-ketoglutarate dioxygenase (TauD). ***J. Biol. Inorg. Chem.*** 23:785-793. PMC7063563. *doi: 10.1007/s00775-018-1574-4*.

198. Hausinger, R. P., B. Desguin, M. Fellner, J. A. Rankin, and J. Hu. 2018. Nickel pincer nucleotide cofactor. ***Curr. Opin. Chem. Biol.*** 47:18-23. PMC4878509. *doi: 10.1016/j.cbpa.2018.06.019*.

199. Desguin, B., M. Fellner, O. Riant, J. Hu, R. P. Hausinger, P. Hols, and P. Soumillion. 2018. Biosynthesis of the nickel-pincer nucleotide cofactor of lactate racemase requires a CTP-dependent cyclometallase. ***J. Biol. Chem.*** 293:12303-12317. PMC6093250. *doi: 10.1074/jbc.RA118.003741*.

200. Fellner, M., J. A. Rankin, B. Desguin, J. Hu, and R. P. Hausinger. 2018. Analysis of the active site cysteine residue of the sacrificial sulfur insertase LarE from *Lactobacillus plantarum*. ***Biochemistry*** 57:5513-5523. PMID 30157639. *doi: 10.1021/acs.biochem.8b00601*.

Bayer EX1073
Bayer v. Corteva - IPR2023-01038

201. Li, M., S. Martinez, R. P. Hausinger, and J. P. Emerson. 2018. Thermodynamics of iron(II) and substrate binding to the ethylene-forming enzyme. ***Biochemistry*** 57:5696-5705. PMC7199160. *doi: 10.1021/acs.biochem.8b00730*.

202. Fellner, M., R. P. Hausinger, and J. Hu. 2018. A structural perspective on the PP-loop ATP pyrophosphatase family. ***Crit. Rev. Biochem. Molec. Biol***. 53:607-622. PMID 30280944. *doi: 10.1080/10409238.2018.1516728*.

203. Hausinger, R. P., C. Q Herr, and J. Hu. 2019. Non-heme Fe(II)- and 2-oxoglutarate-dependent ethylene-forming enzyme. *In* ***Encyclopedia of Inorganic and Bioinorganic Chemistry*** (Ed. R. A. Scott), John Wiley & Sons, Ltd., Chichester, U.K., *doi: 10.1002/9781119951438.eibc2703*.

204. Hausinger, R. P. 2019. New metal cofactors and recent metallocofactor insights. ***Curr. Opin. Struct. Biol.*** 59:1-8. PMID 30711735. *doi: 10.1016/j.sbi.2018.12.008*.

205. Herr, C. Q, L. Macomber, E. Kalliri, and R. P. Hausinger. 2019. Glutarate L-2-hydroxylase (CsiD/GlaH) is an archetype Fe(II)/2-oxoglutarate-dependent dioxygenase***.*** ***Adv. Prot. Chem. Struct. Biol***. 117:63-90*.* PMC7132994. *doi: 10.1016/bs.apcsb.2019.05.001*.

206. John, C. W., G. M. Swain, R. P. Hausinger, and D. A. Proshlyakov. 2019. Strongly coupled redox-linked conformational switching at the active site of the non-heme iron-dependent dioxygenase, TauD. ***J. Phys. Chem. B*** 123:7785-7793. PMC7092797. *doi: 10.1021/acs.jpcb.9b05866*.

207. John, C. W., R. P. Hausinger, and D. A. Proshlyakov. 2019. Structural origin of the large redox-linked reorganization in the 2-oxoglutarate dependent oxygenase, TauD. ***J. Am. Chem. Soc***. 141:15318-15326. PMC7092798. *doi: 10.1021/jacs.9b07493*.

208. Hu, J., and R. P. Hausinger. 2020. Nickel-pincer nucleotide cofactor-containing enzymes. *In* ***Comprehensive Natural Products III: Chemistry and Biology***, (Eds. Liu, H.-W., and T. P. Begley), Elsevier, 4:111-130. *doi: 10.1016/B978-0-12-409547-2.14616-5*.

209. Fellner, M., K. G. Huizenga, R. P. Hausinger, and J. Hu. 2020. Crystallographic characterization of a tri-Asp metal-binding site at the three-fold symmetry axis of LarE. ***Sci. Rep.*** 10:5830. PMC7118094. *doi: 10.1038/s41598-020-62847-6*.

