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Professional Profile

Dr. Montgomery is a chemist that specializes in small molecule synthesis and characterization, electrochemistry, and catalysis. She leverages her inorganic and analytical chemistry skills to help clients understand how chemical composition drives the performance of mixtures and products. She applies her technical expertise across a wide range of products used in the energy, aviation, automotive, and cosmetics industries.

Dr. Montgomery has experience in the aviation industry from her time at AIRCO, where she was responsible for evaluating the composition and performance of fuel products against industry standards (e.g., ASTM) and internal product specifications. She has also worked in the personal care products industry at The Estée Lauder Companies, where she developed quality control and quality assurance methods used for raw material screening and production control, compliance support, and evaluation of manufacturing processes.

During her doctoral research, Dr. Montgomery studied the chemical mechanisms by which inorganic catalysts facilitate chemical transformations, including hydrogen evolution and carbon dioxide reduction processes that have potential for fuel-forming industrial processes. Her work included multistep synthesis and characterization of chelating ligands and transition metal (cobalt) coordination complexes using air-free synthetic techniques as well as synthesis and characterization of polymer thin films through electropolymerization. This research leveraged a range of analytical techniques, including FTIR, GC-MS, NMR, UV-Vis, PL, AFM, and XPS. Dr. Montgomery is also well versed in electrochemical techniques including cyclic voltammetry (CV), differential pulse voltammetry (DPV), electrochemical quartz crystal microbalance (EQCM), and bulk electrolysis.

Academic Credentials & Professional Honors

Ph.D., Chemistry, University of North Carolina, Chapel Hill, 2025

B.S., Chemistry, Villanova University, 2020

Francis Preston Venable Chemistry Scholarship Award (2024)

UNC-CH Graduate School Dissertation Completion Fellowship (2024)

Floyd Edmister Service Award (2023)

American Chemical Society Scholastic Achievement Award (2020)

Prior Experience

Research Intern, Air Company, 2024

Quality Assurance Intern, The Estée Lauder Companies Inc., 2019

Publications

Montgomery, C. L.; Lee, J.; Donley, C. L.; Jackson, M. N.; Tereniak, S. J.; Dempsey, J. L. Kinetic Analysis of Proton-Coupled Electron Transfer at an Electrode-Immobilized Complex. ACS Electrochemistry. 2025, 1, 303 – 314.

Montgomery, C. L.; Ertem, M. Z.; Claytor, Z. H.; Dempsey, J. L. Impact of Pendant Amine Basicity on Electrochemically-Promoted Cobalt Hydride Formation: Kinetic and Mechanistic Analysis. Submitted.
Montgomery, C. L.; Ertem, M. Z.; Chevalier, L.; Dempsey, J. L. Circumventing Kinetic Barriers to Metal Hydride Formation with Metal-Ligand Cooperativity. J. Am. Chem. Soc. 2024, 146 (44), 30020–30032.

Otte, K. S.; Niklas, J. E.; Studvick, C. M.; Montgomery, C. L.; Bredar, A. R. C.; Popov, I. A.; La Pierre, H. S. Proton-Coupled Electron Transfer at the Pu5+/4+ Couple. J. Am. Chem. Soc. 2024, 146 (31), 21859–21867.

Amtawong, J.; Montgomery, C. L.; Bein, G. P.; Raithel, A. L.; Hamann, T. W.; Chen, C.-H.; Dempsey, J. L. Mechanism-Guided Kinetic Analysis of Electrocatalytic Proton Reduction Mediated by a Cobalt Catalyst Bearing a Pendant Basic Site. J. Am. Chem. Soc. 2024, 146 (6), 3742–3754.

Kelm, J. E.; Smith, A.; Montgomery, C. L.; Anderson, V. D.; Kinkade, C.; Urbin, S.; Mason, D.; McIntosh, J.; Hall, J.; Dempsey, J. L. House, R. Discipline-specific Graduate Student and Postdoctoral Professional Development Programming in the Department of Chemistry at the University of North Carolina at Chapel Hill. In Professional Mentoring Programs for Science Students: Career Mentoring for Students in the Physical Sciences; ACS Symposium Series; ACS, 2024 Vol. 1470, 145–163.

Montgomery, C. L.; Amtawong, J.; Jordan, A. M.; Kurtz, D. A.; Dempsey, J. L. Proton Transfer Kinetics of Transition Metal Hydride Complexes and Implications for Fuel-Forming Reactions. Chem. Soc. Rev. 2023, 52 (20), 7137–7169.

Moffa, K. L., Teahan, C. N., Montgomery, C. L., Shepherd, S. L., Dickenson, J. C., Benson, K. R., Olsen, M., Boyko, W. J., Bezpalko, M., Kassel, W. M., Dudley, T. J., Harrison, D. P., Paul, J. J. Ruthenium terpyridine Phenol-Substituent supports PCET and semiquinone-like behavior. Polyhedron 2023, 244 (2), 116582.

Presentations

Montgomery, C. L. Pollution to Power: Converting Carbon Dioxide into Sustainable Fuel. Three Minute Thesis Competition, Chapel Hill, NC, 2024.

Montgomery, C. L., Chevalier, L., Dempsey, J. L. Circumventing Barriers to Metal Hydride Formation Using Ligand-Cooperativity. 4th International Conference on Proton Coupled Electron Transfer, Port Aventura, Spain, 2023.

Montgomery, C. L., Dempsey, J. L. Versatile Synthon for Surface Immobilization and Implications for Kinetic Analysis. Triangle Student Research Competition, Chapel Hill, NC, 2022.

Montgomery, C. L., Teahan, C. N., Shepherd, S. L., Bezpalko, M., Kassel, W. M., Harrison, D. P., Dudley, T. J., Paul, J. J. Electrochemical Properties of Hydroxyl-Substituted Terpyridine Complexes as a Function of pH. 275th American Chemical Society National Meeting, Orlando, FL, 2019.