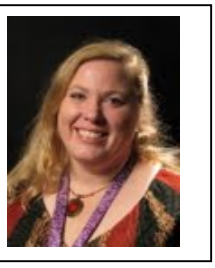
Faculty Research in Chemistry at UCA

Analytical Chemistry

Dr. Robert Mauldin serves as Chair of the Department of Chemistry. He has 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.

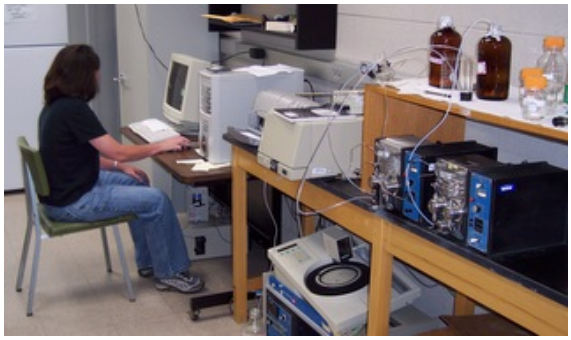
Dr. Karen Steelman is an Analytical Chemist passionate about the field of Archaeological Chemistry - using chemistry to help archaeologists answer questions about the past. Her research laboratory develops sample preparation methods for accelerator mass spectrometry radiocarbon dating, including plasma oxidation, supercritical carbon dioxide cleaning, and traditional chemical methods. Recently, in collaboration with Dr. Ginny Adams of the UCA Biology Department, Dr. Steelman and her students have become involved in an Environmental Chemistry project determining the water quality of runoff in cave systems. Dr. Steelman was a 1999 Watson Fellow studying museum conservation in Costa Rica, Chile, Australia, and Great Britain.



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.

Biochemistry

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.



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.

Inorganic Chemistry

Dr. Patrick Desrochers and his research students study the coordination chemistry of nickel, its interactions with amino acids and hydrogen-rich materials. These interactions are related to the biochemistry of this metal; in some bacteria nature uses nickel to catalyze commercially significant reactions. The association of nickel with sulfur in the form of cysteine is a common theme in this chemistry. Some reactions catalyzed by nickel-enzymes include the consumption and production of hydrogen gas and methane generation from rotting vegetation. Both hydrogen and methane are attractive as alternative fuels. His laboratory studies new complexes of nickel and sulfur in order to understand how the association of nickel with cysteine is useful in these kinds of reactions. He is also interested in nickel interactions with hydrogen sources, including borohydride and ammonia. These systems are being investigated for their reactivity as selective organic reductants and as potential hydrogen storage media for fuel cell applications. Most recently work in his lab 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.

Organic Chemistry

Dr. 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.

Dr. Richard Tarkka has historically focused his research on developing methods to synthesize polymers with uniform size distribution. Currently, he is collaborating with Prof. Patrick Desrochers of the UCA Chemistry Department. Their project focuses on the synthesis of new solid-supported organic ligands, and the use of these systems, when coordinated with metal ions, in the selective binding of specific amino acids and peptide sequences. The ultimate goals of the project are new methods for protein purification and quantification of sulfur-containing amino acids.

Physical Chemistry

Dr. Perry's work focuses on various applications in nanotechnology, which is truly an interdisciplinary field. The overriding goal of research in the Perry lab is to learn to control and characterize the chemistry of organic and biological molecules in proximity to small metal nanostructures. Different projects include areas of biochemistry, environmental, physical and organic chemistry. Some of the systems under investigation include analgesics (such as aspirin and ibuprofen), amino acids, pesticides/herbicides, and a range of different aromatic isomers that impact a host of industries such as organic synthesis, catalysis, medicine, cosmetics, the automotive industry, and energy and space related research.

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.