Research Directions:

The Department of Chemistry offers undergraduate and post-graduate students research opportunities in six principal areas:

- Analytical Chemistry
- Physical Chemistry
- Inorganic Chemistry
- Organic Chemistry
- Biochemistry
- Industrial Chemistry

Visit each principal area for a more detailed description of the research activities performed. Contact the appropriate advisor of record or individual research faculty member to discuss the alignment of your research interests.

Analytical Chemistry

Modern analytical chemistry is focused largely on instrumental analysis. It involves new applications, new methods of analysis, the discovery of new principles of measurements, and the application of other discoveries for qualitative and quantitative measurements. Analytical chemistry makes important contributions to diverse fields including industry, medicine, biology, physics, ،geology, food science and nanotechnology.

Students conducting research with analytical faculty receive training in chromatography, electrochemistry and spectroscopy. These skills and the interdisciplinary training serve well during the job search after graduation.

Physical Chemistry

Research around physical chemistry can be broken into Computational Chemistry such as Quantitative structure-activity relationship (QSAR) and Quantitative structure property relationships (QSPR), Colloids including Surfactants and Micelles, Mathematical Chemistry, Surface Chemistry, Electrochemistry, Reaction Kinetics, Reaction Thermodynamics, Electroanalysis and Biosensors. Many of these areas involve a unique collaboration for solving problems with other specialists in other fields such as inorganic, analytical, organic, pharmaceutical, industrial, and medicinal chemistry.

Inorganic Chemistry

Inorganic chemistry is a very broad area of chemistry which includes all of the elements of the periodic table, including some that are the elements usually considered to be part of organic chemistry. Some portions of inorganic chemistry deal strictly with inorganic compounds, but others are a blend of two or more other subdisciplines, such as organometallic, bioinorganic, and materials chemistry. As a result of this variety, inorganic chemistry has applications ranging from catalysis to medicine. For example, inorganic compounds are important catalysts in numerous industrial processes, including the synthesis of methanol, acetic acid, and polyethylene. Inorganic compounds are used to treat various medical conditions, such as the antitumor compound cis-$Pt(NH_3)2Cl_2$(cis-platin), and new metal-containing complexes for therapeutic and medical imaging are being developed.

The design and synthesis of new compounds and the discovery of new metalloproteins has led to the discovery of unusual and highly complex structures, many of which contain multiple metal centers. Inorganic chemistry employs the whole range of modern instrumentation to analyze and characterize new compounds, including single crystal X-ray structure determination, several types of spectroscopy, electrochemical methods, magnetic susceptibility, computational methods, and others.

Organic Chemistry

Organic chemistry involves the scientific study of the structure, properties, and reactions of compounds and materials that contain carbon atoms.

The Organic Section offers exciting research and training opportunities on the synthesis and functions of organic compounds in both the traditional fields of synthetic and physical organic chemistry and in the emerging interdisciplinary fields of green (environmentally benign), bio-organic, medicinal, and materials chemistry. Areas of strength include the developments of green catalysts and synthetic methodologies, drug delivery systems, and therapeutically useful small organic compounds.

Students are strongly encouraged to visit the websites of the organic chemistry faculty to further explore the highlights and details of their ongoing research.

Biochemistry

Biochemistry is the study of the chemicals and processes of living things. It is essential to medicine (the only branch of chemistry taught in medical schools), drug discovery, and the discovery of life processes that are altered by the environment and pathology. Other than the

simple biochemicals and lipids, there are the macromolecules, including proteins and DNA. Determining the structure of these and how various drugs and other chemicals bind to them is the basis of modern drug design. Another branch of biochemistry, molecular biology, exploits the properties of DNA to allow nearly any gene to be isolated, modified, and expressed in near-unlimited quantities. Biochemists also collaborate with cell biologists to learn how proteins (proteomics) and DNA (genomics) differ between living things and as organisms respond to their environment (cell signaling). Also, it has a pivotal role in the understanding of genetic disorders that enables the development of diagnostic tests, forensic medicine well production of new drugs using genetic engineering.

Students conducting research with biochemical faculty receive training in different techniques including chromatography, electrophoresis, PCR, Bio drop, mass spectrometry, microscopy, spectroscopy, and hyphenated techniques, as well as more specialized techniques. These skills, together with the interdisciplinary training, serve well during the job search after graduation.

Industrial Chemistry

The research in Industrial Chemistry focusing into many directions of research as :

1- **polymer** which include the development of new polymers that could be applied in different applications as ion exchangers, hydrogels, thermal insulators, energy storages, solar cells, electrically conductive. Also the research focus on preparation of interpenetrating networks from different trade polymers. On the other hands the work was followed for the recycling of the plastics and rubber, whereby the method of recycling and reused or renew use was applied on wasted tiers, plastics and papers.

2- **biodiesel** which include the preparation of the biodiesel from different plant sources and improves their burning properties.

3- **research in petrochemicals and oil fields** which include the study of oil fragment and processing also the preparation of some catalysts used to improve the fuel characteristics.