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RESEARCH INTERESTS

The *Shultz* group examines relationships between molecular structure of paramagnetic molecules and their properties, so-called “magneto-structural correlations.” Such studies are important first steps in the design of molecules for spintronics (*spin*-based electronics) and for understanding and controlling electron transfer/transport events in general. In particular, we design, synthesize and characterize transition metal complexes of semiquinone-type ligands. Of particular interest to our group are the factors affecting magnetic interactions amongst unpaired electrons within the same molecule. Collectively, these interactions are called “exchange coupling” (designated by the exchange parameter, J) and our group has revealed how substituents, electron delocalization, conformation and donor-acceptor interactions define both the sign ($J > 0$ = high-spin ground state; $J < 0$ = low-spin ground state) and magnitude of J . We are also determining how exchange interactions affect electronic excited state dynamics. Such studies could lead to a new class of light-absorbing molecules used in dye-sensitized solar cells.

EDUCATION

<i>Postdoctoral Research Fellow</i> California Institute of Technology <i>Advisor:</i> Professor Dennis A. Dougherty <i>Research Area:</i> High-spin organic molecules	July 1989 - August 1992
<i>Ph.D., Organic Chemistry</i> The University of Texas at Austin <i>Advisor:</i> Professor Marye Anne Fox <i>Research Area:</i> Tetraphenylethylene excited states and dianions	June 1989
<i>B.A., Chemistry</i> Shippensburg University of Pennsylvania <i>Advisor:</i> Professor John H. Grezlak <i>Research Area:</i> Polymer chemistry	May 1984

RESEARCH EXPERIENCE

<i>Professor of Chemistry</i> North Carolina State University	2003
<i>Associate Professor of Chemistry</i>	1998 - 2003

North Carolina State University	
<i>Assistant Professor of Chemistry</i>	1992 - 1998
North Carolina State University	
<i>Postdoctoral Research Fellow</i>	1989 - 1992
California Institute of Technology	
<i>Research Assistant</i>	1985 - 1989
The University of Texas at Austin	

HONORS

As an Undergraduate

1. Eastman Kodak Scholarship Award, Spring 1982
2. Analytical Chemistry Award, Spring 1983
3. Lehigh University Summer Research Fellow, Summer 1983
4. Class of 1920 Award in Science, Spring 1984

As NC State University Faculty

5. Research Corporation Cottrell Scholar Award, 1995
6. National Science Foundation CAREER Award, 1995
7. Sigma Xi Research Award, 1997
8. University of Texas, Department of Chemistry Distinguished Alumni Speaker, 1997
9. Inducted into Phi Kappa Phi National Honor Society, 1998
10. Camille Dreyfus Teacher-Scholar, 1998
11. Shippensburg University Outstanding Alumni Award, 1998
12. Member, Advisory Committee for VIIth International Conference on Molecular Magnetism, San Antonio, 2000

DEGREES AWARDED

1. Debra J. Driscoll, M.S., 1995, "New Molecular Magnetic Materials Based on Semiquinone Complexes of Iron (III)." (*co-chair with Charles Cornman*)
2. Joseph Perrone, M.C., 1995, "Animations of Organic Reactions."
3. Kay A. Sandberg, Ph.D., 1998, "Theoretical Investigations of Spin-Spin Interactions: Semiempirical Estimations of the Exchange Parameter for Diradical Metalloporphyrin Cations and Zero Field Splitting Parameter for Conjugated Diradicals."
4. Martha G. Hollomon, Ph.D., 1998, "Synthesis and Characterization of Oligomeric/Polymeric Assemblies as Organic Based Molecular Magnetic Materials."
5. Andrew K. Boal, M.S., 1998, "Molecules for Magnets. I: Synthesis and Characterization of Several Bis(semiquinone)s. II: Structure-Property Relationships in Trimethylenemethane Type Biradicals."
6. Kevin P. Gwaltney, Ph.D., 1999 "Cross-Conjugated Bis(Porphyrin)s: Synthesis, Electrochemical Behavior, Mixed Valency, and Biradical Dication Formation."
7. Christopher P. Mussari, M.S., 2001 "Investigating the Evolving Phenomenon of Magnetism: The Study of Spin-Spin Interactions in Radical Substituted Porphyrins, and Synthetic Efforts toward Realizing Multi-Dentate Organic Molecules and Very High-Spin Polyradical Complexes."

8. Scot H. Bodnar, Ph.D., 2002 "Electronic Studies of High-Spin Organic Molecules: From the Effects of Substituents on Exchange Coupling to New Heterospin Species."
9. Mary A. Klein, M.S., 2003 "Substituted Carbonyl-Linked Bis(dioxolene) Complexes: Is a Carbonyl an Effective Ferromagnetic Coupler?"
10. Joe Sloop, Ph.D., 2003 "Substituent Effects on Spin Density Distribution and Exchange Coupling in Semiquinone Complexes."
11. Rosario M. Fico, Jr., Ph.D., 2003 "Electronic Structure of Biradicals." (co-chair with Marye Ann Fox)
12. Sofi Bin-Salomon, Ph.D., 2005 "New Valence Tautomeric Materials."
13. Candice L. Brannen, Ph.D., 2006 "Donor Acceptor Biradicals."
14. Linda Ogallo, M.S., 2006 "Synthesis of Ligands for Magnetic Materials."
15. Tashni-Ann Coote, Ph.D., 2007 "Substituent Effects on Exchange Coupling"
16. Robert D. Schmidt, Ph.D., 2010 "Investigation of the Electronic and Magnetic Properties of Electron Exchange: Exchange Coupled Donor-Acceptor Biradicals and Novel Magnetic Behaviors of Bis(pyridyl)Cobalt Dioxolene Valence Tautomers"

PUBLICATIONS

(*Prior to coming to NC State; †Undergraduate co-authors)

