

JOHN STEVEN OLSON

TITLE: Ralph and Dorothy Looney Professor of Biochemistry and Cell Biology

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BIRTHDATE: May 21, 1946 **PLACE OF BIRTH:** Evanston, Illinois **CITIZENSHIP:** U.S.A.

MARITAL STATUS: Married to Dr. Sharon L. Olson, Professor and Director of The School of Physical Therapy, Texas Woman's University, Houston and Dallas, TX

CHILDREN: Jennifer S. Graves-Olson (B.A, Rice U., 1996; MD/PhD, UT Southwestern, 2006)
Timothy S. Olson (B.A., Rice U., 1998; MD/PhD, U. of Virginia, 2006)
Katherine E. Olson (B.A., Rice U., 2006, BA Kinesiology)

EDUCATION: University of Illinois, Urbana, Illinois, B.S. (Chemistry), 1968.
Cornell University, Ithaca, New York, Ph.D. (Biochemistry), 1972
University of Michigan, Ann Arbor, Michigan, Postdoctoral studies, 1973.

HONORS:

Phi Lambda Upsilon Scholarship Award (University of Illinois)
James Scholar (University of Illinois)
Bronze Tablet (University of Illinois)
Co-Salutatorian (University of Illinois, 1968)
Dupont Teaching Award (Cornell University, 1970)
National Science Foundation Pre-doctoral Fellowship (Cornell University, 1968-1972)
National Institutes of Health Postdoctoral Research Fellowship (University of Michigan, 1972-1973)
Dreyfus Teacher-Scholar Award (1977)
Amoco Teaching Award at Rice University (1995)
Elected American Association for the Advancement of Science Fellow (1997)
George R. Brown Award for Superior Teaching at Rice University (1998)
George R. Brown Award for Superior Teaching at Rice University (2000)
George R. Brown Award for Superior Teaching at Rice University (2001)
Biophysical Society Emily M. Gray Award for Education in Biophysics (2007)

MAJOR RESEARCH INTERESTS: Application of rapid reaction techniques to biophysical and biochemical problems; protein engineering by recombinant DNA technology; structural (X-ray, IR, and NMR) and functional studies of ligand binding to hemoglobins, myoglobins, and model heme compounds; design of heme protein-based blood substitutes; red blood cell physiology; biosynthesis of heme and hemoglobin; gas transport and exchange in capillaries.

RESEARCH AND PROFESSIONAL EXPERIENCE:

Dorothy and Ralph Looney Professor of Biochemistry and Cell Biology, Rice University, 1997-present
Director, Houston Area Molecular Biophysics Pre-doctoral Training Program (NIH sponsored training grant- Baylor College of Medicine, Rice University, University of Houston, UT Medical School Houston, UT MD Anderson Cancer Center, and UT Medical Branch Galveston), 1998-2003
Director, Cellular and Molecular Biochemistry Pre-doctoral Training Program (NIH sponsored training grant- Rice Biochemistry and Chemical Engineering Departments), 1984-1989
Chairman of Biochemistry, Rice University, 1984-1987
Professor of Biochemistry, Rice University, 1983-present
Associate Professor of Biochemistry, Rice University, 1977-1983

Assistant Professor of Biochemistry, Rice University, 1973-1977
National Institutes of Health Postdoctoral Fellow, Department of Biological Chemistry, University of Michigan, 1972-1973 (V. Massey and G. Palmer)
National Science Foundation Pre-doctoral Fellow, Section of Biochemistry and Molecular Biology, Cornell University, 1968-1972 (Q. H. Gibson)
Research Assistant, Toni Company, Summer 1968
Undergraduate Research Student, Department of Biochemistry, University of Illinois, 1967-1968 (G. Weber)
Analytical Chemist, Dean's Food Company, Summer 1967
Illinois Heart Association Science Program Participant, Burnside Laboratory, University of Illinois, 1963

TEACHING and SERVICE:

a. DEPARTMENT, Biochemistry & Cell Biology (since 1995)

Lecturer, **Biochemistry (Fall Semester) Bios 301 (150-200 students), 1987-present**
Lecturer, **Physical Chemistry for the Biosciences (Spring Semester) Bios 352 (40-70 students), 1988-present**
Lecturer, Advanced Biochemistry (Spring Semester) Bios 302 (70-100 students), 2004
Laboratory Instructor, Advanced Spectroscopy Graduate Laboratory Module, (Spring Semester) Bios 532 (5-12 students), 1999-2002.
Guest Lecturer or minor participant in various other BCB and BIOE courses
Mentor, Graduate and Undergraduate Research Courses (Bios. 401, 402, 575, 599, 611, 612, 800)
Member, Graduate Student Recruiting and Admissions Committee (1980-present)
Graduate Program Director, 1996-1999
Member, Faculty Search Committee (1987-1995, Chair 2001-2002), Graduate Curriculum Committee (1984-1994; 2003), Undergraduate Curriculum Committee (2001), Graduate Student Advisory Committee (1984-1999; 2004-present).
Member, 29 Research Progress Review/PhD thesis Committees (chair of 11) since 1995
Teaching Mentor for four assistant professors

b. RICE UNIVERSITY (since 1995)

Member, Provost's Special Committee on Research and Business Related Policies and Practices, 1994-1995
Member, Search Committee for Vice Provost for Research and Graduate Studies, 1995-1996
Member, Weiss School of Natural Sciences Subcommittee for Graduate Program Enhancement Strategic Planning, October 1996-March 1997
Member, Vice Provost's committee on Intellectual Property, November 1996-May 1997
Member of Steering Committee, Houston Area Molecular Biophysics Pre-doctoral Training Program, 1987-present
Member, Student Health Committee, 1988-1998
Member, Keck Center for Computational and Structural Biology, 1990-present
Member, Executive Committee for the Keck Center for Computational and Structural Biology, 1999-2005
Member, Institute of Biosciences and Bioengineering, 1987-present
Member, University Patent and Intellectual Property Committee, 1999-present
Member, Committee to Establish the Houston Area NMR Center, 1999-2005
Member, CETE (Center for Excellence in Tissue Engineering) Steering Committee, 2000-present
Member, Graduate Council, 2000-present
Member, Science and Engineering Information and Technology Committee, 2002-2004
Instructor, AP Biology Teachers Workshop, 2-day course with 4 lectures and 4 laboratory exercises, sponsored by Office of Continuing Studies, Rice University. (June 2006)
Instructor, IB Biology Teachers Workshop, 1-day course, 4 lectures (joint with Dr. Susan Cates) and 2 demonstrations, sponsored by Office of Continuing Studies, Rice University. (March 2007)

c. PROFESSIONAL (since 1995)

- Member of Editorial Board, *The Journal of Biological Chemistry*, July 1, 1980-June 30, 1985 and July 1, 1987-June 30, 1992
- Member, Molecular and Cellular Biophysics Study Section (BBCA) for Grant Reviews, National Institutes of Health (October 1991 – June 1995)
- Consulting and Research Collaboration Agreement with Baxter Hemoglobin Therapeutics, Inc., Boulder, Colorado, 1991 - 2003
- Education and Research Committee and Institutional Review Board for Studies with Human Subjects, Kelsey-Seybold Clinic, Houston, Texas, 1979-1993
- Ad hoc member of site visit team; GM program project, University of Iowa, reviewed in Washington, D.C., August 1998.
- Reviewer, Hem-2 Study Section, SBIR Programs, November, 1999
- Ad hoc Reviewer, National Institutes of Health, BBCA Molecular and Cellular Biophysics Study Section, February 22-23, 2002
- Part-time Member of Erythrocyte and Leukocyte Biology (ELB) Study Section, National Institutes of Health, Center for Scientific Review, Bethesda, MD, 2003
- Member, Biophysical Society, 1985 - present
- Member, American Chemical Society, 1973 - present
- Member, American Society of Biological Chemists, 1976 – present
- Member and Fellow, American Association for the Advancement of Science, 1990 - present
- Reviewer for *Biochemistry*; *J. Biol. Chem.*; *Cell*; *Proc Natl. Acad. Sci, USA*; *Blood*; *Free Rad. in Biol. and Med.*; *J. Inorg. Chem.*; *J. Amer. Chem. Soc.* (~15 papers per year).

