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Education and Training

1995–1997	Vienna University of Technology, 1st Diploma in Chemistry (B.S. equivalent, 1998)
1997–1998	University of North Carolina, Chapel Hill. Undergraduate Exchange Student under the TASSEP Program (Chemistry)
1998–2003	Massachusetts Institute of Technology, Ph.D. (2003) Advisor: Gregory C. Fu (Organic Chemistry)
2003-2006	Massachusetts Institute of Technology, Postdoctoral. Advisor: Daniel G. Nocera (Inorganic Chemistry)

Professional Experience

Professional Appointments

2019–	International Guest Chair, the Energy and Environment Solutions Initiative at University of Pau and Pays de l'Adour (E2S-UPPA)
2013–	Full Professor of Chemistry, Boston College
2012–2013	Associate Professor of Chemistry, University of Oregon
2010–2013	Cofounder and Chief Science Officer of QE Chemicals, Inc.
2010–2013	Director, Master's industrial internship program in organic synthesis at the University of Oregon
2006–2012	Assistant Professor of Chemistry, University of Oregon

Professional Service

2022-2023	*Chem. Soc. Rev.* guest editor for a themed issue on the Applications of Main Group Chemistry in Synthesis, Catalysis, and Biomedical and Materials Research
2022	2021 Top 10% reviewer for *Angew. Chem. Int. Ed.* Journal
2021	Co-organizer, Pacifichem 2021, Symposium "Unusual Structure and Reactivity in the Main Group: From Fundamental to Functional Materials (#222)"
2018-2019	*Chem. Soc. Rev.* guest editor for a themed issue on Contemporary Research in Boron Chemistry
2018	Chair of the organizing committee for the 16th Boron Chemistry Meeting in the Americas (BORAM XVI) at Boston College
2016–	Advisory Board Member for Boron in the Americas Organization
2015	Co-organizer, Pacifichem 2015, Symposium "Organo-Main Group Avenues toward Advanced Materials (#16)"
2012–	Editorial Advisory Board Member for Organic & Biomolecular Chemistry (OBC) (2017 Outstanding Reviewer for OBC)
2012–2016	Project leader for the collaborative DOE EERE project "Novel Carbon(C)-Boron(B)-Nitrogen(N)-Containing H_2 Storage Materials"
2010–2016	US representative to the International Energy Agency (IEA), Hydrogen Implementing Agreement (HIA) Hydrogen Storage Task

2009	Local Co-organizer, "Hydrogen Road Tour '09" Eugene Stop
2008–2013	Academic Advisor and Lead Contact at University of Oregon, Trans Atlantic Science Student Exchange Program (TASSEP)

Awards

2010	NSF Career Award (declined due to overlap with NIH funding)
2012	Journal of Physical Organic Chemistry Award for Early Excellence
2012	Camille Dreyfus Teacher-Scholar Award
2014	ACS Organometallics Young Investigator Fellow
2016	Friedrich Wilhelm Bessel Research Award of the Alexander von Humboldt Foundation
2018	Boron in the Americas Award in recognition for Distinguished Achievement in Boron Chemistry

Research Interests

Synthetic organic, inorganic, and organometallic chemistry, boron heterocycles, novel aromatic compounds, hydrogen storage, optoelectronic materials, boron-containing biomimetics

Publications

As Independent Faculty:
(† denotes undergraduate coauthor)