1. *"Twisting in the Tetraphenylethylene Dianion," Fox, M.A.; Shultz, D.A. *J. Org. Chem.* **1988**, *53*, 4386-4390.
2. *"Spectroscopic Properties of Bis[*n*.1]metacyclophanylidenes," Shultz, D.A.; Fox, M.A. *Tetrahedron Lett.* **1988**, *29*, 4377-4379.
3. *"The Effect of Phenyl Ring Torsional Rigidity on the Photophysical Behavior of Tetraphenylethylenes," Shultz, D.A.; Fox, M.A. *J. Am. Chem. Soc.* **1989**, *111*, 6311-6320.
4. *"Structural Effects on the Disproportionation of Tethered Tetraphenylethylene Radical Anions," Shultz, D.A.; Fox, M.A. *J. Org. Chem.* **1990**, *55*, 1047-1051.
5. *"Approaches to Magnetic Organic Materials," Dougherty, D.A.; Grubbs, R.H.; Kaisaki, D.A.; Chang, W.; Jacobs, S.J.; Shultz, D.A.; Anderson, K.K.; Jain, R.; Ho, P.T.; Stewart, E.G. *Magnetic Molecular Materials*, D. Gatteschi *et al.*, eds., Kluwer Academic Publishers, 1991, pp. 105-120.
6. *"Evaluation of Possible Ferromagnetic Coupling Units — The bis(TMM) Approach to High-Spin Organic Molecules," Jacobs, S.J.; Shultz, D.A.; Jain, R.; Novak, J.; Dougherty, D.A. *J. Am. Chem. Soc.* **1993**, *115*, 1744-1753.
7. †"Preparation of *meso*-Tetra(4-galvinolphenyl)porphyrin — A Building Block for Molecular Magnetic Materials," Shultz, D.A.; Knox, D.A.; Morgan, L.W.; Sandberg, K.; Tew, G.N. *Tetrahedron Lett.* **1993**, 3975-3978.
8. †"Electrochemical Oxidation of a Galvinol-Substituted Alkanethiol Self-Assembled Monolayer," Shultz, D.A.; Tew, G.N. *J. Org. Chem.*, **1994**, *59*, 6159-6160.
9. "Comparative Stability of Fluoroketone Hemi-thioacetals, -Ketals, and -Hydrates," Linderman, R.J.; Tennyson, S.D.; Shultz, D.A. *Tetrahedron Lett.* **1994**, *35*, 6437-6440.

10. †"Preparation and Characterization of a Bis-Semiquinone — a Bidentate Dianion Biradical," Shultz, D.A.; Boal, A.K.; Driscoll, D.J.; Kitchin, J.R.; Tew, G.N. *J. Org. Chem.*, **1995**, *60*, 3578-3579.
11. †"Galvinitroxide — a New Triplet Biradical," Shultz, D.A.; Boal, A.K. *Mol. Cryst. Liq. Cryst.* **1995**, *272*, 75-79.
12. "Preparation and Characterization of a Bis-galvinoxyl-disulfide," Shultz, D.A.; Zhao, Q. *Tetrahedron Lett.* **1996**, *37*, 8837-8840.
13. †"Preparation of Paramagnetic Ligands for Coordination-Complexes and Networks With Interesting Magnetic Properties," Shultz, D.A.; Boal, A.K.; Driscoll, D.J.; Farmer, G.T.; Hollomon, M.G.; Kitchin, J.R.; Miller, D.B.; Tew, G.N. *Mol. Cryst. Liq. Cryst.* **1997**, *305*, 303-310.
14. "The Biradical, Bis-(3,5-di-*tert*-butyl-4-phenoxy)methyleneadamantane, Exhibits Matrix-Dependent EPR Spectra Suggesting Rotamer Bistability with Differential Exchange Coupling," Shultz, D.A.; Boal, A.K.; Farmer, G.T. *J. Am. Chem. Soc.* **1997**, *119*, 3846-3847.
15. *"Attempted Synthesis of a Stable, Quintet, Tetraphenoxy Tetraradical: Facile Rearrangement of a Substituted Bicyclobutane," Anderson, K.K; Shultz, D.A.; Dougherty, D.A. *J. Org. Chem.* **1997**, *62*, 7575-7584.
16. "Spin Delocalization in Phenylnitroxide-substituted Metalloporphyrins," Shultz, D.A.; Gwaltney, K.P.; Lee, H. *J. Org. Chem.* **1998**, *63*, 769-774.
17. *†"The Effect of Aliphatic Amine Bases on the Aggregation of Alkali Metal Salts of 3,5-Di-*tert*-butylsemiquinone (3,5-DBSQ)," Shultz, D.A.; Boal, A.K.; Campbell, N.P. *Inorg. Chem.* **1998**, *37*, 1540-1543.
18. "An Improved Method for Estimating ZFS Parameters for Delocalized Biradicals," Shultz, D.A.; Sandberg, K.A. *J. Phys. Org. Chem.* **1998**, *11*, 819-824.
19. "A Modified Procedure for Sonogashira Couplings: Synthesis and Characterization of a Bis-porphyrin, 1,1-Bis-[5'-ethynyl-10',15',20'-Trimesityl-(Zn)-porphyrinyl]-Methylenecyclohexane," Shultz, D.A.; Gwaltney, K.P.; Lee, H. *J. Org. Chem.* **1998**, *63*, 4034-4038.
20. "Electrochemical and Spectroelectrochemical Study of a Bis-arylgalvinol-substituted Alkyldisulfide Monolayer and Mixed Monolayers on Polycrystalline Gold," Sagara, T.;* Midorikawa, T.; Shultz, D.A.;* Zhao, Q. *Langmuir* **1998**, *14*, 3682-3690.
21. "Synthesis and Characterization of a Nitroxide-Semiquinone Biradical," Shultz, D.A.; Farmer, G.T. *J. Org. Chem.* **1998**, *63*, 6254-6257.
22. "pH-Gated Single Electron Tunneling in Chemically Modified Au Nanoclusters," Brousseau, L.; Zhao, Q.; Shultz, D.A.; Feldheim, D.L. *J. Am. Chem. Soc.* **1998**, *120*, 7645-7646.
23. "Oxidation of a Bis[Zn(II) porphyrin] Yields a Nondisjoint, Exchange-Coupled π Dication-Biradical," Shultz, D.A.; Lee, H.; Gwaltney, K.P. *J. Org. Chem.* **1998**, *63*, 7584-7585.
24. "Synthesis and Electron Paramagnetic Resonance Spectral Characterization of Bis(Semiquinone)s," Shultz, D.A.; Boal, A.K.; Farmer, G.T. *J. Org. Chem.* **1998**, *63*, 9462-9469.
25. "A Semiempirical Computational Assessment of Porphyrins as Building Blocks for Molecule-Based Magnets — Spin-Spin Coupling in Radical-substituted Metalloporphyrins," Shultz, D.A.; Sandberg, K.A. *J. Phys. Org. Chem.* **1999**, *12*, 10-18.
26. "Au Particles as Templates for the Synthesis of Hollow Conductive Polymer Nanocapsules," Marinakos, S.M.; Shultz D.A.; Feldheim, D.L. *Adv. Mater.* **1999**, *11*, 34-37.

