

Faculty Profile

 

- [Faculty Directory](#)
- [Curriculum Vitae](#)
- [List of Publications](#)
- [Research Group Homepage](#)

F. Ann Walker

Regents Professor Emerita - Retired

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Honors

- Galileo Circle Fellow, College of Science, University of Arizona, 2009
- Alfred Bader Award in Bioinorganic Chemistry, American Chemical Society, 2006
- Alexander von Humboldt Senior Research Award, 2003-2004
- Luigi Sacconi Medal, Inorganic Chemistry Division, Italian Chemical Society, 2001
- Inducted as Regents Professor, University of Arizona, 2001
- Francis P. Garvin - John M. Olin Medal of the American Chemical Society, 2000

Education and Appointments

- B.A. 1962, The College of Wooster
- Ph.D. 1966, Brown University
- Postdoc 1966-67, UCLA

Research Interests

- Biochemistry
- Inorganic
- Physical
- Bioinorganic
- Biophysics
- Chemical Biology
- Chemical Reaction Dynamics/Kinetics/Interactions
- Protein and Membrane Biochemistry
- Spectroscopy/molecular Structure
- Structural Biology

Research Summary

Bioinorganic Chemistry of Hemes and Heme Proteins; Site-Directed Mutagenesis, Electrochemistry, NMR and EPR Spectroscopies.

We study a wide range of bioinorganic and biological systems, all of which fall under the general theme of gaining a better understanding of the heme centers in heme proteins that are vital to the life of almost all living organisms. The overall goals of this research are to characterize the nitrosylheme proteins from blood-sucking insects. Nitric oxide has been shown to be an important neurotransmitter, vasodilator, and other chemical messenger. We have recently shown that *Rhodnius prolixus* (the "kissing bug")^{1,2} and *Cimex lectularius* (the bedbug)³ each have at least one NO-carrying heme protein in their saliva that helps them succeed in their goal of living on the blood of higher animals. We are investigating the 3-D structures, spectroscopy (NMR, EPR, UV-vis, MCD, Mössbauer and resonance Raman), thermodynamics (kinetics and equilibria of

NO binding, and reduction potentials in the presence of NO) of the NO-binding heme proteins from both of these insects⁴. Current research on these proteins includes preparation and investigation of appropriate site-directed mutants to test hypotheses as to which amino acid side chains affect NO and histamine binding and release.

1. J. M. C. Ribeiro, J. M. H. Hazzard, R. Nussenzveig, D. Champagne, F. A. Walker, *Science* 1993, *260*, 539.
2. J. M. C. Ribeiro, F. A. Walker, *J. Exper. Med.* 1994, *180*, 2251.
3. J. G. Valenzuela, F. A. Walker, J. M. C. Riberiro, *J. Exper. Biol.* 1995, *198*, 1519.
4. F. A. Walker, *J. Inorg Biochem.* 2005, *99*, 216-236.

Selected Publications

- "Effect of the N-Terminus on Heme Cavity Structure, Ligand Equilibrium and Rate Constants, and Reduction Potentials of Nitrophorin 2 from *Rhodnius prolixus*," Berry, R. E.; Shokhireva, T. Kh.; Filippov, I.; Shokhirev, M. N.; Zhang, H.; Walker, F. A. *Biochemistry* 2007, *46*, 6830-6843. (DOI: 10.1021/bi7002263)
- Effect of Mutation of Carboxylate Side-Chain Amino Acids Near the Heme on the Midpoint Potentials and Ligand Binding Constants of Nitrophorin 2 and its NO, Histamine and Imidazole Complexes," Berry, R. E.; Shokhirev, M. N.; Ho, A. Y. W.; Yang, F.; Shokhireva, T. K.; Zhang, H.; Weichsel, A.; Montfort, W. R.; Walker, F. A. *J. Am. Chem. Soc.* 2009, *131*, 2313-2327. (DOI: 10.1021/ja00006a066)
- "1H and 13C NMR Spectroscopic Studies of the Ferriheme Resonances of the Low- Spin Imidazole, Histamine and Cyanide Complexes of wt Nitrophorin 2 and NP2(V24E) as a Function of pH," Yang, F.; Knipp, M.; Berry, R. E.; Shokhireva, T. K.; Zhang, H.; Walker, F. A. *J. Biol. Inorg. Chem.* 2009, *14*, 1077-1095. (DOI: 10.1007/200775-009-00551-3)
- "The Unprecedented Peroxidase-like Activity of *Rhodnius prolixus* Nitrophorin 2: Identification of the [FeIV=O Por]₊ and [FeIV=O Por](Tyr38) Intermediates and Their Role(s) in Substrate Oxidation," Singh, R.; Berry, R. E.; Yang, F.; Zhang, H.; Walker, F. A.; Ivancich, A. I. *Biochemistry* 2010, *49*, 8857-8872.
- "NMR Studies of Nitrophorin Distal Pocket Side Chain Effects on the Heme Orientation and Seating of NP2 as Compared to NP1," Shokhireva, T. K.; Berry, R. E.; Zhang, H.; Walker, F. A. *J. Inorg. Biochem.* 2011, *105*, 1238-1257. (DOI: 10.1016/j.jinorgbio.2011.06.001) PMCID: PMC3155619
- "Nuclear Inelastic Scattering and Mössbauer Spectroscopy as Local Probes for Ligand Binding Modes and Electronic Properties in Proteins: Vibrational Behavior of a Ferriheme Center Inside a β -Barrel Protein," Moeser, B.; Janoschka, A.; Wolny, J. A.; Paulsen, H.; Filippov, I.; Berry, R. E.; Zhang, H.; Chumakov, A. I.; Walker, F. A.; Schünemann, V. *J. Am. Chem. Soc.* 2012, *134*, 4216-4228. (DOI: 10.1021/ja210067t) PMCID: PMC3296872
- "Native N-Terminus Nitrophorin 2 from the Kissing Bug: Similarities to and Differences from NP2 (D1A)," Berry, R. E.; Muthu, D.; Garrett, S. A.; Shokhireva, T. K.; Zhang, H.; Walker, F. A. *Chem. Biodiv.* 2012, *9*, 1739-1755. (DOI: 10.1002/cbdv.201100449) PMCID: PMC3523740
- "Electron Spin Density on the Axial His Ligand of High-Spin and Low-Spin Nitrophorin 2 Probed by Heteronuclear NMR Spectroscopy," Abriata, L. A.; Zaballa M-E.; Berry, R. E.; Yang, F.; Zhang, H.; Walker, F. A.; Vila, A. J. *Inorg. Chem.* 2013, *52*, 1285-1295. (DOI: 10.1021/ic301805y)

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