CURRENT RESEARCH SUPPORT (2006):

1. Olson, J.S. (principal investigator), "Functional Properties of Hemoglobin and Myoglobins," National Institutes of Health GM 35649-33 to 37: 9/1/07 to 8/31/11: \$1,262,360 total costs for four years; \$209,000 in direct costs per year for 9/1/2007 to 8/31/2008. This grant has had continuous funding since 1973.
2. Olson, J.S. (principal investigator), "The Design of Heme-Protein Based Blood Substitutes": National Institutes of Health HL 47020-14A2 to 19: 06/01/2006 to 5/31/2011: ~\$1,637,569 total costs for 5 years; \$218,475 in direct costs (\$325,569 total costs) for 06/1/2007 to 5/31/08. Plus R03 HL 47020-15S1: 09/01/2007-08/31/2008: \$43,195 total costs for minority graduate student stipend for one year (direct costs: \$29,755).
3. Olson, J.S. (principal investigator), "Chemical Mechanisms of Ligand Binding to Heme Proteins," Grant C-612 from the Robert A. Welch Foundation (33 consecutive years): 2005-2008, \$240,000 total costs; \$80,000 per year for June 1, 2005 to May 31, 2008. This grant has had continuous funding since 1974.

COMPLETED RESEARCH GRANTS (since 1995):

1. Olson, J. S. (principal investigator) "Collaboration Agreement with Baxter Hemoglobin Therapeutics, Inc (formerly Somatogen, Inc.)" Support for salary of Instructor and instrumentation Specialist for the Laboratory of Molecular Biophysics at Rice (Dr. J. Nichols and Dr. S. Cates): Period 5/16/1996 to 5/15/2002, \$10,000 per year, total \$70,000.
2. Olson, J. S. (principal investigator) "Houston Area Molecular Biophysics Pre-doctoral Training Program" NIGMS T32 (GM 08280, Years 11-15): Period 7/01/98 to 6/30/03. ~\$200,000 direct costs per year for a total of ~\$500,000 for five years. This program provides pre-doctoral education and research training in molecular biophysics to graduate students from Baylor College of Medicine, Rice University, the University of Houston, the University of Texas Medical School Houston, University of Texas Medical Branch Galveston, and The M.D. Anderson Cancer Center. The training grant was renewed July 1, 2003, with Theodore Wensel (Baylor College of Medicine) as the Program Director and is on-going.
3. Olson, J. S. (principal investigator) "U. S. - Japan Seminar: Molecular Dynamics of Ligand Binding to Myoglobins and Hemoglobins," NSF sponsored. \$12,000 direct costs. (1996-1997)

4. Gibson, Q. H. (principal investigator); Olson J. S., and Phillips, G. N. Jr. (co-investigators) "Kinetics of Enzymes and Hemoglobin-Ligand Reactions," NIH sponsored (Grant transferred from Cornell University with Gibson's move to Rice University). \$176, 705 direct costs total. (1996-1998).
5. Phillips, G. N., Jr. (principal investigator), Olson, J.S. (co-investigator) "Synthetic Heme Co-Factors in Engineered Globins as Physiological Ligand Biosensors." Texas Advanced Technology Program. \$54, 263 direct costs total (1996-1998).

PUBLICATIONS (Theses, Refereed Papers, Book Chapters (57 Abstracts not shown)):

1. Olson, J.S., Spectral and Binding Properties of Three Sulfonamide Derivatives of Dimethylamino-naphthalene Sulfonic Acid, B.S. Thesis, University of Illinois (Urbana), 1968.
2. Hauska, G.A., McCarty, R.E., and Olson, J.S., The Relation of the Light-Induced Increase in Absorbance at 518 nm to Photophosphorylation in Digitonin Subchloroplast Particles, *FEBS Lett.*, 7, 151-156 (1970).
3. Edelstein, S.J., Rehmar, M.J., Olson, J.S., and Gibson, Q.H., Functional Aspects of the Subunit Association-Dissociation Equilibria of Hemoglobin, *J. Biol. Chem.*, 245, 4372-4381 (1970).
4. Olson, J.S., and Gibson, Q.H., Organic Phosphates and the Reaction of n-Butyl Isocyanide with Human Hemoglobin, *Biochem. Biophys. Res. Commun.*, 41, 421-426 (1970).
5. Olson, J.S., and Gibson, Q.H., The Reaction of n-Butyl Isocyanide with Human Hemoglobin. I. Determination of the Kinetic Parameters Involved in the Last Step in Ligand Binding, *J. Biol. Chem.*, 246, 5241-5253 (1971).
6. Olson, J.S., Andersen, M.E., and Gibson, Q.H., The Dissociation of the First Oxygen Molecule from Some Mammalian Oxyhemoglobins, *J. Biol. Chem.*, 246, 5919-5923 (1971).
7. Lindstrom, T.R., Olson, J.S., Mock, N.H., Gibson, Q.H., and Ho, C., Nuclear Magnetic Resonance Studies of Hemoglobins. VIII. Evidence for Preferential Ligand Binding to β Chains within Deoxyhemoglobins, *Biochem. Biophys. Res. Commun.*, 45, 22-26 (1971).
8. Olson, J.S., and Gibson, Q.H., The Reaction of n-Butyl Isocyanide with Human Hemoglobin. II. The Ligand-Binding Properties of the α and β Chains within Deoxyhemoglobin, *J. Biol. Chem.*, 247, 1713-1726 (1972).
9. Olson, J.S., The Reaction of n-Butyl Isocyanide with Hemoglobin, Ph.D. Thesis, Cornell University, Ithaca, N.Y. (1972).
10. Olson, J.S., and Gibson, Q.H., The Functional Properties of Hemoglobin Bethesda, ($\alpha_2\beta_2^{145}\text{His}$), *J. Biol. Chem.*, 247, 3662-3670 (1972).
11. Olson, J.S., Gibson, Q.H., Nagel, R.L., and Hamilton, H.B., The Ligand-Binding Properties of Hemoglobin Hiroshima ($\alpha_2\beta_2^{146}\text{Asp}$), *J. Biol. Chem.*, 247, 7485-7493 (1972).
12. Andersen, M.E., Olson, J.S., Gibson, Q.H., and Carey, F.G., Studies on Ligand Binding to Hemoglobins from *Teleosts* and *Elasmobranchs*, *J. Biol. Chem.*, 248, 331-341 (1973).
13. Olson, J.S., and Gibson, Q.H., The Effects of pH and Anions on the Properties of the α and β Chains within Human Deoxyhemoglobin, *J. Biol. Chem.*, 248, 1616-1622 (1973).
14. Olson, J.S., and Gibson, Q.H., The Release of Protons and Anions during Ligand Binding to Human Deoxyhemoglobin, *J. Biol. Chem.*, 248, 1623-1630 (1973).
15. Moffat, K., Olson, J.S., Gibson, Q.H., and Kilmartin, J.V., The Ligand-Binding Properties of desHis(146 β) Hemoglobin, *J. Biol. Chem.*, 248, 6387-6393 (1973).
16. Olson, J.S., Ballou, D.P., Palmer, G., and Massey, V., The Reaction of Xanthine Oxidase with Molecular Oxygen, *J. Biol. Chem.*, 249, 4350-4362 (1974).
17. Olson, J.S., Ballou, D.P., Palmer, G., and Massey, V., The Mechanism of Action of Xanthine Oxidase, *J. Biol. Chem.*, 249, 4363-4382 (1974).
18. Quioco, F.A., and Olson, J.S., The Reaction of Creatine Kinase with 2-Chloro-mercuri-4-fitrophenol, *J. Biol. Chem.*, 249, 5885-5888 (1974).
19. Wiedermann, B.L., and Olson, J.S., Acceleration of Tetramer Formation by the Binding of Inositol Hexaphosphate to Hemoglobin Dimers, *J. Biol. Chem.*, 250, 5273-5275 (1975).