27. "Paramagnetic Zinc(II) Complexes of a Bis(Catechol): Dependence of Product Spin-State on Tautomerization of the Bis(Catechol) Ligand," Shultz, D.A.; Bodnar, S.H.. *Inorg. Chem.* **1999**, *38*, 591-594.
28. "Structure-Property Relationships in Trimethylenemethane-Type Biradicals. II. Synthesis and EPR Spectral Characterization of Dinitroxide Biradicals," Shultz, D.A.; Boal, A.K.; Lee, H.; Farmer, G.T. *J. Org. Chem.* **1999**, *64*, 4386-4396.
29. "Synthesis and Characterization of a Planarized, Trimethylenemethane-Type Bis(Semiquinone) Biradical," Shultz, D.A.; Lee, H.; Fico, R.M., Jr. *Tetrahedron* **1999**, *55*, 12079-12086.
30. "Cross-Conjugated Bis(Porphyrin)s: Synthesis, Electrochemical Behavior, Mixed Valency, and Biradical Dication Formation," Shultz, D.A. Lee, H.; Kumar, R.K.; Gwaltney, K.P. *J. Org. Chem.* **1999**, *64*, 9124-9136.
31. "Both an Oxidation/Reduction Sequence and Deprotonation of a Unique Paramagnetic Ligand Lead to a Mixed-Valent Complex," Shultz, D.A.; Bodnar, S.H.; Kumar, R.K.; Kampf, J.W. *J. Am. Chem. Soc.* **1999**, *121*, 10664-10665.
32. "Electronic Properties of Bisporphyrin Biradical Dications," Shultz, D.A.; Lee, H.; Gwaltney, K.P.; Sandberg, K.A. *Mol. Cryst. and Liq. Cryst.* **1999**, *334*, 459-467.
33. "Preparation and EPR Spectroscopic Investigation of Conjugated Oligomers Containing Semiquinone Repeat Units," Shultz, D.A.; Hollomon, M.G. *Chem. Mater.* **2000**, *12*, 580-585.
34. "Synthesis of Nanometer-sized Hollow Polymer Capsules from Alkanethiol-coated Gold Particles," Minglang Wu, M.; Stacy A. O'Neill, S.A.; Louis C. Brousseau, L.C.; Wyatt McConnell, W.; Shultz, D.A.; Feldheim, D.L.; Linderman, R.J. *Chem. Commun.* **2000**, 775-776.
35. "Synthesis and Structure of a Complex Having a Quartet Ground State with Three Entirely Different Spin Carriers: Nitronyl Nitroxide, *ortho*-Semiquinone, and Cu^{II}," Shultz, D.A.; Bodnar, S.H.; Vostrikova, K.E.; Kampf, J.W. *Inorg. Chem.* **2000**, *39*, 6091-6093.
36. "A Ferromagnetically Coupled Bis-Semiquinonato Ligand Enforces High-Spin Ground States in Bis-Metal Complexes," Caneschi, A.; Dei, A.; Lee, H.; Shultz, D.A.; Sorace, L., *Inorg. Chem.* **2001**, *40*, 408-411.
37. "Molecular Structures of Carbonyl-Linked Bis(Dioxolene) Complexes: Can a Carbonyl Group Act as an Effective Ferromagnetic Coupler?," Shultz, D.A.; Bodnar, S.H.; Kumar, R.K.; Lee, H.; Kampf, J.W. *Inorg. Chem.* **2001**, *40*, 546-549.
38. "Molecular Structure of and Exchange Coupling in a Bis(Semiquinone) Complex," Shultz, D.A.; Bodnar, S.H.; Kampf, J.W. *Chem. Commun.* **2001**, 93-94.
39. "Structure-Property Relationships in Building Blocks for Open-Shell Molecules and Materials," Shultz, D.A. *Synth. Met.* **2001**, *122*, 495-500 (Miller Symposium, invited).
40. "Structure-Property Relationships in Cross-Conjugated, High-Spin, Dinuclear Ligands: Building Blocks for Open-Shell Molecules and Materials," Shultz, D.A. *Polyhedron* **2001**, *20*, 1627-1631 (ICMM, invited).
41. "Charge Distribution in bis-Dioxolene Radical Metal Complexes. Synthesis and DFT Characterization of Dinuclear Co^{III} and Cr^{III} Complexes with a Mixed Valent, S = 1/2 Semiquinone-Catecholate Ligand," Bencini, A.; Daul, C.A.; Dei, A.; Mariotti, F.; Lee, H.; Shultz, D.A.; and Sorace, L. *Inorg. Chem.* **2001**, *40*, 1582-1590.
42. "Spin Robustness of a New Hybrid Inorganic-Organic High-Spin Molecule," Depperman, E.; Bodnar, S.H.; Vostrikova, K.E.; Shultz, D.A.;* Kirk, M.L.* *J. Am. Chem. Soc.* **2001**, *123*, 3133-3134.

