

Claude Monet Science Experiment: Milk Fat Color Mixing

Interaction of polar molecules within a colorful environment using the principles of polarity and simple color mixing

Inspired by the Claude Monet, *Charing Cross Bridge* artwork at the SBMA



Image Credit: Claude Monet, *Charing Cross Bridge*, 1899. Oil on canvas. Bequest of Katharine McCormick in memory of her husband, Stanley McCormick.

EXPERIMENT

1. Pour enough milk in the dinner plate to completely cover the bottom to the depth of about 1/4 inch. Allow the milk to settle for one minute.
2. Add one drop of each of the four colors of food coloring - red, yellow, blue, and green - to the milk. Keep the drops close together in the center of the plate of milk.

MATERIALS:

Milk (whole milk)
Dinner plate
Food coloring
Dish-washing soap
Cotton swabs

tip of the cotton swab to the center of the milk. It's important not to stir the mix. Just touch it with the tip of the cotton swab. Go ahead and try it. Did anything happen?

4. Now place a drop of liquid dish soap on the other end of the cotton swab. Place the soapy end of the cotton swab back in the middle of the milk and hold it there for 10 to 15 seconds. Look at that burst of color! It's like the 4th of July in a bowl of milk!



3. Find a clean cotton swab for the next part of the experiment. Predict what will happen when you touch the

5. Add another drop of soap to the tip of the cotton swab and try it again. Experiment with placing the cotton swab at different places in the milk. Notice that the colors in the milk continue to move even when the cotton swab is removed. What makes the food coloring in the milk move?

What is the Science behind this Art?

Milk is mostly water but it also contains vitamins, minerals, proteins, and **tiny droplets of fat** suspended in solution. Fats and proteins are sensitive to changes in the surrounding solution (the milk). The secret of the blending colors is the chemistry of that tiny drop of soap. Dish soap, because of its **bipolar characteristics** (nonpolar on one end and polar on the other), weakens the chemical bonds that hold the proteins and fats in solution. The soap's polar, or hydrophilic (water-loving), end dissolves in water, and its hydrophobic (water-fearing) end attaches to a fat globule in the milk. This is when the fun begins.

The molecules of fat bend, roll, twist, and contort in all directions as the soap molecules race around to join up with the fat molecules. During all of this fat molecule gymnastics, the food coloring molecules are bumped and shoved everywhere, providing an easy way to observe all the invisible activity. As the soap becomes evenly mixed with the milk, the action slows down and eventually stops.

*Prepared by Janey Cohen and Pat Bixler
Crane Country Day School Science Department and
adapted from stevespanglerscience.com*

