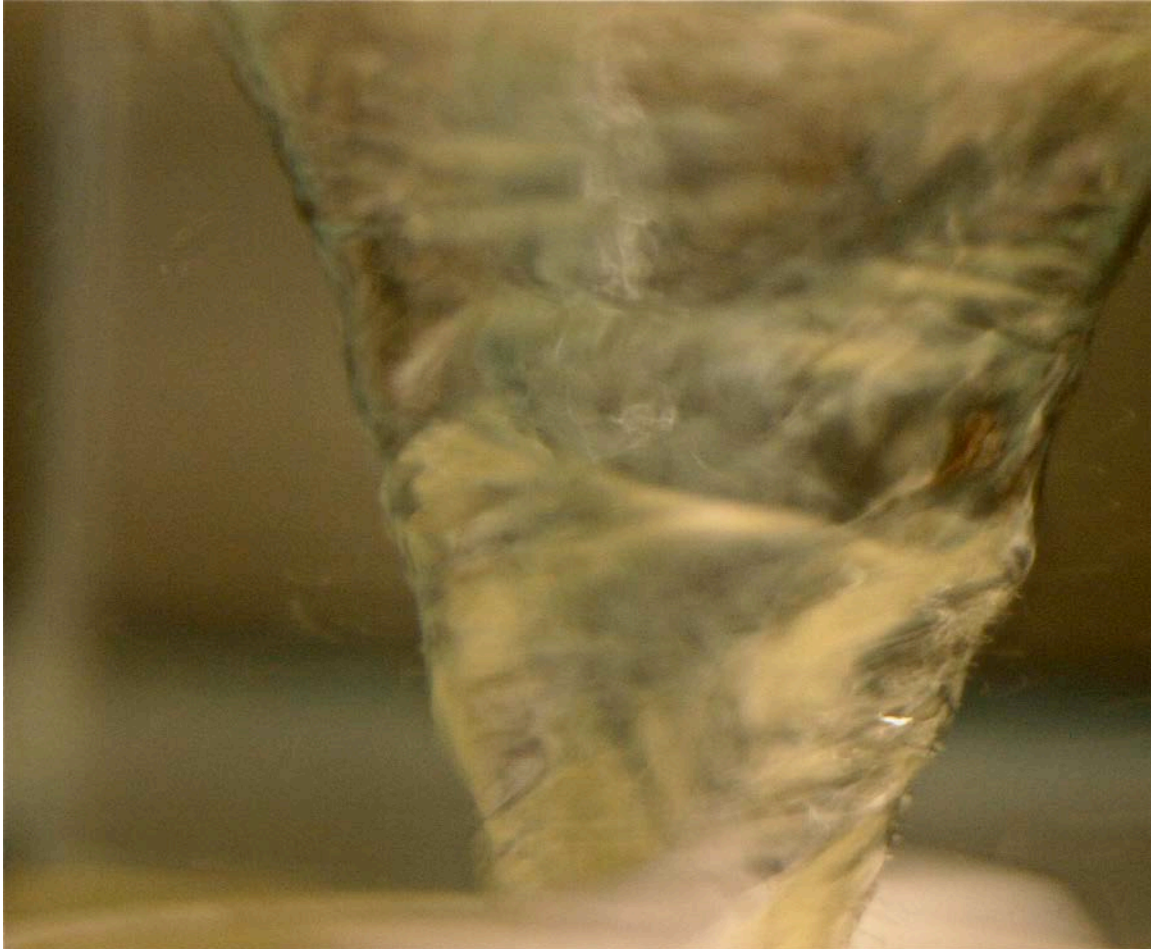


# Flow Visualization



## “Whirlpool”

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By:

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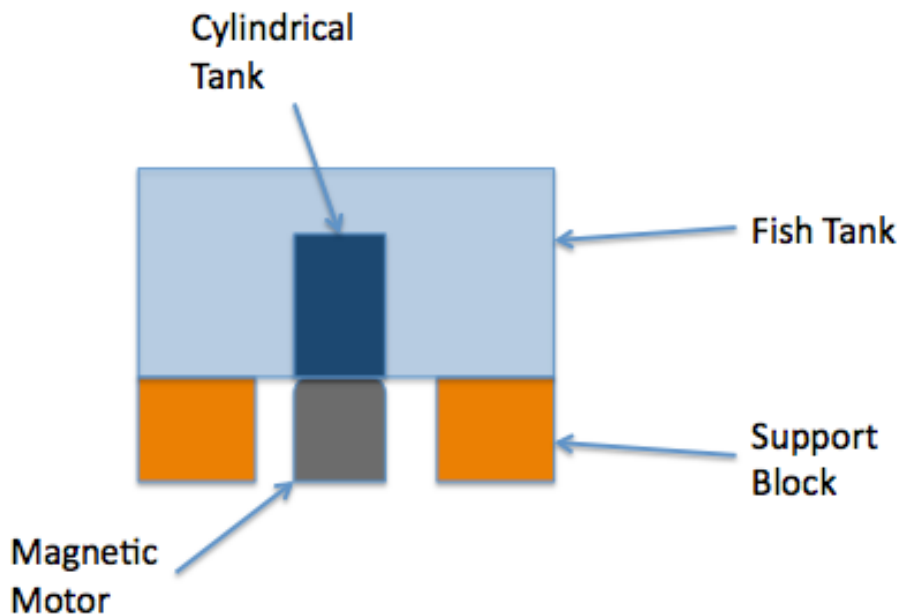
Kristopher Tierney, Lael Siler, and William Derryberry

