



# Montague – CTE Scholar Michael Tice (2012-2013) College of Geosciences



## Rapid 3-D Prototyping Enables Geological Visualization and Inquiry

Developing the ability to visualize structures and the processes that occur on them is critical to learning to think like a professional geoscientist. It is also one of the most difficult skills to teach. We used Montague – CTE Scholar funds to develop a 3-D prototyping facility for this purpose. A 3-D scanner allows digitization of complex surfaces for manipulation on a computer workstation. A 3-D printer is used to produce solid models of digital representations. Using this facility in undergraduate research builds 3-D reasoning skills by allowing students to develop hypotheses about complex surfaces, develop digital models of relevant structures, and then test their hypotheses with solid models.

During the summer of 2013, 11 undergraduates participated in a research class investigating problems related to diffusive transport across complex microbial surfaces. Three projects used this new system. We anticipate broadening its use to include projects in Geology majors' courses.

### Question



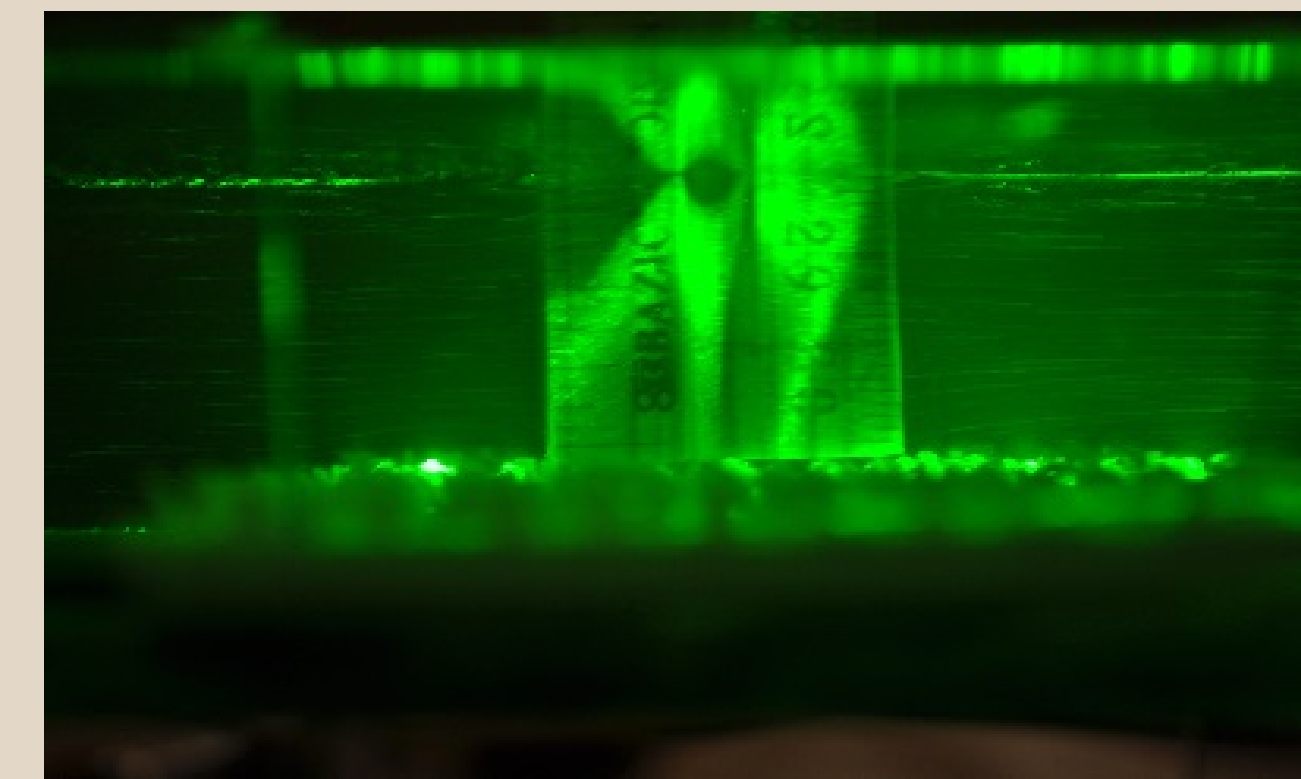
Bacteria growing in hot springs of Yellowstone National Park form small cones. Do cones maximize transport of nutrients across the mat surface?

