JOHN STEVEN OLSON

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

ADDRESS: Department of BioSicences, Rice University MS 140, 6100 Main Street, Houston, Texas 77005-1892
E-mail: olson@rice.edu

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

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)
Presidential Mentoring Award from Rice University (2017)

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:

Ralph and Dorothy Looney Professor of Biochemistry and Cell Biology, Rice University, 1997-2018, Emeritus 2018-present
Adjunct Professor of Pediatrics-Hematology & Oncology, Baylor College of Medicine, 2006-2018
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, 1983-1997
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 1988))

Lecturer, Biochemistry (Fall Semester and Spring Semester, starting 2016) Bioc/s 301 (150-200 students), 1987-2017;
Lecturer, Advanced Biochemistry (Spring Semester) Bioc/s 302 (~70 students) Spring 2004, 2011-2015.
Lecturer, Physical Chemistry for the Biosciences (Spring Semester) Bios 352 (40-70 students), 1988-2007.
Laboratory Instructor, Advanced Spectroscopy Graduate Laboratory Module, Bios 532 (5-12 students), 1999-2002, 2008-2009.
Instructor in courses prior to 1988: Bioc 361 (6 hr Biochemistry lecture course, 1975 to 1984), Bioc 566-568 (graduate advanced experimental biochemistry lecture and lab course), Bioc 365 and 367 (undergraduate experimental biochemistry lecture and lab course).
Guest Lecturer or minor participant in various other BCB courses (Bioc 583, 481, Bioe 615, and others)
Mentor, Graduate and Undergraduate Research Courses (Bios. 401, 402, 575, 599, 611, 612, 800)
Member, Graduate Student Recruiting and Admissions Committee (1980-1999)
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; 2004-2010).
Member, >80 Research Progress Review/PhD thesis Committees (chair of >25) since 1973
Teaching Mentor for four assistant professors.

b. RICE UNIVERSITY (since 1990)

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, 1987-2008
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, 1999-2016
Member, Committee to Establish the Houston Area NMR Center, 1999-2005
Member, Graduate Council, 2000-2013
Chair, Graduate Council, 2010-2013
Member, Science and Engineering Information and Technology Committee, 2002-2004
Member, Promotion and Tenure Committee, appointed temporarily for Spring 2010.
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 l, 1980-June 30, 1985; July 1, 1987-June 30, 1992; July 1, 2010 - June 30, 2015.

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 Somatogen, Inc and later 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 elected Fellow (1997), American Association for the Advancement of Science, 1990 - present

Reviewer for Biochemistry; *Cell; Proc Natl. Acad. Sci, USA; Blood; Free Rad. in Biol. and Med.; J. Inorg. Chem.; J. Amer. Chem. Soc*. (~15 papers per year).

COMPLETED RESEARCH SUPPORT at Retirement (2016-2017):

1. NIH P01 HL110900 Program Project Grant- Joel M. Friedman, Program Director, Albert Einstein College of Medicine - "Mechanisms and Modulation of Acellular Hb Toxicity" - 8/01/12-7/31/17 – No cost extension. Olson, J.S. P.I. on two subcontracts: Project 2: Engineering HbA to Evaluate Toxicity and Clearance - $215,000 (direct costs per year); and Core C: Recombinant HbA Production for In Vivo Toxicity Studies - $150,000 (direct costs per year plus first year equipment cost of $81,710, Bioreactor).
2. Olson, J.S. (principal investigator), "Chemical Mechanisms of Ligand Binding to Heme Proteins," Grant C-612 from the Robert A. Welch Foundation: $100,000 per year for June 1, 2014 to September 31, 2017. This grant has had continuous funding since 1974.

