DEPARTMENT OF BIOLOGY
College of Arts & Sciences

SUMMER RESEARCH OPPORTUNITIES
FOR UNDERGRADUATE WOMEN

APPLICATION DEADLINE: MARCH 3, 2003

The Biology Department is pleased to offer the following research project(s) for the summer of 2003. Interested students are urged to contact the faculty member(s) directing the project(s) that most interest them. By contacting the faculty member, you can discover more about the project, learn what your responsibilities will be, and if possible, develop a timetable for the twelve-week research period.

Studies of the Genetics and Molecular Biology of Unusual Micro-organisms that Thrive in Geothermal Environments (See www.biology.uc.edu/faculty/grogan/grog.htm).

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These hyperthermophilic archaea grow optimally at conditions (high temperature and low pH) that rapidly kill all well-studied organisms; they provide extremely thermostable enzymes for biotechnology, as well as molecular clues regarding the early evolution of cellular life. Over the past several years, we have been able to develop important genetic techniques for two Sulfolobus species, and are now combining these with techniques of biochemistry and molecular biology. In 2003, WISE participants have a choice of several projects that investigate how these simple cells function under extreme conditions. Topics include i) mechanisms of protein thermostability, ii) properties of DNA exchange and recombination, iii) genome variability, and iv) genetic engineering of hyperthermophiles.

Quantitative Analysis of Movement and Muscle Activity of Ectothermic Vertebrates

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Current projects in the lab include quantitative analysis of movement and muscle activity of ectothermic vertebrates such as lizards and fish. We currently have several projects on the locomotion and behavior of arboreal (tree-dwelling) lizards to determine how they move on surfaces with different incline and width as well as how they maneuver through complicated networks of perches. We have just recently begun to investigate how lizards jump and turn in midair.

The following links provide more detail regarding the research in my lab.
http://www.biology.uc.edu/faculty/jayne/bruce.htm
http://www.biology.uc.edu/faculty/jayne/bcjhi10.htm
http://www.biology.uc.edu/faculty/jayne/bcjonlin.htm

Investigating the Population Biology of the Endangered North American Chestnut

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The chestnut was once the tallest tree in our flora, and also one of the major dominants of eastern forests. Since the introduction of the chestnut blight in 1904, over 3 billion trees have succumbed, and it has been predicted that the species may go extinct early next century. Our research involves applying DNA fingerprinting techniques to compare genetic diversity in natural stands with resistant lineages being developed by the American Chestnut Foundation. The plan is to introduce these resistant strains back to our forests. Students working on this project will learn how to extract and manipulate plant DNA for DNA fingerprinting, and how the resultant data are scored and analyzed.

Plant Reproductive Biology and Population Genetics

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Plant reproductive biology and population genetics, using a combination of ecological and genetic approaches. Interested students will have the opportunity to assist in one of two projects. The first involves research on the effects of habitat fragmentation in the yellow violet, *Viola pubescens*, within the Greater Cincinnati area. Past work on this species in an agricultural landscape indicates that populations in small forest fragments have fewer insect pollinators and less genetic diversity than populations located in larger habitats. Presumably, these effects will be compounded in urban areas because of increased isolation of populations and detrimental human impacts. This research will yield important information not only for preservation of the yellow violet, but also for the conservation of rare plant species in southern Ohio. Participation in this project will involve a choice of either fieldwork (monitoring local violet populations, pollinators, etc.) or lab work (learning a molecular genetic technique such as isozymes, ISSRs, and microsatellites). The second project is a study of the reproductive biology and population genetics of parasitic plants - specifically, squawroot (*Conopholis americana*) and beechdrops (*Epifagus virginiana*). Surprisingly, little is known of the basic biology of these plants, beyond the fact that they have lost the ability to photosynthesize. This research will help us understand how these plant reproduce, their seed dispersal mechanisms, and how genetically variable populations are from one another. For both projects, familiarity with basic genetic principles is desired, but not necessarily required.