20. Olson, J.S., Effects of *p*-Hydroxymercuribenzoate Binding on the Visible Absorption Spectrum of Methemoglobin, *J. Biol. Chem.*, 251, 441-446 (1976).
21. Olson, J.S., Binding on Inositol Hexaphosphate to Human Methemoglobin, *J. Biol. Chem.*, 251, 447-458 (1976).
22. Friedman, B.E., Olson, J.S., and Matthews, K.S., Kinetic Studies of Inducer Binding to Lactose Repressor Protein, *J. Biol. Chem.*, 251, 1171-1174 (1976).
23. Olson, J.S., Spectral Differences between the α and β Heme Groups within Human Deoxyhemoglobin, *Proc. Nat. Acad. Sci. U.S.A.*, 73, 1140-1144 (1976).
24. Olson, J.S., and Binger, C., The Effect of Ligand Size and Stereochemistry on the Reactivity of the α and β Chains within Hemoglobin, *Biochim. Biophys. Acta*, 434, 428-439 (1976).
25. Reisberg, P., Olson, J.S., and Palmer, G., Kinetic Resolution of Ligand Binding to the α and β Chains within Human Hemoglobin, *J. Biol. Chem.*, 251, 4379-4383 (1976).
26. McGovern, P., Reisberg, P., and Olson, J.S., Aggregation of Deoxyhemoglobin Subunits, *J. Biol. Chem.*, 251, 7871-7879 (1976).
27. Charlton, S.C., Olson, J.S., Hong, K.Y., Pownall, H.J., Louie, D.D., and Smith, L.C., Stopped-Flow Kinetics of Pyrene Transfer between Human High-Density Lipoproteins, *J. Biol. Chem.*, 251, 7942-7955 (1976).
28. Friedman, B.E., Olson, J.S., and Matthews, K.S., Interaction of *lac* Repressor with Inducer: Kinetic and Equilibrium Measurements, *J. Mol. Biol.*, 111, 27-39 (1977).
29. Hille, R., Palmer, G., and Olson, J.S., Chain Equivalence in the Reaction of Nitric Oxide with Hemoglobin, *J. Biol. Chem.*, 252, 403-405 (1977).
30. Coin, J.T., and Olson, J.S., The Kinetics of Oxygen Binding to Human Red Blood Cells, *Clinical and Biochemical Aspects of Hemoglobinopathies and Other Hemoglobin Abnormalities* (W. Caughey, ed.) (1978), pp. 559-576.
31. Coin, J.T., and Olson, J.S., The Rate of Oxygen Uptake by Human Red Blood Cells, *J. Biol. Chem.*, 254, 1178-1190 (1979).
32. Hille, C.R., Olson, J.S., and Palmer, G.A., Spectral Transitions of Nitrosyl Hemes during Ligand Binding to Hemoglobin, *J. Biol. Chem.*, 254, 12110-12120 (1979).
33. Reisberg, P.I., and Olson, J.S., Equilibrium Binding of Alkyl Isocyanides to Human Hemoglobin, *J. Biol. Chem.*, 255, 4144-4150 (1980).
34. Reisberg, P.I., and Olson, J.S., Rates of Alkyl Isocyanide Binding to the Isolated α and β Subunits of Human Hemoglobin, *J. Biol. Chem.*, 255, 4151-4158 (1980).
35. Reisberg, P.I., and Olson, J.S., Kinetic and Cooperative Mechanisms of Ligand Binding to Human Hemoglobin, *J. Biol. Chem.*, 255, 4159-4169 (1980).
36. Palmer, G., and Olson, J.S., Concepts and Approaches to the Understanding of Electron Transfer Processes, in *Molybdenum and Molybdenum Containing Enzymes* (M. Coughlin, ed.), Pergamon Press (1980) pp. 187-220.
37. Miller, D.M., Olson, J.S., and Quiocho, F.A., The Mechanism of Sugar Binding to the Periplasmic Receptor for Galactose Chemotaxis and Transport in *E. coli*, *J. Biol. Chem.*, 255, 2465-2471 (1980).
38. Dunaway, M., Olson, J.S., Rosenberg, J.M., Kallai, O.B., Dickerson, R.E., and Matthews, K.S., Kinetic Studies of Inducer Binding to the *lac* Repressor-Operator Complex, *J. Biol. Chem.*, 255, 10115-10119 (1980).
39. Olson, J.S., Rapid Mixing Measurements of Ligand Binding to Hemoglobin, in *Hemoglobins*, volume 76 of *Methods in Enzymology*, (E. Antonini, L. Rossi-Bernardi, and E. Chiancone, eds.), Academic Press (1981) pp. 631-651.
40. Olson, J.S., Numerical Analysis of Kinetic Ligand Binding Data, in *Hemoglobins*, volume 76 of *Methods in Enzymology*. (E. Antonini, L. Rossi-Bernardi, and E. Chiancone, eds.), Academic Press (1981) pp. 652-667.
41. McKinnie, R.E., and Olson, J.S., Effects of Solvent Composition and Viscosity on the Rates of CO Binding to Heme Proteins, *J. Biol. Chem.*, 256, 8928-8932 (1981).

42. Porras, A.G., Olson, J.S., and Palmer, G., The Reaction of Reduced Xanthine Oxidase with Oxygen: Kinetics of Peroxide and Superoxide Formation, *J. Biol. Chem.*, 256, 9096-9103 (1981).
43. Olson, J.S., Mims, M.P., and Reisberg, P.I., Kinetic Mechanisms of Ligand Binding to Heme Proteins, in *Hemoglobin and Oxygen Binding* (C. Ho, W.A. Eaton, J.P. Collman, Q.H. Gibson, J.S. Leigh, E. Margoliash, K. Moffat, and W.R. Scheidt, eds.), Elsevier North Holland, Inc., New York (1982) pp. 393-398.
44. Davis, M.D., Olson, J.S., and Palmer, G., Charge Transfer Complexes between Pteridine Substrates and the Active Center Molybdenum of Xanthine Oxidase, *J. Biol. Chem.*, 257, 14730-14737 (1982).
45. Olson, J.S., McKinnie, R.E., Mims, M.P., and White, D.K., Mechanisms of Ligand Binding to Pentacoordinate Protoheme, *J. Am. Chem. Soc.*, 105, 1522-1527 (1983).
46. Mims, M.P., Olson, J.S., Russu, I.M., Muira, S., Cedel, T.E., and Ho, C., Proton Nuclear Magnetic Resonance Studies of Isonitrile-Heme Protein Complexes, *J. Biol. Chem.*, 258, 6125-6134 (1983).
47. Rose, M.Y., and Olson, J.S., The Kinetic Mechanism of Heme Binding to Human Apohemoglobin, *J. Biol. Chem.*, 258, 4298-4303 (1983).
48. T'sai, A., Olson, J.S. and Palmer, G., The Oxidation of Yeast Complex III: Evidence for a Very Rapid Electron Equilibration Between Cytochrome *c*₁ and the Iron-sulfur Center, *J. Biol. Chem.*, 258, 2122-2125 (1983).
49. Miller, D.M., Olson, J.S., Pflugrath, J.W., and Quioco, F.A., Rates of Ligand Binding to Periplasmic Proteins Involved in Bacterial Transport and Chemotaxis, *J. Biol. Chem.*, 258, 13665-13672 (1983).
50. Mims, M.P., Porras, A.G., Olson, J.S., Noble, R.W., and Peterson, J.A., Ligand Binding to Heme Proteins: An Evaluation of Distal Effects, *J. Biol. Chem.*, 258, 14219-14232 (1983).
51. Davis, M.D., Olson, J.S., and Palmer, G., The Reaction of Xanthine Oxidase with Lumazine: Characterization of the Reductive Half-reaction, *J. Biol. Chem.*, 259, 3526-3533 (1984).
52. Vandegriff, K.D., and Olson, J.S., A Quantitative Description in Three Dimensions of Oxygen Uptake by Human Red Blood Cells, *Biophys. J.*, 45, 825-835 (1984).
53. Vandegriff, K.D., and Olson, J.S., The Kinetics of O₂ Release by Human Red Blood Cells in the Presence of External Sodium Dithionite, *J. Biol. Chem.*, 259, 12609-12618 (1984).
54. Vandegriff, K.D., and Olson, J.S., Morphological and Physiological Factors Affecting Oxygen Uptake and Release by Red Blood Cells, *J. Biol. Chem.*, 259, 12619-12627 (1984).
55. Boland, E.J., Unno, H., Olson, J.S., and Hellums, J.D., An *In-vitro* Method for Simulation of Oxygen Transport in the Microcirculation, in *Oxygen Transport to Tissue VI* (D. Bruley, H.I. Bicher, and D. Reneau, eds.), Plenum Publishing Co. (1985) pp. 251-259.
56. Boland, E.J., Olson, J.S., and Hellums, J.D., Development of an *In-vitro* Method for Simulation of Oxygen Transport in the Microcirculation, in *Oxygen Transport to Tissue VII* (F. Kreuzer, S.M. Cain, Z. Turek, and T.K. Goldstick, eds.), Plenum Publishing Co. (1985) pp. 923-936.
57. Chakerian, A.E., Pfahl, M., Olson, J.S., and Matthews, K.S., A Mutant Lactose Repressor with Altered Inducer and Operator Binding Parameters, *J. Mol. Biol.*, 183, 43-51 (1985).
58. Rose, M.Y., Thompson, R.A., Light, W.R., and Olson, J.S., Heme Transfer between Phospholipid Membranes and Uptake by Apohemoglobin, *J. Biol. Chem.*, 260, 6632-6640 (1985).
59. Gibson, Q.H., Olson, J.S., McKinnie, R.E., and Rohlfs, R.J., A Kinetic Description of Ligand Binding to Sperm Whale Myoglobin, *J. Biol. Chem.*, 261, 10228-10239 (1986).
60. Whitson, P.A., Olson, J.S., and Matthews, K.S., Thermodynamic Analysis of the Lactose Repressor-Operator DNA Interaction, *Biochemistry*, 25, 3852-3858 (1986).
61. Daly, T.J., Olson, J.S., and Matthews, K.S., Formation of Mixed Disulfide Adducts at Cysteine-281 of the Lactose Repressor Protein Affects Operator and Inducer Binding Parameters, *Biochemistry*, 25, 5468-5474 (1986).
62. Boland, E.J., Nair, P.K., Lemon, D.D., Olson, J.S., and Hellums, J.D., An *In Vitro* Capillary System for Studies on Microcirculatory O₂ Transport, *J. Appl. Physiol.*, 62, 791-797 (1987).