Previously Completed RESEARCH GRANTS (since 1995):

1. Olson, J.S. (principal investigator), "Functional Properties of Hemoglobin and Myoglobins," National Institutes of Health GM 35649-33 to 36: 9/1/07 to 8/31/11: $1,259,204 total costs for four years; $206,910 in direct costs with No Cost Extension for 9/1/2010 to 8/31/2012. This grant had continuous funding from1973-2012.
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) last year with No Cost Extensions for 06/1/20010 to 5/31/012. This grant had continuous funding from1992-2012.
3. 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.
4. 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 provided 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.

5. 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)
6. 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).
7. 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 (*Abstracts not shown)***)**
(Current Google Scholar Citation Statistics: Total Citations = 24,507; h-index=87; i10-index = 230)

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 b 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, ($\alpha_2\beta_2^{145}$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 ($\alpha_2\beta_2^{146}$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 a and b 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(146β) 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. Quiocho, 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 Quiocho, 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 O_2 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 O_2 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 O_2 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).
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PATENTS

1. U.S. Patent 6022849 issued February 2000, entitled "Mutant Recombinant Hemoglobins containing Heme Pocket Mutations", Filling January 1995. 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 6204009 issued March 2001, entitled "Nucleic Acids Encoding Mutant Recombinant Hemoglobins containing Heme Pocket Mutations", Filling February 1998. 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).
3. U.S. Patent 6812207 issued November 2004, entitled " Hemoglobin Mutants That Reduce Heme Loss" Docket Number 251/US, Filling, Sept 2000 - Inventors: J. S. Olson, T. L. Whitaker, Mark S. Hargrove (all Rice University and based primarily on studies from HL47020).
4. U.S. Patent 7049406, issued May 2006 entitled “Hemoglobin Mutants with Increased Soluble Expression And/Or Reduced Nitric Oxide Scavenging,” Filling March 2002 - co-inventors M. J. Weickert, C. B. Glascock, A. J. Mathews, D. D. Lemon, D. H. Doherty (Somatogen/Baxter Hemoglobin Therapeutics) and J. S. Olson (Rice University based on studies supported by GM 35649 and HL 47020).
5. U.S. Patent 7642233, issued January 2010 entitled: "Enhancing Recombinant Hemoglobin (rHb) Production by Co-expression with Alpha Hemoglobin Stabilizing Protein (AHSP);" Filling March 2007 Co-inventors: John S. Olson and Mitchell J. Weiss (U. Pennsylvania, CHOP) (Rice University studies supported by HL 47020)
6. U.S. Patent 7803912 issued September 2010 entitled "Increasing the Stability of Recombinant Adult Human Apohemoglobin;" Filling March 2007, Co-inventors: John S. Olson and George N. Phillips, Jr. (U. Wisconsin); (Rice University studies supported by GM 35649 and HL 47020)
7. U.S. Patent 11859177, issued November 2019 entitled "Theranostic Methods and Systems for Diagnosis and Treatment of Malaria," Filling July 26, 2019 (continuation of application 14/333,145 filed on July 16, 2014). Co-Inventors Dmitri Lapotko, Katslaryna Hleb, Janet Braam, and John S. Olson (Olson studies supported by GM 35649 and HL 47020)

GRADUATE STUDENT SUPERVISION and TRAINING (all, 1973-present)

