Summary

Teaching through research is a guiding principle in our NSF-AIRE recognized program. We construct our program so that our students learn the skills and techniques necessary to be productive in research. The requested ion trap mass spectrometer with electrospray and atmospheric pressure chemical ionization interfaces (LC/MS) is the next necessary resource to prepare our students to be creative, independent, and well-trained scientists.

The new instrument will provide a novel linkage and enhancement of our full chemistry curriculum. We will use the MS in General Chemistry for characterization of transition metal complexes. In Organic Chemistry students will do natural products isolation and structure characterization. In Physical Chemistry we will study proton affinities in gas phase and solution. Instrumental Analysis will discuss the fundamentals of the ionization and mass analysis processes. Our Biochemistry students will use LC/MS in protein sequencing.

These LC/MS-enhanced curricular components will allow us to introduce exciting and important new approaches to chemistry, including combinatorial chemistry, solid-phase synthesis, and computer aided molecular design. We will implement a program in combinatorial chemistry that links our Organic, Physical, Instrumental, and Biochemistry courses to map the active site of the proteolytic enzyme papain. Students in our Organic course will use solid-phase synthesis to make resin-bound combinatorial mixtures of papain substrates. These mixtures will then be analyzed in Instrumental Analysis for structure and purity, and in Biochemistry in a kinetic assay. The results of the papain assay will be used for QSAR and receptor modeling studies in Physical Chemistry.

Beyond curricular developments, the instrument will be used to significantly enhance student/faculty research opportunities. We require all our students to do independent research, which include projects in natural product synthesis and isolation, metal-binding peptides, the incorporation of modified nucleotides into DNA, bioinorganic chemistry of copper, DNA cross-linking agents, the utility of carbene addition in organic synthesis, aquatic photochemistry of Fe(II) and Fe(III) and degradation of pesticides, and guest-host chemistry.