### Model System



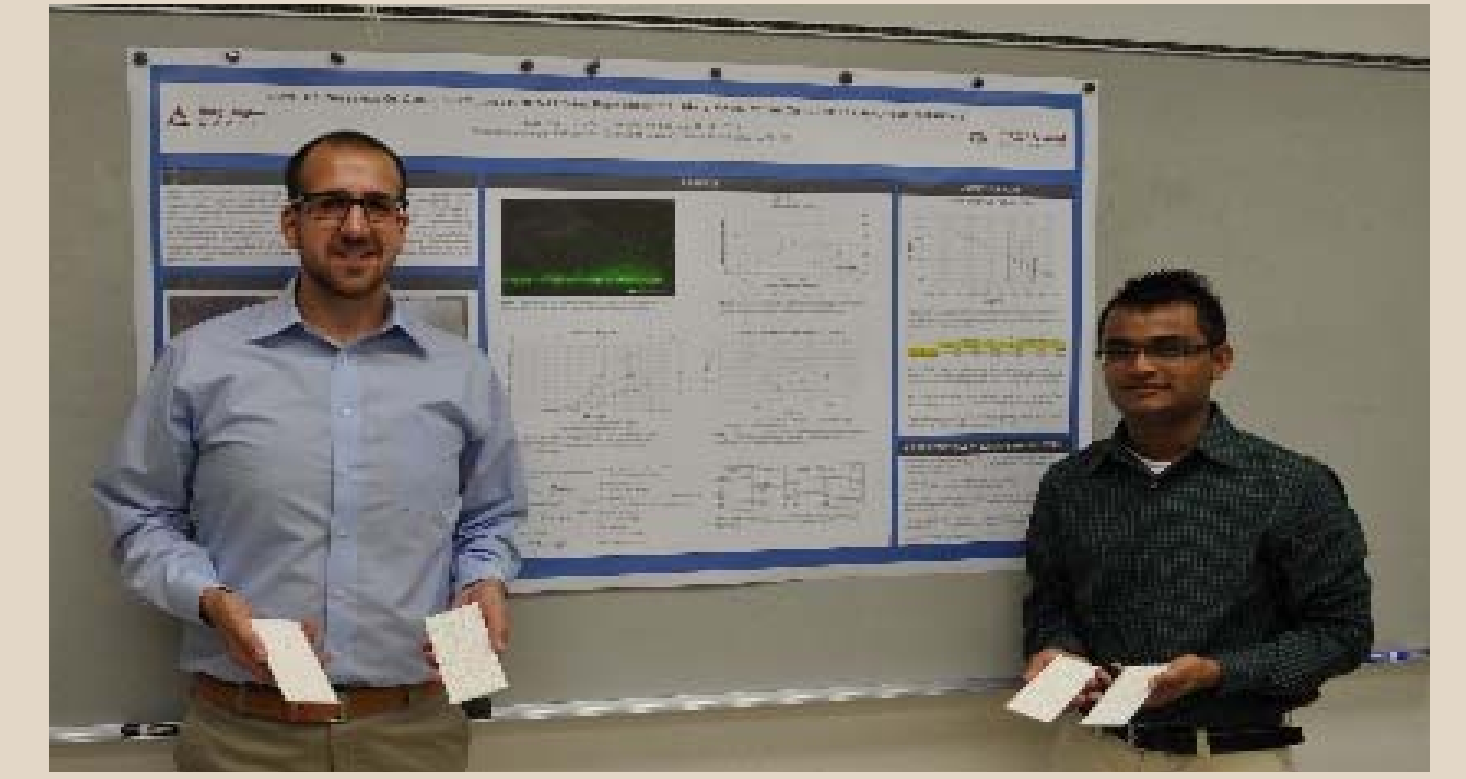
Answering this question requires visualizing fluid flow over mat surfaces. Students constructed large clay models of individual cones, scanned them to produce digital models, and printed large fields of cones similar to those observed in the field.

### Experiment



Models were used in fluid flow experiments to calculate how rapidly nutrients could have been supplied to mats under different thicknesses and velocities of flows.

### Result



Students presented preliminary results at the end of class. Four students are continuing their visualization projects through the 2013/2014 academic year.