

Emerging Scientists Workshop – Project List

01- “Assessing Catalytic Properties via Electrochemistry” (Chemistry A)

We are designing catalysts that contain a transition metal center and a new redox non-innocent ligand that will be useful in the creation of polyethylene, which comprises many modern plastics. For this experiment, you will be conducting electrochemical studies on the catalysts in an inert environment to assess their potential catalytic activity.

02- “Identification of Toxic Chemicals in Water Sources” (Chemistry B)

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

03- “Cognitive Responses to Chemical Information” (Chemistry Education)

We are studying the difference between how novices and experts process chemical information for the purposes of developing more effective education methods. For this experiment, you will utilize eye-tracking equipment to monitor eye gaze and duration to identify cognitive features activated during thinking and learning.

04- “Surface Modification to Improve Semiconductor Properties” (Chemistry C)

We are studying the surface chemistry of the next generation of organic (plastic) electronics in order to minimize the device failures which occur at mismatched interfaces. For this experiment, you will modify the surface of pentacene organic semiconductors and then assess the subsequent change in surface energy via goniometry.

05- “Imaging of Single Atoms at Surface” (Nanoscience A)

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.

06- “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.

07- “Preparation of Novel Medical Targets” (Medicinal Chemistry)

We are preparing and isolating novel compounds for their use in pharmaceuticals. For this experiment, you will setup a synthetic sequence then analyze the chemical change via NMR, which characterizes the change in each hydrogen within the molecule.

08- “How to Decipher the Atomic Structure of a Protein” (Biochemistry A)

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.

09- "Study of Efficacy of Molecular Switches on Surfaces" (Materials Chemistry/Nanoscience B)

We utilize molecular switches for smart electronic devices, and accordingly need to understand their switching properties in solid state. For this experiment, you will characterize the switches via the change in their optical spectrum, then prepare and analyze thin (4-30 molecule thick) films via spin coaters and PM-IRRAS.

10- "Microscopy Studies of Gold Nanoparticles" (Nanoscience C)

We are studying the effect of molecular switches on the collective electron oscillations within gold nanoparticles of various sizes. For this experiment you will utilize a transmission electron microscope (TEM) to view the 13 nanometer gold nanoparticles. The complementary scanning electron microscope (SEM) is also utilized.

11- "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.