63. Lemon, D.D., Nair, P.K., Boland, E.J., Olson, J.S., and Hellums, J.D., Physiological Factors Affecting O₂ Transport by Hemoglobin in an *In Vitro* Capillary System, *J. Appl. Physiol.*, 62, 798-806 (1987).
64. Light, W.R., Rohlfs, R.J., Palmer, G., and Olson, J.S., Functional Effects of Heme Orientational Disorder in Sperm Whale Myoglobin, *J. Biol. Chem.*, 262, 46-52 (1987).
65. Gaul, D.F., Ondrias, M.R., Findsen, E.W., Palmer, G., Olson, J.S., Davidson, M.W., and Knaff, D.B., Spectroscopic and Kinetic Properties of an Oxygen-binding Heme Protein from *Chromatium vinosum*, *J. Biol. Chem.*, 262, 1144-1147 (1987).
66. Chakerian, A.E., Olson, J.S., and Matthews, K.S., Thermodynamic Analysis of Inducer Binding to the Lactose Repressor Protein: Contributions of Galactosyl Hydroxyl Groups and b Substituents, *Biochemistry*, 26, 7250-7255 (1987).
67. Tsai, A.-L., Olson, J.S., and Palmer, G., The Kinetics of Reoxidation of Yeast Complex III: An Evaluation of the Q-cycle, *J. Biol. Chem.*, 262, 8677-8684 (1987).
68. Olson, J.S., Rohlfs, R.J., and Gibson, Q.H., Ligand Recombination to the α and β Subunits of Human Hemoglobin, *J. Biol. Chem.*, 262, 12930-12938 (1987).
69. Rohlfs, R.J., Olson, J.S., and Gibson, Q.H., A Comparison of the Geminate Recombination Kinetics of Several Monomeric Heme Proteins, *J. Biol. Chem.*, 263, 1803-1813 (1988).
70. Lemon, D.D., Boland, E.J., Nair, P.K., Olson, J.S., and Hellums, J.D., Effects of Physiological Factors on Oxygen Transport in an *In Vitro* Capillary System, in *Oxygen Transport to Tissue*, X, (M. Mochizuli, C.R. Honig, T. Koyama, T.K. Goldstick, and D.F. Bruley, eds.), Plenum Press, New York (1988) pp. 37-44.
71. Olson, J.S., Mathews, A.J., Rohlfs, R.J., Springer, B.A., Egeberg, K.D., Sligar, S.G., Tame, J., Renaud, J.-P., and Nagai, K., The Role of the Distal Histidine in Myoglobin and Haemoglobin, *Nature*, 336, 265-266 (1988).
72. Springer, B.A., Egeberg, K.D., Sligar, S.G., Rohlfs, R.J., Mathews, A.J., and Olson, J.S., Discrimination between Oxygen and Carbon Monoxide and Inhibition of Autooxidation by Myoglobin: Site-Directed Mutagenesis of the Distal Histidine, *J. Biol. Chem.*, 264, 3057-3060 (1989).
73. Johnson, K.A., Olson, J.S., and Phillips, G.N., Jr., Structure of Myoglobin-Ethyl Isocyanide: Histidine as a Swinging Door for Ligand Entry, *J. Mol. Biol.*, 207, 459-463 (1989).
74. Mathews, A.J., Rohlfs, R.J., Olson, J.S., Tame, J., Renaud, J.-P., and Nagai, K., The Effects of E7 and E11 Mutations on the Kinetics of Ligand Binding to R State Human Hemoglobin, *J. Biol. Chem.*, 264, 16573-16583 (1989).
75. Rohlfs, R.J., Mathews, A.J., Carver, T.E., Olson, J.S., Springer, B.A., Egeberg, K.D., and Sligar, S.G., The Effects of Amino Acid Substitution at Position E7 (Residue 64) on the Kinetics of Ligand Binding to Sperm Whale Myoglobin, *J. Biol. Chem.*, 265, 3168-3176 (1990).
76. Nair, P.K., Hellums, J.D., and Olson, J.S., Prediction of Oxygen Transport Rates in Blood Flowing in Large Capillaries, *Microvascular Research*, 38, 269-285 (1989).
77. Nair, P.K., Huang, N.S., Hellums, J.D., and Olson, J.S., A Simple Model for Prediction of Oxygen Transport Rates by Flowing Blood in Large Capillaries, *Microvascular Research*, 39, 203-211 (1990).
78. Egeberg, K.D., Springer, B.A., Sligar, S.G., Carver, T.E., Rohlfs, R.J., and Olson, J.S., The Role of Val⁶⁸(E11) in Ligand Binding to Sperm Whale Myoglobin: Site-Directed Mutagenesis of a Synthetic Gene, *J. Biol. Chem.*, 265, 11788-11795 (1990).
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175. Olson J. S., Soman, J., and Phillips, G. N. Jr. Ligand Pathways in Myoglobin: A Review of Trp Cavity Mutations, *IUBMB Life* **59**, 552-562 (2007).
176. Mocny, J. C., Olson, J. S., and Connell, T. D. Passively released heme from hemoglobin and myoglobin is a potential source of nutrient iron for *Bordetella bronchiseptica*. *Infection & Immunity*, **75**, 4857-66 (2007).
177. Olson, J. S., and Ghosh, A, "Mammalian Myoglobin as a Model for Understanding Ligand Affinities and Discrimination in Heme Proteins," Chapter 1, pp. 3-17, *The Smallest Biomolecules: Perspectives on Heme-Diatomic Interactions* (Ed. Abhik Ghosh) Elsevier, London, (2007).
178. Ran, Y., Zhu, H., Liu, M., Fabian, M., Olson, J. S., Aranda, R. IV., Phillips, G. N., Jr., Dooley, D. M., and Lei, B. Bis-Methionine Coordination in Shp Facilitates Rapid Heme Transfer to HtsA of the HtsABC Transporter in a Plug-in Mechanism. *J. Biol. Chem.* **282**, 31380-8 (2007)
179. Aranda, R., Worley, C. E., Liu, M., Bitto, E., Cates, M. S., Olson, J. S., Lei, B., and Phillips, G. N. Jr. Bis-methionyl coordination and heme stacking in the crystal structure of the heme-binding domain of the streptococcal cell surface protein Shp *J. Mol. Biol.* **374**, 374-83 (2007).
180. Graves, P.E., Henderson, D. P., Horstman, M. J., Solomon, B. J., and Olson, J. S. Enhancing Stability and Expression of Recombinant Hemoglobin in *E. coli*: Progress in the Development of a Recombinant HBOC Source. *Biochem. Biophys. Acta. Proteins and Proteomics*, **1784**, 1471-1479 (2008).
181. Zhu, H., Xie, G., Liu, M., Olson, J. S., Fabian, M., Dooley, D. M., and Lei, B. Pathway for Heme Uptake from Human Methemoglobin by the Iron-Regulated Surface Determinants (Ird) System of *Staphylococcus aureus*. *J. Biol. Chem.* **283**, 18450-60 (2008).
182. Olson, J. S. From O₂ Diffusion Into Red Blood Cells To Ligand Pathways In Globins. Chapter 14 (pp. 161-182) in *DIOXYGEN BINDING AND SENSING PROTEINS, A Tribute to Beatrice and Jonathan Wittenberg* (Eds. M. Bolognesi, G. di Prisco, C. Verde), Springer-Verlag Italia Srl, Milano, Italy, July 2008.
183. Villarreal, D.M., Phillips, C. L., Kelley, A. M., Villarreal, S., Villaloboz, A., Hernandez, P., Olson, J. S., and Hendersen, D. P. Enhancing Recombinant Hemoglobin Production in *Escherichia coli* BL21(DE3) containing the *Plesiomonas Shigelloides* Heme Transport System. *J. Appl. Environ. Micro.* **74**, 5854-6 (2008).
184. Hussain, F., Olson, J. S., and Wittung-Stafshede, P. Conserved residues modulate protein stability and copper release in human copper chaperone Atox1. *Proc Natl. Acad. Sci., USA*, **105**, 11158-63 (2008).

