Project number: 1

Faculty name
Sheila Patek

Faculty lab website (if available)
http://www.bio.umass.edu/biology/pateklab/home

Name of person to directly oversee apprentice
Elizabeth Murphy

Position of person overseeing apprentice
Lab technician

Title of project
Animal Husbandry/ Aquarium Maintenance

Description of project
This project explores how marine crustaceans are maintained and observed in the marine aquaria of a research laboratory. An introductory experience, suitable for a first-year student or a student entering a research laboratory for the first time, the apprentice would work side-by-side with the laboratory technician to feed and care for mantis shrimp, while also observing, documenting, and describing their feeding behaviors. Many of the most basic behaviors have yet to be described and quantified in these fascinating animals, and with their broad range of food preferences (from tiny brine shrimp to hard-shelled snails), it is fascinating to examine the feeding strategies used to capture these prey.

The apprentice would receive training in aquarium animal husbandry, animal observations, development and maintenance of laboratory notebooks, and digital filming of animal behaviors. The apprentice would also attend weekly lab meetings of all of the lab members and participate in discussions about ongoing research projects and the scientific literature.

Qualifications of student
The student should be reliable and willing to commit to a consistent schedule throughout the semester. Also, the student should have a strong interest in marine animals or animal behavior.

Number of work hours per week
1-5 hours per week

Are you looking for a particular type of student?
1st year student

Independent study credit
no

Paid
no

Could this project be extended into an honors thesis?
no
Project number:
2

Faculty name
Sheila Patek

Faculty lab website (if available)
http://www.bio.umass.edu/biology/pateklab/home

Name of person to directly oversee apprentice
Elizabeth Murphy

Position of person overseeing apprentice
Lab technician

Title of project
High Speed Video and Mantis Shrimp Strike Kinematics

Description of project
This project uses advanced high speed video technology to record the extremely fast mantis shrimp predatory strike. Mantis shrimp are colorful and charismatic marine crustaceans that are found in coral reefs all over the world, as well as in muddy burrows in our own backyard on Cape Cod. These animals move at speeds of up to 20 m/s, underwater, and produce cavitation bubbles on impact with their prey. We are currently in the video-gathering phase of a project exploring the kinematics of this strike. While the basic kinematics have already been characterized, we would like to put together an acceleration profile of the strike, and couple data such as velocity with data on the force of the impact. The apprentice will work side by side with the laboratory technician gathering high speed video data and force data using live animals. The apprentice will learn how to operate our high speed video camera (which can take video at up to 250,000 frames per second) and will be primarily responsible for assisting in video collection and preliminary analysis. If there is time and inclination, the apprentice may learn how to digitize the video and gather kinematic data using Matlab. The apprentice would also attend weekly lab meetings of all of the lab members and participate in discussions about ongoing research projects and the scientific literature.

This project is ideal for someone who is interested in biology, physics, and likes working with live animals and high tech equipment. This would also be a good project for someone who is still testing the waters of a research laboratory and isn't yet ready for a fully independent project.

Qualifications of student
The student should be reliable and willing to commit to a consistent schedule throughout the semester. Also, the student should have a strong interest in marine biology or biomechanics, and an interest in learning how to use advanced technology in a research setting.

Number of work hours per week
5-10 hours per week

Are you looking for a particular type of student?
Anyone!
Independent study credit
no
Paid
no
Could this project be extended into an honors thesis?
no
Project number: 3

Faculty name
Patricia Brennan

Faculty lab website (if available)

Name of person to directly oversee apprentice
Patricia Brennan

Position of person overseeing apprentice
Faculty

Title of project
Genital evolution in snakes

Description of project
Snakes have incredibly diverse genitalia, and the selection pressure responsible for this variation remains unknown. In this particular project we will be completing dissections of water snakes (Nerodia) and photographing a measuring hemipenes and vaginas from a sample population of over 200 individuals to determine intra-specific variation and ontogeny. The student will need to dissect frozen specimens, photograph hemipenes, and use Image J to measure landmarks in hemipene morphology.

Qualifications of student
Intro Bio is required. Evolution desirable (but could be replaced by other pertinent Bio or Animal Science upper level classes). Must be reliable, responsible, organized and work well without constant supervision.

Number of work hours per week
5-10 hours per week

Are you looking for a particular type of student?
3rd or 4th year student

Independent study credit
yes

Paid
no

Could this project be extended into an honors thesis?
Possibly
Project number:
4

Faculty name
Elsbeth Walker

Faculty lab website (if available)
http://www.bio.umass.edu/biology/ewalker/

Name of person to directly oversee apprentice
Sarah Conte

Position of person overseeing apprentice
Postdoc

Title of project
Molecular Genetics of Micronutrient Homeostasis

Description of project
Micronutrient deficiency in the human diet is a worldwide health issue. One method to improve the human diet is through biofortification—increasing the nutritional content of commonly consumed staple crop plants. The Walker lab is currently studying the Yellow Stripe-Like (YSL) gene family; a family of metal transporters necessary for the internal transport and storage of essential metal micronutrients such as iron, copper, and zinc. A number of projects are available to interested undergraduate apprentices. These would include: characterizing YSL gene expression across developmental life cycle in maize (Zea mays), cloning full length ZmYSL cDNA, and map based cloning of a yellow stripe gene. Depending on the project, student researchers will have the opportunity to learn a number of basic molecular skills including RNA extraction, DNA extraction, PCR, DNA sequencing.

Qualifications of student
Responsible, ability to work independently. Strong preference will be given to academically excellent students.

Number of work hours per week
5-10 hours per week

Are you looking for a particular type of student?
Anyone!

Independent study credit
yes

Paid
no

Could this project be extended into an honors thesis?
yes
Project number: 5

Faculty name
Tobias Baskin

Faculty lab website (if available)
http://www.bio.umass.edu/biology/baskin/

Name of person to directly oversee apprentice
Karen Sanguinet

Position of person overseeing apprentice
Postdoc

Title of project
Plant Morphogenesis

Description of project
How does a plant build an organ (leaf, root, flower petal) with a specific shape? To understand how this works, we are isolating and studying mutants that make misshapen roots. This is a large project with many parts. There are hoards of plants to grow for the screen. There are physiological experiments on root growth that are needed as a reference for mutant phenotypes. Because we already suspect the involvement of certain genes, there is cloning, construct building, and transformation to be done. Finally, because we like to look at the plants to see what is going on, there are live cells to be imaged. Which aspect of all this student would work with will depend on the interests of the student and pressing needs in the lab.

