SUMMER 2024 OPPORTUNITIES

1. **BENOIT LAB:** Survival of insects in temperate regions is dependent on the ability to overwinter. The northern house mosquito *Culex pipiens pipiens*, vector for West Nile virus, endures winter through a period of hibernation (diapause). Diapause of this mosquito is characterized by a shift from blood to sugar feeding, accumulation of storage lipids, increased resistance to cold and dehydration stress and arrestment of oocyte development. Along with these factors, longevity increases from only a few weeks in nondiapausing females to well over eight months for diapausing individuals. It is unknown how activity and sleep dynamics change during dormancy. In this project, we will characterize sleep and activity during mosquito dormancy through combined behavioral and physiological studies, and follow this with sleep manipulation studies to determine impact of sleep deprivation on winter survival. The information generated from this research will be critical to understand how periods of sleep-like states impact mosquito dormancy, potentially revealing targets of opportunity for mosquito control.
   Website: http://insectphysiology.uc.edu/
   Time requirement: The student could work for 2 months, as many hours as available.

2. **CHIURILLO LAB:** The research activities of my laboratory are focused on the study of the protozoan parasite *Trypanosoma cruzi*, which is the etiological agent of Chagas disease (CD). *T. cruzi* is transmitted through direct interaction with insect vectors, known as the "kissing bugs," which are only found in the Americas. However, migration of infected people is doing that CD cases are growing in nontraditional affected areas, such as North America. It is estimated that as many as 8 million people in Latin America have CD, most of whom do not know they are infected. CD now affects at least 300,000 residents of the United States. After infection, CD may remain asymptomatic for years or even decades,

but in one third of cases CD can progress to dilated cardiomyopathy. There is no vaccine to prevent the disease, and the treatments available show low effectivity in the chronic phase of CD. Our approach involves the use of various reverse genetics strategies, such as CRISPR, to genetically manipulate the parasite, and study the role of genes encoding protein kinases and/or proteins putatively involved in cytokinesis, which is the last step of cell division. In our molecular parasitology laboratory, we perform routinely basic molecular biology, cellular biology and biochemistry techniques: DNA and protein electrophoresis, PCR, DNA extraction, cloning, etc., as well as cell culture and bioinformatics analyses of DNA/protein sequence data. Our final goal is to identify essential targets for the survival of the parasite that will help to the design of new chemotherapy against this pathogen.
Website: https://researchdirectory.uc.edu/p/chiurima
Time requirement: Student should be open to dedicating 4 weeks, from June 24 to July 19 and 20/h per week.

3. **CULLEY LAB:** The research in our plant biology laboratory aims to make a difference in our world today by focusing on two different challenges: (1) How to effectively conserve rare and endangered plant species, and (2) How to reduce the number of invasive species introduced into the United States, especially plants of horticultural origin. Our endangered species work primarily involves rare native Hawaiian species, and we partner with researchers at the Cincinnati Zoo and Botanical Garden’s Center for the Research of Endangered Wildlife (CREW). We use a combination of genetic techniques to determine levels of genetic variation in remaining wild populations and to support Hawaiian conservationists in their goal to reintroduce some of these species back into the wild. Our second focus on invasive species aims to understand the evolutionary and ecological reasons why a non-native species introduced into a new area may suddenly start to spread. We use cutting-edge genetic techniques combined with field and greenhouse studies.
Website: https://culleylab.com/

Time requirement: Student should be open to dedicating ideally up to 6 weeks, starting in early June, working approximately 15-30 hours per week would be ideal (but flexible).

4. **GROSS LAB**: *Project Title:* Examining the genetics of taste system development in blind Mexican cavefish. *Project Description:* The Gross Lab is looking for interested, motivated and dedicated high school student interested to gain research experience examining the development of the taste system. Our lab studies the blind Mexican cavefish, and closely-related surface fish, which live in very different environments. These environments have led to dramatic differences in the positions of taste buds. This research experience will involve some animal husbandry and breeding, potentially cloning some taste receptor genes, performing immunohistochemistry to identify taste buds in other cavefish populations, and expression analyses (either quantitative PCR, or in situ hybridization) for our expanded extraoral taste bud project.
   Website: https://homepages.uc.edu/~grossja
   Time requirement: negotiated with the lab head and personnel. At least a one month commitment, with ~4-5 hours a few days a week.

5. **JHA LAB:** Students will work on understanding corticalc ircuitry involved in sensing and storage of information in a biological brain. If time permits, students will develop models for these in Python.
   Website: https://researchdirectory.uc.edu/p/jhari
   Time requirement: Time dedicated to this work 1 month (June, 2024); 5 hours per week.

