Timothy E. Machonkin

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EDUCATION

1989-1993	Honors B.S. Chem. and B.S. in Cellular & Molecular Biology, <i>University of Michigan</i> Undergraduate Honors Thesis: "Reactivity of Mononuclear Dichloro-Manganese(IV) Schiff Base Complexes Towards Alkenes" Advisor: Vincent L. Pecoraro
1993-2000	Ph.D. in Inorganic Chemistry, <i>Stanford University</i> Ph.D. Dissertation: "Spectroscopic and Biochemical Studies of Multicopper Oxidases Involved in Iron Metabolism" Advisor: Edward I. Solomon
2000-2003	NIH Postdoctoral Fellow, <i>University of Wisconsin</i> Research Area: Paramagnetic NMR methodology and studies of human [2Fe-2S] ferredoxin Advisor: John L. Markley

PROFESSIONAL EXPERIENCE

2003-2006	Assistant Professor, University of Rochester, Dept. of Biochemistry & Biophysics
2006-12	Assistant Professor, Whitman College, Dept. of Chemistry
2010-2011	Visiting Scientist, University of British Columbia, Dept. of Microbiology & Immunology
2012-present	Associate Professor & Department Chair, Whitman College, Dept. of Chemistry

TEACHING EXPERIENCE

- 1993-1997 Stanford University. Teaching assistant, Head teaching assistant, and Instructor for the Stanford Summer Science and Math Institute (an intensive three-week program for incoming underrepresented-minority students). Guest Lecturer for Coordination Chemistry.
- 2003-2006 University of Rochester. Lecturer for Biochemistry, Structural Biology, and Advanced Enzymology.
- 2006-present Whitman College. Course instructor for General Chemistry I, General Chemistry II, Quantitative Analysis, Inorganic Chemistry, Advanced Synthesis Laboratory, and Bioinorganic Chemistry.

RESEARCH MENTORING EXPERIENCE

1997-2000 Stanford University. Two undergraduates and two first-year graduate students. Both graduate students are now professors (Colorado and CINVESTAV, Mexico).

2000-2003	University of Wisconsin. One undergraduate and two graduate students. The undergraduate student obtained a PhD in Biophysics from Johns Hopkins University.
2003-2006	University of Rochester. Five undergraduates, three technicians, and one graduate student (jointly with a faculty member in Chemistry). Two undergraduates and one technician attended graduate school in the biological sciences.
2006-present	Whitman College. 17 undergraduates (11 female, one underrepresented minority). Eight have gone to PhD programs in Chemistry or related fields (at Wisconsin, Yale, Chicago, ETH in Zürich, etc.), three have gone to medical school, one is in Teach for America, and one is working in a biomedical startup. Three students are currently in the group.

HONORS, FELLOWSHIPS, AND AWARDS

1993	Honors in Chemistry
1993	American Institute of Chemists Award for Outstanding Senior Chemistry Major
1993	Phi Beta Kappa
1993-1996	National Science Foundation Predoctoral Fellowship
1996-1997	Stanford University Lieberman Fellowship
1997	Award for Outstanding Freshmen/Sophomore Academic Advisor
2000-2003	National Institutes of Health Postdoctoral Fellowship
2005-2006	NYSTAR Watson Investigator (one of 10 per year in New York)
2010	Visiting Scientist Award, University of British Columbia Life Sciences Institute
2012	G. Thomas Edwards Faculty Award for Excellence in Teaching and Scholarship

COLLEGE SERVICE

2007-2010	Member, Academic Information Technology Advisory Group (chair, 2009-2010)
2008	Member, Innovation in Teaching Grant Selection Committee
2008-2010	Academic Advisor & Faculty Mentor to two College Success Foundation Achievers students
2009-2010, 2012-present	System Administrator for the 400 MHz Bruker Avance III NMR spectrometer
2011-2014	Member, Library Committee (chair 2012-2013)
2012-present	Chair of the Chemistry Department
2012-2013	Reviewer for two faculty members' first-year "informal review"
2014-present	Member, Curriculum Committee

ADDITIONAL ACTIVITIES

Reviewer for J. Am. Chem. Soc., J. Biol. Inorg. Chem., J. Inorg. Biochem., FEBS Lett., Biochemistry, and PLOS One

Reviewer for NSF MRI grants for NMR spectrometers (2012), NSF RUI grants (2013, 2014) and Austrian Science Fund grant (2013)

Session chair at ACS for the Inorganic Division

PUBLICATIONS

Law, N.A., Machonkin, T.E., McGorman, J.P., Larson, E.J., Kampf, J.W., and Pecoraro V.L. (1995) A Structurally Characterized Dichloro-Manganese(IV) Complex Capable of Halogenating Alkenes, *J. Chem. Soc. Chem. Commun*, 2015-2016.

