Departmental Mission Statement

Our major goal is to provide our students with the most rigorous education in the core concepts of chemistry. We strive to provide a meaningful and relevant education in which the core concepts are framed in the most exciting science topics of today, including materials and energy research, nanotechnology, computational chemistry, natural products, drug design and protein research. We strive to provide our students with a broad range of interdisciplinary learning and research opportunities. At the same time we provide our students with a solid foundation in the core traditional areas of chemistry.

Student Learning Goals

A. Students will understand and apply basic research methods as used professionally in chemistry, including research design, data analysis, and interpretation.

Specific Student Learning Objectives

1. Students will be able to identify, describe and demonstrate research methods used to probe chemical reactions.

2. Students will be able to design and articulate an independent research project.

3. Students will be able to effectively critique conclusions presented in the primary literature.

Comments on Learning Objectives.

1. This Learning Objective involves the correct use various instrumental analyses in the full characterization of different reaction types. This Learning Objective most likely fits into Superlab.

2. This Learning Objective is designed to probe a student’s ability to digest the chemical literature, formulate new ideas and articulate them clearly. This objective will take the form of an independent research proposal that is based upon the primary literature and includes new ideas and directions. This would serve a few purposes. First, it would provide preparation for senior thesis experience in that they need to be able to propose future experiments in current projects. Second, it would provide another source for the evaluation of their critical thinking skills.

3. This Learning objective is designed to measure a student’s ability to analyze and critique the primary literature. This is performed routinely in the advanced level courses offered by the chemistry department.
B. Students will understand the fundamental basis for the structures and reactivities of atoms, molecules and non-molecular solids and the analytical techniques used for their determination.

Specific Student Learning Objectives

1. Students will be able to demonstrate the strengths and limitations of different models for bonding.

2. Students will be able to identify characterization tools to probe bonding motifs.

3. Students will be able to collect, analyze and interpret spectra using various forms of instrumentation.

4. Students will be able to access and search the primary literature for examples of functional molecules.

Comments on Learning Objectives.

1. This learning objective is designed to probe student understanding of the different models of chemical bonding, with focus on the strengths and weaknesses of each. This objective will be targeted in first semester general chemistry and first semester organic chemistry. A strong foundation in chemical bonding is critical for the understanding of molecular reactivities and structures.

2. As the Chemistry department revises the introductory curriculum, we plan to create a laboratory program that is more focused on connections between chemical structure, reactivity and methods of characterization. We plan to completely reconstruct the first laboratory experience such that characterization tools are integrated into discussions of structure. For example, UV-Vis spectroscopy is used to observed electronic transitions and it will be described and implemented as the courses discuss the electronic structure of molecules. We have identified several techniques to introduce, each of which probe a different structural motif. These include UV-Vis spectroscopy (electronic transitions), IR and Raman Spectroscopy (bond strengths), atomic absorption (electron structure), NMR spectroscopy (molecular connectivity and nuclear structure) and X-ray diffraction (solid state structure).

3. As described above, we plan to create a series of laboratory experiments that will give students hands on experience with a wide range of instrumentation. These techniques are currently not integrated into the lab program or the lecture courses. They tend to be taught as a ‘Spectroscopy’ unit in which many are described. We believe integrating them into the lecture courses and creating a new laboratory sequence will strengthen the connections between techniques and the chemistry.

4. The primary literature will be used to demonstrate the breath of molecular structures and to further develop correlations between structure and reactivity. The primary focus of
the learning objective is to introduce standard portals used to search the literature, including SciFinder Scholar and the Web of Knowledge.