96. Lee, H.; Alvarado, M.; Ingram, S.†; Liu, S.-Y. "*N*-Functionalization of 1,2-Azaborines" *Manuscript in revision.*
95. Zhang, C.; Chrostowska, A.; Liu S.-Y.; Karamanis,* P.; Otero N. "Between Electron Delocalization and Low-Lying Excited States of BN-Doped Aromatic Hydrocarbons" *Chem. Phys. Lett.* **2023**, *ASAP.* DOI: 10.1016/j.cplett.2023.140615.
94. Ishibashi, J. S. A.; Lamine, W.; Miqueu, K. ; Liu, S.-Y. "The Aromatic Claisen Rearrangement of a 1,2-Azaborine" *Org. Biomol. Chem.* **2023**, *21*, 3778-3783. DOI: 10.1039/D2OB02186B.
    * Invited as part of the special issue "Celebrating the 20th anniversary of Organic and Biomolecular Chemistry".
93. Wang, Z.; Zhang, C.; Wu, J.†; Li, B.; Liu, S.-Y. "*trans*-Hydroalkynylation of Internal 1,3-Enynes Enabled by Cooperative Catalysis" *J. Am. Chem. Soc.* **2023**, *145*, 5624-5630. DOI: 10.1021/jacs.3c00514.
92. Wang, Z.; Lamine, W.; Miqueu, K.; Liu, S.-Y. "A Syn Outer-Sphere Oxidative Addition: The Reaction Mechanism in Pd/Senphos-Catalyzed Carboboration of 1,3-Enynes" *Chem. Sci.* **2023**, *14*, 2082-2090. DOI: 10.1039/D2SC05828F.
91. Zhang, Y.; Wang, Z.; Lamine, W.; Xu, S.; Li, B.; Chrostowska, A.; Miqueu, K.; Liu, S.-Y. "Mechanism of Pd/Senphos-Catalyzed trans-Hydroboration of 1,3-Enynes: Experimental and Computational Evidence in Support of the Unusual Outer-Sphere Oxidative Addition Pathway" *J. Org. Chem.* **2023**, *88*, 2415-2424. DOI: 10.1021/acs.joc.2c02841.
90. Giustra, Z. X.; Chen, G.; Vasiliu, M.; Karkamkar, A.; Autrey, T.; Dixon, D. A.; Liu, S.-Y. "A Comparison of Hydrogen Release Kinetics from 5- and 6-Membered 1,2-BN-Cycloalkanes" *RSC Adv*. **2021**, *11*, 34132-34136. DOI: 10.1039/D1RA07477F2.
89. Liu, Y.; Puig de la Bellacasa, R.; Li, B.; Cuenca, A. B.; Liu, S.-Y. "The Versatile Reaction Chemistry of An Alpha-Boryl Diazo Compound" *J. Am. Chem. Soc*. **2021**, *143*, 14059-14064. DOI: 10.1021/jacs.1c06112.
88. Wang, Z.; Wu, J.†; Lamine, W.; Li, B.; Sotiropoulos, J.-M.; Chrostowska, A.; Miqueu, K.; Liu, S.-Y. "C-Boron Enolates Enable Palladium Catalyzed Carboboration of Internal 1,3-Enynes" *Angew. Chem. Int. Ed*. **2021**, *60*, 21231-21236. DOI: 10.1002/anie.202108534.
    * Selected by the editors as a "Hot Paper".
87. Chen, M.; Unikela, K. S.; Ramalakshmi, R.; Li, B.; Darrigan, C.; Chrostowska, A.; Liu, S.-Y. "A BN-Doped Cycloparaphenylene Debuts" *Angew. Chem. Int. Ed*. **2021**, *60*, 1556-1560. DOI: 10.1002/anie.202010556.
    * Highlighted in *SYNFACTS* **2021**, *17(02)*, 149.
86. Zhang, Y.; Li, B.; Liu, S.-Y. "Pd-Senphos Catalyzed trans-Selective Cyanoboration of 1,3-Enynes" *Angew. Chem. Int. Ed.* **2020**, *59*, 15928-15932. DOI: 10.1002/anie.202005882.
85. Boknevitz, K.; Darrigan, C.; Chrostowska, A.; Liu, S.-Y. "Cation-pi Binding Ability of BN Indole" *Chem. Commun*. **2020**, *56*, 3749-3752. DOI: 10.1039/D0CC00869A.

