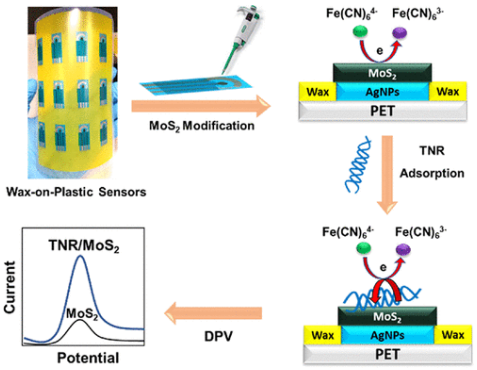
Faculty Research in Chemistry at UCA

For more information on each professor's research scroll down to other pages.	
Analytical Chemistry	
Mauldin	He applies atomic absorption spectroscopy (analyzing for trace metals) to environmental, historical, and laboratory waste remediation samples. He also works on incorporating the principles of scientific reasoning as outlined in this book in the education of science journalists.
Yarberry	Her primary current interest is in the field of chemical education.
Qamar	He is developing inexpensive microfluidic analytical devices, printed on paper and plastic, to analyze biological samples, like glucose in urine.
Biochemistry	
Dunlap	Her research is on calcium regulated proteins. Some bind calcium directly, others work in tandem with these, regulating functions like muscle contraction and the firing of neurons.
Isom	Her research involves the computational analysis of 3D biomacromolecular structures, especially nucleic acids (RNA, DNA) and proteins.
Kelley	Her research interest is in the field of retinoid (Vitamin A) metabolism and its roll in cellular functions.
Inorganic Chemistry	
Desrochers	His research studies the coordination chemistry of metal ions. The molecules show magnetic properties desirable in small devices.
Massey	Her research develops catalysts that harness sunlight to reduce carbon dioxide to useful molecules, for renewable fuels and industrial manufacturing.
Yang	His research focuses on the nitrous oxide and carbon dioxide activation and construction of dynamic coordination polymer materials
Organic Chemistry	
Carter	His research interests include investigating the role played by free radical intermediates in the damage of biologically important molecules.
Naumiec	His research is on the development of drug candidates to treat tropical diseases.
Tarkka	The goals of his research project are new methods for protein purification and quantification of sulfur-containing amino acids.
Physical Chemistry	
Dooley	Her research involves the measurement of aerosol optical properties using pulsed laser cavity ring-down spectroscopy.
Long	Her research focuses on modeling how DNA interacts with metal nanoparticles using computational methods.
Taylor	His research focuses on the chemistry of gas phase ions with a variety of small molecules.

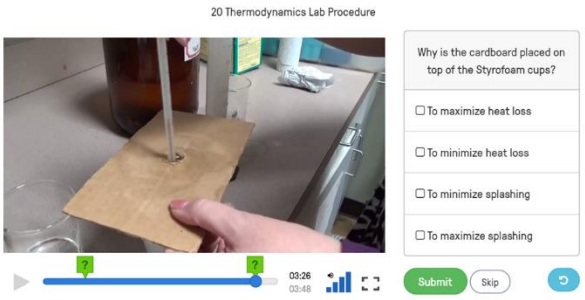
Analytical Chemistry

Dr. Robert Mauldin conducted research in a variety of topics in environmental chemistry, including the fate of herbicides, the study of pollution brought about by the combustion of coal, and the production of ground-level ozone. Lately, his interests have expanded to include the development of new teaching labs and mechanisms to assess learning in chemistry and the sciences. In 2006, he co-authored the book, Understanding Scientific Reasoning. He is currently working on incorporating the principles of scientific reasoning as outlined in this book in the education of science journalists. He also is currently very active in the application of atomic absorption/graphite furnace absorption spectroscopy applied to the analysis of trace metals ions in environmental (Arkansas fish), historical (Caddo pottery), and lab waste remediation samples. For more information please see his faculty page.

Dr. Ahmad Qamar specializes in Analytical Chemistry and his research focuses on wax printing and inkjet printing of functional materials on various flexible substrates for the development of low-cost diagnostic devices. While fabricating low cost diagnostic devices, he hopes to discover alternative ways to develop economical flexible sensor prototypes and make them available all around the world, especially in extremely resource deprived areas. "Wonders happen in science because of good teamwork and collaboration. We always learn from each other and contribute together." (Dr. Ahmad Qamar). He plans to make significant contributions to the development of non-invasive diagnostic methods. His research may lead to pre-clinical health diagnostics at home that can reduce visits to the hospital. See this site for more information.