All students will learn some genetics in action and experimental design. Depending on which aspect is chosen, students will learn research-grade farming, microscopy, or molecular biology.

Hours can be flexible, but we will expect a commitment of at least 10 hours per week.

Qualifications of student
Enthusiasm. Freshmen and sophomores need have no lab experience; preference would be given to juniors and seniors who have done some kind of lab work before (in addition to lab courses).

Number of work hours per week
10-15 hours per week

Are you looking for a particular type of student?
Anyone!

Independent study credit
yes

Paid
yes

Could this project be extended into an honors thesis?
yes
Project number: 6

Faculty name
John Stoffolano

Faculty lab website (if available)

Name of person to directly oversee apprentice
Dr. Stoffolano

Position of person overseeing apprentice
Faculty

Title of project
Factors Affecting the Crop of Adult Flies

Description of project
The crop is a storage organ of the fly that is used to store carbohydrate or protein liquids prior to processing in the midgut digestive tract of the adult fly. This diverticulated structure/organ is unique to the flies and doesn't exist in other insects. We are currently investigating what nerves project to the crop and what chemicals they might deliver that can act as neuromodulators of the muscular pumps involved in pushing the fluids forward and into the midgut for digestion. We are looking at the following adults: common house fly, tsetse fly, and 2 species of blowflies. If we better understand the factors that regulate crop functioning it might be possible to stop crop movement, thus the transmission of various pathogens such as the organisms causing trachoma and/or the deadly strain of E. coli. The ability to do this will have major implications on the health of humans whether in developing countries or in developed countries.

One can read a recent paper on the crop by my laboratory by going to:

If you want to see a copy of our recently submitted manuscript to Journal of Experimental Biology, email me at stoff@ent.umass and I will send you a pdf file.

Effect of serotonin on the supercontractile muscles of the adult blowfly crop

PLEASE NOTE THAT ALL OF MY HONOR'S STUDENTS HAVE HAD THEIR WORK ACCEPTED FOR PUBLICATION AND THEY HAVE GONE ONTO EITHER GRADUATE SCHOOL OR VETERINARY SCHOOL.

Qualifications of student
The apprentice would learn the following skills:
1. Microdissections of adult flies
2. Fluorescent antibody nerve tracking using confocal microscope
3. Bioassay techniques for evaluating various neuromodulators

Number of work hours per week
10-15 hours per week

Are you looking for a particular type of student?
Anyone!
Independent study credit
yes
Paid
no
Could this project be extended into an honors thesis?
yes
Project number:
7

Faculty name
John Stoffolano

Faculty lab website (if available)

Name of person to directly oversee apprentice
John Stoffolano

Position of person overseeing apprentice
Faculty

Title of project
The Salivary Gland Hypertrophy Virus of the Common House Fly

Description of project
The recent discovery of the salivary gland hypertrophy virus in the adult house fly has created a need for more information about how the virus infects the fly, its route in the fly, and how we can better manipulate it to be used as a biological control agent of this nuisance and vector (i.e., the deadly strain of the bacterium of E. coli, salmonella and trachomatis) of many human disorders. Our lab. is currently maintaining the house fly and the virus and are conducting experiments that will help us better understand how the salivary glands are involved in virus transmission; and, we are trying to develop a better system for keeping the virus alive longer in the environment and but still being able to infect adult flies.

The apprentice will learn the following skills:
1. Learn how to keep the flies
2. Learn how to microdissect out the salivary glands
3. Learn how to use viral infected salivary glands to either store the virus and/or to use it to inject and infect other flies
4. Learn how to inject the virus into adult flies
5. Learn how to use PCR to detect the virus at various stages of infection

Qualifications of student
1. Students MUST BE INDEPENDENT LEARNERS
2. Students make a time commitment to work on and complete the project
3. Students must be willing to work in a rearing room to raise the flies

PLEASE NOTE THAT EVERY HONOR’S STUDENT THAT HAS WORKED IN MY LAB. HAS FINISHED THE PROJECT THAT IS ULTIMATELY PUBLISHED AND THEY BECOME AN AUTHOR ON THIS PAPER.

Number of work hours per week
5-10 hours per week

Are you looking for a particular type of student?
Anyone!

Independent study credit
no
Paid
no
Could this project be extended into an honors thesis?
yes
Project number:
8

Faculty name
Rebecca Spencer (Cognition and Action Lab)

Faculty lab website (if available)
http://cognaclab.com/wp/

Name of person to directly oversee apprentice
BENGİ BARAN

Position of person overseeing apprentice
Graduate student

Title of project
Sleep and Memory Consolidation

Description of project
The Cognition and Action Lab is interested in investigating the relationship between sleep and memory throughout the life span. Research from our lab and others have shown that memory performance is better if learning is followed by sleep. The beneficial effects of sleep are evident even after a brief daytime nap. However, our lab has recently revealed that this sleep benefit is diminished in aging. Several projects in our lab tap on different aspects of memory to discover the nature of this effect. This Fall we will investigate:
- the effects of sleep on a procedural skill learning task (mirror tracing) in young adults
- napping and memory in preschool aged children
- the effects of sleep on emotional processing and emotional memory consolidation in healthy older adults
- the effects of sleep on cognitive sequence learning in young adults
- sleep-dependent spatial memory consolidation in young and older adults
- the relationship between sleep disturbances and cognitive functioning in individuals with Parkinson's disease and cerebellar ataxia
- The effect of sleep on the extinction of conditioned fear
- The effect of sleep on therapeutic extinction of phobic fears
- Sleep and memory for the different components of motor learning
In investigating these topics we utilize several methods including behavioral testing, polysomnography and neuroimaging.

Qualifications of student
We generally expect our applicants to devote 8-10h/week for research and be available mornings and evenings between 8-10 when most of our testing takes place. RAs are expected to attend to general lab meetings and prepare presentations about their research projects. They are also expected to attend weekly project update meetings with grad student advisors. Expertise on Matlab, E-prime and MS Office is preferable.

