**Summer 2023 UPS REU Research Descriptions**

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| Summer 2023 research experience*Mentor:* Bryan Thines*Title of Research:* Control of the plant cell cycle under stress*Description:* Our research group investigates how plants stay resilient when faced with environmental stresses, such as those imposed by climate change. Specifically, we study how the cell cycle, a process that enables cells to divide and an organism to grow, is altered when surroundings become inhospitable. We have identified genes that we think control plant cell division and morphology in response to changing environments. Currently, we harness *Arabidopsis thaliana* as a model system and probe its gene functions using molecular genetic approaches.*Lab Projects for Summer 2023:* We have created many gene knockout and overexpression plants that have altered cell cycle outcomes. The next step is to assess how well these plants respond to environmental stress, both at the whole organism and molecular levels. These project will harness standard molecular techniques (ie. PCR), as well as studying how resilient these plants are under stress at the whole organism level. |
| Summer 2023 research experience*Mentor:*Leslie Saucedo*Title of Research:* Investigating the roles of antioxidants in cancer.*Description:* Our lab uses *Drosophila melanogaster* as a model system for understanding how alterations in gene expression enables cells to grow in an uncontrolled manner: a key attribute of cancer cells. We specifically focus on genes known to be conserved across species, including humans. Most recently we have been interested in how the cellular redox environment can either suppress or promote tumorigenesis. Thanks to the relative ease of manipulating and tracking genes in fruit flies, we are able to alter the activity of master regulators of antioxidant activity while simultaneously altering genes involved in cellular growth, division, apoptosis etc… We analyze our results primarily at the cellular level, using stains and microscopy.*Lab projects for summer 2023:* We’ve recently developed tools to measure the levels of Reactive Oxygen Species (ROS) within cells. This summer we aim to quantify how our genetic manipulations that lead to tumors are altering ROS levels. The work involves learning how to set genetic crosses and identify dominant markers in *Drosophila*, how to perform microdissections, and lastly, how to use confocal microscopy to quantify ROS.  |
| Summer 2023 research experience*Mentor:* Rachel Pepper*Description:* Research in the Pepper Lab investigates biophysical questions with a focus on fluid mechanics. In particular, we look at how water interacts with living organisms. There are two main research areas in my lab: flow around microscopic organisms that live in bodies of water attached to surfaces, and seed dispersal from splash cup plants. The microscopic organisms are present in most bodies of water and help keep these bodies clean and in balance. Splash cup plants can disperse their seeds up to 100x their body size. We address questions in these areas using experiments, theory, and numerical simulations. For more information (and previous student projects) visit drpepperlab.com.*Lab Projects for Summer 2023:*For the splash-cup project the REU student will investigate how a relevant plant characteristic affects the dispersal height and distance of seeds. This could include studying the speed of the incoming drop,the shape of the cup, the number of seeds, seed size or shape, or another aspect of the student’s interest. For the microscopic organism project, there are several areas where we are considering measuring the feeding current generated by these organisms: in the field in bodies of water around Tacoma, in different types of controlled flow in the lab, and in 3D using holography. The REU student could choose one of these measurements as their project. |
| Summer 2023 research experience*Mentor:* ***Dr. Oscar Sosa****Description:* ***Resolving the production and fate of nitrogenous metabolites in the surface ocean****Lab Projects for Summer 2023:****The REU student will develop a project that examines the degradation of nitrogenous metabolites by microbial communities in the Salish Sea ecosystem****. Nitrogen-containing metabolites have important physiological functions in marine microbes, including photosynthetic algae and bacteria. But their exact biochemical fate remains poorly understood.* ***The goal of this project is to describe the types of bacteria and metabolic pathways that determine the fate of these compounds using genomic approaches.****The student will learn and apply the following skills and approaches in this project:*1. ***Field oceanography:*** *the student will participate in field work at sea to collect samples and conduct experiments with the natural microbial communities in the Salish Sea.*
2. ***Molecular microbiology:*** *the student will apply molecular sequencing approaches to study the collective genomes of microbial communities.*
3. ***Programming and bioinformatics*** *approaches will be implemented to analyze DNA sequencing data from the samples collected at sea and examine the genes and metabolic functions they contain.*
4. ***Written and verbal science communication:*** *the student is expected to communicate scientific results from the project in the format of a research report, a short science talk, and a research poster (optional) for presentation at a scientific meeting.*

*The REU student is not expected to have these skills prior to the REU. They will receive direct mentorship from Dr. Sosa to learn how to implement these approaches and will be required to participate in lab discussions and group meetings.****Key terms:*** *marine microbes, metabolism, bioinformatics, ocean science.* |