210. Good, N. M., M. Fellner, K. Demirer, J. Hu, R. P. Hausinger, and N. C. Martinez-Gomez. 2020. Lanthanide-dependent alcohol dehydrogenases require an essential aspartate residue for metal coordination and enzymatic function. ***J. Biol. Chem***. 295:8272-8284. PMC7294098. *doi:10.1074/jbc.RA120.013227*.

211. Nevarez, J. L., A. Turmo, J. Hu, and R. P. Hausinger. 2020. Biochemical pincer complexes. ***ChemCatChem***, 12:4242-4254. PMC7561051. *doi:10.1002/cctc.202000575R1*.

212. Desguin, B., J. Urdiain-Arraiza, M. Da Costa, M. Fellner, J. Hu, R. P. Hausinger, T. Desmet, P. Hols, and P. Soumillion. 2020. Uncovering a superfamily of nickel–pincer nucleotide-dependent α-hydroxyacid racemases and epimerases. ***Sci. Rep***., 10:18123. PMC7583248. *doi: 10.1038/s41598-020-74802-6*.

213. McCracken, J., T. M. Casey, and R. P. Hausinger. 2021. ^{1}H-HYSCORE reveals structural details at the Fe(II) active site of taurine:2-oxoglutarate dioxygenase. ***Appl. Magn. Resonance***, 52:971-994. PMC8896577. *doi: 10.1007/s00723-020-01288-w*.

214. Chaturvedi, S. S., R. Rajeev, J. Hu, R. P. Hausinger, and C. Z. Christov. 2021. Atomic and electronic structure determinants distinguish between ethylene formation and L-

Bayer EX1073
Bayer v. Corteva - IPR2023-01038

arginine hydroxylation reaction mechanisms in the ethylene-forming enzyme. ***ACS Catalysis*** 11:1578-1592. *doi: 10.1021/acscatal.0c03349*.

215. Rankin, J. A., S. Chatterjee, Z. Tariq, S. Lagishetty, B. Desguin, J. Hu, and R. P. Hausinger. 2021. The LarB carboxylase/hydrolase forms a transient cysteinyl-pyridine intermediate during nickel-pincer nucleotide cofactor biosynthesis. ***Proc. Natl. Acad. Sci. USA*** 118:e2106202118. PMC8488589. *doi: 10.1073/pnas.2106202118*.

216. Proshlyakov, D. A., M. A. Farrugia, Y. D. Proshlyakov, and R. P. Hausinger. 2021. Iron-containing ureases. ***Coord. Chem. Rev***. 448:214190. PMC8896516. *doi: 10.1016/j.ccr.2021.214190*.

217. Hausinger, R. P. 2022. Microbial metabolism of nickel. *In* ***Microbial Metabolism of Metals and Metalloids***, (Ed. Hurst, C. J.), Springer. pp. 415-502. *doi: 10.1007/978-3-030-97185-4_14*.

218. Turmo, A., J. Hu, and R. P. Hausinger. 2022. Characterization of the nickel-inserting cyclometallase LarC from *Moorella thermoacetica* and identification of a cytidinylylated reaction intermediate. ***Metallomics*** 14:mfac014. PMC8962377. *doi: 10.1093/mtomcs/mfac014*.

219. Chatterjee, S., K. F. Parson, B. T. Ruotolo, J. McCracken, J. Hu, and R. P. Hausinger. 2022. Characterization of a [4Fe-4S]-dependent LarE nickel insertase that facilitates nickel-pincer nucleotide cofactor biosynthesis in *Thermotoga maritima*. ***J. Biol. Chem.*** 298:102131. PMC9283937. *doi: 10.1016/j.jbc.2022.102131*.

220. Chatterjee, S., S. Gatreddi, S. Gupta, J. L. Nevarez, J. A. Rankin, A. Turmo, J. Hu, and R. P. Hausinger. 2022. Unveiling the mechanisms and biosynthesis of a novel nickel pincer enzyme. ***Biochem. Soc. Trans.*** 50:1187-1196. PMC9880988. *doi: 10.1042/BST20220490*.

221. Chatterjee, S., and R. P. Hausinger. 2022. Sulfur incorporation into biomolecules: Recent advances. ***Crit. Rev. Biochem. Molec. Biol.*** 57:461-476. PMC10192010. *doi: 10.1080/10409238.2022.2141678*.

222. Gatreddi, S., J. Urdiain-Arraiza, B. Desguin, R. P. Hausinger, and J. Hu. 2023. Structural and mutational characterization of a malate racemase from the LarA superfamily. ***BioMetals***. 36:303-313. PMC9388697. *doi: 10.1007/s10534-022-00372-x*.

