

DIY SCI: Milk-A-Delic Colors

What is it?

Did you know that milk changes colors??? No no I don't mean when it gets spoiled...unless we're spoiling it with some science. But then again spoiling it with science isn't such a bad thing now is it? If you're a bit confused, don't worry we've got you covered. During this DIY we're going to play with some milk and make some milk-a-delicious colors. Ready to wow?! Let's begin!



What you'll need (for a group of 20 scholars)

- Milk (1 bottle per group of 5)
- Q-tips (1 per scholar)
- Bowl (1 per scholar)
- Liquid Dish soap (1 bottle per group)
- Food coloring (1 pack per group of 4-5)

How to make it Milk-A-Delic:

1. Pour just enough milk in the bowl to completely cover the bottom to a depth of about $\frac{1}{4}$ of an inch and wait for the milk to become still
2. Add one drop of each of the four colors of food coloring to the milk and be sure to keep the drops close together in the center of the plate of milk.
3. Now take a Q-tip and just hold it for a second and PREDICT what you think will happen when you touch the tip of the q-tip in the center of the milk
4. Now dip that end of the q-tip in the center of the milk but DO NOT MIX IT AROUND. What happened?
5. Now place a drop of the dish soap on the other end of the q-tip
6. Place the soapy end of the q-tip back in the middle of the milk and hold it there for 10-15 seconds

What do you notice?

- Did your bowl start to look like the 4th of July fireworks just happened in your bowl? COOL RIGHT!?!
- FOR FUNSZIES: 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?

Milk is mostly water, but it also contains vitamins, minerals, proteins, and tiny droplets of fat suspended within its solution. Fats and proteins are sensitive to changes in the surrounding solution, which in this case is the milk.

The secret of the bursting colors is in the chemistry of that tiny drop of soap. Like other oils, milk fat is what scientists call a non-polar molecule. That means that it doesn't dissolve in water. But, when soap is mixed in, the non-polar (hydrophobic) portion, the portion that doesn't dissolve in water, of the soap structures break up and collect the non-polar fat molecules. Then the polar surface of the soap structure (hydrophilic) connects to a polar water molecule with the fat held inside the soap structure. Thanks to the soap connection, literally, the non-polar fat can then be carried by the polar water. This is when the milk-a-delicious magic happens.

The molecules of fat move in all sorts of directions as the soap molecules move around to join up with the fat molecules. During all of this dancing done by the fat molecule, the food coloring molecules are shoved everywhere, which makes it easy for us to observe all of the invisible movement. As the soap mixes evenly with the milk, the action slows and eventually stops. Because there's more fat to combine with all of those soap molecules milk with a higher fat content produces a better EXPLOSION of color.