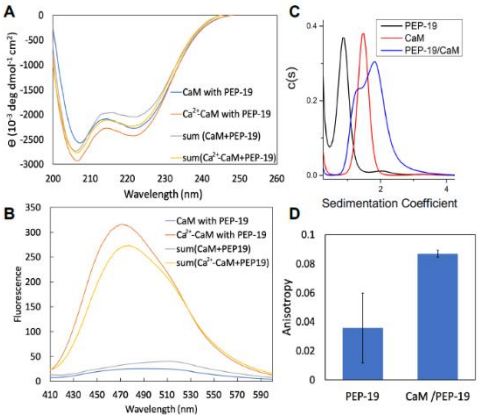


Dr. Faith Yarberry was trained as an analytical chemist. Her primary current interest is in the field of chemical education. She is interested in developing new laboratory exercises and works with secondary educators to improve the preparedness of students entering college chemistry courses. For more information please see her faculty page.

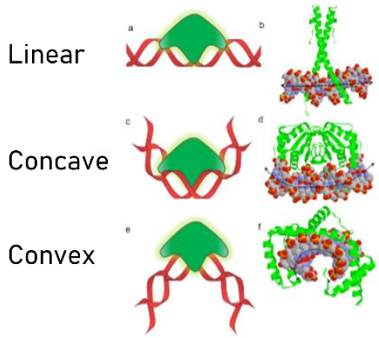


Biochemistry

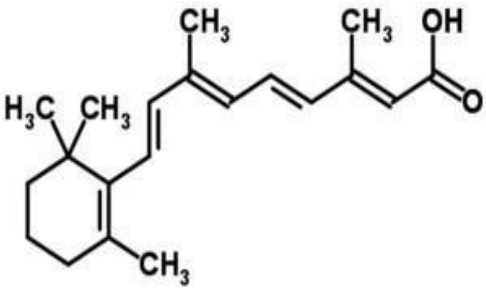
Dr. Victoria Dunlap graduated from UCA in 2007 and went on to receive her PhD in Molecular and Cellular Biochemistry from the University of Kentucky. Her research studies the changes in calcium concentrations can transmit messages within a cell. The protein calmodulin (CAM) can translate these calcium messages. When calcium concentration increases, calmodulin binds to and changes the shape of other proteins (PEP19). The change in shape of calmodulin's target proteins changes their function, turning them on or off depending on the protein and cell type.



Dr. Lori Isom specializes in the elegant, intricate field of Biochemistry. Her research involves the computational analysis of 3D biomacromolecular structures including proteins, DNA, RNA as well as protein/DNA complexes. The primary focus of her research is the investigation of the effect of cation (positively-charged atoms or molecules) binding on macromolecular structure. Such influence on nucleic acid and/or protein structure promotes proper folding and activity of the macromolecule and may be involved in cellular processes such as gene activation, DNA replication and repair, all of which are components that when malfunctioning can lead to the development of cancer and other diseases. For more information please see her website.



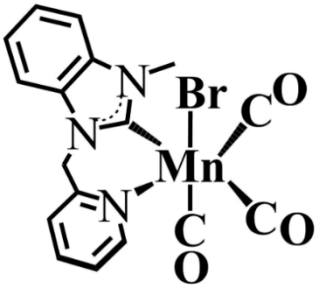
Dr. Melissa Kelley is a biochemist. Her research interest is in the field of retinoid metabolism. Vitamin A (retinol) and its analogs, retinoids, are essential for many critical life processes including regulating cellular communication. Abnormal cellular communication culminates in various disease states including cancer, Alzheimers, and rheumatoid arthritis. Retinoid metabolism is an integral part of regulating cellular communication. Although the communication cascades are well defined, the particular molecules responsible for prompting these cascades remains poorly defined. The Kelley laboratory focuses on identifying the biologically active metabolites of retinol that mediate cellular adhesion and proliferation. For more information please see her website.