Number of work hours per week
5-10 hours per week

Are you looking for a particular type of student?
Anyone!
Independent study credit
X

Paid
no
Could this project be extended into an honors thesis?
possibly
Project number:
9

Faculty name
R. Thomas Zoeller

Faculty lab website (if available)
http://www.bio.umass.edu/biology/zoeller/

Name of person to directly oversee apprentice
Judy McKinley Brewer

Position of person overseeing apprentice
Sr Research Fellow

Title of project
PCB Disruption of Thyroid Hormone Actions in Developing Kidney

Description of project
Long-lasting environmental pollutants are known to disrupt endocrine systems and to cause neurological, reproductive and metabolic alterations at critical points of brain and organ development in both humans and animals. We know, from our previous cell based and biochemical work, that one group of pollutants - polychlorinated biphenyls (PCBs) - can be metabolized to form compounds that bind to the thyroid hormone receptors and interfere directly with thyroid hormone signaling. Using genetically-specialized mouse models, we hope to discover which of the forms of thyroid receptor (alpha or beta) is most involved in mediating thyroid hormone signaling responses to PCB exposure during sensitive developmental periods. We know that PCB effects on thyroid hormone signaling are tissue specific, and the apprentice on this project will focus on the kidney. Other members of our group are working to evaluate neurological (brain development) changes and to translate this work to human public health.

The apprentice on this project will become proficient in isolation of RNA from tissues (kidney), reverse transcription of cDNA, and planning appropriate controls for Quantitative Real-time PCR (QRT-PCR) analyses of thyroid hormone-responsive genes in those tissues. After running the experiments, they will evaluate, document, and present the results so they are suitable for manuscript inclusion. They will participate in and contribute to community lab activities including making general-use reagents, attending lab meetings, and appraising plans and results for other lab projects. Depending on time frames and the desire of the student, other tissues or other elements of the project can be included.

Qualifications of student
The student must be entirely reliable, eager to participate, and self-motivated. Attention to detail, patience, willingness to follow a planned protocol, to keep accurate records, and good team skills are essential. A sense of humor is always appreciated! Advanced skills such as facility with pipetting tiny volumes or previous work with PCR or other molecular techniques will help the project move more quickly.

Number of work hours per week
10-15 hours per week

Are you looking for a particular type of student?
3rd or 4th year student
Independent study credit
X

Paid
no
Could this project be extended into an honors thesis?
yes
Project number: 10

Faculty name
Daniel Cooley

Faculty lab website (if available)
http://people.umass.edu/dcooley/

Name of person to directly oversee apprentice
Arthur Tuttle

Position of person overseeing apprentice
Lab technician

Title of project
Development of Components of Sustainable Disease Management for Apples

Description of project
Student will work with others in the lab in culture of fungi, experiments on fungal development on the apple host, and/or collection and analysis of field data from experimental and commercial orchards where advanced integrated management methods are being tested. The student will select a sub-project within the overall project, such as the identification of a fungal isolate or analysis of weather data records in correlated with disease development, and will use the lab resources to complete the sub-project. Students may choose to emphasize field work or lab work, or develop a combination.

Qualifications of student
Basic course(s) in biology. Experience with Excel useful. Experience with PCR and sterile technique useful.

Number of work hours per week
5-10 hours per week

Are you looking for a particular type of student?
3rd or 4th year student

Independent study credit
X

Paid
no

Could this project be extended into an honors thesis?
yes
Project number:
11

Faculty name
Michelle DaCosta

Faculty lab website (if available)

Name of person to directly oversee apprentice
Michelle DaCosta

Position of person overseeing apprentice
Faculty

Title of project
Plant Responses to Environmental Stresses

Description of project
In our lab, our goal is to understand how organisms acclimate and adapt to environmental stresses. Using plants as an experimental system, we specifically investigate physiological mechanisms that allow plants to survive under extreme conditions, including drought, temperature extremes, and other global climate change factors. This is a unique opportunity for students not only to gain insight into basic biological processes, but also to extend this information and apply research results to solve real-world problems in plant biology.

Students will develop an understanding of how to perform scientific experiments, which will include establishing and maintaining plants, conducting laboratory-based protocols, and data analysis and interpretation. Students will become familiar with various laboratory techniques and instrumentation that will help to describe plant responses to environmental stresses at the whole-plant level, as well as the biochemical and molecular levels. In addition, the student will also have the opportunity to regularly present research results at lab meetings and interact with other graduate and undergraduate students in the program.

Qualifications of student
We are looking for highly motivated and dependable individuals. Previous experience working with plants is not required.

Number of work hours per week
5-10 hours per week

Are you looking for a particular type of student?
3rd or 4th year student

Independent study credit
X

Paid
no

Could this project be extended into an honors thesis?
yes
Project number: 12

Faculty name
William J. Manning

Faculty lab website (if available)

Name of person to directly oversee apprentice
Jennifer Albertine

Position of person overseeing apprentice
Graduate student

Title of project
Plant Response to Interactive Effects of Elevated CO2 & O3

Description of project
This project will test the hypothesis that stimulatory effects of future elevated CO2 levels on plant growth and physiology will be reduced by concomitant increases of ozone. Experiments will be done in large exposure chambers in the Air Pollution Research Lab, where effects of present levels of CO2 and O3 can be compared to future elevated levels. Plant responses will include growth rates, stomatal conductance and photosynthesis, cell wall constituents and biomass. Initial experiments involve the C3 grass Phleum pratense, a common pasture grass and a source of allergenic pollen. Biomass samples will be analyzed for nutritional quality for ruminant mammals. This is an excellent opportunity for a student interested in plant science/biology and its application to studying significant environmental problems, i.e. predicting effects of global warming. Student will learn how to set up a long-term whole plant biology experiment, how to evaluate responses, use equipment such as porometers, photosynthesis analyzers, CO2 and O3 analyzers, and how to analyze plant tissues for cell wall constituents. Entering and analyzing data and learning how to draw conclusions is a key part of the experience.

Qualifications of student
Some experience in growing plants and knowledge of plants is desired. Must have a genuine interest in the project and be mature enough to be reliable and dependable and accurate. Good communication skills and ability to know when to ask questions and be willing to make suggestions.

Number of work hours per week
5-10 hours per week

Are you looking for a particular type of student?
Anyone!