43. "One-Electron Reduction of an Antiferromagnetically-Coupled Triradical Yields a Mixed-Valent Biradical with Enhanced Ferromagnetic Coupling," Shultz, D.A.;* Kumar, R.K. *J. Am. Chem. Soc.* **2001**, *123*, 6431-6432.
44. "Observation of a Hysteretic Phase Transition in a Crystalline Dinitroxide Biradical That Leads to Magnetic Bistability," Shultz, D.A.* Fico, R.M., Jr.; Boyle, P.D.; Kampf, J.W. *J. Am. Chem. Soc.* **2001**, *123*, 10403-10404.
45. "Thermal Hysteresis in Molecule-Based Magnetic Materials Can Be Induced by Appropriate Dioxolene Ligand Design," Bodnar, S.H.; Caneschi, A.; Dei, A.;* Shultz, D.A.;* Sorace, L. *Chem. Commun.* **2001**, 2150-2151.
46. "Structure-Property Relationships in New Semiquinone-Type Ligands — Past, Present, and Future Research Efforts," Shultz, D.A. *Comments Inorg. Chem.* **2002**, *23*, 1-21.
47. "High-Spin Metal Complexes Containing a Ferromagnetically-Coupled Tris(Semiquinone) Ligand," Caneschi, A.; Dei, A.;* Mussari, C.P.; Shultz, D.A.* *Inorg. Chem.* **2002**, *41*, 1086-1092.
48. "The Singlet-Triplet Gap in Triplet Ground-State Biradicals Is Modulated by Substituent Effects," Shultz, D. A.;* Bodnar, S. H.; Lee, H.; Kampf, J. W.; Incarvito, C. D.; Rheingold, A. L. *J. Am. Chem. Soc.* **2002**, *124*, 10054-10061.
49. "Trends in Metal-Biradical Exchange Interaction for First-Row MII(Nitronyl Nitroxide-Semiquinone) Complexes," Shultz, D. A.; Vostrikova, K. E.; Bodnar, S. H.; Koo, H.-J.; Whangbo, M.-H.; Kirk, M. L.; Depperman, E. C.; Kampf, J. W. *J. Am. Chem. Soc.* **2003**, *125*, 1607-1617.
50. "The Donor-Acceptor Contributions to Exchange Coupling in HeteroSpin Biradicals," Shultz, D. A. *Polyhedron* **2003**, *22*, 2423-2426 (ICMM, Invited).
51. "A New Paradigm for Design of High-Spin Organic Molecules: The Mechanism of Spin-dependent Delocalization in Exchange-Coupled Mixed-Valent Organic Species," Franzen, S.; Shultz, D. A. *J. Phys. Chem. A* **2003**, *107*, 4292-4299.
52. "Trends in Exchange Coupling for Trimethylenemethane-Type Bis(Semiquinone) Biradicals and Correlation of Magnetic Exchange with Mixed Valency for Cross-Conjugated Systems," Shultz, D. A.; Fico, R. M., Jr.; Bodnar, S. H.; Kumar, R. K.; Vostrikova, K. E.; Kampf, J. W.; Boyle, P. D. *J. Am. Chem. Soc.* **2003**, *125*, 1161-1171.
53. "Conformational Exchange Modulation in Trimethylenemethane-Type Dinitroxide Biradicals: Correlation of Molecular Geometries with Spin Densities," Shultz, D. A.; Fico, R. M., Jr.; Lee, H.; Kampf, J. W.; Kirschbaum, K.; Pinkerton, A. A.; Boyle, P. D. *J. Am. Chem. Soc.* **2003**, *125*, 15426-15432.
54. "Polyoxolenes may provide a tool for designing paramagnetic molecules with predetermined spin topologies," Bencini, A.; Caneschi, A.; Dei, A.; Gatteschi, D.; Sangregorio, C.; Shultz, D.; Sorace, L.; Vaz, M. G. F. *Comptes Rendus Chimie* **2004**, *6*, 663-676.
55. "Supramolecular Control of Valence Tautomerism on a Gold Nanoparticle," Bin-Salamon, S.; Brewer, S.; Lappi, S. Feldheim, D. L.; Franzen, S.; Shultz, D. A. *J. Am. Chem. Soc.* **2005**, *127*, 5328-5329.
56. "Valence Tautomerization and Exchange Coupling in a Cobalt-Nitronyl Nitroxide-Semiquinone Complex," Shultz, D. A.; Krishna Kumar, R.; Bin-Salamon, S.; Kirk, M. L. *Polyhedron* **2005**, *24*, 2876-2879.

57. "Testing Bridge-Mediated Differences in Dinuclear Valence Tautomeric Behavior," Bin-Salamon, S.; Brewer, S. H.; Depperman, E. C.; Franzen, S.; Kampf, J. W.; Kirk, M. L.; Kumar, R. K.; Lappi, S.; Peariso, K.; Preuss, K. E.; Shultz, D. A. *Inorg. Chem.* **2006**, *45*, 4461-4467.
58. "Ligand Design Modulates Photoinduced Properties of Cobalt-dioxolene Valence Tautomers," Beni, A.; Dei, A.; Shultz, D. A.; Sorace, L. *Chem. Phys. Lett.* **2006**, *428*, 400-404.
59. "Electron Spin-Spin Exchange Coupling Mediated by the Porphyrin Pi System," Shultz, D. A.; Mussari, C. P.; Ramanathan, K. K.; Kampf, J. W. *Inorg. Chem.* **2006**, *45*, 5752-5759.
60. "Design, Synthesis and Properties of Conformationally Fixed Semiquinone Monoradical Species," Shultz, D. A.; Sloop, J. C.; G., W. *J. Org. Chem.* **2006**, *71*, 9104-9113.
61. "Donor-Acceptor Biradicals as Ground State Analogues of Photoinduced Charge Separated States," Kirk, M. L.; Shultz, D. A.; Depperman, E. C.; Brannen, C. L. *J. Am. Chem. Soc.* **2007**, *129*, 1937-1943.
62. †"Substituent Effects on Exchange Coupling: 5-Aryl-Substituted Semiquinones and Their Complexes with MnII and CuII," Shultz, D. A.; Sloop, J. C.; Coote, T.-A.; Beikmohammadi, M. *Inorg. Chem.* **2007**, *46*, 273-277.
63. "Manipulation of the Spin Coupling Manifold in Bimetallic Ytterbocene Complexes of Bridging bis(Bipyridyl) Ligands," Carlson, C. N.; Kuehl, C. J.; Ogallo, L.; Shultz, D. A.; Thompson, J. D.; John, K. D.;* Morris, D. E.* *Organometallics.* **2007**, *26*, 4234-4242.
64. "Ferromagnetic Nanoscale Electron Correlation Promoted by Organic Spin-Dependent Delocalization," Kirk, M. L.; Shultz, D. A.; Schmidt, R. D.; Habel-Rodriguez, D.; Hyoyoung Lee, H.; Lee, J. J. *Am. Chem. Soc.* **2009**, *131*, 18304-18313.
65. "Magnetic Bistability in a Cobalt bis(Dioxolene) Complex: Long-Lived Photoinduced Valence Tautomerism," Shultz, D. A. Schmidt, R. D.; Martin, J. D. *Inorg. Chem.* **2010**, *49*, 3162-3168.
66. "Goldilocks Effect in Magnetic Bistability: Remote Substituent Modulation and Lattice Control of Photo-Induced Valence Tautomerism and Light-Induced Thermal Hysteresis," Schmidt, R. D.; Shultz, D. A.; Martin, J. D.; Boyle, P. D. *J. Am. Chem. Soc.* **2010**, *132*, 6261-6273.
67. "Hyperfine Interaction, Spin Polarization, and Spin Delocalization as Probes of Donor-Bridge-Acceptor Interactions in Exchange Coupled Biradicals," Kirk, M. L.; Shultz, D. A.; Habel-Rodriguez, D.; Schmidt, R. D.; Sullivan, U. *J. Phys. Chem. B* **2010**, *114*, 14712-14716.
68. "Nitronyl Nitroxide Radicals as Organic Memory Elements with Both n- and p-type Properties," Lee, J.; Bang, G-w.; Lee, E.; Shultz, D. A.; Schmidt, R. D.; Forbes, M. D. E.; Lee, H. *Angew. Chem. Int. Ed.* **2011**, *50*, 4415-4418.
69. "Linear Free Energy Relationships in Semiquinone Species and Their Mn(II) and Cu(II) Complexes," Sloop, J. C.; Shultz, D. A.; Beikmohamadi, M. *J. Phys. Org. Chem.* **2012**, *25*, 101-109.
70. "Synthesis of and structure-property relationships in zinc complexes of bis-metaphenylene semiquinone biradical species," Sloop, J. C.; Shultz, D. A.; Coote, T.; Shepler, B.; Sullivan,