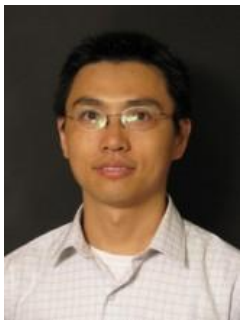


Inorganic Chemistry

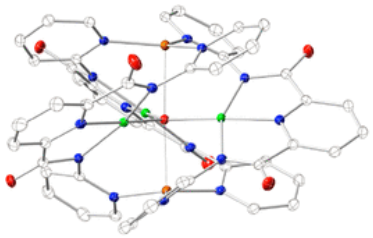
Dr. Patrick Desrochers and his students study the coordination chemistry of metal ions. These include early and late transition metals (Cr and Mo) through Fe and Rh, to Ni, Cu, and Zn. When properly controlled, ions of these metals elicit desirable behavior like amino acid selectivity (Ni), heterogeneous polymerization catalysis (Rh), interesting magnetic characteristics (Fe, Ni), and reversible binding of small molecules and substrates (CO, NH_3, BH_4^-, HCCH; Mo, Ni, Cu) important in industrial reactions and hydrogen-rich storage materials. This control results from using facial scorpionate chelates, specifically designed for electronic, steric, and reusable utility. Most recently work has focused on anchoring these chemical systems to plastic substrates to improve their recyclability and use in applications ranging from protein purification to small-molecule sensors, reusable heterogeneous catalysts, and tailored magnetic materials. For more information please see his website.

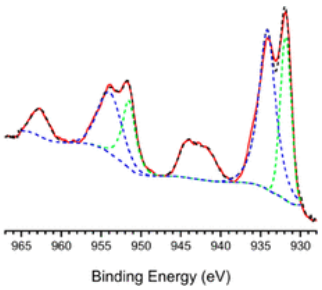
Dr. Marsha Massey is an organometallic chemist with particular interest in the areas of alternative energy catalysis and chemical education.
Alternative Energy Catalysis: Dr. Massey's research in this area focuses on designing small molecule catalysts for producing fuels from the greenhouse gas, CO_2. Her approach utilizes molecules containing transition metals (Mn, Ru, Fe) to activate CO_2 after applying electricity to the solution. Ideally, this electricity will be sourced from energy harvested from solar panels, thus storing the energy produced from sunlight!
Chemical Education: Dr. Massey welcomes an opportunity to work with students on developing new course materials or programs which can help people learn chemistry. Currently, she is interested in using peer motivation and mentoring to improve student learning at the college level. This includes studying, designing, and conducting supplemental instruction (SI) sessions for students in first- and second-level chemistry courses.





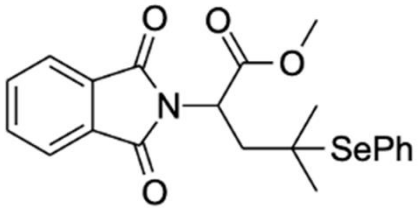
Dr. Lei Yang's research seeks to the development of synthetic inorganic functional molecules and materials: (1) Model complexes of the active sites of metal containing enzymes; (2) Transition metal compounds with novel structural features and spectroscopic properties; (3) Small molecular activation by transition metal complexes. Currently, his research program focuses on the nitrous oxide and carbon dioxide activation and construction of dynamic coordination polymer materials. The general approach is design and synthesize organic ligand systems to support transition metal ion to obtain the materials with novel functions. Students have opportunities to learn organic/inorganic synthesis, X-ray crystallography, spectroscopic characterization (NMR, FT-IR, UV-vis, CV, MS and EPR) and Schlenk line techniques. For more information please see his website.



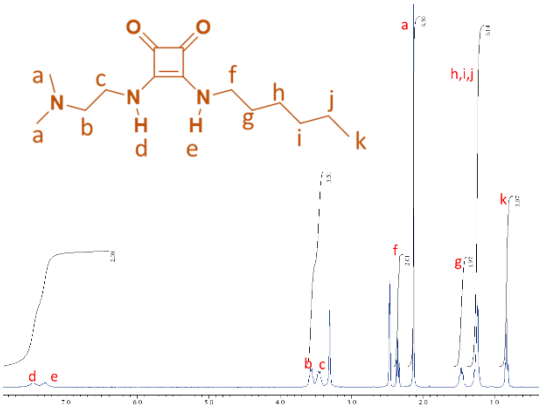


Organic Chemistry

Dr. Nolan Carter specializes in bioorganic chemistry. His research interests include investigating the role played by free radical intermediates in the damage of biologically important molecules such as DNA and proteins. These radical intermediates can be generated by photochemical activation of chemically synthesized precursor molecules. For more information see his faculty page.



