MENTOR PROGRAM PROJECT EXAMPLES

FROM BIOLOGY

Ecological Services of Rodents in managing weeds in row crop agriculture: We are conducting research on the roles of small mammals (mostly prairie deer mice) in managing weeds in crop fields. Rodents appear to consume vast quantities of weed seeds which may regulate weed populations without the need for herbicides. The research involves live trapping, mark-and-recapture techniques throughout the winter in corn and bean fields. The work is muddy and cold, and most of the work occurs in the early morning hours. In addition to sampling mouse populations, we are also analyzing fecal material using real-time PCR techniques to quantify the amount of DNA material from each species of weed. This will eventually be used to back calculate the dietary intake of weed seeds by these animals. In addition to the basic field work, there may be opportunities to conduct independent research projects later on. I would also be able to pay for student technicians for hours contributed beyond the minimum number required for the mentoring credits. This is a good opportunity to see one aspect of research in sustainable agriculture and conservation ecology. And the mice are easily as cute as anything you can hope to see in Iowa.

Student Background Requested: No special background is needed except a willingness to work in cold, wet, and muddy conditions. You will be trained in animal handling and data collection. The possibility exists to get involved in lab work as well to learn rtPCR techniques as well, but field work is a priority. Because of the nature of working with wild animals, you must be available to work at first light for a couple of hours for at least a couple of days per week. There is also some opportunity to work in the afternoons, but all activities directly involving animals occur at dawn or shortly thereafter.

Student Duties: To assist in the setting and checking of live traps in the fields around Ames. You will be expected to learn to identify and handle live animals, mark them with ear tags, and collect the necessary data. Reliability is a must. The project has some well defined goals, but additional side projects are possible. Most of these involve measuring things like foraging preferences of the mice and their dietary efficiency in consuming target weed and crop seeds.

FROM COMMUNICATION STUDIES

Science Communication in Controversial Settings: I am part of a team of faculty and researchers in Communication, Journalism, English, Philosophy and Education who study what happens when science and democracy mix. We ask questions like: What roles (if any) should scientists play in policy debates? Should scientists just provide the facts, and then let others make arguments and appeals? Or should scientists advocate, too? If they do, what happens to their objectivity and trustworthiness? And if other advocates are distorting scientific results in order to score political points, how should scientists respond? We examine these and other
questions of science communication in policy controversies. We use several methods in our research, ranging from analyzing news reporting on science issues, to experiments testing how people respond to different scientific messages, to philosophical investigations of the relationship of democracy and science. We have received NSF funding to develop a set of teaching materials which will help young scientists learn how to communicate in controversial settings.

**Student Background Requested:** An interest in science, communication, policy controversies, and/or science education. Curiosity, critical thinking, independence, personal responsibility, internet research skills—short, an honors student!

**Student Duties:** The student(s) will work with us to do background research on specific cases where scientists have gotten involved in policy controversies. This will involve activities like searching news databases like Lexis-Nexis for all reports of a particular controversy, or searching blogs for all arguments about a particular scientist. The student(s) will be responsible for retrieving all the items found by the research, designing a system to identify and archive the items, and building a database with basic information on each of them. The student(s) will also be responsible for a preliminary analysis of the items, summarizing the case and identifying major themes and arguments in the material. Depending on what our research team is doing in the spring, there may be other kinds of research opportunities available as well, to be jointly determined by us and the students.

**FROM COMPUTER ENGINEERING**

**Application Acceleration using Graphics Processing Units (GPUs):** Our group has several research projects in application acceleration using GPUs that may be of interest to a FHP student. We have access to several NVIDIA Tesla servers that contain the latest in GPU technology. There are several different applications (e.g. linear dynamics, wind farm simulation, stereo vision, data mining) that we have previously mapped to FPGA technology. We are interested in seeing how well some of these traditional computationally-intensive applications map to GPUs and the CUDA programming environment. Selected students will be paired with a graduate student working on a complimentary project. There is a potential for longer-term research projects and support if this initial mentoring is successful.

**Student Background Requested:** I would expect a student to have some cursory background computer programming (C/C++) and some familiarity with Linux programming environments. More importantly than any specific background, I expect a student to be willing and eager to learn new skills and concepts, and to have an inquisitive mind.

**Student Duties:** Reading research papers, writing software, designing hardware, simulation, debugging. The student will be expected to learn several cutting-edge design tools at their own pace, with some mentoring by myself and associated graduate students.
FROM KINESIOLOGY

The Cardiovascular System and Health in First Responders: 1) Cardiovascular disease in law enforcement populations. I study the sworn officers of the Iowa Dept. of Public Safety. In the spring semester, ~500 officers come to my lab for their annual medical examination. About 25-50% of them complete stress tests as part of this exam. Mentees will interact with the officers (much as a nurse does in a physician's office), taking blood pressure and other vital signs, assisting with the stress tests, etc. 2) Using a virtual reality environment, assess the physiological responses of firefighters to the stresses of firefighting. This work is done at Howe Hall, in the C6. Most of the related to this project, for 2012-13, is oriented to data analyses. We've done a lot of data collection and now need to determine what it's telling us. So, mentees will help us figure this out. 3) We're also looking at aging in law enforcement officers via assessing telomere length in officers vs. civilians. By the spring semester, we'll have collected the raw samples and will be analyzing it (e.g., PCR, survey work, etc).

Student Background Requested: Students who have either a "pre-med" or "pre-allied health professions" orientation seem to get the most out of this experience. The most important characteristics the student must possess are an interest in the human body, especially the cardiovascular system, and an interest in helping others in 'hands on' or clinical environments. Some basic human anatomy and physiology is desired, but not critical.

Student Duties: Varies by research area: 1) Assisting in testing humans could include running lab machines, handling blood samples, etc. 2) Taking heart rates, blood pressures and running EKG machines. For the DPS project, testing is done during the morning, so students should be available some mornings during the hours of 7:45 a.m. to 10:00 a.m. (doesn't have to be every morning and doesn't have to be the entire morning). The other projects vary in their schedule.

FROM VET MICROBIOLOGY & PREVENTIVE MEDICINE

Virulence Mechanisms of Bacterial Pathogens: Mycoplasmas are cell wall-less bacteria that infect a wide variety of hosts and cause chronic respiratory diseases. Mycoplasma hyopneumoniae is a swine pathogen and is a major disease causing agent in pig units. Our laboratory is actively studying the surface proteins of M. hyopneumoniae and determining molecular mechanisms of pathogenesis. One major project is the construction of specific mutants in surface protein genes through recombineering. These mutants will then be studied for changes in phenotype including alterations in surface protein proteolytic cleavage patterns. As a member of this team, you would learn a variety of genetic and immunoblot techniques. In addition, we are developing vaccines against mycoplasmal pathogens so an honors student could be involved in purification of recombinant proteins for use in vaccine studies and learning how to analyze proteins using a combination of methods.
**Student Background Requested:** Basic biology in high school is necessary. A background in microbiology would be helpful but not required. An interest in infectious diseases and the mechanisms they employ to cause disease is important. Also, for data analysis projects, a background in mathematics and statistics would be essential.

**Student Duties:** The duties would vary depending upon the skills and background of the student.