

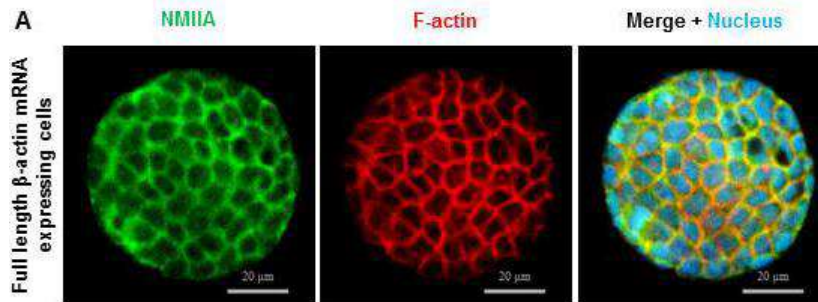
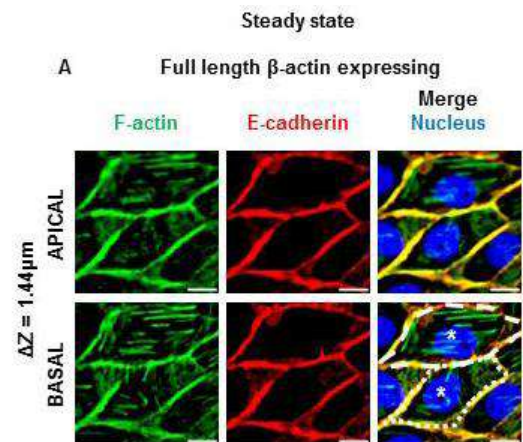
**Rutgers University Newark 2016 Summer IMAGE Program  
July 5<sup>th</sup>- August 19<sup>th</sup> 2016**

The Biological Sciences and Earth & Environmental Sciences departments of Rutgers University Newark are sponsoring a 7 week immersive STEM research experience for current 10<sup>th</sup> and 11<sup>th</sup> grade students that have successfully completed courses in Biology and either Chemistry or Environmental Science. The program will run Monday through Friday from 10:00 am until 4:00 pm from July 5, 2016, through August 19, 2016. There is no cost to participate in the program, but transportation and meals are not included.

**7 Week Immersive STEM Research Experience Topics include:**

**Investigating kidney epithelial tissue structure and function using quantitative light microscopy**

The majority of cancers develop when normal epithelial tissues become dysfunctional. To better understand how epithelial cells respond to tissue dysfunction we will use brightfield and fluorescence microscopy to characterize model kidney epithelial tissues undergoing dysfunction. Students will learn how to culture model epithelial tissue, label-specific proteins in fixed tissue using antibody labeling, image specific proteins using fluorescence microscopy, image tissue movement using time lapsed imaging, and image specific proteins in living tissue. Additionally, students will have the opportunity to use these skills during a mentored research project in the lab of a faculty member from Rutgers University



Newark.

**Imaging to understand the biology behind algae: drivers of global climate.**

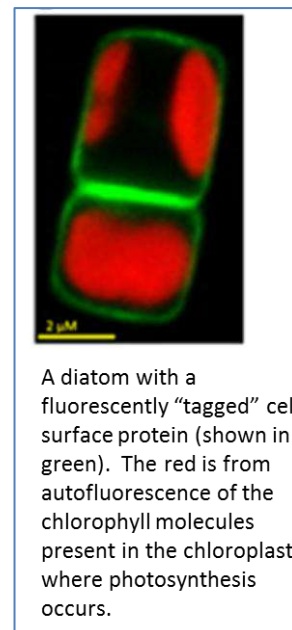
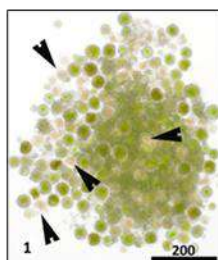
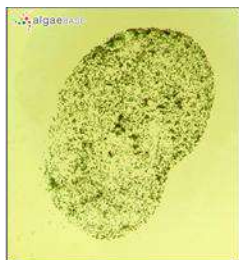
Dr. Kustka's group collaborates with Dr. Rodriguez's group to better understand the underlying biology responsible for the behavior of single celled algae. These organisms play a huge role in removing carbon dioxide from the atmosphere, at about the same extent as the tropical rainforests. The aspects of their biology that we want to study are directly related to their role in helping control global climate.