185. Maillett, D. H., Simplaceanu, V., Shen, T-J., Ho, N.T., Olson, J. S., and Ho, C. Interfacial and distal pocket mutations exhibit additive effects on the structure and function of hemoglobin. *Biochemistry* **47**, 10551-10563 (2008).
186. Salter, M. D., Nienhaus, K., Nienhaus, G. U., Dewilde, S., Moens, L., Pesece, A., Nardini, M., Bolognesi, M., and Olson, J. S. The Apolar Channel in *Cerebratulus lacteus* Hemoglobin is the Route for O₂ Entry and Exit. *J. Biol. Chem.* **283**, 35689-35702 (2008).
187. Aranda, R, Cai, H., Worley, C. E., Levin, E. J., Li, R., Olson, J. S., Phillips, G. N. Jr., and Richards, M. P., Structural analysis of bovine, trout IV, and perch hemoglobin: Effects of the heme pocket environment on autooxidation and hemin loss rates, *Proteins* **75** 217-230 (2009).
188. Asmundson, A. L., van der Walde, A., Lin, D. H, Olson, J. S., and Anthony-Cahill, S. J., Co-Expression of Human α - and Circularly Permuted β -Globins Yields a Hemoglobin with Normal R state but modified T state Properties, *Biochemistry* **48**, 5456-5465 (2009).
189. Yu, X., Mollan, T. L., Butler, A., Gow, A. J., Olson, J. S., and Weiss M. J. "Analysis of Human α Globin Gene Mutations that Impair Binding to the Alpha Hemoglobin Stabilizing Protein (AHSP)," *Blood* **113**, 5961-5969 (2009).
190. Smaggehe, B. J., Hoy, J. A., Percifield, R., Kundu, S., Hargrove, M. S., Sarath, G., Hilbert, J-L., Watts, R. A., Dennis, E. S., Peacock, W. J., Dewilde, S., Moens, L., Blouin, G. C., Olson, J. S., and Appleby, C. Correlations between Oxygen Affinity and Sequence Classifications of Plant Hemoglobins, *Biopolymers*, *in press* (2009).
191. Golbeck, R.S., Pillsbury, M. L., Jensen, R. A., Mendoza, J. L., Nguyen, R. L., Olson, J. S., Soman, J., Kliger, D. S., and Esquerra, R. M. Optical Detection Of Disordered Water Within A Protein Cavity, *in press J. Amer. Chem. Soc.* (2009).
192. Culbertson, D., and Olson, J. S. Folding and Assembly of Myoglobins and Hemoglobins, Chapter submitted for *Protein Folding and Metal Ions: Mechanisms, Biology, and Disease* (edited by C. M. Gomes & P. Wittung-Stafshede) Taylor & Francis Books, Inc, submitted for editing (Winter 2009/2010).
193. Mollan, T., Yu, X., Weiss, M. J., and Olson, J. S. The Role of α -Hemoglobin Stabilizing Protein in Redox Chemistry, Denaturation, and Hemoglobin Assembly, for ARS Forum: *Redox Protective Scavengers of Hemoglobin* (ed. D. Schaer & A. Alayash) in *Antioxidants and Redox Signaling*, *in press* (2009).
194. Bianchetti, C. M., Blouin, G. C., Bitto, E., Olson, J. S., and Phillips, G. N. Jr. The Structure and NO Binding Properties of of the Nitrophorin-like Hem-binding Protein from Arabidopsis thaliana gene locus Atlg79260.1, *Proteins*, submitted (2009)
195. Sodatova, A. V., Ibrahim, M., Olson, J. S., and Spiro, T. G. New Light on NO Bonding in Fe(III) Heme Proteins from Resonance Raman Spectroscopy and DFT Modeling, *J. Amer. Chem. Soc.*, submitted (2009).

PATENTS

a. Issued:

1. U.S. Patent 6,022,849 issued 1999, entitled "Mutant Recombinant Hemoglobins containing Heme Pocket Mutations", Inventors: J. S. Olson (Rice University based on studies supported by GM 35649 and HL 47020), J. Aitken and A. Mathews (Somatogen, Inc.), K. Nagai (MRC, Cambridge, U.K).
2. U.S. Patent 6,114,505 issued 2000, entitled " Hemoglobin Mutants That Reduce Heme Loss" Docket Number 251/US, submitted October 23, 1995 - Inventors: J. S. Olson, T. L. Whitaker, Mark S. Hargrove (all Rice University and based primarily on studies from HL47020).
3. U.S. Patent 6,455,676, issued September 2002 entitled "Hemoglobin Mutants with Increased Soluble Expression And/Or Reduced Nitric Oxide Scavenging," Docket Number 351PCT, submitted September 5, 1997 - co-inventors D. Doherty, D. Lemon (Somatogen/Baxter Hemoglobin Therapeutics) and J. S. Olson (Rice University based on studies supported by GM 35649 and HL 47020).

b. Under review:

4. Patent Application PCT/US2005/032627 - Provisional patent submitted September 15, 2004, and complete application submitted September 15, 2005: "Increasing the Stability of Recombinant Adult Human Apohemoglobin (apo-rHb) by Amino Acid Replacements Based on Sequence Comparisons with Sperm Whale Hemoglobin α and β genes and Human Fetal Hemoglobin γ genes;" Co-inventors: John S. Olson and George N. Phillips, Jr. (U. Wisconsin); Rice TTO number 25002.
5. Patent Application PCT/US2005/033028 - Provisional patent submitted September 15, 2004, and complete application submitted September 15, 2005: "Enhancing Recombinant Hemoglobin (rHb) Production by Co-expression with Alpha Hemoglobin Stabilizing Protein (AHSP);" Co-inventors: John S. Olson and Mitchell J. Weiss (U. Pennsylvania, CHOP); Rice TTO number 25001

GRADUATE STUDENT SUPERVISION (all, 1973-present)**Current Graduate Students:**

Name:	Degree Sought:
T. Mollan	Ph.D.
M. Salter	Ph.D.
I. Birukou	Ph.D.
D. Culbertson	Ph.D.

Past Graduate Students (25):

- George C. Blouin, Ph.D., "Alkyl Isocyanides as Transition State Analogs for Ligand Entry and Exit in Globins," 2008, Postdoctoral Fellow Rice University, Houston, Texas.
- Robert E. Brantley, Jr., Ph.D., "The Mechanism of Autooxidation of Myoglobin," 1993, Assistant Professor, Middle Georgia College, Cochran, Georgia
- Ted E. Carver, Ph.D., "Kinetic Barriers to Ligand Binding in Myoglobin," 1993, Research Scientist, 3-Dimensional Pharmaceuticals, Philadelphia, Pennsylvania
- J. Thaddeus Coin, Ph.D., "The Kinetics of Oxygen Uptake and Release by Human Red Blood Cells," 1978, Neurologist (MD), Wilmington, NC.
- Raymond Eich, Ph.D., "Reactions of Nitric Oxide with Myoglobin," 1997, IP Consultant and Patent Agent, Williams Morgan & Amerson, Houston, Texas
- Erin L. Foley, Ph.D., "Physiologically Relevant Reactions of Myoglobin and Hemoglobin with NO," 2005. Seeking employment.
- Angela Hale, M.A., "Electrostatic Regulation of Oxygen Binding to the Neuronal Hemoglobin of *Cerebratulus lacteus*," 2004, Isolagen, Houston, Texas
- Mark S. Hargrove, Ph.D., "The Structural Determinants of Myoglobin Stability," 1996, Associate Professor, Dept. of Biochemistry, Biophysics & Molecular Biology, Iowa State University
- Angela N. Hvitved, Ph.D. "NO Dioxygenation in Mammalian Hemoglobins and Microbial Flavohemoglobins." 2007, ASBMB Science Policy Fellow, Bethesda, MD.
- Philip E. Graves, M.S. "Enhancing Stability and Expression of Recombinant Hemoglobin in *E. coli*," 2008, Research Assistant, UT Southwestern Medical School.
- C. Russ Hille, Ph.D., "The Reaction of Hemoglobin with Nitric Oxide," 1978, Chair, Department of Biochemistry and Molecular Biology, University of California, Riverside.
- Kenneth A. Johnson, Ph.D., "X-ray Structures of Myoglobin and Hemoglobin-Alkyl Isocyanide Complexes," 1993, Research Scientist, Uppsala University, Sweden
- Rachel Leininger Schweers, Ph.D., "Electrostatic Regulation of O₂ and CO Binding in the α and β Subunits of Recombinant Human Hemoglobin," 2004, Research Scientist, Independent Forensics of Illinois, Lombard, IL.
- Douglas D. Lemon, Ph.D., "Oxygen and Carbon Dioxide Exchange by Human Hemoglobin and Erythrocytes," 1989, Myogen, Inc., Boulder, Colorado
- W. Richard Light, Ph.D., "Heme Interactions with Apomyoglobin and Lipid Bilayers," 1988, Research Scientist, Biopure, Inc., Boston, Massachusetts