A. Graduate Students in Olson Laboratory (31):

Ivan Birukou, Ph.D., "Determination of the Pathways for Oxygen Binding to Human HbA," 2011,
George C. Blouin, Ph.D., "Alkyl Isocyanides as Transition State Analogs for Ligand Entry and Exit in Globins," 2008.
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Ronald J. Rohlfs, Ph.D., "Quantum Yields and Mechanism of Ligand Binding to Heme Proteins," 1989.
Melanie Y. Rose, Ph.D., "Heme Transport and Incorporation into Globin," 1982.
Mallory D. Salter, Ph.D. "Ligand Diffusion Pathways and Mechanisms for Regulating O_2 Affinity in Globins." 2011.
Premila P. Samuel (now Russell), Ph.D. " Expression, Folding, and Assembly Mechanisms of Monomeric Myoglobins and Oligomeric Hemoglobins." 2017 (Co-mentored with George N. Phillips, Jr.)
Rachel Lehninger Schweers, Ph.D., “Electrostatic Regulation of O_2 and CO Binding in the α and β Subunits of Recombinant Human Hemoglobin,” 2004.
Emily E. Scott, Ph.D., "Apomyoglobin and Ligand Movements in Mammalian Myoglobins," 1998.
Lucian P. Smith, Ph.D., “The Effects of Amino Acid Substitution on Apomyoglobin Stability, Folding Intermediates, and Holoprotein Expression,” 2003.
Robert D. Smith, Ph.D., "Correlations Between Bound n-Alkyl Isocyanide Orientations and Pathways for Ligand Binding in Recombinant Myoglobins," 1999.
Kim D. Vandegriff, Ph.D., "Experimental and Theoretical Analyses of Oxygen Exchange by Human Erythrocytes," 1984.
Timothy L. Whitaker, Ph.D., "Residues Controlling the Function and Stability of the CD Corner in Myoglobin and Hemoglobin," 1996.

B. <u>Other graduate students at Rice University</u> who received training and published papers with the Olson laboratory.

1. B. Ellen Friedman Kathleen S. Matthews, Advisor)
2. David M. Miller (Florante A. Quiocho, Advisor)
3. Marietta Dunaway (Kathleen S. Matthews, Advisor)
4. Arturo G. Porras (Graham Palmer, Advisor)
5. Michael D. Davis (Graham Palmer, Advisor)
6. Ah-Lim Tsai (Graham Palmer, Advisor)
7. Peggy A. Whitson (Kathleen S. Matthews, Advisor)
8. Thomas J. Daly (Kathleen S. Matthews, Advisor)
9. Artemis E. Chakerian (Kathleen S. Matthews, Advisor)
10. Pratap K. Nair (J. David Hellums, Chem. Eng.,Advisor)
11. Nancy S. Huang (J. David Hellums, Chem. Eng., Advisor)
12. Michael L. Quillin (George N. Phillips, Jr. , Advisor)
13. Thomas Page (J. David Hellums, Chem. Eng. Advisor)
14. Wen-I Chang (Kathleen S. Matthews, Advisor)
15. Miguel L.Teodoro (George N . Phillips, Jr. , Advisor)
16. Elaine C. Liong (George N . Phillips, Jr., Advisor)
17. Wei Zhang (George N. Phillips, Jr., Advisor)
18. Faiza Hussain (Pernilla Wittungstafshede, Advisor)
19. Matt Pena (Yousif Shamoo, Advisor)
20. Wenjie Zheng (Jane Tao, Advisor)

C. <u>Graduate students in the USA,</u> who received training and published papers with the Olson laboratory.

1. David F. Gaul (Texas Tech U., David Knaff, Advisor)
2. Barry A Springer (University of Illinois, CU, Steven Sligar, Advisor)
3. Yi Dou (Case Western University, Masao Ikeda-Saito, Advisor)
4. Hao Zhu (University of Texas, Austen Riggs, Advisor)
5. Mark V. Thorsteinsson (Virginia Tech U., David Bevan Advisor).
6. Yi Qui (University of Texas, Austin - Austen Riggs)
7. James Knapp (University of Texas, Austin - Austen Riggs and Marvin Hackert)
8. Roman Aranda (U. Wisconsin, George Phillips, Advisor)
9. A. L. Amundson (Western Washington U., Spencer Anthony-Cahill)
10. Erin S. Honsa (Baylor College of Medicine, Anthony Maresso, Advisor)
11. Megan Sjodt (UCLA, Robert Clubb, Advisor)

