Merck/AAAS Undergraduate Research Program 2007

Loyola Marymount University has received an award from the Merck/AAAS Undergraduate Research Program* to support five Research Associates for ten weeks during the summer of 2007. Each research associate will work with at least two faculty advisors on a interdisciplinary project that spans biology and chemistry, field and laboratory research and centers on the Ballona Wetlands. Each student will participate in Project 1 and an additional project to be chosen from Projects 2-5.

The summer program will extend from May 21 through July 27. Research associates will receive a stipend of $3000 and housing will be provided, if needed. In addition, each research associate will be expected to present results at an LMU departmental seminar and at a regional or national conference. Research associates are encouraged to continue their research in the Fall 2007 semester by enrolling for independent study with their advisor.

If you wish to apply, please submit the attached application the Biology office (Seaver 219) form by **4:30PM on Friday, February 23.**

Project 1: Monitoring Air, Water, and Soil for Urban Contamination (Dr. Rachel Adams, Dr. Lambert Doezema, Dr. John Dorsey, Dr. Jim Landry)

The Ballona Creek Estuary has been designated as an impaired water body with respect to chlorinated pesticides, polychlorinated biphenyls (PCBs), lead, and zinc. The surrounding urban environment has impacted the chemistry and biology of the wetlands. In addition, the wetlands have high ozone exposure. This study will focus on three of these pollutants: PCB's, heavy metals, and volatile hydrocarbons, chemical precursors to ozone. Students will collect samples from both the sediments and the water column, using metal corers and passive polyethylene devices (PEDs). They will measure concentrations of PCB's using gas chromatography-electron capture detection (GC-ECD) and heavy metals using atomic absorption spectrophometry. Ambient air samples will be collected in evacuated 2 liter stainless steel canisters and analyzed for hydrocarbons using GC-FID. Correlations to location, time, rainfall, and tidal action will allow the identification of the sources of major pollutant loading. All five Merck undergraduate research associates will participate in this project.

Project 2: Developing *Salicornia virginica* as a Biological Monitor (Dr. Pippa Drennan, Dr. Jim Landry)

Aquatic organisms, e.g. mussels, are often used to monitor pollution, but these organisms do not provide information across the entire wetlands and are limited in biomass. Terrestrial organisms offer greater distribution and mass, but little is known about the effect of pollutants on terrestrial biota. We suggest using *Salicornia virginica*, the dominant plant species of the Ballona Wetlands, as a biological monitor of pollution. Students will sample plants in areas of different tidal/freshwater influence and test them for PCB's and heavy metals using techniques similar to those for the water and sediments. Samples taken across an annual cycle will provide information as to whether pollutants accumulated in the plants reenter the sediments of the wetlands when plants drop dead branches. Additionally, students will measure sodium and potassium levels using flame photometry in different plant parts (roots, old stems and developing young green internodes) to provide insight into the tissue partitioning of ions to which this species is adapted (as a halophyte) by comparison to the partitioning of the pollutants.

For consideration, individuals interested in a fellowship must interview with Dr. Drennan (pdrennan@lmu.edu) or Dr. Landry (jlandry@lmu.edu).

Project 3: Biomagnification of Wetlands Contaminants (Dr. Martin Ramirez, Dr. Jim Landry, Dr. Jeremy McCallum)

The transfer of pollutants from the plant trophic level to higher trophic levels and their concomitant concentration will be investigated using spiders as the model organism. In particular, this project will examine heavy metal levels in individual garden spiders (*Argiope trifasciata*) living along transects extending from pickleweed (*Salicornia sp.*) into adjacent non-salt marsh vegetation at Ballona, where they were found to be abundant in a prior study. Flying insects, which provide a biological transfer pathway from *Salicornia* to *Argiope*, may not be restricted to pickleweed patches. Thus, sampling transects will include adjacent areas as well as locations in the wetlands that differ in tidal and fresh water inputs. Students will determine the heavy metal content and/or organic pollutant content of spider bodies following published protocols.

For consideration, individuals interested in a fellowship must interview with Dr. Ramirez (mramirez@lmu.edu), Dr. Landry (jlandry@lmu.edu), or Dr. McCallum (jmccallu@lmu.edu).