- U.; Kampf, J. W.; Boyle, P. D. *J. Phys. Org. Chem.* **2012**, *25*, 314-321.
71. "Spectroscopic Studies of Bridge Contributions to Electronic Coupling in a Donor-Bridge-Acceptor Biradical System," Kirk, M. L.; Shultz, D. A.; Depperman, E. C.; Habel-Rodriguez, D.; Schmidt, R. D. *J. Am. Chem. Soc.* **2012**, *134*, 7812-7819.
72. "Transition Metal Complexes of Donor-Acceptor Biradicals," Kirk, M. L.; Shultz, D. A. *Coord. Chem. Rev.* **2012**, accepted.
73. "A Theoretical Assessment of Cobalt bis(dioxolene) Valence Tautomeric Complexes for Molecular Spintronics Applications: from Molecules to Polymers," Calzolari, A.; Chen, Y.; Dougherty, D. B.; Shultz, D. A.; Lewis, G. F.; Buongiorno Nardelli, M. *J. Phys. Chem. B* **2012**, accepted.
74. "Modification of Molecular Spin Crossover in Ultra-thin Films," Pronschinske, A.; Chen, Y.; Lewis, G.; Shultz, D. A.; Buongiorno Nardelli, M.; Dougherty, D. *Nanolett* **2012**, submitted.
75. "Iron (II) Spin Crossover Films on Au(111) : Scanning Probe Microscopy and Photoelectron Spectroscopy," Pronschinske, A.; Bruce, R.; Lewis, G.; Chen, Y.; Buongiorno Nardelli, M.; Shultz, D. A.; You, W.; Dougherty, D. *J. Phys. Chem. B* **2012**, accepted.

BOOK CHAPTERS AUTHORED

1. Organic Chemistry, in "Chemistry, A Molecular Science," Dennis W. Wertz, Patterson Jones Interactive, 1997.
2. Conformational Exchange Modulation in Trimethylenemethane (TMM)-Type Biradicals, in "Magnetic Properties of Organic Materials," Paul M. Lahti, Ed., Marcel Dekker, 1999.
3. Valence Tautomerization in Dioxolene Complexes of Cobalt, in "Magnetism: Molecules to Materials II," Joel S. Miller and Marc Drillon, Eds., Wiley-VCH, 2001.

BOOKS EDITED

1. Fox and Whitesell, "Organic Chemistry," Jones and Bartlett Publishers
2. Pavia, *et al*, "Introduction to Spectroscopy, 2nd Edition," Harcourt Brace College Publishers

INVITED LECTURES (Colleges and Universities)

1. George Washington University, 12/16/94, "Synthesis of Multispin Organic Assemblies"
2. Shippensburg University, 03/29/95, "New High-Spin Organic Molecules for Molecular Magnets"
3. Indiana University, 02/10/97, "Structure-Property Relationships in Building Blocks for Molecular Magnets"
4. Purdue University, 02/11/97, "Structure-Property Relationships in Building Blocks for Molecular Magnets"
5. University of Alabama, 04/18/97, "Structure-Property Relationships in Building Blocks for Molecular Magnets"
6. Carnegie-Mellon University, 05/06/97, "Structure-Property Relationships in Building Blocks for Molecular Magnets"

7. University of Texas at Austin, 10/24/97, "Structure-Property Relationships in Building Blocks for Molecular Magnets"
8. University of Massachusetts at Amherst, 12/4/97, "Structure-Property Relationships in Building Blocks for Molecular Magnets"
9. East Carolina University, 10/16/98, "Design, Synthesis, and Exchange Coupling in Bis(Semiquinone) Biradicals"
10. University of Kentucky, 10/30/98, "Design, Synthesis, and Exchange Coupling in Bis(Semiquinone) Biradicals"
11. University of Bern (Switzerland), 12/17/98, "Design, Synthesis, and Exchange Coupling in Bis(Semiquinone) Biradicals"
12. University of Florence (Italy), 12/08/98, "Design, Synthesis, and Exchange Coupling in Bis(Semiquinone) Biradicals"
13. University of North Carolina, Chapel Hill, 03/04/99, "Design, Synthesis, and Exchange Coupling in Bis(Semiquinone) Biradicals"
14. University of Florence (Italy), 07/23/99, "Cross-Conjugated Bis(Porphyrin)s: Synthesis, Electrochemical Behavior, Mixed Valency, and Biradical Dication Formation"
15. University of New Mexico, Albuquerque, 09/22/00, "Synthesis and Properties of Novel Semiquinone Ligands."
16. NC Central University, 01/25/01, "Structure-Property Relationships in Semiquinone Ligands and Their Metal Complexes."
17. Hampden-Sydney College, 01/26/01, "Design, Synthesis, and Characterization of Bis(Semiquinone) Ligands and Their Metal Complexes: How an Organic Chemist Has Fun with Inorganic and Physical Chemistry."
18. Michigan State University, 03/28/01, "Structure-Property Relationships in Semiquinone Ligands and Their Metal Complexes."
19. University of Florence (Italy), 07/18/02, "New Developments in Semiquinone Chemistry"
20. University of Michigan, Ann Arbor, 01/07/03, "Electronic Structure-Property Relationships in Semiquinone-type Complexes"
21. University of Colorado, Boulder, 02/13/03, "Electronic Structure-Property Relationships in Semiquinone-type Complexes"
22. Colorado State University, Ft. Collins, 02/18/03, "Electronic Structure-Property Relationships in Semiquinone-type Complexes"
23. University of Waterloo, Ontario, Canada, 04/22/03, "Orbital Control of Exchange Coupling Using Semiquinone-type Ligands"
24. University of Guelph, Ontario, Canada, 04/23/03, "Orbital Control of Exchange Coupling Using Semiquinone-type Ligands"
25. McMaster University, Hamilton, Ontario, Canada, 04/24/03, "Orbital Control of Exchange Coupling Using Semiquinone-type Ligands"
26. Marshall University, 10/06/03, "Molecular Analogs of Magnets: How Does Hund's Rule Apply to Organic Biradicals?"
27. University of California, San Diego, 11/03/03, "Orbital Control of Exchange Coupling in Organic Biradicals"
27. Florida State University, Tallahassee, 11/06/03, "Orbital Control of Exchange Coupling in Organic Biradicals"