D. International graduate students, who received training and published papers with the Olson laboratory.

1. Jeremy Tame (Cambridge U., U.K., Kiyoshi Nagai, Advisor)
2. Steven Smerdon (U. York, U.K., Anthony J. Wilkinson, Advisor)
3. Andrea Brancaccio (University of Rome, Italy, Maurizio Brunori, Advisor)
4. Richard A. Watts (University of Australia (Canberra), Elizabeth Dennis, Advisor)
5. Saturo Unzai (Osaka U., Hidecki Morimoto, Advisor).
6. Helen Ferraz, Universidade Federal do Rio de Janeiro (Cristiano P. Borges, Advisor)
7. Federica Draghi (University of Rome, Maurizio Brunori, Advisor)

Rice Undergraduate Research Students(48)

Academic Year	Students
1974-1975	Cynthia D. Binger, Bernhard L. Wiedermann
1975-1976	Patricia M.F. McGovern, George H. Meier
1976-1977	Kendall J. Blumer, Steven C. Meschter
1977-1978	Martha Pritchett, Christopher L. Jagmin
1978-1978	James M. Berry
1978-1979	James M. Berry, Pamela J. Davis
1981-1982	Mark Jenkins
1982-1983	Mark Jenkins, Richard D. Woessner
1985-1986	Tony Ai-Chi Pham
1986-1987	Theodore E. Carver
1989-1990	Pampee Paul
1990-1991	Kurt Wey
1991-1992	Daniel Lyons, Raymond H. Eich
1992-1993	Traci D. Allen, Raymund F. Eich, H. Henry Lai
1993-1994	Francis E. Chen, Raymund F. Eich, H. Henry Lai, Brian C. Knowles
1994-1995	Francis E. Chen
1995-1996	Manish A. Vira, Joshua J. Warren
1996-1997	Alison F. Woo
1997-1998	Sarah A. Klizas, Brett Partridge
1998-1999	Eden Paster, R. Chase Thebault
1999-2000	Francis Mark Dunning, Erin Weber
2003-2004	Brian Solomon
2004-2005	Molly Horstman
2005-2006	Cambria Alpha, Phillip Parmet, Windsen Pan
2006-2007	Ben Shields, Windsen Pan
2007-2008	Tejas Manchandia
2008-2009	Ritu Rajan, Arindam Sarkar

2009-2010	Deepika Satish
2010-2011	Elliot SoRelle
2012-2013	David Jiang,
2013-2014	David Jiang, Nader Aboul-Fettouh
2014-2015	Jake Jacobs, Kristen Sweeney
2015-2016	Kristen Sweeney (William Ou – officially George Phillips' student)

POSTDOCTORAL SUPERVISION (since 1995):

Name:	Year(s) Supervised:
A. Benitez Cardenas	2014 - 2017
N. Pandey	2014 - 2015
T. Guu	2012 - 2013
M. Walkowicz	2011 - 2012
G. Blouin	2008 - 2010
C. Varnado	2006 - 2016
D. Maillett	2003 - 2004
N. Matsuda	2002 - 2006
Y. Dou	1997 - 2002
E. Scott	1998 - 1999
M. Hargrove	1995 - 1998

COLLABORATIONS (GRANTS and PAPERS, 1995 -Present):

Abdu Alayash	CBER, FDA	Oxidative reactions of Hbs and Mbs
Spencer Anthony-Cahill	Western Washington U.	Blood substitute design
Philip Anfinrud	NIH, Bethesda, MD	Time Resolved Crystallography
Martino Bolognesi	University of Milan	Structures of invertebrate Hbs
Paul Champion	Northeastern U.	Ultrafast heme protein reactions
Terry D. Connell	SUNY, Buffalo	Heme transport by *Bordetella avium*
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)
Teizo Kitagawa	Okazaki National Research Institue	Resonance Raman studies of Mbs/Hbs
Anthony Maresso	Baylor College of Medicine	Heme transport by *Bacillus Anthracis*
JJ Miranda	Harvard University	Thermoglobins *(Aquifex aeolicus)*
Benfang Lei	Montana State, Vet. School	Heme transport by *Streptococcus* G
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
Andre Palmer	Ohio State University	Blood Substitute Design
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, TR X-ray crystallography
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, CHOP	AHSP, rHb co-expression