84. Giustra, Z. X.; Yang, X.; Chen, M.; Bettinger, H. F.; Liu, S.-Y. "Accessing 1,2-Substituted Cyclobutanes through 1,2-Azaborine Photoisomerization" *Angew. Chem. Int. Ed.* **2019**, *58*, 18918-18922. DOI: 10.1002/anie.201912132.
    * Highlighted in *SYNFACTS* **2020**, *16(02)*, 178.
83. Liu, Y.; Liu, S.-Y. "Exploring the Strength of a Hydrogen Bond as a Function of Steric Environment using 1,2-Azaborine Ligands and Engineered T4 Lysozyme Receptors" *Org. Biomol. Chem.* **2019**, *17*, 7002-7006. DOI: 10.1039/C9OB01008D.
    * Selected as part of the 2019 Org. Biomol. Chem. HOT Article Collection.
    * Invited as part of a special issue on "Trends in Organoboron Chemistry" (refereed).
82. Lin, H.; McConnell, C. R.; Jilus, B.; Liu, S.-Y.; Jäkle, F. "Changing up BN-Polystyrene: Effect of Substitution Pattern on the Free-Radical Polymerization and Polymer Properties" *Macromolecules* **2019**, *52*, 4500-4509. DOI: 10.1021/acs.macromol.9b00466.
81. McConnell, C. R.; Liu, S.-Y. "Late-Stage Functionalization of BN-Heterocycles" *Chem. Soc. Rev.* **2019**, *48*, 3436-3453. DOI: 10.1039/C9CS00218A.
    * Invited as part of a special issue on "Contemporary Research in Boron Chemistry" (refereed).
    * For the editorial to the special issue, see: Liu, S.-Y.; Stephan, D. W. "Contemporary Research in Boron Chemistry" *Chem. Soc. Rev.* **2019**, *48*, 3434-3435.
80. McConnell, C. R.; Haeffner, F.; Baggett, A. W.; Liu, S.-Y. "1,2-Azaborine's Distinct Electronic Structure Unlocks Two New Regioisomeric Building Blocks via Resolution Chemistry" *J. Am. Chem. Soc.* **2019**, *141*, 9072-9078. DOI: 10.1021/jacs.9b03611.
80. McConnell, C. R.; Haeffner, F.; Baggett, A. W.; Liu, S.-Y. "1,2-Azaborine's Distinct Electronic Structure Unlocks Two New Regioisomeric Building Blocks via Resolution Chemistry" *J. Am. Chem. Soc.* **2019**, *141*, Just Accepted. DOI: 10.1021/jacs.9b03611.
79. Boknevitz, K.; Italia, J. S.; Chatterjee, A.; Liu, S.-Y. "Synthesis and Characterization of an Unnatural Boron and Nitrogen-containing Tryptophan Analogue and its Incorporation into Proteins" *Chem. Sci* **2019**, *10*, 4994-4998. DOI: 10.1039/C8SC05167D.
    * Selected as part of the 2019 Chemical Science HOT Article Collection.
78. Ishibashi, J. S. A.; Darrigan, C.; Chrostowska, A.; Li, B.; Liu, S.-Y. "A BN Anthracene Mimics the Electronics Structure of more Highly Conjugated Systems" *Dalton Trans.* **2019**, *48*, 2807-2812. DOI: 10.1039/c9dt00481e.
77. Brown, A. N.; Li, B.; Liu, S.-Y. "Expanding the functional group tolerance of cross-coupling in 1,2-dihydro-1,2-azaborines: Installation of alkyl, alkenyl, aryl, and heteroaryl substituents while maintaining a B–H bond" *Tetrahedron* **2019**, *75*, 580-583. DOI: 10.1016/j.tet.2018.12.039.
    * Invited as part of a themed issue dedicated to "Frustrated Lewis Acids and Organoboranes" (refereed).
76. Edel, K.; Ishibashi, J. S. A.; Liu, S.-Y.; Bettinger, H. F. "Superelectrophilicity of 1,2-Azaborine: Formation of Xenon and Carbon Monoxide Adducts" *Angew. Chem. Int. Ed.* **2019**, *58*, 4061-4064. DOI: 10.1002/anie.201813503.
75. Edel, K.; Yang, X.; Ishibashi, J. S. A.; Lamm, A. N.; Maichle-Mössmer, C.; Giustra, Z. X.; Liu, S.-Y.; Bettinger, H. F. "The Dewar Isomer of 1,2-dihydro-1,2-azaborinines: Isolation, Fragmentation, and Energy Storage" *Angew. Chem. Int. Ed.* **2018**, *57*, 5296-5300. DOI: 10.1002/anie.201712683.
74. Giustra, Z. X.; Liu, S.-Y. "The State of the Art in Azaborine Chemistry: New Synthetic Methods and Applications" *J. Am. Chem. Soc.* **2018**, *140*, 1184-1194. DOI: 10.1021/jacs.7b09446.