6. **KUMAR LAB:** The student will be involved in development of indoor Unmanned Aerial Vehicles (UAVs) with applications such as emergency response in buildings or telehealth services inside people's homes. Operation of drones in indoor environment is particularly challenging due to several reasons including loss of

access to GPS information, and proximity with obstacles and humans. For safe operation of UAVs in indoor environment, some level of autonomy is needed to allow UAVs to avoid collisions and carry out basic maneuvers without any assistance from humans. Incorporating autonomy in drones operating in indoor environment is often challenging due to the fact that positional feedback from GPS is intermittent or unavailable. The UAV needs to solve the problem of localization, i.e., finding its position and orientation using onboard sensors such as vision, laser, or other proximity sensor such as ultrasound sensors, via a process called Simultaneous Localization and Mapping (SLAM). Furthermore, the UAV should be able to use its positional estimate to perform navigation in a precise manner to enable safe operation. The objective of this project is to develop hardware and software means to carry out the process of SLAM and autonomous navigation of UAVs in indoor environments.
Website: https://researchdirectory.uc.edu/p/kumarmu
Time requirement: Negotiated with the lab head and personnel.

7. **LANDER LAB:** The student will be involved in the characterization of trypanosome mutant cell lines to study signal transduction pathways in trypanosomes. In this regard, the intern will be trained in different cell and molecular biology techniques, such as cell culture, gel electrophoresis, DNA isolation, PCR, cell counting, media preparation, bacterial transformation, and other related techniques.
Website: https://homepages.uc.edu/~landerlab/wordpress/about/
Time requirement: Negotiated with the lab head and personnel. 4 weeks, 4 h/day. The internship period would be June 17 - July 12.

8. **LAYNE LAB:** In the Layne lab research interns will join ongoing, novel research projects in either of two broad areas: 1) spatial navigation, 2) color vision. In the first, *spatial navigation*, we study how animals know where they are, particularly how they know their current location relative to a starting point, such as home. We also study how animals know the location of other objects in the

environment, particularly how they visually perceive the direction of objects seen with eyes that are highly mobile - how is this eye mobility accounted for? In the second, *color vision,* we study whether animals have 'color vision', that is, whether animals are capable of visually discriminating objects based solely on differences in reflected/emitted wavelengths of light. To test this we use a behavioral assay in which an unconditioned response is elicited by a visual stimulus that be changed in wavelength and intensity. This is a way of asking the animal “can you see this?” The device we use is novel and invented in the Layne lab.
Website: https://researchdirectory.uc.edu/p/laynejn
Time requirement: Negotiated with mentor

9. **MOREHOUSE LAB:** The Morehouse Lab studies how animals see the world, with a focus on insects and spiders. The student would work on one or more projects related to jumping spider perception of color, motion and/or depth. Approaches would include field work, behavioral assays, gaze tracking, ophthalmoscopy, hyperspectral measurements, retinal histology and microspectrophotometry, and/or computational approaches to video analyses of animal behavior.
Website: https://homepages.uc.edu/~morehonn/
Time requirement: Number of hours per week: Negotiable depending on student availability, but a minimum of 10 hours per week. Total amount of time: up to 240 hours over 6 weeks.

10. **NOROUZI LAB:** Our research focuses on video summarization, where we aim to build machine learning models capable of generating concise video snippets or highlights (referred to as video skim) that encapsulate the narrative of a long video but in a significantly shorter format. For instance, our models can condense a 5-minute hamburger cooking recipe video into a 1-minute abstract video. Video summarization is a complex task involving multiple steps:
1. Determining how to represent video frames or shots using deep features extracted from pre-trained deep learning models.

2. Predicting the importance of video frames or shots based on their visual, audio, and other content.
3. Assembling the most crucial segments of the video to create a comprehensive summary.
During this internship, you will learn the basics of image processing and be introduced to a video summarization framework.
Website: https://researchdirectory.uc.edu/p/norouzmi
Time requirement: Preference for a student that can dedicate 6 weeks (20h/week) on their python programming skills and work with graduate students.

11. **ROLLMANN LAB**: The student would work on experiments aimed at understanding the genetic and neural bases of behavior in fruit flies. Behaviors examined may include an examination of their thermal preference, humidity preference, or taste/smell preferences as well as the neurons that mediate these responses.
Website: https://homepages.uc.edu/~rollmasm/
Time requirement: A minimum of 10 hours per week. Negotiated with mentor.

12. **VANDERELST LAB**: My lab works on modeling bat echolocation using computer simulations and robots. Based on their interests, students could be involved in all aspects of the work in the lab. Students could help programming robots, building setups, running computer simulations or robotic experiments. In addition, interested students could work on 3D design, 3D printing, or laser cutting to create parts for the robotic experiments. Finally, the internship could also focus on basic electronics, for example, working with microcontrollers.
Website: https://www.bitsofbats.net/
Time requirement: Negotiated with mentor.