Anthony Wilkinson U. York, UK Mammalian Mbs and crystallography

PRESENTATIONS (2000 – 2018 (retirement)):

1. "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).
2. "Blood Substitutes, An Update," Lecture, Advances in Tissue Engineering Course, Rice University, Houston, Texas (August 13, 2000).
3. "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).
4. "NO Dioxygenation, Vasoregulation, and Blood Substitutes," Symposium in Honor of Reinhold and Ruth Benesch, Rockefeller University, New York, City, New York (October 30, 2000).
5. "Blood and Money: Using Chemistry and Biophysics to Design Second Generation O_2 Delivery Pharmaceuticals," Welch Foundation Lecture Tour, The University of Texas, Permian Basin, Department of Chemistry, Odessa, Texas (November 8, 2000).
6. "Blood and Money: Using Chemistry and Biophysics to Design Second Generation O_2 Delivery Pharmaceuticals," Welch Foundation Lecture Tour, Department of Chemistry, McMurry University (and Hardin Simmons and Abilene Christian Universities) (November 9, 2000).
7. "Blood and Money: Using Chemistry and Biophysics to Design Second Generation O_2 Delivery Pharmaceuticals," Welch Foundation Lecture Tour, Department of Chemistry, Midwestern State University, Wichita Falls, Texas (November 10, 2000).
8. "Blood Substitutes and NO Dioxygenation," Workshop on Myoglobin Biophysics and Physiology, Los Alamos National Laboratory, Los Alamos, New Mexico (November 28, 2000).
9. "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).
10. "NO Dioxygenation, Vasoregulation, and Blood Substitutes," invited lecture, Department\ of Biochemistry, University of Wisconsin, Madison, Wisconsin (April 9, 2001).
11. "O_2 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).
12. "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).
13. "Blood Substitutes," Invited lecture, Advances in Tissue Engineering Course, CETE and Department of Bioengineering, Rice University, Houston, Texas (August 15, 2001).
14. "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).
15. "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).
16. "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)
17. "Blood, Toil, Tears, and Sweat: The Design of Second Generation O_2 Delivery Pharmaceuticals," Invited talk, New England Biolabs, Beverly, Massachusetts (May 13, 2002)
18. "NO Dioxygenation, Vasoregulation, and Blood Substitutes," Invited talk, Dept. of Biochemistry and Molecular Pharmacology, U Mass Med. School, Worcester, Massachusetts (May 15, 2002)
19. "Protein Engineering at Rice," Invited talk, Special Session at the May Board of Trustees Meeting, Rice University, Houston, Texas (May 2002)

