

# What Makes Up Milk?

**Engage K-6 grade students with this fun activity that demonstrates the sensitivity of fats and proteins in milk!**

## **Introduction:**

Milk is mostly water but it also contains vitamins, minerals, proteins and tiny droplets of fat suspended in solution. The following three lessons demonstrate how fats and proteins are sensitive to changes in the surrounding solution (the milk).

**Grade Level:** 4-Middle School Reading and Science

**Objective:** After completing these activities, students will understand how sensitive fats and proteins are to new substances and how this sensitivity helps control the molecules in milk so different products can be made from milk.

## **Suggested Reading Materials:**

IAITC [Specialty Crop](#) and [Dairy](#) Ag Mags

*A Cow, a Bee, a Cookie and Me* by Meredith Hooper (ISBN:0-7534-5067-4)

*Clarabelle: Making Milk and So Much More* by Cris Peterson (ISBN-10: 1-59078-310-7)

## **Milk... An Explosion of Color!**

When you add soap to milk, the weak chemical bonds that hold the proteins in the solution are altered. It becomes a free-for-all! The molecules of protein and fat bend, roll, twist and contort in all directions. The food coloring molecules are bumped and shoved everywhere, providing an easy way to observe all the invisible activity.

At the same time, soap molecules combine to form a *micelle*, or cluster of soap molecules. These micelles distribute the fat in the milk. This rapidly mixing fat and soap causes swirling and churning where a micelle meets a fat droplet.

Milk is mostly water, and has surface tension like water. The drops of food coloring floating on the surface tend to stay put. Liquid soap wrecks the surface tension by breaking the cohesive bonds between water molecules and allowing the colors to zing throughout the milk. What a party!

# Milk... An Explosion of Color (cont.)

## Materials:

Milk (whole or 2%)

Dinner plate

Cotton swabs

Food coloring (red, yellow, green, blue)

Dish-washing soap (Dawn brand works well)

## Directions:

1. Pour enough milk in the dinner plate to completely cover the bottom. Allow the milk to settle. There should be no ripples in the milk before starting this activity.
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.
3. Find a clean cotton swab for the next part of the experiment. Predict what will happen when you touch the 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.
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.
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.

## Review

1. Describe how the milk reacted when you first added the food coloring drops (step number 2).
2. What did you predict would happen when you touched the cotton swab to the center of the milk, why (step number 3)? Explain what actually happened.
3. Explain what happened when the soapy cotton swab was held on the surface of the milk.
4. What happened when you placed the soapy cotton swab in different locations of the plate? Would this work with the plain cotton swab, why or why not?
5. What makes the food coloring in the milk move?
6. Explain why this activity would or would not work with regular tap water.

**Exercise adapted from Kitchen Chemistry:**

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