- David H. Maillett, Ph.D., "Engineering Hemoglobins and Myoglobins for Efficient O₂ Transport," 2004, Postdoctoral Fellow, Department of Biological Sciences, Pittsburgh NMR Center, Carnegie Mellon University, Pittsburgh, Pennsylvania
- Russell E. McKinnie, Ph.D., "Kinetics and Thermodynamics of Ligand Binding to Sperm Whale Myoglobin," 1986, Customer Technical Support, Lucent Technologies, Naperville, Illinois
- Martha Mims, Ph.D., "Ligand Binding to Heme Proteins: An Evaluation of Distal Effects," 1983, Associate Professor, Department of Hematology, Baylor College of Medicine, Houston
- Paul. I. Reisberg, Ph.D., "Mechanisms of Ligand Binding to Hemoglobin," 1980, Assistant Professor, Wellesley College, Boston, Massachusetts
- Ronald J. Rohlf, Ph.D., "Quantum Yields and Mechanism of Ligand Binding to Heme Proteins," 1989, Research Assistant Professor, Department of Medicine, University of California, San Diego, California until 1996, current employment unknown.
- Melanie Y. Rose, Ph.D., "Heme Transport and Incorporation into Globin," 1982, Anesthesiologist, Falls Community Hospital and Clinic, Marlin, Texas
- Emily E. Scott, Ph.D., "Apomyoglobin and Ligand Movements in Mammalian Myoglobins," 1998, Assistant Professor, University of Kansas, Lawrence
- Lucian P. Smith, Ph.D., "The Effects of Amino Acid Substitution on Apomyoglobin Stability, Folding Intermediates, and Holoprotein Expression," 2003, Postdoctoral Fellow, Department of Genome Sciences, University of Washington, Seattle
- Robert D. Smith, Ph.D., "Correlations Between Bound n-Alkyl Isocyanide Orientations and Pathways for Ligand Binding in Recombinant Myoglobins," 1999, Resident, Texas A&M University, Corpus Christi Hospital, Corpus Christi, TX
- Kim D. Vandegriff, Ph.D., "Experimental and Theoretical Analyses of Oxygen Exchange by Human Erythrocytes," 1984, Senior Research Scientist, Department of Medicine, University of California Medical School, La Jolla, California
- Timothy L. Whitaker, Ph.D., "Residues Controlling the Function and Stability of the CD Corner in Myoglobin and Hemoglobin," 1996, Resident in Psychiatry, University of Cincinnati Medical School, Cincinnati, Ohio

POSTDOCTORAL SUPERVISION (since 1995):

<u>Name:</u>	<u>Year(s) Supervised:</u>
G. Blouin	2008-present
A. Kilpatrick	2008-2009
C. Varnado	2006-present
D. Maillett	2003 - 2004
N. Matsuda	2002 - 2006
Y. Dou	1997 - 2002
A. Mathews	2000 - 2001
H. Ferraz (visiting scientist)	2001
H. Hargrove	1995 - 1998
E. Scott	1998
S. Unzai (visiting grad student)	1995 - 1996
R. Watts (visiting grad student)	1996

CURRENT COLLABORATIONS (GRANTS and PAPERS, 2004-Present):

Abdu Alayash	CBER, FDA	Oxidative reactions of Hbs and Mbs
Philip Anfinrud	NIH, Bethesda, MD	Time Resolved Crystallography
Paul Champion	Northeastern U.	Ultrafast heme protein reactions
Terry D. Connell	SUNY, Buffalo	Heme transport by <i>Bordetella avium</i>
Marian Fabian	Rice University	EPR/Redox titrations

Joel Friedman	Albert Einstein College of Medicine	Geminate recombination in the solid state
Paul Gardner	Children's Hospital, Cincinnati	FlavoHbs
Robert Goldbeck	UC, Santa Cruz	Ultrafast Mb kinetics
Quentin Gibson	UMass Med. Center, Worcester	Animal Hbs/laser kinetics
Michael Gustin	Rice University	FlavoHbs
Mark S. Hargrove	Iowa State U.	Plant hemoglobins
Douglas Henderson	UT Permian Basin	Bacterial heme transport)
Chien Ho	Carnegie Mellon U.	Comparison of rHb production)
JJ Miranda	Harvard University	Thermoglobins (<i>Aquifex aeolicus</i>)
Benfang Lei	Montana State, Vet. School	Heme transport by <i>Streptococcus G</i>
Luc Moens	University of Antwerp, Belgium	Cerebratulus Hb
Sylvia Dewilde	University of Antwerp, Belgium	Invertebrate Hbs
G. Ulrich Nienhaus	University of Ulm, Germany	Time resolved IR
George N. Phillips, Jr.	U. Wisconsin, Biochemistry	X-ray crystallography, SW rHb
Mark P. Richards	U. Wisconsin, Animal Sci.	Heme-mediated lipid oxidation
Austen Riggs	University of Texas, Austin	Animal Hbs
William Royer	UMass Med. Center, Worcester	Animal Hbs
Thomas Spiro	Princeton University	Resonance Raman of myoglobins
Ah-Lim Tsai	UT Medical Center, Houston	Rapid freezing EPR
Kim Vandegriff	Sangart, Inc.	Animal studies, blood pressure
Mitchell J. Weiss	U. Pennsylvania, CHP	AHSP, rHb co-expression

PRESENTATIONS (since 1995):

1. "From Picosecond Biophysics to Blood Substitutes," Continuing Studies Course taught by teaching award recipients, Rice University, October 25, 1995
2. "Engineering Myoglobins and Hemoglobins," Department of Physiology and Biophysics, Case Western Reserve University, November 6, 1995
3. "Inhibition of NO-induced Oxidation of Myoglobin and Hemoglobin by Protein Engineering," Workshop on Current Issues in Blood Substitute Research and Development, Departments of Medicine and Bioengineering, University of California, San Diego, California, March 18-20, 1996
4. "Protein Engineering Strategies for Designing More Stable Blood Substitutes," VI International Symposium on Blood Substitutes, Montréal, Canada, August 4, 1996
5. "Factors Governing Hemoglobin and Myoglobin Stability and their Expression in *E. coli*," Scientific Advisory Board Meeting, Somatogen, Inc., Boulder, Colorado, November 14, 1996
6. "From Picosecond Biophysics to Blood Substitutes," Department of Biochemistry, Ohio State University, Columbus, Ohio, May 13, 1997
7. "Engineering Myoglobins and Hemoglobins: From Picosecond Biophysics to Blood Substitutes," Somatogen, Inc., Boulder, Colorado, July 9, 1997
8. "Mechanisms for Ligand Binding to Myoglobin," Forty-Sixth Harden Conference, Structure and Mechanism of Oxidases and Related Systems, Plymouth, U.K., August 31, 1997
9. "Biophysics and Blood Substitutes," Cardiovascular group, University of Texas at Houston Medical School, Houston, Texas, November 6, 1997
10. "From Biophysics to Blood Pressure: Engineering Hemoglobin-Based O₂ Delivery Pharmaceuticals," Staples Seminars in Biochemistry, University of Maine, April 16, 1998
11. "Kinetics of Ligand Binding to Myoglobin," International Conference on Oxygen Binding and Oxygen Activating/Sensing Heme Proteins, Asilomar Conference Center, Pacific Grove, California, September 23, 1998
12. "Application of Molecular Biophysics to the Design of Second-Generation Blood Substitutes," 1998 George R. Brown Teaching Award Winners Series, Rice Continuing Education Course, Rice University, November 5, 1998
13. "Engineering Myoglobins and Hemoglobins: From Picosecond Biophysics to Blood Substitutes," Department of Biochemistry, Virginia Tech University, Blacksburg, Virginia, November 30, 1998
14. "Blood and Money: Development of Safe Oxygen Delivery Pharmaceuticals," Society of Rice University Women, Rice University, October 25, 1999.
15. "Course in The Rational Design of Second Generation Blood Substitutes," Advances in Tissue Engineering, Rice University, August 22, 1999.
16. "Molecular Biophysics and Blood Substitutes: Designing Second Generation O₂ Delivery Pharmaceuticals," Rice Alumni College, Rice University, April 17, 1999.
17. "Blood and Money: The Rational Design of Second Generation Blood Substitutes," Speaker, Structural Symposium on Structural Biology, UT Medical Branch at Galveston, Texas (May 20, 2000).
18. "Blood Substitutes, An Update," Lecture, Advances in Tissue Engineering Course, Rice University, Houston, Texas (August 13, 2000).
19. "Protein Engineering: Culmination of the Revolution in Biology," Lecture for the continuing education course entitled THE YEAR'S BEST: 2000 RICE UNIVERSITY TEACHING AWARD WINNERS, Rice University, Houston, Texas (October 5, 2000).
20. "NO Dioxygenation, Vasoregulation, and Blood Substitutes," Symposium in Honor of Reinhold and Ruth Benesch, Rockefeller University, New York, City, New York (October 30, 2000).
21. "Blood and Money: Using Chemistry and Biophysics to Design Second Generation O₂ Delivery Pharmaceuticals," Welch Foundation Lecture Tour, The University of Texas, Permian Basin, Department of Chemistry, Odessa, Texas (November 8, 2000).
22. "Blood and Money: Using Chemistry and Biophysics to Design Second Generation O₂ Delivery Pharmaceuticals," Welch Foundation Lecture Tour, Department of Chemistry, McMurry University (and Hardin Simmons and Abilene Christian Universities) (November 9, 2000).