20. "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)
21. "Blood, Toil, Tears, and Sweat: The Design of Second Generation O_2 Delivery Pharmaceuticals," Advances in Tissue Engineering course, CETE and Dept. of Bioengineering, Rice University, Houston, Texas (August 17, 2002)
22. "Protein Engineering at Rice," Invited talk, Tanox delegation, Rice University (September 26, 2002)
23. "Blood, Toil, Tears, and Sweat: Using Molecular Biophysics to Design O_2 Delivery Pharmaceuticals." Department of Chemistry, University of Texas, El Paso, El Paso, Texas. (March 28, 2003)
24. "Electrostatics, Baseball Gloves, and Blood Substitutes." Department of Biochemistry & Cell Biology, Rice University, Houston, Texas. (March 31, 2003)
25. "The Design of Blood Substitutes." Baylor College of Medicine Course, Structural Basis of Human Disease, Texas Medial Center, Houston, Texas. (May 1, 2003)
26. "Blood Pressure, Baseball Gloves, and Blood Substitutes." Advances in Tissue Engineering Course, CETE and Department of Bioengineering, Rice University, Houston, Texas. (August 15, 2003)
27. "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)
28. "Blood, Toil, Tears, and Sweat: Using Molecular Biophysics to Design O_2 Delivery Pharmaceuticals." Department of Chemistry, University of Texas, San Antonio, San Antonio, Texas. (September 8, 2003)
29. "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)
30. “Blood Pressure, NO Dioxygenation, Hemoglobin Expression, and the Design of Blood Substitutes," Iowa State University, Ames, Iowa (September 16-17, 2004)
31. "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)
32. "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)
33. "Recombinant Hemoglobin: A Potential Starting Material for all Hb-based Blood Substitutes," BioPure, Inc., Cambridge, Massachusetts (June 10, 2005).
34. "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)
35. "O_2 Transport, NO Dioxygenation, and the Design of Recombinant Hemoglobin-Based Blood Substitute," Auburn University, Auburn, Alabama (March 2006)
36. "Design of Hemoglobin-Based Oxygen Carriers (HBOCs)," Structural Basis of Human Disease -- Baylor College of Medicine Graduate Course, Houston, Texas (April 2006)
37. "Design of Third Generation Hemoglobin-Based Oxygen Carriers (HBOCs)," Short Course in Tissue Engineering, CETE, Rice University, Houston, Texas (August 2006)
38. "O_2 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)
39. "Designing Recombinant Hemoglobin to Be a Safe and Effective Blood Substitute," 48th American Society of Hematology Annual Meeting and Exposition, Orlando, Florida (December 2006)
40. "Biophysics, Baseball Gloves, and Blood Substitutes," Emily M. Gray Award Lecture, 51st Annual Biophysical Society Meeting, Baltimore, Maryland (March 2007).

41. "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)
42. "O_2 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
43. "Hemoglobin-Based Oxygen Carriers (HBOCs) and Hypertension," Structural Basis of Human Disease - Baylor College of Medicine Graduate Course, Houston, Texas, April 2007.
44. "Pathways for O_2 binding to globins, NO dioxygenation, and Hb-based Blood Substitutes," University of Texas Medical Branch Galveston, September 2007
45. "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
46. "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.
47. "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.
48. "Hemoglobin-Based Oxygen Carriers (HBOCs) and Hypertension," Structural Basis of Human Disease - Baylor College of Medicine Graduate Course, Houston, Texas, April 2008.
49. "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.
50. "Lessons Learned from Mutagenesis: Reactions of NO with Mbs and Hbs," Second Annual Wake Forest Nitrogen Oxide Conference at Nemacolin Resort, Farmington, PA, May 22-25, 2008
51. "Evolution of O_2 transport and storage by hemoglobins: From Bacteria to Plants and Animals," AP Biology Teachers Workshop, Rice University, June 2008
52. "Recombinant Hemoglobin is the Ultimate Starting Material for all Hb-based blood substitutes," NSF REU Cellular Engineering Lunch Seminar, Rice University, June 2008
53. "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.
54. "NO Binding, NO dioxygenation, and Nitrite Reactions," at XVth International Conference on Oxygen Binding and Sensing Proteins (O2BiP), Aarhus University, Aarhus, Denmark, August 2008
55. "Hemoglobin Gates and Tunnels: Different Ways to Capture O_2 and Detoxify NO," Department of Chemistry and Biochemistry and Institute of Computational Sciences and Engineering, University of Texas, Austin, TX January, 2009.
56. "Hemoglobin Gates and Tunnels: Different Ways to Capture O_2 and Detoxify NO," Department of Chemical and Biomolecular Engineering, Ohio State University, Columbus Ohio, March 2009.
57. "Structure Based Design of Blood Substitutes," Structural Basis of Human Disease - Baylor College of Medicine Graduate Course, Houston, Texas, April 2008.
58. "Strategies for Engineering Safer, More Efficient, and More Stable Hb-Based Blood Substitutes." TAGEN G-COE Workshop on Metals in Medicine and Biochemistry, Sendai, Japan, July 2009
59. "Myths and Truths about the Reactions of NO with Hemoglobins." TAGEN G-COE Mini-Symposium on Biological Inorganic Chemistry**,** Sendai, Japan, July 2009