Independent study credit
X

Paid
no
Could this project be extended into an honors thesis?
yes
Project number: 13

Faculty name
Bruce Byers

Faculty lab website (if available)

Name of person to directly oversee apprentice
Bruce Byers

Position of person overseeing apprentice
Faculty

Title of project
Song and Social Mate Choice in Prairie Warblers

Description of project
Female songbirds evaluate potential mates at least in part by listening to their songs. This project seeks to determine the aspects of male singing performance that are correlated with mate choice by female Prairie Warblers. The data for this project are in hand (recordings of Prairie Warbler songs and records of the habitat choices and mating success of the recorded birds). The next tasks are 1) to analyze and make detailed measurements of the songs and 2) to devise a strategy for modeling the relationship between aspects of singing and proxy measurements of social mate choice.

Qualifications of student
The Prairie Warbler project requires a student who is reliable, meticulous, and interested in animal behavior.

Number of work hours per week
10-15 hours per week

Are you looking for a particular type of student?
Anyone!

Independent study credit
X

Paid
no

Could this project be extended into an honors thesis?
yes
Project number: 14

Faculty name
Craig Albertson

Faculty lab website (if available)
http://www.bio.umass.edu/biology/about/directories/faculty/r-craig-albertson

Name of person to directly oversee apprentice
Dr. Kevin Parsons

Position of person overseeing apprentice
Postdoc

Title of project
Craniofacial Diversification in Fishes

Description of project
Bony fishes (teleosts) exhibit the greatest level of anatomical divergence, and greatest number species of any vertebrate assemblage. Our lab is generally interested in understanding the genetic and developmental processes that underlie the evolutionary success of this group. A vital first step in this process involves a thorough characterization of the patterns of anatomical divergence within and among different groups of fishes. We are looking for undergraduate researchers interested in helping with this endeavor. Specific tasks will include the dissection of the craniofacial skeleton in various fish species (mainly cichlids and Antarctic icefish), digital imaging, and statistical analyses. Previous training in statistics is not required (we will teach you). This is an excellent opportunity to hone your dissecting skills, and the explicit anatomical nature of this experience can be especially beneficial for those looking to go on to medical or dental school. Upon successful completion of the anatomical aspects of this study, there will be opportunities to continue in the lab and work toward addressing genetic and/or developmental questions of craniofacial evolution.

Qualifications of student
Enthusiasm and interest

Number of work hours per week
1-5 hours per week

Are you looking for a particular type of student?
Anyone!

Independent study credit
X

Paid
no

Could this project be extended into an honors thesis?
yes
Project number:
15

Faculty name
Cristina Cox Fernandes

Faculty lab website (if available)
http://bcrc.bio.umass.edu/ummnh/

Name of person to directly oversee apprentice
Cristina Cox Fernandes

Position of person overseeing apprentice
Faculty

Title of project
Fish Identification at the UMass Amherst Natural History Collections

Description of project
Our fish collection has specimens that need to be identified and classified. During the work on the UMass Natural History Fish Collection students will sort and use identification keys to determine fish species. Specimens are preserved in fluids, usually 70% alcohol. Students will learn museum protocols and will become acquainted with research material and museum collections. Also how to generate labels.

Qualifications of student
BIO 542 - Ichthyology (taken or presently being taken)

Number of work hours per week
1-5 hours per week

Are you looking for a particular type of student?
3rd or 4th year student

Independent study credit
X

Paid
no

Could this project be extended into an honors thesis?
yes
**Project number:**
16

**Faculty name**
Magdalena Bezanilla

**Faculty lab website (if available)**

**Name of person to directly oversee apprentice**
Peter van Gisbergen

**Position of person overseeing apprentice**
Graduate student

**Title of project**
Unlocking the Mysteries of Cell Division

**Description of project**
The Bezanilla lab is interested in understanding how cells establish and maintain cell polarity. This process is fundamental to many biological processes ranging from development to the patterning of tissues and organisms. Certain cell types, such as neurons in animals and pollen tubes in plants, have extreme polarization. These cells exhibit long, exaggerated extensions, which are fundamental to their biological function: establishment of neuronal contacts for neurons and fertilization for pollen tubes. One thing in common between these two different cell types is that they use the cytoskeleton to achieve their unique shapes. The Bezanilla lab investigates the molecular cues that control cell polarity and ultimately cell shape.

This project will investigate the function of formins in growth and cell division, both key to establishing proper polarity. In the lab's favorite model organism, the moss *Physcomitrella patens*, there are three classes of formins. This project will focus on class I formins, which we predict play a role in cell division, since some class I formins localize to the cell division machinery. However, not all class I formins have been tagged so far, and their precise function is unknown. This project will include fluorescently tagging the remaining formins, transforming plants and determining that the plant lines contain the transformed construct.

The student working on this project will learn a wide variety of laboratory skills including culturing and genetically transforming plants, DNA isolation from plants, PCR, rapid recombination-based cloning techniques, protein isolation, immunoblotting, various bacterial techniques and fluorescence microscopy. Additionally, projects are flexible and side projects may pop up, resulting in additional skills to be learned.

The Bezanilla lab is a friendly, open and dynamic lab and if you are a motivated, interested student, we encourage you to apply. Currently there are two more undergraduates working in the lab. This position will give strong preference to sophomores.

**Qualifications of student**
Students need not have any prior lab experience. Work study students are encouraged to apply.

**Number of work hours per week**
10-15 hours per week
Are you looking for a particular type of student?
2nd year student

Independent study credit
yes
Paid
yes
Could this project be extended into an honors thesis?
yes
Project number:
17

Faculty name
Li-Jun Ma

Faculty lab website (if available)
http://www.umass.edu/psis/personnel/lijun.html

Name of person to directly oversee apprentice
Li-Jun Ma

Position of person overseeing apprentice
Faculty

Title of project
Genome-scale DNA Methylation Mapping

Description of project
Whole Genome Bisulfite Sequencing (WGBS) measures absolute levels of DNA methylation at single-nucleotide resolution across the genome and provides the power to study epigenomic of the organism. The WGBS data for a model organism, Fusarium oxysporum, has been generated. Based on the mount of information accumulated about this organism, this project will focus on the genome-scale analysis of epigenetic regulation.