More information on these and other projects is also available online at www.biology.uc.edu/faculty/culley/theresa.html

Impact of Instream Habitat Restoration on Biological Water Quality in a Stressed River

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Urban streams are polluted by non-point and some point source effluents that may limit colonization by fish and macroinvertebrates, upon which biocriteria by Ohio EPA are based. However, concomitant degradation of habitat accompanies urban streams with loss of riffles by channelization and loss of riparian zone. Cincinnati Municipal Sewer District will create two riffles over and around obstacles in the Mill Creek during the spring/summer of 2003. We have examined the macroinvertebrates around these facilities in 2000, and would like to compare the improvement in biocriteria by the construction of Newberry Riffles and J Weirs on two sites below the Hopple Street and Western Hills Viaducts. Electrofishing, Dendy plate samplers and kick nets will be used to study fish and macroinvertebrates above and below these sites. The fish-eating birds (Great Blue Herons, Green Herons, Black Crown Night Herons, Kingfishers, and Osprey) thrive on young-of-the-year fish in the mouth of the Mill Creek. The importance of this work for future restoration of instream habitat by city, county, and state cannot be underestimated

Research that Addresses the Ecology and Evolution of Vertebrates

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Changes in population density are often due to biological interactions such as competition and predation. In turn, these processes can be mechanistically linked to behavioral interactions among individuals. Pacific island lizard communities serve as a model system, because invasions and competitive displacements are currently taking place among many species on a global scale. Understanding how invasive species impact residents is a high priority for conservation and management. The Petren lab also uses molecular techniques to provide a valuable historical perspective for interpreting ecological interactions. Research projects in this lab are likely to involve observing behavioral interactions among a captive population of house geckos, or a conducting a molecular genetic laboratory study of allelic or sequence divergence of closely related species or populations.

QUANTITATIVE AND QUALITATIVE ASSESSMENT OF HUMAN GENETICS COURSES FOR NON-SCIENCE MAJORS (NSM)

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This project is being coordinated with the American Society of Human Genetics Information and Education Committee. A sub-committee of this group has been charged with carrying out projects to improve human genetics education for undergraduate non-science majors. Currently, no information is available on the number and nature of NSM human genetics courses being taught around the U.S. This study will focus on determining the number of such courses taught, how many students are taking them, and the development of a survey to administer to NSM human genetics course instructors. The survey will determine the content and structure of the courses, the types of students enrolled, and the instructional materials and approaches used. This information will allow comparison of what is actually being taught to what a group of professional geneticists believe should be taught. The project will analyze the collected data on the courses offered nationally, determine the faculty teaching them, create the survey instrument, perform a pilot of the survey, and carry out the survey and analysis.

Comparison of Emergent Plant Biomass and Species Composition in Constructed and Natural Wetlands of Varying Ages

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Around metro Cincinnati, as in most cities, wetlands are being constructed as nonpoint runoff treatment systems and to attenuate peak flow discharge from impervious surfaces. Others are being built for mitigation purposes and to enhance habitat for wetland ducks, birds, amphibians, plants and insects. Most are left barren to be colonized randomly. We propose to examine 1, 3, and 10 year-old wetlands. These include both constructed and planted sites, with 1 and 3 year volunteer wetlands constructed as land drainage treatment systems. Species composition and stem density will be surveyed in each wetland using transects, on which will be measured elevation with distance. The hypothesis is that vegetation species composition and growth will be determined by hydrology, measured as elevation, depth to groundwater, and redox potential. The growth and phenology of one species, either the soft stem bulrush (Scirpus acutus) or cattail (Typha latifolia), will be followed over the summer on quadrates near optimal conditions in each system. We will examine the phenotypic/genotypic variation found in the species in reproductive output, seed number, and its ratio compared to stem/leaf length and diameter. We want to know if retention/detention wetlands are as biodiverse as mitigation type wetlands that are planted and in the early stages of succession. Sites will include a 319a wetlands, a retention/detention wetland, and several aged wetlands planted at HCPD's Miami Whitewater Park.