60. "Myoglobin: From Electrostatic Fields to Gates and Tunnels."14th International Conference on Biological Inorganic Chemistry (ICBIC 14), Session on *New Trends in Bioinorganic Chemistry*, Nagoya, Japan, July 2009
61. "NO Dioxygenation, Autooxidation, Hemin loss, and Re-engineering the Distal Pocket of Recombinant Hb-Based Oxygen Carriers." Invited Lecture at XII ISBS International Symposium on Blood Substitutes Parma, Italy, August 2009
62. “Hemoglobn disorders and structure-based design of blood substitutes.” Structural Basis of Human Disease - Baylor College of Medicine Graduate Course, Houston, Texas, April 2010
63. "Evolution of Hemoglobin Gates and Tunnels: Different Ways to Capture O_2," Department of Physiology and Biophysics, Virginia Commonwealth University Medical Center, Richmond, VA.
64. ""“NO Dioxygenation, Globin Evolution, and Recombinant Hb-based Blood Substitutes.” Department of Medicinal Chemistry, University of Kansas, Lawrence, KS April, 2011
65. “NO Dioxygenation, Globin Evolution, and Recombinant Hb-based Blood Substitutes.” Department of Biochemistry & Molecular Biology, University of Kansas Medical School, Kansas City, KS.
66. “Hemoglobn disorders and structure-based design of blood substitutes.” Structural Basis of Human Disease - Baylor College of Medicine Graduate Course, Houston, Texas, May 2011
67. "Recombinant Hb-Based Oxygen Carriers: Optimizing Design, Testing Toxicities, and Production Problems" - Interagency Alternative Oxygen Therapeutics Working Group , NIH/DOD/FDA - Massachusetts General Hospital, Boston, MA July 2011
68. "Engineering Recombinant Hb-Based O_2 Carriers to Be More Effective, Safer, and Easier To Produce" XIII International Symposium on Blood Substitutes and Oxygen Therapeutics (ISBS) - Boston, MA, August 2011
69. "Strategies for Engineering Safer, More Efficient, and More Stable Recombinant Hemoglobins for Use as O_2 Delivery Pharmaceuticals" - Sangart, Inc., San Diego, CA October 2011
70. "Acellular Hb Toxicity, NO Dioxygenation, and Engineering Hb-Based Oxygen Carriers (HBOCs)" - Greater Philadelphia Red Cell Club, Children's Hospital of Philadelphia, PA October 2011.
71. “Recombinant Hb-Based Oxygen Carriers.” Structural Basis of Human Disease - Baylor College of Medicine Graduate Course, Houston, Texas, April 2012
72. “How ligands bind to Globins: A Sliding Rule for Affinity, NOD, and Gates versus Tunnels for Entry and Exit” Session Chair, XVIIth International Conference on Oxygen Binding and Sensing Proteins (O2BiP), University of Parma, Parma, Italy, August 2012
73. “Recombinant Hb-Based Oxygen Carriers: Optimizing Design, Testing Toxicities, and Production Problems,” – Rice University course, BIOE 615: Bioengineering and Cardiac Surgery, November 2012
74. “Gates versus Tunnels: from Alkyl Isocyanides to Mutagenesis Mapping” - Protein structure, function, and dynamics: a tribute to MAURIZIO BRUNORI, Symposium sponsored by Department of Biochemical Sciences, Sapienza University of Rome, Rome, Italy, November 2012.
75. "Recombinant Hb-Based Oxygen Carriers: Optimizing Design, Testing Toxicities, and Enhancing Production." Sangart External Scientific Advisory Board Meeting March 2013
76. "Recombinant Hb-Based Oxygen Carriers: Optimizing Design, Testing Toxicities, and Enhancing Production." Citywide Transfusion Medicine conference, Methodist Hospital, April 2013
77. “Blood Substitutes (HBOCs), Transfusions with Old Red Blood Cells, and the Toxicity of Plasma Cell-free Hemoglobin” Structural Basis of Human Disease - Baylor College of Medicine Graduate Course, Houston, Texas, May 2013
78. "Hemoglobin Evolution and Engineering: From Baseball Gloves to Blood Substitutes" Seminar at the University of Nebraska, Lincoln, September 2013.
79. "The Kinetics of Ligand Binding: From Pac-Man to Pathways" – Symposium Honoring Florante A. Quiocho, BCM Biochemistry, September 2014

