MSRIP 2013 Faculty Research Projects

The following faculty research projects are organized by colleges, and then alphabetically by department. Students are encouraged to look at related fields, as well as within their major departments for research projects, which might be interesting to them. For example, the research project in the Theater department might also be interesting to sociology or education majors.

**Bourns College of Engineering**

**Bioengineering**

Faculty Mentor: **Dr. Huinan Liu**  
Research Setting: Lab  
Research Project: Dr Liu’s Lab research involves design, fabrication and evaluation of novel biomaterials for tissue regeneration and controlled drug delivery. Materials studied in the lab include polymer, ceramic, nanoparticles, polymer/ceramic nanocomposites and resorbable metals. Students will be involved in developing a novel material that promotes nerve regeneration.

**Center for Environmental Research and Technology (CE-CERT)**

Faculty Mentor: **Dr. Kanok Boriboonsomsin**  
Research Setting: Lab  
Research Project: Dr. Boriboonsomsin research focuses on evaluating impact of eco-driving using traffic simulation software. Dr. Boriboonsomsin is also involved in developing innovative ITS applications that benefit the environment, improving the inventorying methods of on-road mobile emissions, evaluating strategies to reduce greenhouse gases from surface transportation, among others.

**Chemical and Environmental Engineering**

Faculty Mentor: **Dr. Haizhou Liu**  
Research Setting: Lab  
Research Project: Dr. Liu’s research focuses on advancing the knowledge and application of environmental chemical processes at the molecular level to provide more reliable water supplies, improve water quality and protect public health, with particular interests in: (1) enhancement of drinking water quality; (2) environmental remediation of hazardous sites; and (3) development of novel water treatment technologies. Our work is aimed to harness chemical reactions and processes of environmental significance to our benefits in engineered applications of water purification and reuse. The summer students will be involved in projects to develop sulfate-radical based water treatment technology and learn fundamental principles of aquatic chemistry, process design and kinetic modeling. Students will also have hands-on experience with a series of advanced analytical tools from the fields of environmental chemistry.

Faculty Mentor: **Dr. Sharon Walker**  
Research Setting: Lab  
Research Project: Dr. Walker’s Lab research is focused on optimizing effective water
treatment and distribution, wastewater reclamation, and to understand mechanisms controlling microbial and particle transport in aquatic environments. Dr. Walker and her students are investigating the factors controlling bacterial and nanoparticle fate and transport as it pertains to water quality. Specifically, the fundamental mechanisms involved in aggregation, deposition, and adhesion occurring at the molecular scale between environmental particles and surfaces are being explored.

Faculty Mentor: **Dr. Ian Wheeldon**  
Research Setting: Lab  
Research Project: Dr. Wheeldon’s Lab research is focused on developing protein engineering technologies and bio-inspired designs to address current challenges in bioenergy, biocatalysis, and biological materials. Over the summer students can be involved in various projects including: 1) biosynthesis of liquid fuels, 2) nanostructure enzyme catalysts and 3) microbial and enzymatic fuel cells.

**Computer Science and Engineering**  
Faculty Mentor: **Dr. Frank Vahid**  
Research Setting: Lab  
Research Project: Dr. Vahid’s Lab research involves 1) developing systems that use sensors/webcams to provide at-home monitoring/notification to help the aging (e.g. fall detection), deaf, blind, and others, 2) developing graphical software for in-home assistive monitoring and 3) developing novel online learning materials for intro programming or digital design.

**Electrical Engineering**  
Faculty Mentor: **Dr. Elaine Haberer**  
Research Setting: Lab  
Research Project: Dr. Haberer's research is focused on synthesis and assembly of nanoscale materials (i.e. semiconductors, noble metals) using biological molecules as peptides and proteins. Dr. Haberer's research is highly interdisciplinary, so students with interest in chemistry, biology, materials, chemical and electrical engineering are encouraged to apply to work in Dr. Haberer's lab.

**Mechanical Engineering**  
Faculty Mentor: **Dr. Marko Princevac**  
Research Setting: Lab  
Research Project: Dr. Princevak’s research interests lie in the fundamental and applied fluid mechanics research - in particular, the application of fundamental turbulence concepts to studies in environmental. Summer projects that students will be involved in include superfog formation and dispersion from highways.
Faculty Mentor: **Dr. Masaru Rao**  
Research Setting: Lab  
Research Project: Dr. Rao's research interests lie in the development and application of novel micro/nanofabrication methods and materials for MEMS, microfluidics, and biomedical microdevices. Dr. Rao’s current lab research involves biomedical microdevice fabrication and characterization.

**College of Humanities, Arts, and Social Sciences**

**Psychology**

Faculty Mentor: **Dr. Carolyn Murray**  
Research Setting: Laboratory  
Research Project: Dr. Murray’s research has focused primarily on the detrimental effects of educational inequities experienced by African Americans — low self-esteem, low expectations by teachers and barriers to achievement — and the manner in which these are reflected in academic achievement. She also has examined the dynamics of parental socialization within the African-American family, paying particular attention to the development of personality.