28. Bryn Mawr College, 09/10/04, "Molecular Analogs of Magnets: How Does Hund's Rule Apply to Organic Biradicals?"
29. University of Nebraska, 1/23/04, "The Physical Organic Chemistry of Exchange Coupling"
30. UNC Wilmington, 02/27/04, "Molecular Analogs of Magnets: How Does Hund's Rule Apply to Organic Biradicals?"
31. Vanderbilt University, 01/11/05, "Ferromagnetic Exchange in Donor-Acceptor Biradicals: Ground State Analogs of Excited State Processes"
32. Roosevelt University, 02/24/05, "Molecular Analogs of Magnets: How Does Hund's Rule Apply to Organic Biradicals?"
33. UT-Austin, 11/04/05, "Ferromagnetic Exchange in Donor-Acceptor Biradicals: Ground State Analogs of Excited State Processes"
34. UNC-Chapel Hill, 11/07/07, "Ground State Analogs of Photo-induced Charge-separated States"
35. University of New Mexico, 12/12/08, "Semiquinone Complexes: Magneto-structural Correlations, New Electronic Structures, and Photochemistry"
36. University of Missouri, St. Louis, 03/30/09, "Ground State Analogs of Photo-induced Charge-separated States?"
37. Shippensburg University, 10/23/09, "Semiquinone Complexes: Magneto-structural Correlations, New Electronic Structures, and Photochemistry."
38. Northwestern University, 03/11/2010m "Donor-Acceptor Biradicals: From Analogs of Photoinduced Charge-Separated Excited States to Nanoscale Electron Correlation"
39. University Federal, Minas Gerais (Brazil), 12/18/2010, "Valence Tautomers."
40. University of Surrey (UK), 9/13/2012, "Structure-Property Relationships of Open-Shell Molecules: From Nanoscopic Electron Correlation to Molecular Spintronics."
41. Michigan State University, Spring 2013
42. Albion College, Spring 2012

PAPERS GIVEN AT PROFESSIONAL MEETINGS

(other presenter underlined)

1. NC Sectional ACS Meeting, NCSU, Raleigh, March 26, 1993; "Macrocyclic Tetrapyrrole Assemblies as Building Blocks for Molecular Magnetic Materials"
2. National ACS Meeting, Chicago, Illinois, August 22, 1993; "Preparation of meso-Tetra(4-galvinolphenyl)porphyrin — A Building Block for Molecular Magnetic Materials"
3. NC Sectional ACS Meeting, Duke University, Durham, April 16, 1994; "Synthesis and Characterization of New Galvinoxyl Radical Derivatives," with Boal, A.K.
4. NC Sectional ACS Meeting, Duke University, Durham, April 16, 1994; "Synthesis and Characterization of Galvinol-substituted Alkanethiols," with Tew, G.N.
5. NC Sectional ACS Meeting, Duke University, Durham, April 16, 1994; "Synthesis and Characterization of Galvinol-substituted Salen Ligands," with Driscoll, D.J.

6. NC Sectional ACS Meeting, Duke University, Durham, April 16, 1994; "Synthesis and Characterization of Organic Polymers with Paramagnetic Repeat Units," with Hollomon, M.G.
7. South East Magnetic Resonance Conference, 10/16/94: "Recent Advances in the Synthesis of Multispin Organic Molecules"
8. Molecular Magnetic Materials Conference (Salt Lake City, UT) 11/22/94: "Recent Advances in the Synthesis of High-spin Organic Molecules"
9. 208th National ACS Meeting, Washington, D.C. "Synthesis and Characterization of New Galvinoxyl Radical Derivatives," Shultz, D.A.* and Boal, A.K.
10. 208th National ACS Meeting, Washington, D.C. "Synthesis and Characterization of Galvinol-substituted SALEN Ligands," Shultz, D.A.* and Driscoll, D.J.
11. 208th National ACS Meeting, Washington, D.C. "Synthesis and Characterization of Organic Polymers with Paramagnetic Repeat Units," Shultz, D.A.* and Hollomon, M.G.
12. 208th National ACS Meeting, Washington, D.C. "Synthesis and Characterization of Paramagnetic Species Generated from a Metallotetraphenylporphyrin Derivative," Shultz, D.A.* and Sandberg, K.A.,"
13. 208th National ACS Meeting, Washington, D.C. "Synthesis and Characterization of Galvinol-Substituted Alkanethiols," Shultz, D.A.* and Gregory N. Tew,"
14. 208th National ACS Meeting, Washington, D.C. "Comparative Stability of Fluoroketone Hemi-thioacetals, -Ketals, and -Hydrates," Linderman, R.J.*; Tennyson, S.D.; Shultz, D. A.
15. 209th National ACS Meeting, Anaheim, CA 04/24/95 "Synthesis and Characterization of Trisemiquinone Ligands"
16. NSF Materials Chemistry Workshop, 10/20/95. "Metal-Semiquinone Complexes as Building Blocks for Molecular Magnetic Materials"
17. 210th National ACS Meeting, Chicago, IL "Synthesis of Radical-Substituted Metalloporphyrins." Shultz, D.A.,* Sandberg, K.A. and Boal, A.K.
18. Molecule-Based Magnetism Conference (Osaka, Japan) 7/15/96: "Preparation of Paramagnetic Ligands for Coordination-Complexes and Networks With Interesting Magnetic Properties"
19. International Conference on Molecule-Based Magnetism, 07/18/96, "Semiquinones as Building Blocks for Molecular Magnets"
20. Hoechst-Celanese Polymer Workshop, 10/28/96, "Radical-Substituted Alkanethiol Monolayers: Toward Molecule-Based Multilayer Magnetic Materials"
21. 212th National ACS Meeting, Orlando, FL "Preparation and Characterization of a Nitroxide-Substituted Metalloporphyrin," Shultz, D.A. and Gwaltney, K.P.
22. 212th National ACS Meeting, Orlando, FL "Preparation and Characterization of Conjugated Polymers with Semiquinone Repeat Units," Shultz, D.A. and Hollomon, M.G.
23. 215th National ACS Meeting, Dallas, TX "Structure-Property Relationships in Trimethylenemethane-type Biradicals: Bis-(3,5-Di-*tert*-butyl-4-phenoxy)methylene-adamantane vs. Bis-(3,5-Di-*tert*-butyl-4-phenoxy)methylene-norbornane," Shultz, D.A., Bourbeau, M.P., and Boal, A.K.

