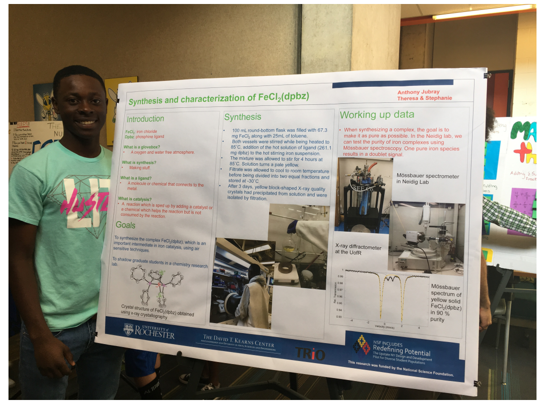
Chemistry

Introduction to Iron Chemistry: Synthesis and Spectroscopy

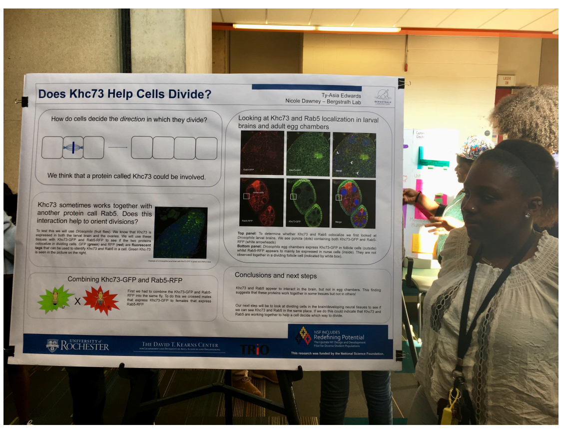
Mentors: Stephanie Carpenter and Theresa Iannuzzi
Student: Anthony Jubray
Following a brief introduction to iron chemistry, the student will learn how plan a procedure and perform lab work in an oxygen-free setting. In addition, the student will synthesize, isolate, and characterize a pure iron compound.



Biology

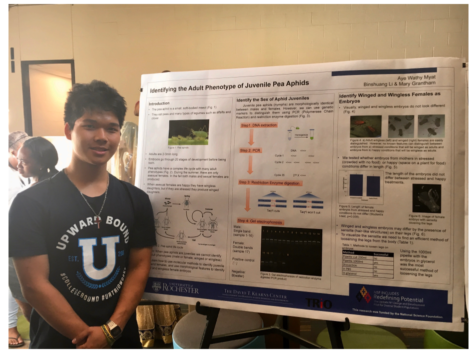
Microscopic Analysis of Two Proteins, Khc73 and Rab5, in the Fruit Fly Brain.
Mentor: Nicole Dawney

Student: Ty-Asia Edwards



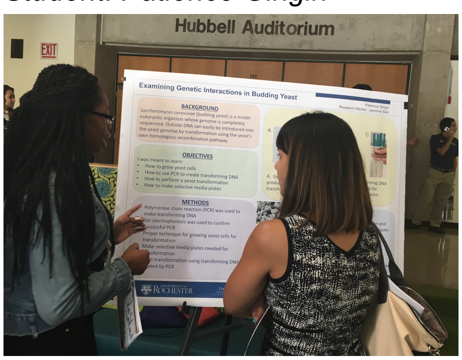
Our lab is interesting in understanding how tissues in the body develop. To explore this question, we use the fruit fly Drosophila melanogaster, which has been a powerful model system for the study of biology over the past 100 years.
Tissues are made of cells. In order for a tissue to grow, its cells have to divide. Surprisingly, cells in certain tissues will divide only in certain directions. For example, some cells in the developing fly brain will only divide “up and down” with respect to the tissue. This directionality is important for generating complexity.
Other laboratories have suggested that a particular factor, a protein called Khc73, participates in determining the direction of cell division. In our lab, we are taking several approaches to understand how it works. One approach is to disrupt Khc73 and see if the direction of cell division changes. Another approach, which is the goal of this project, is to use very advanced microscopy to follow the behaviour of Khc73, in both space and time, as a cell divides. We are particularly interested to see if Khc73 interacts with another protein called Rab5, and can test this possibility by visualizing the two proteins together.
During this project the student will learn the principles of Drosophila genetics. We will also dissect brain tissues from both adult flies and larvae, then perform microscopy and image analysis.

Genetics and Epigenetics in wing dimorphism of pea aphids
Mentor: Mary Grantham and Binshuang Li
Student Aye Wathy Myat



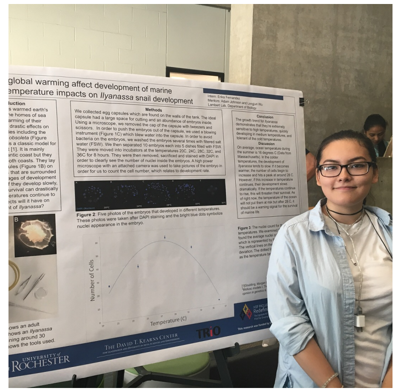
Our lab is interested in the interplay of nature and nurture in affecting final adult morphology. The pea aphid is an ideal system to study this question because it exhibits discrete wing dimorphism in both male and female individuals, yet they are controlled by different mechanisms. In females, environmental signals such as population density (crowding), predator threat, nutrition etc. will influence their wing morph development. Under stress, more winged females will be produced. This process is not determined by genetics; therefore, we hypothesize that epigenetic mechanisms are the major factors. Males, on the other hand, have a simple Mendelian genetic mechanism controlling their wing phenotype. One locus called aphicaus is known to be the switch. However, we are still not clear which gene or genes(s) in this locus are the key element. During the project, two students can participate in our research trying to understand the underlying mechanism of pea aphid wing dimorphism. They will learn some genetics and molecular biology knowledge plus some interesting insect facts. The student interested in environmentally-induced wing dimorphism in female pea aphids will work with Mary. The other student interested in genetically determined male wing dimorphism will work with Binshuang.

Examining genetic interactions in budding yeast
Mentor: Jasmine Siler
Student: Patience Girigiri



This project will focus on using the budding yeast Saccharomyces cerevisiae as a model organism to study genetic interactions between genes involved in DNA damage resistance. The goal of this project is to introduce the student to biological research through real life experiences in the lab. The student will learn genetics and molecular biology techniques and use them to conduct research. These techniques include making media and solutions, growing yeast cells, light microscopy, PCR amplification of DNA fragment, yeast transformation, agarose gel electrophoresis, and DNA purification. The student will also learn how to properly record, analyze and present experimental results.

Testing the optimal temperature for snail embryos to grow



Mentor: Longjun Wu and Adam Johnson
Student: Erika Fernandez
The eastern marine mud snail (Ilyanassa) is an important experimental model for studying early animal embryonic development. However, the best temperature for their embryonic develop is still unknown. In this project, the student will compare the snail's early development rate in different temperature settings. The temperature of the fastest development will be recorded.

Biomedical Engineering

Instructor: Mark R. Buckley
Mentor: Ibrahima Bah

Student: Fidele Nbizi
Most diseases alter the mechanical properties (e.g., stiffness) of the biological tissues that they affect. Thus, mechanical testing of biological tissues is a valuable research tool with the potential for translation into the clinic. For example, mechanical testing of tissue biopsies could supplement pathological evaluation to improve disease diagnosis. However, most mechanical testing systems are too large and require too much set up time for use in a clinical setting. Thus, in this project, students will use the CAD software SolidWorks to design a simple, rapid-use mechanical testing device for use with tissue biopsies. Once designed, the device will be 3D printed and validated experimentally.