Faculty Mentor: **Dr. Tuppett Yates**  
Research Setting: Child Laboratory  
Research Project: Dr. Yates currently has 2 studies in his lab. The first follows elementary school children and the second follows 200 foster youth as they age out of foster care. Lab’s research studies explore processes underlying risk and resilience among vulnerable pediatric populations. Students have the opportunity to work directly with high-risk children and families, as well as coding observational data and collecting physiological and cardiac data.

**Women's Studies**

Faculty Mentor: **Dr. Amalia Cabezas**  
Research Setting: Field work and library research  
Research Project: The summer research with Dr. Cabezas's will focuses on human trafficking and prostitution. More generally Dr.Cabezas is interested in Chicano and Latino studies, Latin American and Caribbean studies, tourism and leisure studies, sexualities studies, and women's/feminist/gender studies.

**College of Natural and Agricultural Sciences**

**Biochemistry**

Faculty Mentor: **Dr. Li Fan**  
Research Setting: Lab
Research Project: Dr. Fan’s Lab research is focused on expression and purification of recombinant proteins for structural studies. Specifically Dr. Fan and his students are interested in structure and function of proteins involved in fundamental cellular processes such as DNA repair, DNA replication, etc. They use X-ray crystallography as the main method combined with modern techniques in molecular biology and biochemistry to study the targeted proteins in order to understand the structural basis for their biological functions.

**Biology**

Faculty Mentor: **Dr. Theodore Garland, Jr.**
Research Setting: Laboratory
Research Project: Behavior, physiology, and neurobiology of lines of mice that have been selectively bred for high voluntary wheel running. Students will gather behavioral data and analyze how this data relates to the physiology of the mouse and to the mammal as a species. Publications on these mice can be found here: [http://biology.ucr.edu/people/faculty/Garland/Experimental_Evolution_Publications_by_Ted_Garland.html](http://biology.ucr.edu/people/faculty/Garland/Experimental_Evolution_Publications_by_Ted_Garland.html).

**Botany and Plant Sciences**

Faculty Mentor: **Dr. Venu Gonehal**
Research Setting: Lab
Research Project: Dr. Gonehal’s Lab research is focused on molecular analysis of stem cell maintenance. Dr Gonehal and his collaborators work on 1) defining the molecular code and its regulation, at genome scale, for distinct cell types of the SAM stem-cell niche, and 2) transforming the molecular code into spatial maps representing functional interactions within living SAMs by utilizing dynamic live-imaging methods.

Faculty Mentor: **Dr. Linda Walling**
Research Setting: Lab
Research Project: Two research projects dominate lab’s current research initiatives. First, we are dissecting the mechanisms used to perceive phloem-feeding whiteflies in squash, tomato and Arabidopsis. Second, we identified a peptidase (leucine aminopeptidase) that responds to bacterial pathogens, wounding and tissue-damaging herbivores. This enzyme has led us into studies to understand the role of N-terminal processing enzymes during development and in response to stress. We utilize multidisciplinary approaches in both projects by incorporating the tools of biochemistry, genetics, cell biology, and genomics.

**Chemistry**

Faculty Mentor: **Dr. Ryan Julian**
Research Setting: Lab
Research Project: Dr. Julian’s lab focuses on the development of novel applications of mass spectrometry to investigate the chemistry of peptides and proteins both in solution and in the gas phase. Dr. Julian and his collaborators have modified a
Faculty Mentor: **Dr. Catharine Larsen**  
Research Setting: Lab  
Research Project: Dr. Larsen’s current research that is focused on organic synthesis of important pharmacophores for the discovery of new potential drug therapies will be expanding beyond cancer to Alzheimer’s, cardiovascular/stroke, and malaria in the coming year. Dr. Larsen’s lab is also involved in development of green catalytic methods of making compounds of interest that will be applied to catalysis (in-house) and materials applications (in-house synthesis and characterization with collaborators at UC Irvine).

Faculty Mentor: **Dr. Yadong Yin**  
Research Setting: Lab (Chemistry Laboratory for Materials Science)  
Research Project: The lab works with magnetically tunable photonic materials; Students will be involved in of nanometer scale colloidal particles; synthesis and self-assembly of magnetic particles and fabrication of magnetically responsive photonic nanostructures.

Faculty Mentor: **Dr. Jingsong Zhang**  
Research Setting: Lab  
Research Project: Dr. Zhang’s research concentrates on atmospheric chemistry, air pollution measurements, analytical instrument development, optical spectroscopy, mass spectrometry, and chemical reaction mechanisms.

**Mathematics**

Faculty Mentor: **Dr. Julia Bergner**  
Research Setting: Office and Library  
Research Project: Potential research projects in Dr. Bergner lab include 1) applying methods for finding Egyptian fractions to groupoid cardinality and 2) investigating sequences of directed graphs generated by group actions. She will offer either option for study based on student’s interest.

**Plant Pathology/Microbiology**

Faculty Mentor: **Dr. James Ng**  
Research Setting: Lab  
Research Project: Over the summer students working in Dr. Ng Lab will be involved in plant virology and/or virus-insect vector interaction research. By integrating basic and applied studies, Dr. Ng’s research seeks to address questions concerning
the complex interactions among insect, virus and plant, and how these interactions result in virus transmission and diseases.