24. 216th National ACS Meeting, Boston, MA "Oxidation of a Bis[Zn(II) Porphyrin] Yields a Nondisjoint Dication-Biradical Exhibiting a $\Delta M_S=2$ Transition," Shultz, D.A., Gwaltney, K.P., and Lee, H.
25. 216th National ACS Meeting, Boston, MA "Topology-Mediated Spin-Spin Coupling in Bis(Porphyrin) Biradical Dications," Shultz, D.A., Gwaltney, K.P., and Lee, H.
26. 216th National ACS Meeting, Boston, MA "EPR Spectral Characterization of Bis(Semiquinones)," Boal, A.K., Farmer, G.T., and Shultz, D.A.
27. 216th National ACS Meeting, Boston, MA "Synthesis and Characterization of a Nitroxide—Semiquinone Biradical," Farmer, G.T. and Shultz, D.A.
28. 216th National ACS Meeting, Boston, MA "Structure-Property Relationships in Trimethylenemethane-type Bis(nitroxide) Biradicals," Boal, A.K., Farmer, G.T., and Shultz, D.A.
29. Triangle Area Polymer Group, 04/10/97, "Organic Polymers as Building Blocks for Molecule-Based Magnets"
30. NSF Reactive Intermediates Workshop, 06/20/97, "Molecular Assemblies with Interesting/Useful Magnetic or Magneto-optic Properties"
31. Molecule-Based Magnetism Conference (Siegnesse, France) 9/17/98: "Electronic Properties of Bisporphyrin Biradical Dications," Shultz, D.A., Lee, H., and Gwaltney, K.P.
32. 220th National ACS Meeting, San Francisco, "Substituent effects on spin distribution in 3-*tert*-butyl-5-aryl-semiquinones. M. Beikmohamadi (Undergraduate Researcher)
33. 220th National ACS Meeting, San Francisco, "Porphyrins as a building block for the assembly of organic molecular magnets," K.K. Ramanathan
34. 220th National ACS Meeting, San Francisco, "Electronic and structural properties of unique semiquinone-like zinc complexes," S.H. Bodnar
35. 220th National ACS Meeting, San Francisco, "Relationship between phenyl torsion and exchange coupling in diaryl-trimethylenemethane-type dinitroxide biradicals," R.M. Fico Jr.
36. 220th National ACS Meeting, San Francisco, "Spin-spin coupling in semiquinone-substituted porphyrins," C.P. Mussari
37. 220th National ACS Meeting, San Francisco, CA "New Organic Building Blocks for Open-Shell Molecules and Materials," Shultz, D.A.
38. ICC34, Edinburgh, Scotland, 7/11/00, "Synthesis and Properties of Novel Semiquinone Ligands."
39. ICMM 2000, San Antonio, Texas, 9/18/00, "Synthesis and Properties of Novel Semiquinone Ligands."
40. Pacificchem 2000 (Symposium 128: Free Radicals, From Molecules to Materials), Honolulu, Hawaii, 9/18/00, "Synthesis and Properties of Novel Semiquinone Ligands."
41. Central Regional ACS Meeting, May 18, 2000 "New Organic Building Blocks for Open-Shell Molecules and Materials," Shultz, D.A.
42. ICMM 2002, Valencia, Spain, 10/06/02, "New Developments in Semiquinone Chemistry."
43. Canadian Society of Chemistry 2002, 6/3/02, "New Valence Tautomeric Materials."

43. The 8th International Symposium on Spin and Magnetic Field Effects in Chemistry and Related Phenomena, Chapel Hill, North Carolina, 09/22/03, "Conformational Modulation of Both Exchange and Mixed-Valency in Cross-Conjugated, Open-Shell Molecules"
44. SERMACS, Atlanta, GA, 11/17/03, "Orbital Control of Exchange Coupling in Organic Biradicals"
45. SERMACS, Atlanta, GA, 11/17/03, "New Valence Tautomeric Molecules and Materials"
46. 2nd Russian Conference on High-Spin Molecules, 05/16/04, "Exchange Coupling in Paramagnetic Ligands"
47. International Conference on Molecular Magnetism, Tsukuba, Japan, 10/12/04, "New Valence Tautomeric Molecules and Materials"
48. Donor-Acceptor Gordon Conference, 08/04/08, "Donor-Acceptor Biradicals: From Analogs of Photoinduced Charge-Separated Excited States to Nanoscale Electron Correlation"
49. 32nd Reaction Mechanisms Conference, University of North Carolina at Chapel Hill, 06/28/08, "The Physical Organic Chemistry of Electron Spin Exchange Coupling"
50. Photochemistry Gordon Conference, 07/08/09, "**Part I.** "Photochemistry without Photons: Electron Transfer Parameters from Electronic Structure Studies of Donor-Acceptor Biradicals." **Part II.** "Photochemistry with too many Photons: Photoinduced Bistability in New Valence Tautomer Complexes.""
51. International Spin Chemistry Meeting, 08/11/09, "Electronic Structure and Metal Complexes of Donor-Acceptor Biradicals."
52. Donor-Acceptor Gordon Conference, 08/07/12, "Donor-Bridge-Acceptor Structure-Property Relationships in Metal Complexes of Semiquinone-Bridge-Nitronyl Nitroxide Ligands"
53. Contacts To and Within Molecules, University of Hamburg, Germany, 09/19/12, "Evaluating Bridge-Dependent Electronic Coupling via Exchange Couplings and Hyperfine Coupling Constants in Metal Complexes of Donor-Bridge-Acceptor Biradicals"
54. Sustainable materials and Light-Induced Materials, North Dakota State University, 09/28/12, ""

WORKSHOPS ATTENDED

1. NSF Materials Chemistry Workshop, 10/20/95
2. Hoechst-Celanese Polymer Workshop, 10/28/96
3. NSF Reactive Intermediates Workshop, 6/20/97

FUNDING

(*Funding with an educational component)

