



Department of Chemistry and Biochemistry
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Emerging Scientists Workshop – Project List

01- Diels-Alder Kinetics via NMR (Chemistry A)

We are studying the rates of reaction for various dienophiles so as to compare traditional solution synthesis to our Diels-Alder reaction at the confined sites of organic crystals. For this experiment, you will prep and monitor the solution kinetics of *N*-methylmaleimide with tetracene and determine rate constants for this reaction.

02- How to Study Proteins by Mutagenesis (Biochemistry A)

We are studying the different roles of individual amino acids in a protein. After we find amino acids that we hypothesize are important, we mutate them and analyze whether the protein activity was affected. For this experiment, you will purify by electrophoresis the gene that produces our protein, and how we can find with computational methods candidates for mutagenesis.

03- Imaging of Single Atoms at Surface (Nanoscience)

We are studying the properties of single atoms surfaces using scanning tunneling microscopy, which requires probe tips narrowed, also to nearly a single atom. For this experiment, you will prepare the tips and then image the surface of graphite.

04- How to Decipher the Atomic Structure of a Protein (Biochemistry B)

We are studying lactonases, which are enzymes that regulate cell-to-cell communication signals in bacteria. To understand their function, we obtain a 3D map of the atomic structure using X-ray diffraction methods. For this experiment, you will briefly see the Gryphon crystalliation robot before converting X-ray data into a 3D map of atoms within the enzyme.

05- The Synthesis of Biofuel from Renewable Resources (Chemistry B)

We are studying iron-catalyzed isoprene oligomerizations and co-oligomerizations in an effort to determine new potential biofuel sources. To examine our products potential, we must correlate their properties (boiling point, cetane rating, etc.) to known biofuel sources. For this experiment, you will synthesize your own biodiesel from vegetable oil and analyze the contents by gas chromatography (GC).

06- Confocal Expression Study of Embryonic Pattern Formation in Zebrafish (Biology A)

We are studying the assignment of regional fates along the long axis of the vertebrate body using transgenic zebrafish. For this experiment, you will chart the dynamics of development using a confocal microscopy, which allows for visual reporting of data in real time in fish embryos.

07- Identification of Toxic Chemicals in Water Sources (Chemistry C)

We are studying what potentially toxic compounds may be found in water from various sources (surface waters, drinking water, waste water, etc.) utilizing liquid chromatography tandem mass spectrometry. For this experiment, you will be involved in analyzing a standard solution of two compounds known to exist in the environment. An environmental, tap and/or waste water sample(s) will then be analyzed to determine if the two compounds are present.

08- Molecular Modeling of Oxygen Escape Pathways from Globins (Computational Chemistry)

We are studying the pathways by which oxygen can escape from a monomeric globin molecule. For this experiment you will use a molecular modeling program on our computer cluster and the results of molecular dynamics simulations to understand more about how the protein functions due to its motions.

09- Study of Electronic Efficiency of Organic (Carbon) Semiconductors (Materials Chemistry)

We are studying means for dynamically tuning the efficiency of organic (carbon) semiconductors used in the newest generation of cell phone displays. For this experiment, you will fabricate simple thin-film electronic devices using these organic semiconductors, measure the conductance of these devices, and tune the efficiency.

10- Synthesis of a Boron Mimetic for use as an Enzyme Inhibitor (Chemistry D)

We are synthesizing organic compounds for use as potential inhibitors in the area of medicinal chemistry. For this experiment, you will be performing a step in the synthesis of a potential inhibitor. You will be monitoring the completion of the reaction by utilizing the distinct characteristics of boron through the qualitative technique of thin layer chromatography.

11- Microscopy Studies of Bacterial Viruses (Biology B)

We are studying the behavior of bacterial viruses in the environment and their effect on their host systems. For this experiment you will be imaging both the host and virus with various forms of microscopy culminating with transmission electron microscopy for locating and resolving individual viruses.