The whirlpool displayed on the title page was created in a controlled environment with the aid of a magnetic stirring mechanism. Our group wanted to create a whirlpool that would last long enough for us to effectively photograph it and that is what we did. Whirlpools occur in our everyday lives in many different ways and are easy to recognize. They are the result of fluid swirling around a central axes and can occur in the air, like a dust devil, or in the water, like a sink or bathtub.

This image was created with the use of a white background poster, support boxes, magnetic motor, magnetic stirring rod, tap water, a rectangular 10 gallon fish tank, and a smaller cylindrical tank. The smaller cylindrical tank was placed inside the fish tank and both were filled with the tap water. The reason for two tanks was because the cylindrical tank had draining holes in the side and was therefore not able to hold water on its own. The circular perimeter of the cylindrical tank allowed for a more defined whirlpool then a rectangular tank. This is because rectangular tanks have sharp corners that resist circular fluid flow.

With the two tanks filled with water we then placed the magnetic stirring rod inside the cylindrical tank. It sank to the bottom of the tank and was positioned in the middle. Next we raised the two tanks 6" above the surface we were working on and placed the two support blocks under the tanks to provide enough clearance for the magnetic motor. The magnetic motor was placed directly under the fish tanks and the magnetic stirring rod. The motor is what drove the circular motion of the rod. The complete set up is displayed in figure 1 and 2.

## Side View



*Figure 1.*

## Top View

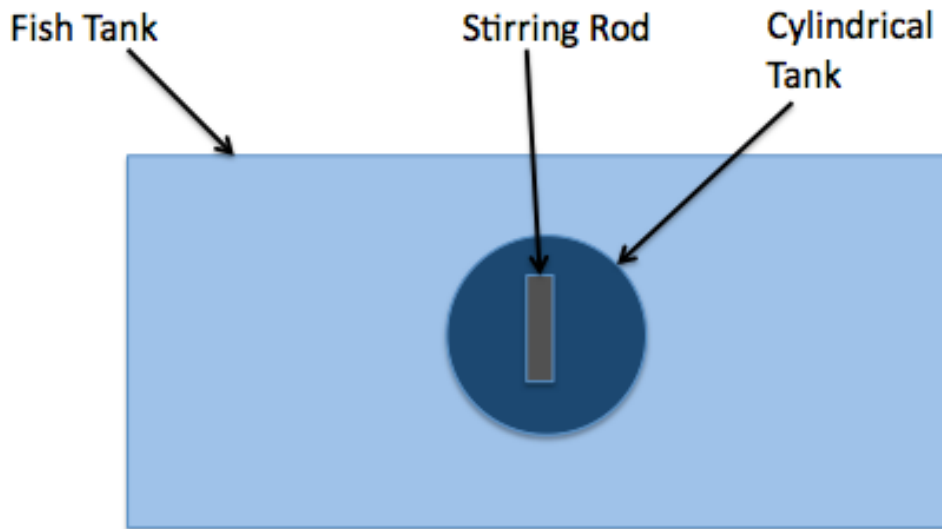


Figure 2.

The 10 gallon tank was 2' X 1' X 1' which the cylindrical tank was 1' tall and had a 6" diameter. The stirring rod was approximately 3" long. This resulted in the whirlpool with a diameter of 2" at its widest part. The whirlpool formed due to the circular motion of the stirring rod. The rod placed a force on the water accelerating it the most near the edges. This is because a object moving circularly has the fastest speed at the ends and slowest near the center. I would estimate that the water at the edges was moving one foot per second.

This image was taken with a Canon EOS Rebel in sport mode. This gave a shutter speed of 1/50 which was sufficient to reduce motion blur. The lens was positioned at the same level as the fluid 2 feet from the 10 gallon tank. The rest of the specifications are shown below:

Dimensions: 3072 x 2048  
Device make: Canon  
Device model: Canon EOS DIGITAL  
REBEL  
Color space: RGB  
Color profile: Camera RGB Profile  
Focal length: 50  
Alpha channel: No  
Red eye: No  
F number: 1.8  
Exposure time: 1/50

This image was then post processed in iPhoto. I adjusted the levels to increase the contrast and also boosted the color using the color booster effect. Finally I used the definition slider bar to increase the clarity. This helped bring out the details on the sides of the whirlpool and helped the picture to look more focused.

I think this image reveals to complexity and beauty that can be found in nature. This whirlpool dances around in simple circles yet the sides of it are full of patterns that can help us understand all the forces in play. So many things effect the motion of the water, even if it is in tiny ways that it would be impossible to reproduce this flow exactly. That is festinating to me and is what makes science to endearing.