

# FYRE First Year Research Experience 2011-12

Chris Makaroff is looking for First Year students to become part of his research projects through the new FYRE program.

To apply e-mail at Martha Weber at [weberme@muohio.edu](mailto:weberme@muohio.edu)

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## Biochemistry Research

### Available FYRE Projects

Molecular and cellular biology of meiosis and chromosome structure  
Structure/function relationships in metallo-hydrolases

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Students will learn and use a wide variety of techniques in biochemistry, cell, molecular, and structural biology to understand relationships between protein structure and their biological function. Visit the website: <http://www.cas.muohio.edu/chm/Faculty/Makaroca/index.htm>

### Protein structure/function relationships

The overall goal of our research is to utilize modern biochemical, cellular and molecular techniques to investigate structure function relationships in proteins essential for cellular metabolism and chromosome function. We are especially interested in understanding processes involved in cellular division and chemical detoxification.

### Molecular and cellular biology of meiosis and chromosome structure

One focus of our work involves the isolation and characterization of Arabidopsis genes required for meiosis and mitosis in order to better understand how chromosome structure is controlled. Current projects include the molecular and biochemical characterization of protein required for chromosome condensation and sister chromatid cohesion during meiosis and mitosis. A second set of genes under study are proteins that contain PHD domains and are thought to control meiotic gene expression by binding to modified histones on the chromosomes. This project utilizes studies at the cellular, molecular, biochemical, and protein structure levels.

### Structure/function relationships in metallo-hydrolases

A second focus of our laboratory involves studies on the Glyoxalase-like enzymes, which are involved in cellular detoxification and the regulation of cellular proliferation. Molecular, biochemical and structural studies are underway to more accurately determine the exact role(s) of glyoxalase II-like proteins in the cell. Structure/function studies on glyoxalase II-like proteins are also underway to identify and characterize the active site of the enzymes and understand their kinetic mechanisms. WE are also investigating the biochemical role of ETHE1, which is responsible for Ethylmalonic Encephalopathy, a complex metabolic disorder in humans.

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Sample Projects Jade Morton, Professor Electrical and Computer Engineering

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## Project 2: GPS Multipath Characterization and Mitigation for Intelligent Vehicle Systems

An accurate and reliable navigation system is an important component of any future intelligent vehicles traveling on road surface, waterways, and in space. GPS is the leading technology in navigation applications. A major source of error in GPS measurements is the multipath error which is caused by reflections of direct line-of-sight GPS signals off structures near a GPS antenna. This project will involve both static and dynamic measurement and characterization of GPS signals in rich multipath environment such as urban environment and under forest canopies. The students will also have the opportunity to collaborate with graduate students from Miami and other universities to work on techniques that mitigate the multipath induced GPS measurement errors. The student will have the opportunity to work with state-of-the-art hardware and software in my labs and interact with graduate students and professionals in the field. The student will have opportunities to interact with professionals and graduate students working in the field and attend national and international professional workshops and conferences.

## Project 3: Atmosphere remote sensing using GPS

GPS satellites travel in orbits that are somewhere between 20,000 to 25,000km above the earth. The signals propagate through the atmosphere and interact with various ions, electrons, and neutral particles along their propagation path. These interactions lead to signal refraction, scattering, diffraction, and distortion. GPS receiver designers do not like these interactions because they result in receiver position measurement errors. We are interested in turning these error measurements into a useful scientific tool to study the atmosphere. With the abundance of satellites in the sky, the small and inexpensive GPS receivers provide us with a great opportunity to remotely sense distribution of species, structure of the atmosphere, and temporal variation of the environment. The students will have the opportunity to work with many different grades of GPS receivers and participate in data collection experiments in interesting locations such as Puerto Rico, Peru, Alaska, etc. One of my previous undergraduate students was given the opportunity to participate in a summer workshop at MIT and presented papers at professional conferences. The students will have opportunities to interact with professionals and graduate students working in the field and attend national and international professional workshops and