80. "Blood Substitutes (HBOCs), Transfusions with Old Red Blood Cells, and the Toxicity of Plasma Cell-free Hemoglobin" Structural Basis of Human Disease - Baylor College of Medicine Graduate Course, Houston, Texas, May 2014
81. "An Introduction to Selectively Engineering Ligand Affinities and Resistance to Autooxidation in Heme Proteins" XVIIIth International Conference on Oxygen Binding and Sensing Proteins (O2BiP), University of Sheffield, July 2014
82. "Transfusions, Hypertension, Evolution, and Baseball Gloves: *Lessons Learned from 46 Years of Hemoglobin Research,* City," University of New York, NYC September 2014
83. "Blood Substitutes (HBOCs), Transfusions with Old Red Blood Cells, and the Toxicity of Plasma Cell-free Hemoglobin" Structural Basis of Human Disease - Baylor College of Medicine Graduate Course, Houston, Texas, May 2015.
84. "Strategies for Engineering rHBOCs: Compromises between Hemoglobin Stability, Production, Function, and Toxicity *In Vivo*." 2015 International Symposium on Blood Substitutes (ISBS – *Toward Novel Blood Transfusion Therapies*) in Lund, Sweden, June 2015.
85. "Ligand discrimination by hemoglobins and myoglobins: How does it work and why", Symposium on Frontiers of Iron Chemistry in Biology, Pacifichem 2015 Meeting (ACS sponsored), Honolulu, HI, December 2015
86. "Blood Substitutes (HBOCs), Transfusions with Old Red Blood Cells, and the Toxicity of Plasma Cell-free Hemoglobin" Structural Basis of Human Disease - Baylor College of Medicine Graduate Course, Houston, Texas, April 2016.
87. "Human Hemoglobinopathies: Lessons in Globin Engineering, Physiology, and Pathologies." Ching-Nan Ou Symposium, Texas Children's Hospital, May 2016.
88. "Strategies for Engineering HBOCs" Combat Casualty Care Research Program (CCCRP)-Oxygen Carrier State of the Science Meeting, Fort Detrick, MD. February 2017
89. "Hemoglobinopathies: Some of the First Structural Interpretations of Human Disease" Structural Basis of Human Disease - Baylor College of Medicine Graduate Course, Houston, Texas, April 2017.
90. "The Fundamentals of Ligand Binding to Human Hemoglobin: *Some Biophysics, Physiology, and Pathology*." Harris County Institute for Forensic Science, Houston, Texas, January 2018
91. "Hemoglobins and Red Cells Really Are Interesting: Lessons Learned from 45 Years of Globin Research at Rice", a valedictory lecture, BioSciences Department at Rice, Houston, TX, January 2018.
92. "Hemoglobinopathies: Some of the First Structural Interpretations of Human Disease" Structural Basis of Human Disease - Baylor College of Medicine Graduate Course, Houston, Texas, March 2018.
93. "Lessons Learned from 50 Years of Hemoglobin Research: Unstirred Layers, Electrostatics, Baseball Gloves, and Molten Globules." Plenary Lecture, XXth International Conference on Oxygen Binding and Sensing Proteins (O2BiP), University of Barcelona, Barcelona, Spain, September 2018.
94. "Hemoglobinopathies: Some of the First Structural Interpretations of Human Disease" Structural Basis of Human Disease - Baylor College of Medicine Graduate Course, Houston, Texas, April 2019.