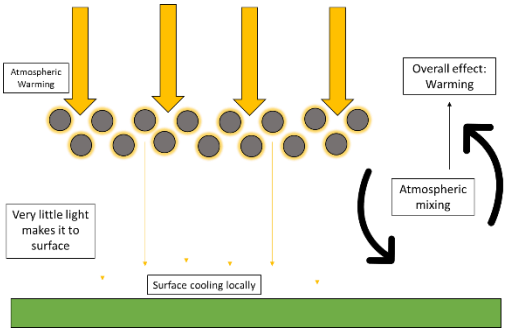
Dr. Gregory Naumiec works to develop nexpensive treatments for illnesses classified as neglected tropical diseases (Chagas, African sleeping sickness, leishmaniasis, etc.). This subset of diseases is believed to affect over one billion people worldwide, causing over 500,000 deaths a year, primarily in the poorest of countries. They are largely responsible for the high morbidity and mortality rates of these at-risk populations. Even though many of these diseases are treatable and preventable, they are commonly neglected since there is little financial incentive to develop treatments for illnesses that occur prevalently in third world countries. Despite existing treatment for most neglected tropical diseases, new research in the field is necessary to mitigate the limited drug options available. It is this limited range of drug options that is leading to increasing drug resistances to current therapeutic methods as well as the continued use of highly toxic drug regimens. His research program helps combat neglected tropical diseases by developing natural product-based drug and near-infrared (NIR) molecular imaging candidates for treatment, diagnosis, and therapeutic monitoring. website.



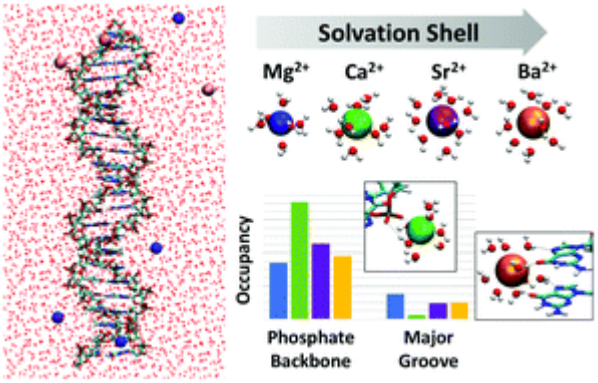
Dr. Richard Tarkka has historically focused his research on developing methods to synthesize polymers with uniform size distribution. He is a strong proponent of the 12 principles of green chemistry. Some of his research involves “greening up” existing experiments, by developing new ways to carry them out with reduced reliance on toxic solvents and using more benign reagents. Currently he is working collaboratively with faculty in the Department of Biology to fingerprint molecules in native honey’s and develop molecular patterns that indicate desirable antibiotic properties in these honeys. See his webpage.

Physical Chemistry

Dr. Kristin Dooley is a physical chemist with a special interest in the area of atmospheric chemistry. She received a BS in Chemistry and Mathematics from UCA in 2004, and a PhD in Chemistry from Texas A&M University in 2009. Her research involves the measurement of aerosol optical properties using pulsed laser cavity ring-down spectroscopy. Read more on her website here.



Dr. Makenzie Long is a computational physical chemist with training in combined quantum and classical methods for modeling condensed phase chemistry. Her current research validates computational methods for modeling DNA binding to metal nanoparticles. DNA is increasingly used as a material in the development of nanoscale devices, such as biosensors. The electronic properties of DNA and metal nanoparticles and their relative size presents a challenge for current computational methods. Her research aims to identify an accurate and computationally efficient approach to model DNA-nanoparticle binding.



Dr. Bill Taylor is trained in the areas of physical chemistry and instrumentation design. His research focuses on the chemistry of gas phase ions with a variety of small molecules. In particular, He is interested in fundamental parameters influencing the product formation in reactions involving the activation of bonds by gas phase metal ions. The essential goal of this work is to gain an understanding of factors influencing reaction outcomes; however, these processes also have potential implications with respect to catalysis. For more information please see his faculty page.