1. NCSU Faculty Research and Professional Development Fund: "Magnetic Organic Polymers," \$4,968 (1992-1993).
2. Petroleum Research Fund/American Chemical Society: "Paramagnetic Discotic Liquid Crystals," \$20,000 (Type G), (1993-1994).
3. NCSU Minigrant: "Animation in Organic Chemistry — A New Age in Chemical Education," \$2,000 (1994-1995).*
4. NCSU Undergraduate Studies Initiative Award: "Animation in Chemistry — A New Age in Chemical Education," \$9,000 (1994).*

5. National Science Foundation: "The Purchase of an X-Ray Diffractometer," as contributor.
6. National Science Foundation, Career Award Program: "Macrocyclic Tetrapyrroles as Building Blocks for Molecular Magnetic Materials," \$207,000 (1995).*
7. Research Corporation: Cottrell Scholar Award, \$50,000 (1995).*
8. Camille and Henry Dreyfus Foundation: "Animation in Organic Chemistry," \$20,600 (1994).*
9. Hoechst-Celanese Corporation/Kenan Foundation: "Radical-substituted Alkanethiol Monolayers on Gold Colloids," \$30,000 (1995).
10. National Science Foundation REU Program: as contributor (1996).*
11. National Science Foundation: "Preparation of Paramagnetic Ligands for Coordination-Complexes and Networks With Interesting Magnetic Properties," \$250,000 (1996).
12. Camille and Henry Dreyfus Foundation: Camille Dreyfus Teacher-Scholar Award, \$60,000 (1998).*
13. National Science Foundation: "Preparation of Paramagnetic Ligands for Coordination-Complexes and Networks With Interesting Magnetic Properties," \$390,000 (2000).
14. American Chemical Society – Petroleum Research Fund Type AC Grant, "Substituent Effects on Exchange Coupling," \$80,000 (2002).
15. National Science Foundation: "Preparation of Paramagnetic Ligands for Coordination-Complexes and Networks With Interesting Electronic Properties," \$390,000 (2003).
16. Los Alamos National Laboratories: "Preparation of Ligands for Lanthanide and Actinide Complexes," \$40,000 (2005).
17. Civilian Research Development Fund: "Bending Crystals," \$12,000 (co-PI with Victor Ovcharenko and Gleb Abakumov, 2007).
18. NCSU Faculty Research and Professional Development Fund: "New Valence Tautomer Molecules," \$5,000 (2009-2011).
19. National Science Foundation: "Center for Chemical Innovation: Center for Molecular Spintronics," \$1,500,000 (2009-2012).
20. National Science Foundation: "Metal Complexes of Donor-Bridge-Acceptor Biradicals: From Nanoscopic Electron Correlation to Inhibition of Back Electron Transfer," \$420,000 (2009-2012).
21. National Science Foundation: "Metal Complexes of Donor-Bridge-Acceptor Biradicals: From Nanoscopic Electron Correlation to Inhibition of Back Electron Transfer," \$390,000 (2012-2015).

PATENTS

1. Daniel L. Feldheim, Stella M. Marinakos, David A. Shultz "Nanoparticle composites and nanocapsules for guest encapsulation and methods for synthesizing same" 1999, US Patent Pending.

COLLABORATIONS

1. "Novel Paramagnetic Monolayers," with Professor Takamasa Sagara, University of Nagasaki, Japan.
2. "Metal Semiquinone Complexes," with Professor Andrea Dei, University of Florence, Italy
3. "MCD Studies of Transition Metal Complexes of Novel Semiquinone Ligands," with Professor Martin Kirk, University of New Mexico.

4. "Bending Crystals," with Victor Ovcharenko (International Tomography Laboratory, RAS, Novosibirsk, Russia) and Gleb Abakumov (Razuvaev Institute of Organometallic Chemistry, Nizhny Novgorod, Russia).
5. "Radical Memory Elements," with Hyoyoung Lee ().
6. "Center for Molecular Spintronics," Dan Dougherty, Marco Buongiorno-Nardelli, Jack Rowe, (NCSU Physics) Joe Tracy (NCSU Materials Science and Engineering), Wei You (UNC-Chapel Hill Chemistry), Frank Tsui (UNC-Chapel Hill Physics).
7. "Molecular Spintronics," Richard Curry (ATI, Surrey, UK).
8. "Valence Tautomers," Carlos Pinheiro (UFMG, Belo-Horizonte, Brazil).

COURSES TAUGHT

Undergraduate Courses

1. Organic Chemistry I; three rotations, typical enrollment: >100
2. Organic Chemistry II; two rotation, enrollment: >100
3. Organic Chemistry I for Majors (with lab); one rotation, enrollment: 39
4. Organic Chemistry II for Majors (with lab); two rotations, typical enrollment: 35

Graduate Courses

1. Advanced Organic Chemistry I (physical organic); five rotations, typical enrollment: 35
2. Physical Methods in Organic Chemistry (spectroscopy); three rotation, enrollment: 35
3. Organic Materials Chemistry; two rotations, typical enrollment: 12
4. Symmetry, Molecular Orbital Theory, and Optical Spectroscopy of Inorganic Compounds, ten rotations, typical enrollment: 10.

DEPARTMENTAL SERVICE

Committees

1. Undergraduate Studies Committee
2. Undergraduate Awards Committee
3. Graduate Recruitment and Admissions Committee
4. Computer Standards and the Future Committee
5. Seminar Committee
6. X-ray Users Committee
7. NMR Users Committee
8. Faculty Search Committees
9. Graduate Student Thesis Advisory Committees (over twenty)
10. Coordinator, Annual Chemistry Department Poster Session and Luncheon

Program Director

1. Chemistry Honors Program; 1994-1999
2. Undergraduate Research Program; 1994-1999
3. Graduate Recruiting Coordinator
4. Graduate Admissions Coordinator

Chemistry 101 Initiative

Contributing author in the Department-published freshman chemistry textbook

UNIVERSITY SERVICE

1. Graduate School Representative for several Ph.D. and M.S. examinations
2. Judge for Sigma Xi Award for Excellence in Graduate Studies, Spring 1994
3. Undergraduate Recruiting
4. Preprofessional Health Career Committee
5. College of Physical and Mathematical Sciences Representative to the Undergraduate Research Symposium Committee
6. University Research Committee
7. WWW Faculty Advisory Committee
8. Vice President, NC State University Chapter of Sigma Xi, 1998-2000

OUTREACH

1. Project SEED Mentor, 1996
2. Park Scholar Mentor, 1996-2000
3. JUDGE: 1998 SERMACS Undergraduate Meeting: RTP, NC, Nov. 7, 1998