Qualifications of student
Have strong interested in genomics, epigenetic regulation and genome evolution; motivated individual who are comfortable with computational and statistic analysis of the data

Number of work hours per week
10-15 hours per week

Are you looking for a particular type of student?
Honors thesis project

Independent study credit
yes

Paid
no

Could this project be extended into an honors thesis?
yes
Project number: 18

Faculty name
Geunhwa Jung

Faculty lab website (if available)
http://www.umass.edu/turfpathology/

Name of person to directly oversee apprentice
Geunhwa Jung

Position of person overseeing apprentice
Faculty

Title of project
Genetics/mycology of Plant Pathogenic Fungi

Description of project
"The turf pathology lab is looking for a motivated independent research student interested in mycology and plant pathology to work on projects involving microbiology, genetics, and bioinformatics of the turf grass pathogen Sclerotinia homoeocarpa. The student would be required to perform the following duties: DNA extraction, PCR, sequencing, gel electrophoresis, culturing and propagation of fungi, and other lab duties. Prior relevant lab experience is preferred, however, coursework in biotechnology and/or microbiology may suffice."

Qualifications of student
Prior lab experiences in biotechnology and/or microbiology
Coursework in genetics, biotechnology and or microbiology

Number of work hours per week
5-10 hours per week

Are you looking for a particular type of student?
3rd or 4th year student

Independent study credit
X

Paid
no

Could this project be extended into an honors thesis?
yes
Project number:
19

Faculty name
Jennifer Ross

Faculty lab website (if available)
http://people.umass.edu/rossj/Ross_Lab/Home.html

Name of person to directly oversee apprentice
Daniel Diaz

Position of person overseeing apprentice
Postdoc

Title of project
Single Molecule Characterization of Microtubule Severing Protein Domains

Description of project
We use high-resolution single molecule imaging to measure microtubule dynamics and the effects of microtubule-associated proteins on those dynamics. A novel family of microtubule-associated protein is the microtubule severing enzymes. These enzymes cut through microtubules using ATP as an energy source. We are currently investigating the effects of different domains on the severing activity of the katanin class of microtubule-severing enzymes. We are looking for an undergraduate to help us (1) purify truncated katanin constructs, (2) measure their ability to cut microtubules in vitro, and (3) analyze the results.

Qualifications of student
We are looking for a student who has high attention to detail and a desire to learn microscopy and microtubule biology. Must be able to use Microsoft Excel and Word. Should be a quick learner and be able to work with your hands.

Number of work hours per week
5-10 hours per week

Are you looking for a particular type of student?
1st year student

Independent study credit
X

Paid
no

Could this project be extended into an honors thesis?
yes
Project number: 20

Faculty name
Pat Wadsworth

Faculty lab website (if available)
bio.umass.edu/biology/wadsworth

Name of person to directly oversee apprentice
Pat Wadsworth

Position of person overseeing apprentice
Faculty

Title of project
Mitotic Spindle Elongation

Description of project
We study cell division in mammalian cells. We are interested in learning how the mitotic spindle is formed and how it is subsequently disassembled at the end of mitosis. During anaphase, chromosomes move toward the spindle poles and the spindle poles move apart, a process called spindle elongation. Spindle elongation involves sliding of antiparallel microtubules in the spindle midzone, and in addition, pulling the spindle poles by astral microtubules. To examine this process, we will track the behavior of spindle poles in live cells (using computer assisted tracking). We will also perturb molecules that are known or suspected to play a role in force production, and measure pole behavior. The goal is a better understanding of the location of force production during spindle elongation in anaphase cells.

Qualifications of student
Ability to follow instructions, and to work independently experience with computers a plus; interest in analysis of image data using software any lab background helpful

Number of work hours per week
1-5 hours per week

Are you looking for a particular type of student?
2nd year student

Independent study credit
X

Paid
no
Could this project be extended into an honors thesis?
yes
Project number: 21

Faculty name
Beth Jakob

Faculty lab website (if available)
http://people.umass.edu/ejakob/

Name of person to directly oversee apprentice
Skye Long and Beth Jakob

Position of person overseeing apprentice
Graduate student

Title of project
Spider Vision

Description of project
Jumping spiders have eight eyes that differ in structure and are specialized for different tasks. Through a series of behavioral experiments (we mask spider eyes and watch the spiders interact with live and video prey) we are figuring out which sorts of information each type of eye collects, and how that information is integrated together. Apprentices will learn how to carry out these experiments and will conduct them. In addition, lab workers will all pitch in and care for the animals.

Qualifications of student
Careful observer; independent worker; good with hands; not afraid of spiders. Strong interest in animal behavior required--some background in behavior, ecology, and/or evolution would be very favorable.

Number of work hours per week
5-10 hours per week

Are you looking for a particular type of student?
Anyone!

Independent study credit
X

Paid
no

Could this project be extended into an honors thesis?
yes
Project number:
22

Faculty name
Dr. Margaret Riley

Faculty lab website (if available)
http://www.bio.umass.edu/biology/riley/

Name of person to directly oversee apprentice
Jenna Farrell

Position of person overseeing apprentice
Other

Title of project
Experience in Science Mentoring and Outreach-Based Projects

Description of project
Project Engage! is an innovative educational program that engages 6-12th grade public school students in independent science and technology research experiences by providing them with access to professional mentors. This project is a collaborative effort between the Massachusetts Academy of Sciences, the Massachusetts State Science & Engineering Fair, the Massachusetts Department of Higher Education, The Intel Corporation, and the Everett Public Schools. The goal of this ambitious initiative is to cultivate a culture of research in public school districts across Massachusetts. To this end, the program also engages teachers, school administrators, parents and members of the community.

A student apprentice will build skills in critical thinking, effective written and oral communication, and working in a team. Training will occur through firsthand experience with project tasks, meetings, and will be ongoing throughout the duration of the apprenticeship. Student will have exposure to various representatives from industry and may have the opportunity to discuss future internship positions as a result of apprenticeship.

Qualifications of student
Students must have interest in working with middle and high-school students and be able to travel twice per month.

