MSPIRE REU Program

A U.S. – NETHERLANDS SUMMER RESEARCH EXPERIENCE FOR UNDERGRADUATES

The MS PIRE program (http://rodgers.chem.wayne.edu/pire) is a research program supported by the U.S. National Science Foundation (NSF) and the Netherlands Foundation for Fundamental Research on Matter (FOM) to establish a United States – Dutch Mass Spectrometry Consortium to facilitate dramatic advances in several areas of analytical, biological, and physical chemistry.

The research and educational activities associated with this program are focused on building strong international collaborations that make use of unique instrumentation available at the FOM Institute for Plasma Physics "Rijnhuizen" and the FOM Institute for Atomic and Molecular Physics (AMOLF).

The MSPIRE program is soliciting applications for a summer research program for outstanding undergraduates majoring in chemistry (http://rodgers.chem.wayne.edu/pire/reu-info.html). This program provides the opportunity for an undergraduate to participate in a research project directed by a MSPIRE faculty mentor. In addition to the research experience, participants will have the opportunity for international cultural experiences via travel to the Netherlands and collaboration with Dutch scientists.

The program is open to undergraduate Chemistry majors who will graduate in 2011 or 2012. Priority will be given to applicants that plan on attending graduate school in Chemistry. Minority applicants are especially encouraged to apply. In addition to completing the on-line application form (http://rodgers.chem.wayne.edu/pire/reu-application.html), a transcript of your undergraduate academic record must be submitted and two letters of recommendations should be provided on your behalf from faculty members who are familiar with your recent progress as a chemistry major (http://rodgers.chem.wayne.edu/pire/reu-recommendation-form.html). All application materials are due by March 31, 2010.

The summer program runs for 10 weeks between mid May and mid August (exact start/end dates can be negotiated between the student and MSPIRE faculty mentor). MSPIRE REUs will spend part of the summer at the home institution of their MSPIRE faculty mentor and part at one of the Dutch facilities.

Participants will receive a $5000 stipend and travel expenses (for travel to the Netherlands to carry out MSPIRE research). At several of the U.S. participating institutions, financial assistance with housing will also be provided.

In addition to academic pursuits, a variety of weekend diversions are available both while in the Netherlands and at the participating U.S. institutions.

The specific research project of each MSPIRE REU student and the research locations will strongly depend upon the MSPIRE faculty mentor. Participating MSPIRE faculty and their research interests are listed below. If you desire more detailed information about specific research projects or have questions regarding the MSPIRE summer REU program, do not hesitate to call or write. Address all inquiries to:

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MSPIRE Faculty and Their Research Interests

Mary T. Rodgers, Wayne State University
Chemistry, thermodynamics, and spectroscopy of protonated and metal-ligand complexes of analytical and biological relevance using tandem mass spectrometry techniques (ESI, FT-ICR MS, IRMPD) and electronic structure theory calculations. Applications to metal ion-amino acid complexes, metal ion-nucleobase complexes, tautomerization of protonated and metal cationized nucleobases and related heterocyclic molecules, metal ion-phosphate ester complexes, metal ion-nucleic acid complexes, and peptido-mimetic protonated base-crown ether complexes.

John R. Eyler, University of Florida
Use of tunable lasers to differentiate isomeric structures of carbohydrates and other biologically relevant species. Tunable CO2, optical parametric oscillator (OPO), and free electron lasers are used to produce infrared multiple photon dissociation (IRMPD) spectra and fragmentation patterns to distinguish between mono- and di-saccharide epimers and anomers, other isomeric intermediates in carbohydrate reactions (e.g., glycosyl oxocarbenium ions), and charged dimeric species of metabolic relevance (guanine, dopamine, cysteine, etc.)

Richard A. Yost, University of Florida
Fundamentals, instrumentation, and applications of mass spectrometry in analytical chemistry. Development of new mass spectrometric imaging and ion mobility instrumentation and techniques, and the application of these techniques in areas such as biomedical, pharmaceutical, environmental, petrochemical, and forensic chemistry.

I. Jonathan Amster, University of Georgia
The development of new FT-ICR techniques for the analysis of biological and synthetic macromolecules using laser desorption and electrospray ionization. Electron detachment dissociation and negative electron transfer dissociation for discerning the structural features of glycosaminoglycan oligosaccharides. Studies of FT-ICR fundamentals, including the effect of ion space-charge on the behavior of ions, using multiparticle computer simulations of ion motion.

Peter B. Armentrout, University of Utah
Chemistry, thermodynamics, and spectroscopy of protonated and metal-ligand complexes of catalytic and biological relevance using tandem mass spectrometry techniques (ESI, FT-ICR MS, IRMPD) and electronic structure theory calculations. Applications to protonated and metal ion-amino acid complexes, metal crown ether complexes, and transition metal carbenes.

Evan R. Williams, University of California, Berkeley
Our group is using the free electron laser to investigate how metal ions interact with the building blocks of life, focusing on amino acids and small peptides, to obtain a detailed understanding of the role of essential metal ions on peptide and protein structure and reactivity. State-of-the-art computational chemistry is used to model these interactions and as an aid to interpreting infrared spectra. These studies complement those done at Berkeley using an OPO laser to measure infrared spectra at higher frequencies to investigate competitive water binding interactions with metal ions and peptides. The ultimate goal of this research is to obtain a detailed understanding of how water and metal ions interact with and affect the structure and chemistry of proteins. Additional information about our research can be found at (http://www.cchem.berkeley.edu/erwgrp/).

Brad K. Bendiak, University of Colorado-Denver
Structural differentiation of carbohydrate molecules using tandem mass spectrometry and variable wavelength photodissociation. Applications to monosaccharides, disaccharides, and product ion substructures of disaccharides with a goal of obtaining detailed structural information about the stereochemistry, anomeric configuration, and ring forms of key product ions derived from disaccharides and larger oligosaccharides via multi-stage tandem mass spectrometry. Isotopic labeling of carbohydrates performed in order to determine their precise origins.

Robert C. Dunbar, Case Western Reserve University
Spectroscopic analysis of conformations of metal-ion complexes with amino acids and small peptides, applying infrared IRMPD action spectroscopy with the free-electron laser. Conformational changes as a function of metal ion identity, peptide chain length, peptide sequence, side-chain interactions. Cation-pi interactions as a structure-determining feature involving aromatic residues. Computational vibrational spectroscopy complementary to the experimental observations. Metal-ion complexes with possible astrochemical relevance.

Nicholas C. Polfer, University of Florida
Our research focus is on reaction products from peptide fragmentation processes in mass spectrometry (MS). These products are structurally characterized by infrared photodissociation spectroscopy, in combination with harmonic frequency calculations at the density functional theory (DFT) level. Our current emphasis is on peptide fragments from collision-induced dissociation (CID), but this will also be extended to reaction products from other dissociation techniques, such as electron transfer dissociation (ETD).