23. "Blood and Money: Using Chemistry and Biophysics to Design Second Generation O₂ Delivery Pharmaceuticals," Welch Foundation Lecture Tour, Department of Chemistry, Midwestern State University, Wichita Falls, Texas (November 10, 2000).
24. "Blood Substitutes and NO Dioxygenation," Workshop on Myoglobin Biophysics and Physiology, Los Alamos National Laboratory, Los Alamos, New Mexico (November 28, 2000).
25. "De-mystifying the Reactions of NO With Hemoglobins and Myoglobins," invited speaker for Symposium on Interplay between Nitric Oxide and Hemoglobin: Current Concepts, The American Physiology Society Meeting, Orlando, Florida (April 1, 2001).
26. "NO Dioxygenation, Vasoregulation, and Blood Substitutes," invited lecture, Department of Biochemistry, University of Wisconsin, Madison, Wisconsin (April 9, 2001).
27. "O₂ Delivery Pharmaceuticals, NO Scavenging, and Vasoregulation," Guest lecture for Baylor College of Medicine course entitled "Structural Basis of Human Diseases", Houston, Texas (April 12, 2001).
28. "Alliances For Graduate Education and the Professoriate (Agep) at Rice University," NIGMS Workshop on Achieving Scientific Excellence Through Diversity, Bethesda, Maryland (May 5-6, 2001).
29. "Blood Substitutes," Invited lecture, Advances in Tissue Engineering Course, CETE and Department of Bioengineering, Rice University, Houston, Texas (August 15, 2001).
30. "Science vs. Religion: From Evolution to the Human Genome," invited lecture for Continuing Studies Course: This Year's Best: 2001 Rice University Teaching Award Winners, Houston, Texas (October 4, 2001).
31. "Protein Engineering: Culmination of the Revolution in Biology," invited lecture for Continuing Studies Course: Encore: A Selection of Rice Teaching Award Winners, Houston, Texas (November 26, 2001).
32. "Structural Basis of the Design of Blood Substitutes," Baylor College of Medicine Course "Structural Basis of Human Disease", Texas Medical Center, Houston, Texas (April 25, 2002)
33. "Blood, Toil, Tears, and Sweat: The Design of Second Generation O₂ Delivery Pharmaceuticals," Invited talk, New England Biolabs, Beverly, Massachusetts (May 13, 2002)
34. "NO Dioxygenation, Vasoregulation, and Blood Substitutes," Invited talk, Dept. of Biochemistry and Molecular Pharmacology, U Mass Med. School, Worcester, Massachusetts (May 15, 2002)
35. "Protein Engineering at Rice," Invited talk, Special Session at the May Board of Trustees Meeting, Rice University, Houston, Texas (May 2002)
36. "Protein Engineering at Rice," Invited talk, Lord Sainsbury, Parliamentary Under Secretary of State for Science, Department of Trade and Industry, U.K. (June 12, 2002)
37. "Blood, Toil, Tears, and Sweat: The Design of Second Generation O₂ Delivery Pharmaceuticals," Advances in Tissue Engineering course, CETE and Dept. of Bioengineering, Rice University, Houston, Texas (August 17, 2002)
38. "Protein Engineering at Rice," Invited talk, Tanox delegation, Rice University (September 26, 2002)
39. "Blood, Toil, Tears, and Sweat: Using Molecular Biophysics to Design O₂ Delivery Pharmaceuticals." Department of Chemistry, University of Texas, El Paso, El Paso, Texas. (March 28, 2003)
40. "Electrostatics, Baseball Gloves, and Blood Substitutes." Department of Biochemistry & Cell Biology, Rice University, Houston, Texas. (March 31, 2003)
41. "The Design of Blood Substitutes." Baylor College of Medicine Course, Structural Basis of Human Disease, Texas Medical Center, Houston, Texas. (May 1, 2003)
42. "Blood Pressure, Baseball Gloves, and Blood Substitutes." Advances in Tissue Engineering Course, CETE and Department of Bioengineering, Rice University, Houston, Texas. (August 15, 2003)
43. "Blood Pressure, Baseball Gloves, and Blood Substitutes: Using Molecular Biophysics to Engineer Heme Proteins." Department of Chemistry, University of Texas, San Antonio, San Antonio, Texas. (September 8, 2003)

44. "Blood, Toil, Tears, and Sweat: Using Molecular Biophysics to Design O₂ Delivery Pharmaceuticals." Department of Chemistry, University of Texas, San Antonio, San Antonio, Texas. (September 8, 2003)
45. "NO Dioxygenation and the Hypertensive Effect of Hb-based Blood Substitutes." 10th Annual Meeting of the Society for Free Radical Biology and Medicine, Workshop 1, Methods in Free Radical Biology and Medicine and their Application, Seattle, Washington. (November 20, 2003)
46. "Blood Pressure, NO Dioxygenation, Hemoglobin Expression, and the Design of Blood Substitutes," Iowa State University, Ames, Iowa (September 16-17, 2004)
47. "Electrostatics, Baseball Gloves, Worms, and Fungi: Lessons on Hemoglobin Physiology," Austen Riggs - Adventures in Hemoglobin Research, University of Texas, Austin, Texas (November 12-14, 2004)
48. "The Design of Blood Substitutes: From Baseball Gloves to Brewing Hemoglobin," Carnegie Mellon University and Pittsburgh Life Sciences Greenhouse, Pittsburgh, Pennsylvania (December 8-9, 2004)
49. "Recombinant Hemoglobin: A Potential Starting Material for all Hb-based Blood Substitutes," BioPure, Inc., Cambridge, Massachusetts (June 10, 2005).
50. "Design of Hemoglobin-Based Blood Substitutes: Recombinant Hb as a Potential Oxygen Carrier," Short Course in Tissue Engineering, Rice University, Houston, Texas (August 13, 2005)
51. "O₂ Transport, NO Dioxygenation, and the Design of Recombinant Hemoglobin-Based Blood Substitute," Auburn University, Auburn, Alabama (March 2006)
52. "Design of Hemoglobin-Based Oxygen Carriers (HBOCs)," Structural Basis of Human Disease - Baylor College of Medicine Graduate Course, Houston, Texas (April 2006)
53. "Design of Third Generation Hemoglobin-Based Oxygen Carriers (HBOCs)," Short Course in Tissue Engineering, CETE, Rice University, Houston, Texas (August 2006)
54. "O₂ Filters, Artificial Gills, and Hemoglobin-Based Blood Substitutes: Mimicking Nature by Protein Engineering," IVth International Conference on Dioxygen Binding and Sensing Proteins, Stazione Zoologica Anton Dohrn, Napoli, Italy (September 2006)
55. "Designing Recombinant Hemoglobin to Be a Safe and Effective Blood Substitute," 48th American Society of Hematology Annual Meeting and Exposition, Orlando, Florida (December 2006)
56. "Biophysics, Baseball Gloves, and Blood Substitutes," Emily M. Gray Award Lecture, 51st Annual Biophysical Society Meeting, Baltimore, Maryland (March 2007).
57. "Heme Protein Engineering: Selective Oxygen Filters, Artificial Gills, and Hemoglobin-Based Blood Substitutes," Iowa State Student Micro Symposium, Iowa State University, Ames IA, (March 2007)
58. "O₂ Transport, NO Scavenging, and the Design of Recombinant Hemoglobin-Based Blood Substitutes" and "Third Generation Recombinant Hemoglobins As the Starting Material for All Hb-based Blood Substitutes." (day-long mini-course) Rice Continuing Education IBDP Workshop: Advanced Topics In Biology, March, 2007
59. "Hemoglobin-Based Oxygen Carriers (HBOCs) and Hypertension," Structural Basis of Human Disease - Baylor College of Medicine Graduate Course, Houston, Texas, April 2007.
60. "Pathways for O₂ binding to globins, NO dioxygenation, and Hb-based Blood Substitutes," University of Texas Medical Branch Galveston, September 2007
61. "Designing Recombinant Hemoglobin to be a Safe, Effective, and Commercially Feasible Blood Substitute." European Society of Hematology -Club du Globule Rouge et du Fer Euroconference: DISORDERS OF IRON HOMEOSTASIS, ERYTHROCYTES AND ERYTHROPOIESIS, Athens, Greece, November 2007
62. "NO Dioxygenation by Single and Multi-domain Globins: The Other Function of Hemoglobins." Southwest Region ACS Meeting, Symposium: Redox Proteins Catalytic and Regulatory Roles (in honor of Dr. David Knaff), Lubbock, TX, November 2007.