Number of work hours per week
5-10 hours per week

Are you looking for a particular type of student?
3rd or 4th year student

Independent study credit
yes
Paid
no
Could this project be extended into an honors thesis?
possibly
Title of project
Analysis of Mating Display Features in a Neotropical Songbird

Description of project
This project examines sexual selection and mating behavior in a species of songbird, the blue-black grassquit. Male grassquits during the breeding season compete for access to females using a distinctive and elaborate mating display, which consists of repeated vigorous leaps accompanied by flashes of plumage patches, in-flight acrobatics (rotations and wing snaps), and vocalizations. Podos and collaborators from Brazil and Scotland have been recording leap displays using both video and acoustic media, from a population in Brasilia, in order to document variation among males in display vigor and performance.

The advertised independent study project will focus on analyzing and interpreting digital video and audio files collected during the 2010-2011 breeding season, with the specific goal of documenting elements of leap displays and male-male variation therein. The participant will delve into computer programs for reviewing and analyzing vocal and acoustic behaviors, and will gain hands-on experience in the analysis and interpretation of behavioral data. The participant will also join in weekly lab meetings with graduate students. These will be run as an independent study for either 2 or 3 credits.

Qualifications of student
Student must have an excellent GPA, an outstanding work ethic, and a keen interest in animals and their behavior.

Number of work hours per week
5-10 hours per week

Are you looking for a particular type of student?
Anyone!

Independent study credit
yes

Paid
no

Could this project be extended into an honors thesis?
yes
Faculty name
Eric Bittman

Faculty lab website (if available)
http://www.bio.umass.edu/biology/about/directories/faculty/eric-l-bittman

Name of person to directly oversee apprentice
Emily Manoogian

Position of person overseeing apprentice
Graduate student

Title of project
Circadian Rhythms in the Brain's Master Pacemaker

Description of project
Our research concerns biological rhythms and their role in physiological coordination. A master clock in the suprachiasmatic nucleus of the hypothalamus regulates the timing of a wide variety of functions elsewhere in the brain and in the peripheral organs. The molecular basis of the pacemaker is a transcriptional-translational feedback loop, and the expression of a handful of core clock genes determines the phase and period of circadian oscillations. Students will use immunocytochemistry to localize and quantify the expression of proteins critical to the function of the circadian pacemaker as well as clock-controlled genes in the hamster brain. Of particular interest is the "duper" hamster, a mutant in which the circadian clock runs unusually fast (completing each cycle in less than 23 hours), and in which light is remarkably potent in resetting the clock. By examining the oscillating expression of critical neuropeptides and comparing the ability of light to induce or suppress expression of proteins that have important roles in determining the phase of the clock, we expect to characterize the mutation and gain insight into the affected gene.

Qualifications of student
Must have quantitative skills and some chemistry background (familiarity with neurobiology, physiology and/or molecular biology preferred). Student will learn neuroanatomy and histological skills as well as immunocytochemistry and light microscopy (with fluorescence).

Number of work hours per week
5-10 hours per week

Are you looking for a particular type of student?
Honors thesis project

Independent study credit
yes
Paid
no
Could this project be extended into an honors thesis?
possibly
Project number: 25

Faculty name
Betsy Dumont

Faculty lab website (if available)
http://www.bio.umass.edu/biology/dumont/

Name of person to directly oversee apprentice
Tom Eiting

Position of person overseeing apprentice
Graduate student

Title of project
Morphology of the Nasal Cavity in Bats

Description of project
The bat family Phyllostomidae is the most ecologically diverse mammal family, with species consuming fruit, nectar, insects, vertebrates, and even blood. This dietary diversity is correlated with great variation in the dimensions of the snout, with short-faced bats eating hard fruit items, and long-faced species consuming flower and nectar resources. These differences in snout dimensions clearly relate to dietary preferences: Short-faced species can access very hard fruits because of their greatly increased bite forces. Long-nosed species, on the other hand, can reach pollen and nectar better, and they have greater structural support for their large and elongated tongue. However, differences in snout shape impact more than just feeding ability. Notably, because the nose elongates or shortens in tandem with the mouth, the internal morphology of the nose is also likely to have changed dramatically with changes in snout shape. The nose carries out many important functions in bats, and for this work we begin by isolating how the olfactory structures in particular may have been impacted by changing snout dimensions. Specifically, we investigate the relative location of olfactory epithelium in the nose and the density of olfactory sensory neurons throughout the epithelium. These parameters play important roles in olfactory ability, so this work allows us to better understand how morphology relates to function in the nasal cavity.

For this project the student will receive sophisticated training in the use of the light microscope, statistical sampling, data collection, and analysis. Important tasks the student will perform include taking photomicrographs of histological preparations and marking slides with the location and extent of olfactory epithelium. These tasks will be done across a diverse sample of bat species that differ in shape, size, and ecology. Depending on the student’s desire and abilities, opportunities exist for the student to use CT data to generate 3D computer models of bat noses, to be trained in cutting-edge comparative methods used in evolutionary biology, and/or to contribute to writing a paper for publication in a scientific journal.

Qualifications of student
We seek a student interested in evolutionary biology, anatomy, or functional morphology who wishes to pursue a research career in one of these or a related field. The successful student will be self-motivated, a hard worker, and eager and willing to learn. Preference will be given to students who have taken or are taking Biology 280 (Evolution).

Number of work hours per week
5-10 hours per week

Are you looking for a particular type of student?
3rd or 4th year student

Independent study credit
yes
Paid
no
Could this project be extended into an honors thesis?
possibly
**Project number:**
26

**Faculty name**
Ana Caicedo

**Faculty lab website (if available)**
www.bio.umass.edu/biology/caicedo/

**Name of person to directly oversee apprentice**
Ian Gillis

**Position of person overseeing apprentice**
Graduate student

**Title of project**
Tomato Fruit Character Evolution

**Description of project**
Fleshy fruits in plants are believed to have evolved as mechanisms of seed dispersal through the attraction of animals that will consume the fruit. However, not all fleshy fruits are palatable, and many questions about the forces driving the evolution of fleshy fruits remain. We are investigating the genetic basis of the evolution of different fruit characteristics (such as loss of toxicity and gain of color) in species of wild tomatoes. Work for this project will include plant care and fruit collection in the greenhouse; lab work will include measurement of fruit traits, DNA extraction, PCR, DNA sequencing, and downstream analyses to assess selective pressures on genes underlying fruit traits.

This is an ongoing project, and students interested in joining the lab for 2-3 years are especially encouraged to apply.

