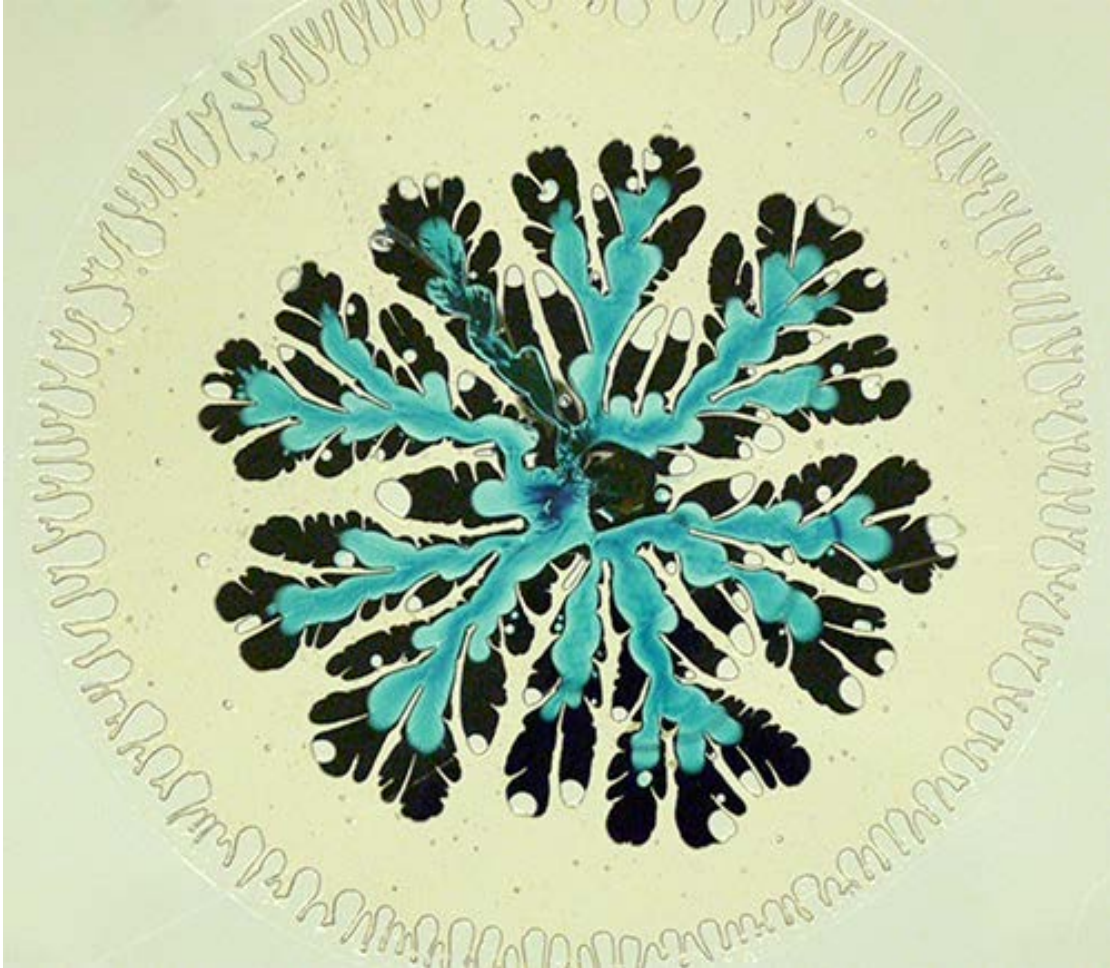


Team Project # 1:  
Image Report

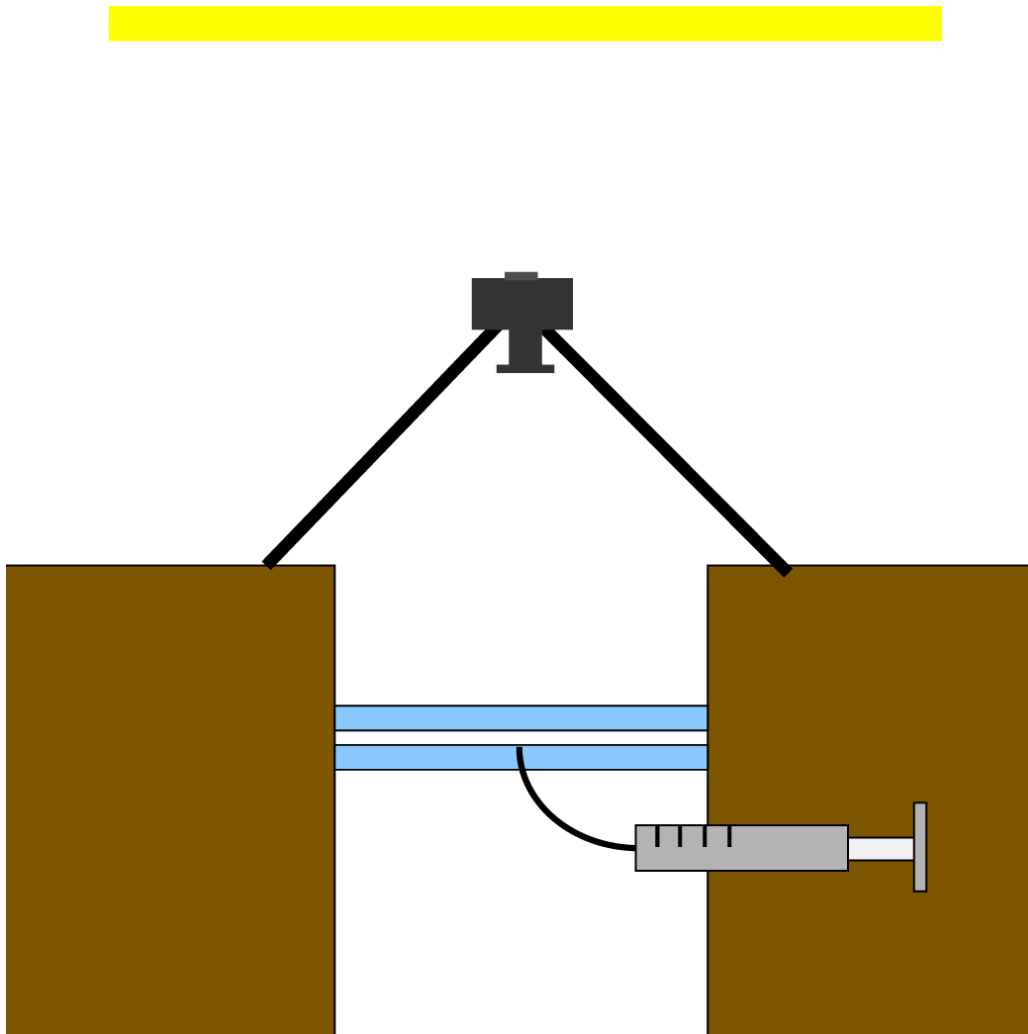


Scott Hodges  
Flow Visualization  
CU Boulder, Spring 2014

I. Project Goal and Description

The goal of this project was to demonstrate the fingering that occurs when liquids of differing viscosities are combined in a Hele-Shaw cell.

## II. Project Setup



Yellow = overhead fluorescent lighting  
Blue = glass panes. Slight gap in between.  
Brown = rolling desks, used to support tripod and camera.  
Black = camera and tripod. Shot overhead, slightly angled.  
Gray = syringe for injecting less viscous fluid.

Materials not pictured: food coloring, honey.

## III. Camera Setup

The camera is a Micro 4/3 model, specifically a Panasonic G5. All controls are set to manual and I used a Pentax 1:4 Macro lens, adapted from a film SLR. The lens has a focal length of 50mm and was located about 24" above the glass pane. The aperture range on the lens is f/4-f/32. I shot at f/5.6 and ISO400 for the best exposure given the lighting situation. The field of view is about 6".

#### IV. Project Methods

To start the project, the syringe was filled with a mixture of blue food coloring and water and the hose was inserted into the hole in the glass. Approx. 1 oz of honey was placed on the bottom pane, directly over the syringe tube.

The top pane of glass was put in place (the set screws created a gap of ~1mm) and the blue water injected into the honey. After full injection, the plunger was withdrawn to suction out some of the fluid- it was at this point the picture I was taken. I was on the team with Alex Unger- this is a still taken during the video he used.

In post-processing I removed the injection tube via the spot healing brush and clone stamp, and brightened the overall image with the levels tool. The image was cropped slightly to create a squarer aspect ratio.

#### V. Conclusion

This project shows the effects of a lower viscosity liquid being injected into a higher viscosity liquid. The technical term for this is the Saffman-Taylor instability. The greater the discrepancy between viscosities, the more intricate the fingering will be.

I am satisfied with the image outcome, though optimally the frame would be slightly larger so the entirety of the fingering would be visible. To take the project further, it would be cool to experiment with different liquids and colors.

#### VI. Sources

1. Lee, Jane J. "The Weird and Beautiful World of Fluid Dynamics." *Wired.com*. Conde Nast Digital, 20 June 0011. Web. 21 Mar. 2014.