## Global climate and iron transport in marine diatoms

Marine diatoms are a group of photosynthetic organisms responsible for 25% of the global carbon dioxide removal from the atmosphere each year. In large regions of the ocean, their ability to remove CO<sub>2</sub> is enhanced when more of the micronutrient iron is available. Despite iron's importance, we know very little about how these diatoms take up iron. We think a protein called FTR1 is involved in iron uptake. We have genetically modified a diatom to express this protein with a fluorescent "tag", and plan to determine how quickly the protein is turned on and moved to the cell surface to take up iron.

## Colony formation in gooey marine algae

A species of marine algae exists as single cells but sometimes will make large colonies where cells stick together. We think this happens when they detect molecules from tiny shrimp that eat them. By making large colonies, they are less vulnerable to being eaten by the tiny shrimp. We have identified proteins (cadherins and others) that are the same as those used by mammalian cells. We are interested to see whether these proteins are turned on when colonies are formed. We will conduct experiments to induce colony formation (by collecting shrimp sweat and pee) and try to see what proteins are involved in this process. This also has global climate implications since these large colonies tend to sink really fast, and their "fixed" carbon then ends up at the bottom of the ocean (most of our petroleum oils are made from algae that sunk to the bottom of the ocean some 90 million years ago).



A diatom with a fluorescently "tagged" cell surface protein (shown in green). The red is from autofluorescence of the chlorophyll molecules present in the chloroplast, where photosynthesis occurs.

## Crowdsourcing in the venus fly traps of the oceans? Some algae might make colonies to "digest" small rocks of iron

Some photosynthetic bacteria also require lots of iron and may make colonies to somehow cooperate and bring iron rich dust particles (tiny rocks) towards the middle of the colony. How a collection of single cells can figure out how to communicate with one another to accomplish this is fascinating – and seems analogous to crowdsourcing and to how venus fly traps catch insects. We will use cutting edge imaging of iron particles and algae to learn more. These particular algae are interesting from a climate perspective because they are capable of a process called nitrogen fixation, and serve to fertilize nutrient poor regions of the ocean (stimulating carbon fixation).

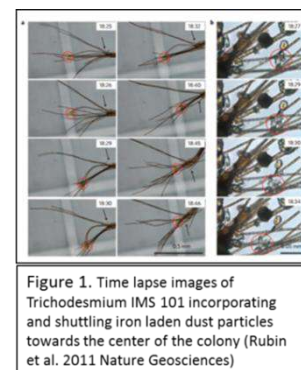


Figure 1. Time lapse images of Trichodesmium IMS 101 incorporating and shuttling iron laden dust particles towards the center of the colony (Rubin et al. 2011 Nature Geosciences)

**Applicants must submit the completed application and the parental consent form.** For more information please contact Ivory Williams, Special Assistant – Science.

Newark Public Schools

2 Cedar Street – Room 915

(973) 733-8474

[iwilliams@nps.k12.nj.us](mailto:iwilliams@nps.k12.nj.us)



## Rutgers University Newark 2016 Summer IMAGE Program - Application

*Please clearly print all information.*

Students Full Name \_\_\_\_\_

Date of Birth \_\_\_\_\_

Home Address \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Parent or Guardian \_\_\_\_\_

Home Phone \_\_\_\_\_

Cell Phone \_\_\_\_\_

E-mail Address \_\_\_\_\_

Ethnicity (optional) \_\_\_\_\_ Gender \_\_\_\_\_ Entering grade \_\_\_\_\_

Name of Newark public school \_\_\_\_\_

School administrative office phone number \_\_\_\_\_

What do you hope to gain from your participation in this program?

---

---

---

---

---

---

---

---

---

---



## **Rutgers University Newark 2016 Summer IMAGE Program - Parent Permission Form**

My signature below confirms that I am giving my child \_\_\_\_\_ permission to participate in the Rutgers University Newark 2016 Summer IMAGE Program. He or she will participate daily Monday through Friday, 10:00 am to 4:00 pm for the duration of the program session from July 5 - August 19, 2016.

Parent/Guardian Name: \_\_\_\_\_

Parent/Guardian signature: \_\_\_\_\_

Home Phone \_\_\_\_\_

Cell Phone \_\_\_\_\_

E-mail Address \_\_\_\_\_