73. Baggett, A. W.; Liu, S.-Y. "A Boron Protecting Group Strategy for 1,2-Azaborines" *J. Am. Chem. Soc.* **2017**, *139*, 15259-15264. DOI: 10.1021/jacs.7b09491.
72. Ishibashi, J. S. A.; Dargelos, A.; Darrigan, C.; Chrostowska, A.; Liu, S.-Y. "BN Tetracene: Extending the Reach of BN/CC Isosterism in Acenes" *Organometallics* **2017**, *36*, ASAP. DOI: 10.1021/acs.organomet.7b00296.
71. Liu, Z.; Ishibashi, J. S. A.; Darrigan, C.; Dargelos, A.; Chrostowska, A.; Li, B.; Vasiliu, M.; Dixon, D. A.; Liu, S.-Y. "The Least Stable Isomer of BN Naphthalene: Toward Predictive Trends for the Optoelectronic Properties of BN Acenes" *J. Am. Chem. Soc.* **2017**, *139*, 6082-6085. DOI: 10.1021/jacs.7b02661.
70. Lee, H.; Liu, S.-Y. "Synthesis of 1,2-Azaborines and the Preparation of Their Protein Complexes with T4 Lysozyme Mutants" *J. Vis. Exp.* **2017**. A video protocol. DOI: 10.3791/55154.
69. McConnell, C. R.; Campbell, P. G.; Fristoe, C. R.[†]; Memmel, P.; Zakharov, L. N.; Li, B.; Darrigan, C.; Chrostowska, A.; Liu, S.-Y. "Synthesis and Characterization of 1,2-Azaborine-Containing Phosphine Ligands: A Comparative Electronic Structure Analysis" *Eur. J. Inorg. Chem.* **2017**, 2207-2210. DOI: 10.1002/ejic.201700242.
68. Zhao, P.; Nettleton, D. O.; Karki, R.; Zecri, F. J.; Liu, S.-Y. "Medicinal Chemistry Profiling of Monocyclic 1,2-Azaborines" *ChemMedChem* **2017**, *12*, 358-361. DOI: 10.1002/cmdc.201700047.
67. Beniwal, S.; Hooper, J.; Miller, D. P.; Costa, P. S.; Chen, G.; Liu, S.-Y.; Dowben, P. A.; Sykes C. H.; Zurek, E.; Enders A. "Graphene-like Boron-Carbon-Nitrogen Monolayers" *ACS Nano* **2017**, *11*, 2486-2493. DOI: 10.1021/acsnano.6b08136.
66. Wan, W.-M.; Baggett, A. W.; Cheng, F.; Lin, H.; Liu, S.-Y.; Jäkle, F. "Synthesis by Free Radical Polymerization and Properties of BN-Polystyrene and BN-Poly(vinylbiphenyl)" *Chem. Commun.* **2016**, *52*, 13616-13619. DOI: 10.1039/C6CC07332H.
65. Xu, S.; Zhang, Y.; Li, B.; Liu, S.-Y. "Site- and Stereo-selective trans-Hydroboration of 1,3-Enynes Catalyzed by 1,4-Azaborine-Based Phosphine-Pd Complex" *J. Am. Chem. Soc.* **2016**, *138*, 14566-14569. DOI: 10.1021/jacs.6b09759.
64. Lee, H; Fischer, M.; Shoichet, B. K.; Liu, S.-Y. "Hydrogen Bonding of 1,2-Azaborines in the Binding Cavity of T4 Lysozyme Mutants: Structures and Thermodynamics" *J. Am. Chem. Soc.* **2016**, *138*, 12021-12024. DOI: 10.1021/jacs.6b06566.
63. Giustra, Z. X.; Chou, L.-Y.; Tsung, C.-K.; Liu, S.-Y. "Kinetics of $-CH_2CH_2-$ Hydrogen Release from a BN-cyclohexene Derivative" *Organometallics* **2016**, *35*, 2425-2428. DOI: 10.1021/acs.organomet.6b00412.
62. Liu, X.; Zhang, Y.; Li, B.; Zakharov, L. N.; Vasiliu, M.; Dixon, D. A.; Liu, S.-Y. "A Modular Synthetic Approach to Monocyclic 1,4-Azaborines" *Angew. Chem. Int. Ed.* **2016**, *55*, 8333-8337. DOI: 10.1002/anie.201602840.
61. Murphy, C. J.; Miller, D. P.; Simpson, S.; Baggett, A. W.; Pronschinske, A.; Liriano, M. L.; Therrien, A. J.; Enders, A.; Liu, S.-Y.; Zurek, E.; Sykes, E. C. H. "Charge Transfer Induced Magic Cluster Formation of Azaborine Heterocycles on Noble Metal Surfaces" *J. Phys. Chem. C* **2016**, *120*, 6020-6030. DOI: 10.1021/acs.jpcc.5b11970.
60. Whittemore, S. M.; Bowden, M.; Karkamkar, A.; Parab K.; Neiner, D.; Autrey T.; Ishibashi, J. S. A.; Chen, G.; Liu, S.-Y.; Dixon, D. A. "Blending Materials Composed of Boron, Nitrogen and Carbon to Transform Approaches to Liquid Hydrogen Stores" *Dalton Trans*. **2016**, *45*, 6196-6203. DOI: 10.1039/c5dt04276c.
    * Invited as part of a themed issue dedicated to "Main Group Transformations" (refereed).
59. Giustra, Z. X.; Ishibashi, J. S. A.; Liu, S.-Y. "Homogeneous Metal Catalysis for Conversion Between Aromatic and Saturated Compounds" *Coord. Chem. Rev.* **2016**, *314*, 134-181. DOI: 10.1016/j.ccr.2015.11.006.