Solomon, E.I., Sundaram, U.M., and Machonkin, T.E. (1996) Multicopper Oxidases and Oxygenases, *Chem. Rev.* 96, 2563-2605.

Solomon, E.I., Machonkin, T.E., and Sundaram, U.M. (1997) Spectroscopy of Multi-Copper Oxidases, in *Multi-Copper Oxidases*, (Messerschmidt, A., ed.), pp 103-128, World Scientific, Singapore.

Root, D.E., Henson, M.J., Machonkin, T.E., Mukherjee, P., Stack, T.D.P., and Solomon, E.I. (1998) Electronic and Geometric Structure of a Trinuclear Mixed-Valence Copper (II, II, III) Cluster, *J. Am. Chem. Soc.* 120, 4982-4990.

Machonkin, T.E., Zhang, H.-H., Hedman, B., Hodgson, K.O., and Solomon, E.I. (1998) Spectroscopic and Magnetic Studies of Human Ceruloplasmin: Identification of a Redox-Inactive Reduced Type 1 Copper Site, *Biochemistry* 37, 9570-9578.

Solomon, E.I., Palmer, A.E., Sundaram, U.M., and Machonkin, T.E. (1998) Spectroscopic Studies of O₂ Intermediates in Copper Proteins: Electronic Structure Contributions to Function in Bioinorganic Chemistry, in *Spectroscopic Methods in Bioinorganic Chemistry*, (Solomon, E.I. and Hodgson, K.O., eds), pp 423-452, ACS Symposium Series, Vol. 692.

Machonkin, T.E., Musci, G., Zhang, H.-H., Bonaccorsi di Patti, M.C., Calabrese, L., Hedman, B., Hodgson, K.O., and Solomon, E.I. (1999) Investigation of the Anomalous Spectroscopic Features of the Copper Sites in Chicken Ceruloplasmin: Comparison to Human Ceruloplasmin, *Biochemistry* 38, 11093-11102.

Machonkin, T.E. and Solomon, E.I. (2000) The Thermodynamics, Kinetics, and Molecular Mechanism of Intramolecular Electron Transfer in Human Ceruloplasmin, *J. Am. Chem. Soc.* 122, 12547-12560.

Machonkin, T.E., Quintanar, L., Palmer, A.E., Hassett R., Severance S., Kosman D.J., and Solomon E.I. (2001) Spectroscopy and Reactivity of the Type 1 Copper Site in Fet3p from *Saccharomyces cerevisiae*: Correlation of Structure With Reactivity in the Multicopper Oxidases, *J. Am. Chem. Soc.* 123, 5507-5517.

Machonkin, T.E., Westler, W.M., and Markley, J.L. (2002) ¹³C{¹³C} 2D NMR: A Novel Strategy for the Study of Paramagnetic Proteins with Slow Electronic Relaxation Rates, *J. Am. Chem. Soc.* 124, 3204-3205.

Machonkin, T.E. and Markley, J.L. (2002) Electron-Nuclear Interactions, in *Encyclopedia of Nuclear Magnetic Resonance*, *Vol.* 9, (Grant, D.M. and Harris, R.K., eds.), pp 384-401, Wiley, Chichester.

Machonkin, T.E., Mukherjee, P., Henson, M.J., Stack, T.D.P., and Solomon, E.I. (2002) The EPR Spectrum of a Cu(II/II/III) Cluster: Anisotropic Exchange in a Bent Cu(II)₂O₂ Core, *Inorg. Chim. Acta 341*, 39-44.

Lin, I.-J., Gebel, E.B., Machonkin, T.E., Westler, W.M., and Markley, J.L. (2003) Correlation Between Hydrogen Bond Lengths and Reduction Potentials in *Clostridium pasteurianum* Rubredoxin, *J. Am. Chem. Soc.* 125, 1464-1465.

