Amaze Your Brain *at Home!*

EXPERIMENTS ALL AGES

MILK MOLECULES on the Move!

MATERIALS

- Whole milk
- Food coloring—multiple colors
- Dish soap
- Cotton swabs
- Dish or other shallow container
- Extension:
  - Additional liquids to test (such as skim milk, water, vegetable oil)
  - Additional detergents to test (such as hand soap, laundry detergent, shampoo)

INSTRUCTIONS

1. Carefully pour some milk into the dish so that it just covers the bottom.
2. Add one or two drops of each color of food coloring close together in the center of the milk.
3. Dip a cotton swab in dish soap. What do you think will happen if you touch the soap to the milk?
4. Gently touch the soapy cotton swab to the center of the milk. Hold the swab still for 10-15 seconds. Do not stir! What do you see happening?
5. Experiment with placing the cotton swab at different places in the milk. Remember to dip the cotton swab in soap each time!
6. Extension: Try the procedure again with a different liquid or a different detergent. What do you think will happen this time?

WHAT'S HAPPENING?

Milk contains many types of molecules, including water, proteins, and fats. The water and protein molecules are what chemists call polar, meaning they are positively charged in some places and negatively charged in other places. The fat molecules are what chemists call nonpolar, meaning that they don't carry an overall charge.

Dish soap molecules are bipolar- one end of the molecule (the head) has a negative charge, while the other end (the tail) does not have a charge.

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MILK MOLECULES on the Move! (CONT.)

MILK MOLECULES

- Water – polar
- Proteins – polar
- Fats – nonpolar

DISH SOAP MOLECULES

- Head – polar
- Tail – nonpolar

POLAR AND NONPOLAR MOLECULES

Polar molecules like to interact with each other, but they do not like to interact with nonpolar molecules. Likewise, nonpolar molecules like to interact with each other, but they do not like to interact with polar molecules.

When you add dish soap to milk, something exciting happens. The polar parts of the dish soap molecules want to be near the polar water and protein molecules in the milk- but the nonpolar parts want to be near the nonpolar fat molecules. This leads to a magnificent dance of twisting and turning molecules to get everyone aligned with the correct partner. The food coloring molecules get caught up in all the excitement, which is what makes the colors move around in the dish!

Try experimenting with different liquids or detergents. What do the results tell you about the molecules involved?