Project 4: Survey of Microorganisms in the Ballona Wetlands (Dr. Rachel Adams, Dr. John Dorsey, Dr. Gary Kuleck)

A survey of the diversity of the microbial community will elucidate its role in the vitality of the wetlands and the impact of urbanization on that community. Understanding the microbial community is critical to the design of bioremediation and water quality projects. Students will isolate DNA from the soil and water samples collected for Project 1. They will amplify the 16S rRNA genes using the polymerase chain reaction, separate the amplified products by SSCP-PAGE (single-strand conformational polymorphism-polyacrylamide gel electrophoresis), elute the individual bands from the gel and sequence the DNA. They will use BLAST to search GenBank for their DNA sequences to identify the bacterial species.

One student will work jointly with Dr. Adams (radams@lmu.edu) and Dr. Kuleck (gkuleck@lmu.edu), and one student will work jointly with Dr. Dorsey (jdorsey@lmu.edu) and Dr. Kuleck. For consideration, individuals interested in a fellowship must interview with one of the advisors on this project.

Project 5: Identification of Biochemical Pathways Responsive to Urban Pollution (Dr. Kam Dahlquist, Dr. Lambert Doezema, Dr. David Moffet, Dr. Carl Urbinati)

Bacterial species identified in Project 4 will be cultured using traditional and modified enrichment techniques to establish stocks of wetland-resident bacteria. Concurrently, the Merck undergraduate research associate will use the Biocatalysis/Biodegradation Database to search for enzymes and pathways involved in mediating the effects of polychlorinated compounds and/or heavy metals. They will correlate these with genomic sequence from bacterial species identified in Project 4 and ultimately build pathways using GenMAPP (Gene Map Annotator and Pathway Profiler).

For consideration, individuals interested in a fellowship must interview with Dr. Dahlquist (kdahlquist@lmu.edu), Dr. David Moffet (dmoffet@lmu.edu) or Dr. Urbinati (curbinati@lmu.edu).

*This award program is funded by The Merck Institute for Science Education and administered by the American Association for the Advancement of Science.

MERCK/AAAS RESEARCH ASSOCIATES APPLICATION FORM
RETURN BY 4:30 PM, FRIDAY, FEBRUARY 23*

*Please fill out this application form and return it to the Biology Office (Seaver 219). Use additional pages if necessary. We will notify those who are selected the week of March 12-16.

Name_____ Class_____

Student ID #_____

Address_____ Phone_____

_____

_____

E-mail address_____

Do you need on-campus housing for the summer?_____

Major (or prospective major)_____

CHOICE OF RESEARCH PROJECT: All students will participate in Project 1 and a second project chosen from Projects 2-5 below. Please indicate with a number in the blank to the left of the project title, your first, second and/or third choice. Details of the projects are found on pages 1 and 2 of this document.

All Students Project 1: Monitoring Air, Water, and Soil for Urban Contamination (Dr. Rachel Adams, Dr. Lambert Doezema, Dr. John Dorsey, Dr. Jim Landry)

_____Project 2: Developing *Salicornia virginica* as a Biological Monitor (Dr. Pippa Drennan, Dr. Jim Landry)

_____Project 3: Biomagnification of Wetlands Contaminants (Dr. Martin Ramirez, Dr. Jim Landry, Dr. Jeremy McCallum)

_____Project 4: Survey of Microorganisms in the Ballona Wetlands (Dr. Rachel Adams and Dr. Gary Kuleck or Dr. John Dorsey and Dr. Gary Kuleck)

_____Project 5: Identification of Biochemical Pathways Responsive to Urban Pollution (Dr. Kam Dahlquist, Dr. Lambert Doezema, Dr. David Moffet, Dr. Carl Urbinati)

Use as much space as you like in answering the questions below; attach additional pages if necessary

Please list all courses taken in Biology and Chemistry and any other science, engineering, or math courses that are relevant to your application for a MERCK/AAAS Fellowship.

Please briefly describe below any previous research experiences you have had.

Please state what you expect to gain from your experience as a Merck/AAAS Research Associate.