58. Kumar, A.; Ishibashi, J. S. A.; Hooper, T. N.; Mikulas, T. C.; Dixon, D. A.; Liu, S.-Y.; Weller, A. S. "The Synthesis, Characterization and Dehydrogenation of Sigma-Complexes of BN-Cyclohexanes" *Chem. Eur. J.* **2016**, *22*, 310-322. DOI: 10.1002/chem.201502986
57. Kukolich, S. G.; Sun, M.; Daly, A. M.; Luo, W.; Zakharov, L. N.; Liu, S.-Y. "Identification and Characterization of 1,2-BN Cyclohexene Using Microwave Spectroscopy" *Chem. Phys. Lett.* **2015**, *639*, 88-92. DOI: 10.1016/j.cplett.2015.09.009.
56. Baggett, A. W.; Guo, F.; Liu, S.-Y.; Jäkle, F. "Regioregular Synthesis of Azaborine Oligomers and Polymer with a syn-Conformation that is Stabilized by N-H...π Interactions" *Angew. Chem. Int. Ed.* **2015**, *54*, 11191-11195. DOI: 10.1002/anie.201504822.
* Selected by the editors as a "Hot Paper".
* Highlighted in *SYNFACTS* **2015**, *11(10)*, 1048.
55. Brown, A. N.; Li, B.; Liu, S.-Y. "Negishi Cross-Coupling is Compatible with a Reactive B-Cl Bond: Development of a Versatile Late-Stage Functionalization of 1,2-Azaborines and its Application to the Synthesis of New BN Isosteres of Naphthalene and Indenyl" *J. Am. Chem. Soc.* **2015**, *137*, 8932-8935. DOI: 10.1021/jacs.5b05879.
54. Saif, M.; Widom, J. R.; Xu, S.; Abbey, E. R.; Liu, S.-Y.; Marcus, A. H. "Electric Dipole Transition Moments and Solvent-Dependent Interactions of Fluorescent Boron-Nitrogen Substituted Indole Derivatives" *J. Phys. Chem. B* **2015**, *119*, 7985-7993. DOI: 10.1021/acs.jpcb.5b03485.
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52. Edel, K.; Brough, S.; Lamm, A. N.; Liu, S.-Y.; Bettinger, H. F. "1,2-Azaborine, the BN derivative of ortho-benzyne" *Angew. Chem. Int. Ed.* **2015**, *54*, 7819-7822. DOI: 10.1002/anie.201502967.
51. Baggett, A. W.; Vasiliu, M.; Li, B.; Dixon, D. A.; Liu, S.-Y. "Late-Stage Functionalization of 1,2-Dihydro-1,2-azaborines via Regioselective Iridium-Catalyzed C−H Borylation: The Development of a New N,N-Bidentate Ligand Scaffold" *J. Am. Chem. Soc.* **2015**, *137*, 5536-5541. DOI: 10.1021/jacs.5b01916.
50. Murphy, C. J.; Baggett, A. W.; Miller, D. P.; Simpson, S.; Marcinkowski, M. D.; Mattera, M. F. G.; Pronschinske, A.; Therrien, A.; Liriano, M. L.; Zurek, E.; Liu, S.-Y.; Sykes, E. C. H. "Effect of BN/CC Isosterism on the Thermodynamics of Surface and Bulk Binding: 1,2-dihydro-1,2-azaborine vs Benzene" *J. Phys. Chem. C* **2015**, *119*, 14624-14631. DOI: 10.1021/jp5126427.
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*Highlighted in C&EN online - [http://cen.acs.org/articles/93/web/2015/01/New-Hydrogen-Storage-Material-Take.html] and in JACS Spotlights (*J. Am. Chem. Soc.* **2015**, *137*, 551-552.)
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47. Chrostowska, A.; Xu, S.; Maziere, A.; Boknevitz, K.; Li, B.; Abbey, E. R.; Dargelos, A.; Graciaa, A.; Liu, S.-Y. "UV-Photoelectron Spectroscopy of BN Indoles: Experimental and Computational Electronic Structure Analysis" *J. Am. Chem. Soc.* **2014**, *136*, 11813-11820. DOI: 10.1021/ja5063899.