63. "Blood Substitutes, Baseball Gloves, NO Dioxygenation, and Hemoglobin Engineering," invited Seminar at Albert Einstein College of Medicine, Yeshiva University, New York City, NY, March, 2008.
64. "Hemoglobin-Based Oxygen Carriers (HBOCs) and Hypertension," Structural Basis of Human Disease - Baylor College of Medicine Graduate Course, Houston, Texas, April 2008.
65. "Strategies for Engineering Safer, More Efficient and More Stable Recombinant Hemoglobins for Use as O₂ Delivery Pharmaceuticals," at the *Workshop on: Hemoglobin Based Oxygen Carriers: Current Status and Future Directions*," Center for Biologics Evaluation and Research, FDA, The National Heart, Lung, and Blood Institute, NIH and Office of the Secretary and Office of Public Health and Science, DHHS, NIH Campus, Bethesda, Maryland, April 2008.
66. "Lessons Learned from Mutagenesis: Reactions of NO with Mbs and Hbs," Second Annual Wake Forest Nitrogen Oxide Conference at Nemaquin Resort, Farmington, PA, May 22-25, 2008
67. "Evolution of O₂ transport and storage by hemoglobins: From Bacteria to Plants and Animals," AP Biology Teachers Workshop, Rice University, June 2008
68. "Recombinant Hemoglobin is the Ultimate Starting Material for all Hb-based blood substitutes," NSF REU Cellular Engineering Lunch Seminar, Rice University, June 2008
69. "The Development of rHb-Based Oxygen Carriers, NO Scavenging, Hypertension, and Nitrite Reduction," Seminar for Atherosclerosis and Vascular Biology Training Program, Baylor College of Medicine, Houston, TX, June 2008.
70. "NO Binding, NO dioxygenation, and Nitrite Reactions," at XVth International Conference on Oxygen Binding and Sensing Proteins (O₂BiP), Aarhus University, Aarhus, Denmark, August 2008
71. "Hemoglobin Gates and Tunnels: Different Ways to Capture O₂ and Detoxify NO," Department of Chemistry and Biochemistry and Institute of Computational Sciences and Engineering, University of Texas, Austin, TX January, 2009.
72. "Hemoglobin Gates and Tunnels: Different Ways to Capture O₂ and Detoxify NO," Department of Chemical and Biomolecular Engineering, Ohio State University, Columbus Ohio, March 2009.
73. "Structure Based Design of Blood Substitutes," Structural Basis of Human Disease - Baylor College of Medicine Graduate Course, Houston, Texas, April 2008.

ATTENDANCE AT SCIENTIFIC MEETINGS (since 1995):

- Robert A. Welch Foundation Research Conference on Molecular Mechanics, Houston, Texas, October 23-24, 1995
- Workshop on Current Issues in Blood Substitute Research and Development, Departments of Medicine and Bioengineering, University of California, San Diego, California, March 18-20, 1996
- VI International Symposium on Blood Substitutes, Montreal, Canada, August 2-5, 1996
- US/Japan Joint Seminar on Molecular Dynamics of Ligand Binding and Myoglobins and Related Heme Proteins – Symposium Director, Rice University, March 2-5, 1997
- Forty-sixth Harden Conference on Structure and Mechanism of Oxidases and Related Systems, invited speaker, Plymouth, U.K., August 28 - September 1, 1997
- International Conference on Oxygen Binding and Oxygen Activating/Sensing Heme Proteins, Asilomar Conference Center, Pacific Grove, California, September 23, 1998 (co-PI)
- Robert A. Welch Foundation Research Conference on Molecular Mechanics, Houston, Texas, October 27-28, 1998
- NSF Summit Meeting on Minorities in Sciences and Engineering, Rice University, October 18-19, 1999.
- Robert A. Welch Foundation Meeting "Synthetic and Biological Chemistry," Houston, Texas, October 25-26, 1999.
- Structural Symposium on Structural Biology 2000, The University of Texas Medical Branch, Galveston, Texas (May 19-21, 2000).
- Keck Symposium 2000, Structural and Functional Genomics, Rice University and Baylor College of Medicine, Houston, Texas (October 16-17, 2000).

- Welch Foundation 44th Conference on Chemical Research, "Macromolecular Structures and Function," Houston, Texas (October 23-24, 2000).
- Symposium in Honor of Reinhold and Ruth Benesch, Rockefeller University, New York City, New York (October 30, 2000).
- Workshop on Myoglobin Biophysics and Physiology, Los Alamos National Laboratory, Los Alamos, New Mexico (November 28-29, 2000).
- American Physiological Society Meeting (FASEB), Orlando, Florida (March 3-April 2, 2001).
- NIGMS Workshop on Achieving Scientific Excellence Through Diversity, Bethesda, Maryland (May 5-6, 2001).
- Robert A. Welch Foundation Meeting, "Chemistry for the 21st Century," Houston, Texas, (October 29-30, 2001).
- Advances in Tissue Engineering Course, CETE and Department of Bioengineering, Rice University, Houston, Texas (August 14-17, 2002)
- Robert A. Welch Foundation Meeting, "Advances in Quantum Chemistry," Houston, Texas (October 28-29, 2002)
- Robert A. Welch Foundation Meeting, Houston, Texas (October 27-28, 2003)
- 10th Annual Meeting of the Society for Free Radical Biology and Medicine, Workshop 1, Methods in Free Radical Biology and Medicine and their Application, Seattle, Washington. (November 20, 2003)
- Robert A. Welch Foundation 48th Conference on Chemical Research, Houston, Texas (October 26, 2004)
- Speaker, Symposium honoring Austen Riggs on his 80th Birthday, University of Texas, Austin, Texas (November 12, 2004)
- Robert A. Welch Foundation 49th Conference on Chemical Research, Houston, Texas (October 24, 2005)
- Short Course in Tissue Engineering, CETE, Rice University, Houston, Texas. (August 2005)
- Robert A. Welch Foundation 50th Conference on Chemical Research, Houston, Texas. (October 20, 2006)
- Short Course in Tissue Engineering, CETE, Rice University, Houston, Texas. (August 2006)
- XIVth International Conference on Dioxygen Binding and Sensing Proteins, Stazione Zoologica Anton Dohrn, Napoli, Italy. (September 2006)
- American Society of Hematology, 48th Annual Meeting and Exposition, Orlando, Florida. (December 2006)
- Biophysical Society, 51st Annual Meeting, Baltimore, Maryland (March 2007).
- Keck Center Annual Retreat, Clear Lake, TX (October 2007)
- Robert A. Welch Foundation 50th Conference on Chemical Research, Houston, Texas, October 22-23, 2007
- European Society of Hematology -Club du Globule Rouge et du Fer Euroconference: DISORDERS OF IRON HOMEOSTASIS, ERYTHROCYTES AND ERYTHROPOIESIS, Athens, Greece, November 2-5, 2007
- Southwest Region ACS Meeting, Symposium: Redox Proteins Catalytic and Regulatory Roles (in honor of Dr. David Knaff), Lubbock, TX, November 6-7, 2007
- Workshop on: "Hemoglobin Based Oxygen Carriers: Current Status and Future Directions," *Center for Biologics Evaluation and Research, FDA, The National Heart, Lung, and Blood Institute, NIH and Office of the Secretary and Office of Public Health and Science, DHHS, NIH Campus, Bethesda, Maryland, April 29-30, 2008.*
- Second Annual Wake Forest Nitrogen Oxide Conference at Nemaquin Resort, Farmington, PA, May 22-25, 2008
- XVth International Conference on Oxygen Binding and Sensing Proteins (O₂BiP), Aarhus University, Aarhus, Denmark, August 17-21, 2008