



## WEEK 1: DYES & DETERGENTS

Let's start camp with a fun activity that everyone's familiar with - painting! Not sure that sounds "science-y" enough? Well, we're not going to be using brushes and paper, we'll be using chemistry to paint on milk!

When you mix milk with food coloring and a drop of soap, some pretty exciting things happen. Be prepared to amaze your friends and family with this dynamic science experiment! It might seem like magic, but it's science!

### Let's get started!

Clear a space on the kitchen counter, your desk, or the picnic table in the backyard. Put on some clothes that can get messy, and get ready to paint without a canvas or brush!

### Hypothesis

Before starting an experiment, scientists first make a hypothesis. Do you know what a hypothesis is? Right!

A hypothesis is a guess or prediction about what you think is going to happen in the experiment.

What do you think will happen when you add drops of the food coloring to the milk? Will the two liquids mix?

What do you think will happen when you add dish soap to the mixture?

Record your hypotheses on your Lab Worksheet.

### Instructions

1. Put on your safety goggles, if you have them. If you wear glasses, that works, too!
2. Place a wide, shallow bowl or plate on a flat work surface. Carefully pour some milk into the bowl.
3. Add several small drops of food coloring to the milk.  
(We used red, blue, yellow and green in our experiments.) Space the drops out around the bowl.
4. Touch the tip of the toothpick to a drop of dish soap and then lightly touch the toothpick to one of the colored drops. What did you see?!
5. Now touch the other colored drops with the dish soap. Did the colors move?
6. Continue to touch the colored drops to make different patterns.
7. Draw your results. Congratulations, Camper, you painted with milk!

### What's happening?

You probably noticed that the drops of food coloring sat on the surface of the milk and did not mix in. This is because milk contains fat. Food coloring is water soluble, which means it mixes well with water, but not with fat. For this reason, the food coloring sits on top of the milk instead of mixing in, or dissolving, like it would in plain water.

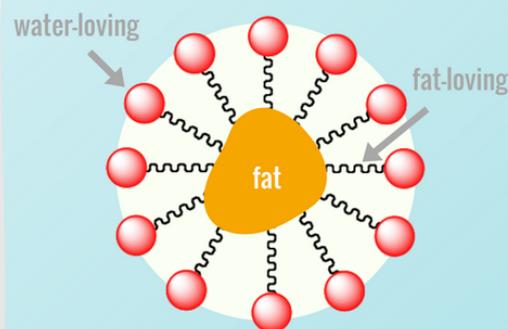
So what caused the crazy color contortions when you touched the dish soap to the food coloring? To answer this, we need to understand a bit about the chemistry of soap. Soap molecules are made up of two different ends. One end loves water (hydrophilic) and the other end hates water (hydrophobic), but loves fat. The hydrophobic, fat-loving ends stick to the fats, surround them, and trap them.

### Supplies

- safety goggles
- wide bowl or plate
- whole milk
- food coloring
- dish soap
- toothpick



### Think about it...



Two different ends of a soap molecule trap fat.

In our experiments, as the dish soap molecules race around trapping the fat molecules in the milk, they push and shove the food coloring molecules all around the bowl. The food coloring allows us to observe these microscopic, molecular gymnastics.

## Design your own experiments

### EXPERIMENT 2: SOAP OR SHAMPOO?

What do you think would happen if you used shampoo instead of dish soap? What about hand soap? Now experiment to find out if you were right!

### EXPERIMENT 3: REMOVE THE FAT

What do you think will happen if you use 2% or skim milk? What about cream? Will they give you the same result as whole milk? Try it!



## Why does it matter?

Can you think of ways that soaps and detergents are important in your everyday life?

- Have you ever tried washing your hair with only water and no shampoo? It doesn't work very well. The detergent in shampoo breaks up the dirt and grease in your hair.
- Think about taking your car through an automated car wash. In addition to all the big brushes and water, the machines also squirt out a lot of sudsy soap to break up the oils and dirt that collect on your car.
- In the garden, some people use a mixture of water and mild soap to remove insects like aphids from their plants. How soap kills insects is not totally understood, but it's thought that it breaks down their cell membranes.

## You own it!

### Test yourself: True or False

1. Food coloring dissolves well in milk.
2. Hydrophilic means "water-loving".
3. Washing your hair without shampoo is a good way to get it really clean.

Answer Key:  
1. False. Food coloring is water soluble and does not dissolve well in fatty milk.  
2. True.  
3. False. Shampoo is needed to break up the dirt and grease in your hair.

### Fun Fact



Laundry detergents, like many cleaning products, are bases. They have a high pH value.



To learn more about acids, bases and the pH scale, check out Yellow Scope's newest kit.

We hope you had fun learning about detergents and how they help us in grabbing grease! Next week at Camp Yellow Scope, we'll try some new tricks with soap, pennies, and drops of water. Intrigued? Check back next Tuesday for new experiments and more summer science fun!

**We'd love to see how your experiments turned out!**  
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