

**Interim Report for SPS Undergraduate Research Award:** Prepared by Ben Stottrup with the help of Andrew Nguyen, Tom Lopez, Nate Johnson, and Nick Hudson.

**Summary of activities:**

Andrew Nguyen, lead student on the project, worked with vendors and sales representatives to purchase the Basler camera described in the report. Ultimately, he was advised to purchase a different and model because of the ease in incorporating the camera into already existing software and slightly greater camera speed. Once purchased Andrew worked to interface the camera with the computer using Labview. This work has been successful and the camera can now be used by a variety of interested parties as described below. He also purchased a set of lenses for the camera to aid students in the unstructured lab project. This provides us with a greater range of experiments the camera can be used in.

Augsburg College has supported our SPS efforts with the the purchase of six less expensive cameras for use in the paired seminar series on image processing (~\$1300 total). To take advantage of this investment the paired seminar series has been moved to the fall semester. These camera's do not have the speed or resolution capabilities of the Point Grey camera purchased with the funds in this award, however the interface with Labview is identical and they will give more students the opportunity to participate in this project.

**Paired Seminar Series:** Dr. Stottrup will offer a free seminar series to incoming first year students and interested SPS members on using digital cameras in science and image processing. Andrew Nguyen will assist in this course. The course was originally planned for Spring semester, but because our spring semester started before the grant notification we have moved it to the fall. This will enable us to better publicize it and include first year students in the program as part of their first-year experience.

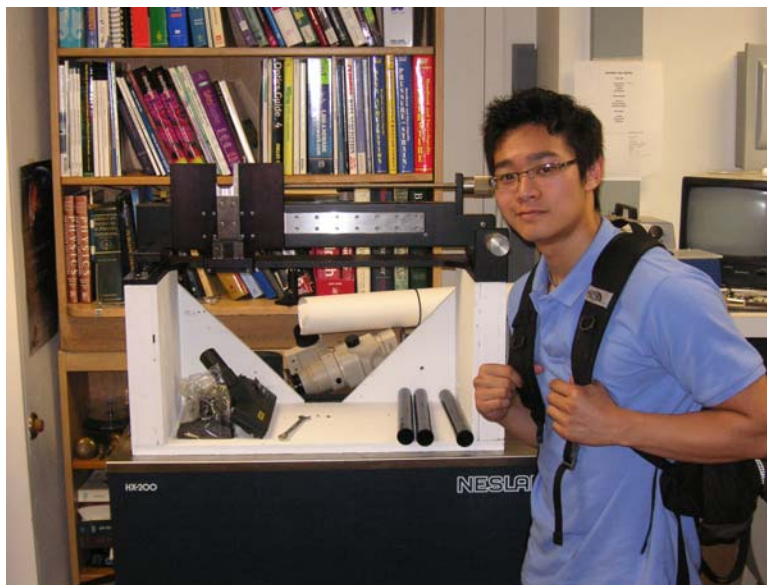
**Collaboration with NIST:** Sophomore Nick Hudson received summer research support through Augsburg College to work with Drs. Stottrup and Halter. Nick has been tracking cell migration using a combination of manual labor and computer algorithms. While he has not directly used the camera purchased with the SPS funds he has worked with data sets from NIST to generate ground truth imaging sets. Nick will take part in the paired seminar series this fall (Figure 1).

**Physarum Experiments:** Figure 2: A microscope stage and xy translator have been assembled for the Physarum experiments. These experiments will happen in parallel with the seminar series (meeting evenings for 10 weeks during the fall).

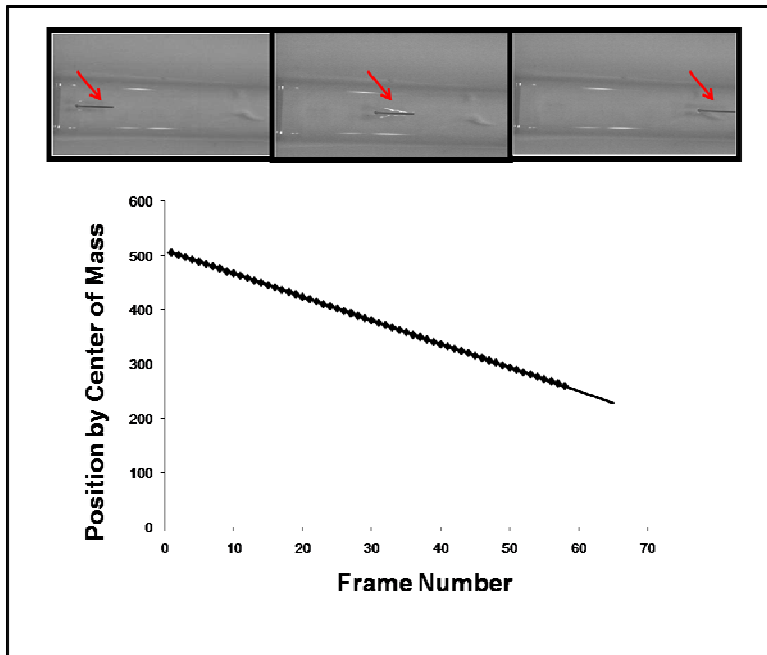
**Unstructured Lab Projects:** Undergraduates Tom Lopez and Nate Johnson have incorporated the Point Grey camera into their magnetic needle viscometer. Nate Johnson resurrected the magnetic needle viscometer as his *Unstructured Lab* project for his General Physics course this spring. Tom intends to calibrate and write an American Journal of Physics paper describing the instruments construction. Data and images from these experiments can be seen below (Figures 3 & 4). The above mentioned microscope stage and setup will also allow us to observe the movement of semi-volital oil droplets on the air water interface. Nick Ward and Andrew Nguyen have already done preliminary experiments to test this system.



**Figure 1 Data Analysis:** Sophomore Nick Hudson has been working with Drs. Halter (NIST) and Stottrup (Augsburg) on developing ground truth data sets from live cell images.



**Figure 2 Microscope Stage:** Andrew Nguyen shows off our homemade microscope stage. The stage offers a large xy translation and hence will enable us to study and monitor larger experiments than a normal bright field microscope.



**Figure 3 Magnetic Needle Viscometer:** Top) A camera records the progress of a magnetic needle as it moves in a constant magnetic field (red arrow highlights needle). Bottom) Data extracted from magnetic needle movies. Images were recorded with Point Grey camera purchased as part of this SPS project.



**Figure 4 Student Researchers:** Undergraduates Tom Lopez and Nate Johnson have made a prototype of a magnetic needle viscometer. The camera purchased with the SPS undergraduate award can be incorporated into an existing Labview program so image acquisition, instrument control, and data analysis can now be fully automated and done in one program.