223. Gatreddi, S., D. Sui, R. P. Hausinger, and J. Hu. 2023. Irreversible inactivation of lactate racemase by sodium borohydride reveals reactivity of the nickel-pincer nucleotide cofactor. ***ACS Catalysis*** 13:1441-1448. *doi: 10.1021/acscatal.2c05461*.

224. Hausinger, R. P., J. Hu, and B. Desguin. 2023. The nickel-pincer coenzyme of lactate racemase: A case study of uncovering cofactor structure and biosynthesis. ***Meth. Enzymol***. 685:341-371. *doi: 10.1016/bs.mie.2023.03.006*.

225. Chaturvedi, S. S., M. G. Thomas, S. B. J. S. Rifayee, W. White, J. Wildey, C. Warner, C. J. Schofield, J. Hu, R. P. Hausinger, T. G. Karabencheva-Christova, and C. Z. Christov. 2023. Dioxygen binding is controlled by the protein environment in non-heme Fe(II) and 2-oxoglutarate oxygenases – A study on histone demethylase PHF8 and an ethylene forming enzyme. ***Chem.—Eur. J.*** 29:e202300138. PMID:36701641. *doi: 10.1002/chem.202300138*.

226. Chaturvedi, S. S., S. B. J. S. Rifayee, R. Ramanan, J. A. Rankin, J. Hu, R. P. Hausinger, and C. Z. Christov. 2023. Can an external electric field switch between ethylene formation and L-arginine hydroxylation in the ethylene forming enzyme***. Phys. Chem. Chem. Phys.*** 25:13772-13783. PMID:37159254. *doi: 10.1039/d3cp01899g*.

Bayer EX1073
Bayer v. Corteva - IPR2023-01038

227. Hausinger, R. P., S. B. J. S. Rifayee, M. G. Thomas, S. Chatterjee, J. Hu, and C. Z. Christov. 2023. Biological formation of ethylene. ***RSC Chem. Biol***. 4:635-646. *doi: 10.1039/D3CB00066D*.

228. Chatterjee, S., J. L. Nevarez, J. A. Rankin, J. Hu, and R. P. Hausinger. 2023. Structure of the LarB-substrate complex and identification of a reaction intermediate during nickel-pincer nucleotide cofactor biosynthesis. ***Biochemistry*** 62:3096-3104. *doi: 10.1021/acs.biochem.3c00242*.

229. Hausinger, R. P. 2023. Five decades of metalloenzymology. ***The Enzymes*** 54:71-105. *doi: 10.1016/bs.enz.2023.03.001*.

230. Hausinger, R. P. 2024. Inhibition of ureases: Studies and applications. *In* ***Ureases: Functions, Classes, and Applications***, (Ed. Ligabue-Braun, R., and C. Carlini), Elsevier, pp. 209-254. *doi*: *10.1016/B978-0-323-91800-8.00006-0*.

231. Guzior, D. V., M. Okros, M. Shivel, B. Armwald, C. Bridges, Y. Fu, C. Martin, A. L. Schilmiller, W. M. Miller, K. M. Ziegler, M. D. Sims, M. E. Maddens, S. F. Graham, R. P. Hausinger, and R. A. Quinn. 2024. Bile salt hydrolase acyltransferase activity expands bile acid diversity. ***Nature*** 626:852-858. *doi: 10.1038/s41586-024-07017-8*.

232. Chatterjee, S., M. Fellner, J. A. Rankin, M. G. Thomas, S. B. J. S. Rifayee, C. Z. Christov, J. Hu, and R. P. Hausinger. 2024. Structural, spectroscopic, and computational insights from canavanine-bound and two catalytically compromised variants of the ethylene-forming enzyme. ***Biochemistry*** 63:1038-1050. *doi: 10.1021/acs.biochem.4c00031*.

Current External Funding

NIH:

- "Nickel-pincer nucleotide enzymes", PI, $800,240 (direct costs total), 9/1/2023-5/31/2027.

NSF:

- "Collaborative Research: Ethylene-Forming Enzyme", PI with Jian Hu and Christo Christov (Mich. Tech. Univ.) as co-PIs, $639,000 total ($356,256 to MSU and $282,744 to MTU), 9/1/2022-8/31/2025.

DOE:

- "The Center for Catalysis in Biomimetic Confinement (CCBC)", Cheryl Kerfeld PI, I am one of ~12 co-PIs, $10,560,000 total, 8/1/2022-7/31/2026. My portion is $716,584 (total costs)

Previous External Grant Support

DOE:

- "Great Lakes Bioenergy Research Center", $25,000,000 (direct costs to the center which provided funds to one postdoc in my lab from 04/15/08-3/30/2011), 10/01/07-09/30/12, I was one of a large number of participants in this multi-university center.

