Swirling Milk

Procedure:

1. Always wear safety goggles.

2. Rinse the graduated cylinders and the two petri dishes in the sink.

3. Use graduated cylinder 1 to measure 20 ml of milk and pour it into the milk petri dish. Return the milk bottle to the ice water beaker.

4. Use graduated cylinder 2 to measure 20 ml of water and pour it into the water petri dish.

5. Add 1-2 drops of each food coloring to both dishes.  
   What happens?  
   Does the color act differently in the milk than the water?

6. Take a clean toothpick, and dip its end into the "detergent" bottle.

7. Carefully touch the center of each food color spot with the soapy toothpick.  Do not stir.  
   What happened to the color?

8. Rinse the graduated cylinders and the petri dishes in the sink.
How does milk react with detergent?

A Closer Look:
When you first place the drop of food coloring into the liquids, it mixes more with the water than the milk. This is because the food coloring is water-based and mixes well with water. Milk is fatty, so the water-based coloring does not mix well with it.

Multiple things cause the colors in the milk to swirl. Detergent reduces the surface tension of the milk by dissolving the fat molecules. This causes the milk outside the soap spot to have a higher surface tension, so it pulls away from that spot. The food coloring moves with the milk molecules, streaming away from the soap spot. Detergent can bind to both fat molecules and water molecules, so it helps the milk and food coloring mix together. As the detergent becomes evenly mixed with the milk, the swirling slows down and eventually stops.

Water has a lower surface tension, so you might see the color spread the first time you touch the detergent to it, but after that the water and food coloring are fully mixed and do not swirl any more.