Machonkin, T.E., Westler, W.M., and Markley, J.L. (2004) Strategy for the Study of Paramagnetic Proteins with Slow Electronic Relaxation Rates: Application to Oxidized Human [2Fe-2S] Ferredoxin, *J. Am. Chem. Soc.* 126, 5413-5426.

Park I.Y., Eidsness M.K., Lin I.-J., Gebel E.B., Youn B., Harley J.L., Machonkin T.E., Frederick R.O., Markley J.L., Smith E.T., Ichiye T., and Kang C.H. (2004) Crystallographic Studies of V44 Mutants of *Clostridium pasteurianum* Rubredoxin: Effects of Side-chain Size on Reduction Potential", *Proteins Struct. Funct. Bioinf.* 57, 618-625. Machonkin, T.E., Westler, W.M., and Markley, J.L. (2005) Paramagnetic NMR Spectroscopy and Density Functional Calculations in Analysis of the Geometric and Electronic Structures of Iron-Sulfur Proteins, *Inorg. Chem.* 44, 779-797.

Lin, I.-J., Gebel, E.B., Machonkin, T.E., Westler, W.M., and Markley, J.L. (2005) Changes in Hydrogenbond Strengths Explain Changes in the Reduction Potentials of a Series of 10 Rubredoxin Variants, *Proc. Natl. Acad. Sci. U.S.A.* 102, 14581-14586.

Rocks, S.S., Brennessel, W.W., Machonkin, T.E., and Holland, P.L. (2009) Solid-state and Proton NMR Characterization of an Iron(II) Complex of a Tridentate, Facially Coordinating N,N,O Donor Ligand, *Inorg. Chim. Acta 362*, 1387-1390.

Lin, I.-J., King, D.S., Machonkin, T.E., Westler, W.M., and Markley, J.L. (2009) Hyperfine-shifted ¹³C and ¹⁵N Resonances from *Clostridium pasteurianum* Rubredoxin: Assignments and Interpretation, *J. Am. Chem. Soc.* 131, 15555-15563.

Machonkin, T.E., Holland, P.L., <u>Smith, K.N., Liberman, J.S.</u>, Dinescu, A., Cundari, T.R., and Rocks, S.S. (2010) Determination of the Active Site of *Sphingobium chlorophenolicum* 2,6-Dichlorohydro-quinone dioxygenase (PcpA), *J. Biol. Inorg. Chem.* 10, 291-301.

Rocks, S.S., Brennessel, W.W., Machonkin, T.E., and Holland, P.L. (2010) Solution and Structural Characterization of Iron(II) Complexes with *Ortho*-Substituted Phenolates: Insights Into Potential Substrate Binding Modes in Hydroquinone Dioxygenases, *Inorg. Chem.* 49, 10914-10929.

Machonkin, T.E. and <u>Doerner, A.E.</u> (2011) Substrate Specificity of *Sphingobium chlorophenolicum* 2,6-Dichlorohydroquinone 1,2-Dioxygenase, *Biochemistry* 50, 8899-8913

Machonkin, T.E., <u>Boshart M.D.</u>, <u>Schofield, J.A.</u>, Rodriguez, M.M., Grubel, K., Rokhsana, D, Brennessel, W.W., Holland, P.L (2014) Structural and Spectroscopic Characterization of Iron(II), Cobalt(II), and Nickel(II) Ortho-Dihalophenolate Complexes: Insights into Metal-Halogen Secondary Bonding, *Inorg. Chem. 53*, 9837-9848.

Schofield, J.A., Brennessel, W.W., Urnezius, E., Rokhsana, D., Boshart M.D., Juers, D., Holland, P.L., Machonkin, T.E. Metal-halogen Secondary Bonding in a Bridging 2,5-Dichlorohydroquinonate Cobalt(II) Complex: Implications for Substrate Coordination in PcpA, *manuscript in preparation*.

(underlined coauthors indicate Whitman undergraduate students)

RECENT TALKS AND POSTER PRESENTATIONS

"Determination of the Active Site and Substrate Specificity of *Sphingobium chlorophenolicum* 2,6-Dichlorohydroquinone 1,2-Dioxygenase (PcpA)" American Chemical Society National Meeting, San Francisco, CA, 2010 (talk).

"Determination of the Active Site and Substrate Specificity of *Sphingobium chlorophenolicum* 2,6-Dichlorohydroquinone 1,2-Dioxygenase (PcpA)" National Science Foundation Inorganic Workshop, Santa Fe, NM, 2010 (talk).