EPA:

- "Overcoming the barriers to *in situ* bioremediation of PCBs", $101,812 (my portion of total), 1/1/94-5/17/96, I was one of many participants in this multi-investigator project.

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NIH:

- "Characterization of bacterial urease", $197,466 (direct costs), 9/86-8/89, **PI**.
- "Mechanism of urease metallocenter biosynthesis", $432,059 (total costs), 6/1/94-6/30/97, **PI**.
- "Mechanism of urease metallocenter biosynthesis", $506,688 (total costs), 7/1/97-6/30/00, **PI**.
- "Mechanistic characterization of taurine dioxygenase", $57,947 (direct costs), 5/1/00-11/30/01, **sponsor** of fellowship awarded to Matthew J. Ryle.
- "Mechanism of urease metallocenter biosynthesis", $750,000 (direct costs), 5/15/01-4/30/07, **PI**.
- "Characterization of alpha-ketoglutarate-dependent dioxygenases", $680,000 (direct costs), 4/1/02-3/31/06, **PI**.
- "Characterization of Fe(II)/alpha-ketoglutarate-dependent hydroxylases", $808,610 (direct costs), 4/1/06-3/31/11, **PI**.
- "Role of ABH1's AP endonuclease activity in immunoglobulin gene diversification", $190,000 (total direct), 8/1/09-7/30/12; **co-PI** with Tina Müller (PI) and Kathy Meek (co-PI).
- "Mechanism of urease metallocenter biosynthesis", $708,000 (direct costs), 9/30/07-8/31/11, plus a one year no-cost extension, **PI**.
- "Transient catalytic oxygen species in iron enzymes", $780,000 (direct), 12/15/2010-11/30/2015, **co-PI** with Denis Proshlyakov (PI).
- "Characterization of Fe(II)/alpha-ketoglutarate-dependent hydroxylases", $1,073,108 (direct costs), 9/30/2011-8/31/2016, **PI**.
- "Nickel-pincer nucleotide enzymes", Dual-PI with Jian Hu, $880,000 (direct costs total), 7/1/2019-8/31/24.
- Diversity supplement to the above grant, Dual-PI with Jian Hu, $148,731 (direct costs total), 5/1/2020-8/31/2023.

NSF:

- "Mechanism of nickel incorporation into urease", $114,000 (total costs), 1/90-6/92, **PI**.
- "Center for Microbial Ecology", one postdoc (11/91-11/93) and one graduate student (6/93-12/97) were supported; **trainer** (one of ~30 faculty in the center).
- "Mechanistic studies of TfdA, an α-ketoglutarate-dependent dioxygenase", $270,000 (total costs), 3/15/97-2/29/00, **PI**.
- "Structure, mechanism, and nickel metallocenter assembly of lactate racemase", $549,300 (total), 9/1/2015-8/30/2018; extended to 8/30/2019, **PI** with Jian Hu as co-PI.
- "Lactate Racemase and Assembly of its Nickel-Pincer Cofactor", **PI** with Jian Hu as co-PI, $567,000 (total), 7/1/2018-6/30/2021 with NCE to 6/30/2022.
- "Collaborative Research: Ethylene-Forming Enzyme", PI with Jian Hu and Christo Christov (Mich. Tech. Univ.) as co-PIs, $579,040 total ($400,000 to MSU and $179,040 to MTU), 7/15/2019-6/30/2022 with NCE to 6/30/2023.

USDA:

- "Biotechnology enhance of nitrogen availability for crop productivity" , $234,812 (direct), 9/84-9/88, **trainer** (one of eight faculty on a training grant)
- "Enhancement of urea fertilizer efficiency", $100,000 (total costs), 9/1/89-8/31/91, **PI**.
- "Characterization and inhibition of bacterial urease", $100,000 (total costs), 9/1/91-8/31/93, **PI**.
- "Mechanistic and structural characterization of urease", $180,000 (total costs), 9/1/93-8/31/95, **PI**.

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- “Urease structures, mechanism, and inhibition”, $270,000 (total costs), 9/1/95-8/31/98, **PI** with co-PI P. Andrew Karplus at Oregon State University.
- "Structural and mechanistic analyses of urease and allantoinase", $140,000 (total costs), 12/1/98-11/31/00, **PI** with co-PI P. Andrew Karplus at Oregon State University.
- “Characterization of allantoinase”, $180,000 (total costs), 12/15/00-12/31/03, **PI**.

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