**Qualifications of student**
Interest in evolution and biology
Previous lab experience would be good but not necessary

**Number of work hours per week**
5-10 hours per week

**Are you looking for a particular type of student?**
Anyone!

**Independent study credit**
yes

**Paid**
no

**Could this project be extended into an honors thesis?**
possibly
Project number:
27

Faculty name
Ana Caicedo

Faculty lab website (if available)
www.bio.umass.edu/biology/caicedo/

Name of person to directly oversee apprentice
Ian Gillis

Position of person overseeing apprentice
Graduate student

Title of project
Tomato Fruit Character Evolution

Description of project
Fleshy fruits in plants are believed to have evolved as mechanisms of seed dispersal through the attraction of animals that will consume the fruit. However, not all fleshy fruits are palatable, and many questions about the forces driving the evolution of fleshy fruits remain. We are investigating the genetic basis of the evolution of different fruit characteristics (such as loss of toxicity and gain of color) in species of wild tomatoes. Work for this project will include plant care and fruit collection in the greenhouse; lab work will include measurement of fruit traits, DNA extraction, PCR, DNA sequencing, and downstream analyses to assess selective pressures on genes underlying fruit traits.

This is an ongoing project, and students interested in joining the lab for 2-3 years are especially encouraged to apply.

Qualifications of student
Interest in evolution and biology
Previous lab experience would be useful but not necessary

Number of work hours per week
5-10 hours per week

Are you looking for a particular type of student?
Anyone!

Independent study credit
yes

Paid
no

Could this project be extended into an honors thesis?
possibly
Project number:
28

Faculty name
Dennis Searcy

Faculty lab website (if available)

Name of person to directly oversee apprentice
D. Searcy

Position of person overseeing apprentice
Faculty

Title of project
Sulfide-metabolizing Activities in Submitochondrial Particles

Description of project
During the evolutionary origin of eukaryotic cells the seminal event was formation of a symbiosis between a bacterium and an Archaeal cell. The closest freeliving relatives of mitochondria are sulfide-consuming bacteria, while the closest relatives of the nucleo-cytoplasm are sulfide-releasing Archaea. Thus, it is likely that the ancient symbiosis was based upon sulfide exchange, and that vestiges should remain in modern eukaryotic cells. To test that we are examining the sulfur metabolizing enzymes of mitochondria and of eukaryotic cytosol.

Historically, in previous studies on mitochondria it has been useful first to prepare "sub-mitochondrial particles" (SMPs), which are purified fragments of mitochondrial membranes. A candidate tissue from which to prepare SMPs is heart muscle, which already has been reported to consume and oxidize sulfide. Techniques to be used will include cell disruption, sonication, and ultracentrifugation. Sulfide and oxygen consumption will be measured using specific electrodes.

Questions include: (1) Can SMPs be prepared that have sulfide-oxidizing activity? (2) If so, what is the ratio between oxygen consumption and sulfide consumption, and what are the products? (3) Is electron transport through SMP’s reversible? Can conditions be changed so that H2S is produced? (4) Can sulfide metabolism bypass certain respiratory poisons such as rotenone? Such a possibility has been predicted from theory.

The observations should inform upon the hypothesis that eukaryotic cells evolved from an ancient sulfur-based symbiosis.

Students should be aware that officially I am retired, although I continue to work in the laboratory.

Qualifications of student
Students must be comfortable with chemistry and math. Bio 285, "Cell and Molecular Biology", should have been passed with a good grade.

Number of work hours per week
5-10 hours per week

Are you looking for a particular type of student?
3rd or 4th year student
Independent study credit
yes
Paid
no
Could this project be extended into an honors thesis?
yes
Project number: 29

Faculty name
Sam Hazen

Faculty lab website (if available)
http://www.bio.umass.edu/biology/hazen/

Name of person to directly oversee apprentice
Pubudu Handakumbura

Position of person overseeing apprentice
Graduate student

Title of project
Plant biofuel genetics

Description of project
A recently discovered microbe, Clostridium phytofermentans, can directly convert a broad range of biomass sources directly to ethanol without expensive thermochemical pretreatment. The Hazen lab has developed a high throughput ethanologen bioassay using C. phytofermentans to measure ethanol production from various plant species.

We seek an undergraduate to assist with various tasks in the laboratory relating to this project.

Plant cultivation: soil preparation, harvesting.

Processing plant samples: grinding, weighing, dispensing and packaging.

Microbiology: anaerobic culturing of Clostridium with plant biomass.

Analytical chemistry: sample preparation and analysis using high performance liquid chromatography.

Level of instruction and responsibility will depend on the student's interest and activity with project.

Unpaid position, can be independent study for credit.

Qualifications of student
Cordial, honest, diligent, competent, reliable and punctual

Number of work hours per week
5-10 hours per week

Are you looking for a particular type of student?
2nd year student

Independent study credit
no
Paid
no
Could this project be extended into an honors thesis?
possibly
Project number: 30

Faculty name
Luke Remage-Healey

Faculty lab website (if available)
www.umass.edu/healeylab

Name of person to directly oversee apprentice
Maaya Ikeda

Position of person overseeing apprentice
Graduate student

Title of project
Neurochemical Regulation of Song Processing

Description of project
Songbirds are used as models to study the neuronal basis of auditory and vocal learning. Young males and females learn songs and develop preferences for songs, respectively, from adult males during a sensitive period after hatching. We are studying the neurochemical mechanisms of vocal learning and auditory processing. In particular we are interested in the interaction between catecholamines and estrogens in the auditory forebrain. So far, we have observed fast changes in brain estradiol levels with norepinephrine administration in the NCM, which is an auditory region that is possibly important for song processing and discrimination. Two hypotheses to explain these results are: 1) a direct regulation of estradiol action by norepinephrine, and 2) the rise in estradiol is caused indirectly by changes in the birds' behavior.

The project involves analyzing the behavior of birds that have norepinephrine or adrenergic receptor antagonists infused in the NCM to determine whether the estradiol levels are dependent on the birds' behavioral state. The position would involve a mix of behavioral observations and scoring, as well as learning basic laboratory techniques for neurochemical analysis.

Qualifications of student
We are seeking a student who is interested in the field of hormones and animal behavior and has taken at least 1 course in biology or neuroscience.