"Determination of the Substrate Specificity of *Sphingobium chlorophenolicum* 2,6-Dichlorohydro-quinone 1,2-Dioxygenase (PcpA)" Metals in Biology Gordon Conference, Ventura, CA, 2011 (poster).

"Defining a Preference for Halogen Substituents in a Ring-Cleaving Dioxygenase" University of British Columbia, Department of Biochemistry and Molecular Biology Discussion Group, Vancouver, BC, 2011 (invited talk for LSI visiting scientist award).

"PcpA: Defining a Preference for Halogen Substituents in a Ring-Cleaving Dioxygenase" International Conference on Bioinorganic Chemistry, Vancouver, BC, 2011 (talk)

"PcpA: Defining a Preference for Halogen Substituents in a Ring-Cleaving Dioxygenase" American Chemical Society National Meeting, San Diego, CA, 2012 (invited talk).

"A Chemical Bond By Any Other Name..." Whitman College Faculty Forum, WA, 2012 (talk).

"Pesticide-Eating Bacteria and an Enzyme That is Specific for Halogenated Aromatic Molecules" Western Washington University, WA 2012 (invited talk).

"Metal-Halogen Secondary Bonding in Iron(II), Cobalt(II), and Nickel(II) 2,6-Dihalophenolate Complexes: Insights into the Substrate Specificity of the Hydroquinone Dioxygenase PcpA" American Chemical Society National Meeting, New Orleans, LA, 2013 (talk).

"Exploring the Substrate Specificity of the 2,6-Dichlorohydroquinone Ring-cleaving Dioxygenase PcpA Through Biochemical and Model Chemistry Approaches" International Conference on Bioinorganic Chemistry, Grenoble, France, 2013 (poster).

"Defining a Preference for Halogen Substituents in the Ring-Cleaving Dioxygenase PcpA" University of Michigan, Ann Arbor, MI, 2013 (invited talk).

"Metal-halogen Secondary Bonding in Iron(II), Cobalt(II), and Nickel(II) 2,6-Dihalophenolate Complexes: Insights Into the Substrate Specificity of the Hydroquinone Dioxygenase PcpA" American Chemical Society National Meeting, Dallas, TX, 2014 (talk).

"Exploring the Substrate Specificity of the 2,6-Dichlorohydroquinone Ring-Cleaving Dioxygenase PcpA Through Biochemical and Model Chemistry Approaches" Washington State University, Pullman, WA, 2015 (invited talk).

GRANTS

2005-2007	NYSTAR Watson Investigator Award "Re-engineering the Enzyme Tyrosinase for Bioremediation of Toxic Phenols" P.I., \$200,000 over 2 years (ended early due to position change)
2006-2009	American Chemical Society—Petroleum Research Fund "G" Grant "Understanding the Origin of Suicide Inactivation in the Extradiol Dioxygenases" P.I., \$35,000 over 2 years, with a 1-year no-cost extension
2006-2009	M.J. Murdock Charitable Trust Start-up Grant P.I., \$25,000 over 2 years, with a 1-year no-cost extension
2007-2010	National Science Foundation—Major Research Instrumentation Grant "MRI: Acquisition of an X-ray Diffraction Instrument for Interdisciplinary and Collaborative Research and Education in an Undergraduate Setting" Co-P.I., \$464,934 over 3 years
2009	Whitman College Perry Grant "Mutagenesis Studies of Ring-Cleaving Dioxygenases Involved in Biodegradation of Chlorinated Pollutants" P.I., \$8000
2009-2012	National Science Foundation—Major Research Instrumentation Grant "MRI: Acquisition of a 400 MHz NMR Spectrometer for Undergraduate Research and Research Training" Co-P.I., \$389,000 over 3 years

2010-2014	National Science Foundation—Research At Undergraduate Institutions Grant
	"RUI: The Sources of Substrate Specificity in Hydroquinone Dioxygenases"
	P.I., \$259,000 over 3 years (plus one year no-cost extension)

- 2010-2011 University of British Columbia Life Sciences Institute Visiting Scholar Award \$10,000
- 2015-2017 National Science Foundation—Research At Undergraduate Institutions Grant "RUI: The Sources of Substrate Specificity in Hydroquinone Dioxygenases" P.I., \$399,456 over 3 years (submitted)