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45. Xu, S.; Haeffner, F.; Li, B.; Zakharov, L. N.; Liu, S.-Y. "Monobenzofused 1,4-Azaborines: Synthesis, Characterization, and Discovery of a Unique Coordination Mode" *Angew. Chem. Int. Ed.* **2014**, *53*, 6795-6799. DOI: 10.1002/anie.201403903.
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42. Rudebusch, G. E.; Zakharov, L. N.; Liu, S.-Y. "Rhodium-Catalyzed B-Arylation of 1,2-Azaborines" *Angew. Chem. Int. Ed.* **2013**, *52*, 9316-9319. DOI: 10.1002/anie.201304443.
    * Highlighted in *SYNFACTS* **2013**, *9(11)*, 1226.
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    * Invited as part of the "6th Heron Island Conference" themed issue (refereed).
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    * Invited as part of a themed issue dedicated to "Boranes and Borohydrides" (refereed).
36. Brough, S. A.; Lamm, A. N.; Liu, S.-Y.; Bettinger, H. F. "Photoisomerization of 1,2-Dihydro-1,2-Azaborine: A Matrix Isolation Study" *Angew. Chem. Int. Ed.* **2012**, *51*, 10880-10883. DOI: 10.1002/anie.201203546.
35. Chrostowska, A.; Xu, S.; Lamm, A. N.; Maziere, A.; Weber, C. D.; Dargelos, A.; Baylere, P.; Graciaa, A.; Liu, S.-Y. "UV-Photoelectron Spectroscopy of 1,2- and 1,3-Azaborines: A Combined Experimental and Computational Electronic Structure Analysis" *J. Am. Chem. Soc.* **2012**, *134*, 10279-10285. DOI: 10.1021/ja303595z.
    * Highlighted in *JACS Spotlights* (*J. Am. Chem. Soc.* **2012**, *134*, 11051-11052).
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Teaching Experience

Sophomore Level Organic Chemistry. This is a course developed for sophomore-level undergraduates. It focuses on three key concepts: 1) basic and some advanced stereochemistry to help students capture the three-dimensionality of molecules; 2) energy diagrams analysis for rationalization/prediction of chemical reactivity and spectroscopic analysis of organic molecules to help students sharpen their analytical and critical thinking skills; 3) chemical synthesis and retrosynthetic analysis to foster creative thinking. These three concepts have been covered in the context of reactivity of alkenes, alkynes, redox reactions, radical reactions, and properties and reactivity of conjugated and aromatic molecules.

Organometallic Chemistry. This is a course developed for advanced undergraduates, masters and graduate students that focuses on the versatility and utility of organometallic chemistry in organic synthesis. In the first part of the course I introduce fundamental concepts of organotransition metal chemistry, which is then followed by in depth discussions of metal-mediated catalytic transformations that are pertinent to organic synthesis. The course material has been developed to emphasize the fundamental mechanistic and physical organic aspects of organometallic chemistry using recent developments in this area (e.g., olefin metathesis and cross-coupling chemistry). The diverse mechanistic patterns that metal-mediated reactions exhibit are well suited for an understanding-based teaching emphasis.

Physical Organic Chemistry. This is a course developed for advanced undergraduates and first-year graduate students. The lectures first introduce fundamental concepts of physical organic chemistry (e.g., molecular orbital theory, transition state theory, kinetics, isotope effects, advanced stereochemistry, and linear free energy relationships). These basic concepts are then applied to understand the properties of molecules as well as to elucidate reaction mechanisms of organic transformations. I provide numerous practice problems to help students understand the theoretical concepts. A centerpiece of the course is elucidating reaction mechanisms using the contents developed in the earlier stages of the course. One goal of this course is to foster problem solving skills, independent critical thinking, and logical reasoning using physical organic chemistry.

Honors General Chemistry. This is a course developed for freshman undergraduates. It is developed as an accelerated general chemistry course that directly begins with the quantum mechanical view of atomic structure and an exploration of the nature and description of chemical bonding that underlies all chemical reactions. It is then followed by an in-depth discussion of thermodynamic laws (1st, 2nd, and 3rd law of thermodynamics), chemical equilibria, and acid-base chemistry. It concludes with chemical kinetics that includes rate-laws, reaction mechanisms, and reaction rate theory. The course is intended to help the students develop problem-solving skills and prepare them for organic chemistry.