Number of work hours per week
5-10 hours per week

Are you looking for a particular type of student?
2nd year student

Independent study credit
no

Paid
no

Could this project be extended into an honors thesis?
yes
Project number:
31

Faculty name
Lynn Adler

Faculty lab website (if available)
http://people.umass.edu/lsadler/

Name of person to directly oversee apprentice
Nicole Soper Gorden

Position of person overseeing apprentice
Graduate student

Title of project
The Ecology of Chemical Defenses in Flowers and Plant-insect Interactions

Description of project
Flowers are in a constant battle to attract organisms that help them (such as pollinators) while deterring organisms that damage them (such as florivores, which eat flowers). Flowers have several traits that serve for attraction (color, size, nectar production, etc), and can also have traits that serve as a deterrent (e.g. flower chemical defenses). Although researchers have spent hundreds of years studying leaf herbivores and leaf defenses, very little research has been done on florivores and flower defenses. This project will look at how flower attractiveness traits and flower chemical defenses affect insects that interact with flowers, and whether damage by florivores induces chemical defenses in flowers. This summer, we manipulated pollinators, florivores, and nectar robbers (which steal nectar without pollinating) and measured how insects interacted with the plants. We also collected many samples that need to be processed to measure chemical defenses in flowers and leaves, determine pollen production, and estimate plant reproduction.

This position is for a lab technician assistant whose job is to help process samples collected over the summer. Duties include:

- Basic chemical extractions of chemical defenses from flowers and leaves (procedures will be taught and are relatively simple)
- Counting and weighing seeds
- Counting pollen from pollen samples
- Estimating flower color (using a computer program)
- Entering data into Excel and proofing data that has already been entered
- Possibly helping with field work

The successful candidate should be comfortable using Excel and other basic computer programs, be able to complete frequently-repetitive tasks, be familiar with the use of basic lab equipment, be comfortable working with chemistry, and be able to work independently and meticulously. In return, you will learn data management skills, lab safety protocols, how to use ImageJ to estimate color, methods of determining plant fitness, two methods of chemical extractions, and methods for counting pollen, as well as becoming familiar with the process of research and experimental design. If the student is interested, they may also help with some occasional field work (i.e. work that is done outside, in the field) for the month of September only.

This position is offered for credit (no pay) for ~ 2 students to work 10-15 hours each a week (depending on the number of credits taken). If the student finds themself
very interested in the project and has been doing a satisfactory job with this position, there is a possibility of an independent project in the future (spring semester and/or summer 2012).

PLEASE NOTE: I like to interview students before hiring them. There is only 4 days between when applications are due and when I have to hire someone, so make sure you include your availability for a short meeting between September 6 and 16 in your application. It would also be helpful if you could email me with your availability for an interview as soon as you apply, since I won’t get to see your application until September 12 (Nicole: nsopereg@cns.umass.edu).

**Qualifications of student**
- Interest in the project and/or in plants, insects, ecology, or evolution
- Familiarity with Excel and basic computer use
- Safe lab protocols
- Ability to use basic lab equipment including microscopes, pipettes, scales, etc.
- Interest in doing basic chemical extractions, and comfort using mild to moderately dangerous chemicals
- Ability to work independently but ask questions when needed
- Ability to do meticulous and sometimes repetitive work
- Ability to learn new protocols quickly

**Number of work hours per week**
10-15 hours per week

**Are you looking for a particular type of student?**
Anyone!

**Independent study credit**
- yes
- Paid
- no

**Could this project be extended into an honors thesis?**
possibly
Project number: 32
Faculty name: Rick Pilsner

Faculty lab website (if available)

Name of person to directly oversee apprentice: Rick Pilsner

Position of person overseeing apprentice: Faculty

Title of project: Epigenetics and the environment

Description of project: The Pilsner lab focuses on how environmental and nutritional factors influence health outcomes via epigenetic processes. Epigenetics, or the heritable changes in gene expression without changes in underlying genetic code, is at the forefront of research uncovering the etiology of numerous diseases. Moreover, epigenetic regulation offers a likely pathway by which environmental exposures influence adverse health outcomes. Specifically, this project will investigate the influence of arsenic exposure on DNA methylation among Bangladeshi adults. It will entail validating human epigenomic microarray data via gene-specific DNA methylation performed on MALDI-TOF MS. Students will gain an understanding of epigenetic processes and work on state-of-the-art platforms to profile DNA methylation levels. Students will also help optimize gene-specific histone modifications assays via real-time PCR.

Qualifications of student: Previous laboratory experience, techniques such as PCR and or real-time PCR, DNA isolation, and other molecular techniques, strong quantitative skills. Bioinformatics experience would also be a plus.

Number of work hours per week: 15-20 hours per week

Are you looking for a particular type of student? Anyone!

Independent study credit: yes

Paid: no

Could this project be extended into an honors thesis? Possibly
Project number:
33

Faculty name
Jeff Podos

Faculty lab website (if available)
http://www.bio.umass.edu/biology/podos/Podos_Lab/index.html

Name of person to directly oversee apprentice
Dana Moseley

Position of person overseeing apprentice
Graduate student

Title of project
Song and Behavior in Swamp Sparrows

Description of project
This position is part of a project to study how young birds learn their songs or preferences for songs. The undergraduate will work with one year old swamp sparrows that have been trained with song models and are maintained in the lab. The position requires that the student be comfortable working with and caring for live animals. Tasks include feeding the birds and maintaining clean housing spaces for the animals. I especially need someone to help for an hour or two on Saturdays. In addition to bird care, there are opportunities to work with data collected in spring 2010 and summer 2011 from these birds. The student would track how birds learn and practice their songs over time and compare learned songs to the training models. Students would use Microsoft excel and two sound analysis programs (Audacity and Signal) to measure song learning.

The work is volunteer (unpaid) and would require 2-5 hours a week depending on the motivation of the student. This position is great for students who want to get started in a lab and get hands-on experience with animals and data. Students early in their college career would be considered and encouraged to apply. More senior students would be able to focus more heavily on the data analysis portion if so inclined.

Qualifications of student
Qualifications of student
Familiarity with Excel and basic computer use,
Safe lab protocols,
Ability to work independently but ask questions when needed,
Ability to learn new protocols quickly ,
Interest in the project.

Number of work hours per week
1-5 hours per week

Are you looking for a particular type of student?
Anyone!

Independent study credit
no
Paid
no
Could this project be extended into an honors thesis?
possibly