Milk on the Move: Biochemistry of Milk

Time: 30 Minutes **Skill Level:** Beginning (age 9-11), Intermediate (age 12-14)

Background

What is Science Inquiry?

Children are natural scientists. From a very early age they explore the world, ask questions and seek answers. This journey of exploration and discovery is Science Inquiry. Science Inquiry helps young people understand their environment, solve problems and gain knowledge about scientific ideas and processes.

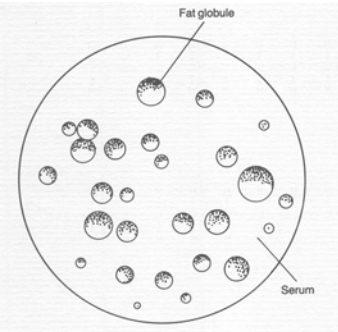
Science and Engineering Practices Youth Should Become Familiar With Are:

1. Asking questions
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations
7. Obtaining, evaluating, and communicating information

FYI-All liquids have a property called surface tension, which is due to the cohesive forces of the liquid's molecules. Pour some water in to a clear glass with a smooth inside surface. Bend down so your eyes are on the same level as the top of the water in the glass. The water will appear to rise up the side of the glass; this is surface tension.

Milk is mostly water. The amount of water ranges from 85.5% to 88.7%. Milk also contains vitamins, proteins and fats. The fats are broken into tiny pieces called globules which are spread evenly throughout the milk when it is homogenized.

Dish soap works to clean dishes because it is bipolar. The molecules have a hydrophilic or "water loving" end and a hydrophobic or "water-fearing" end. The hydrophobic end attaches to fat. When placed in milk soap attaches to the fat globules. When the dish soap is gently introduced to the center of the bowl of milk several things happen at once. The soap reduces the surface tension of the milk freeing the food color to flow. Soap also reacts with both the proteins and fats in the milk; this sets the molecules in motion.



Watch the Video: http://oregon.4h.oregonstate.edu/science-engineering-and-technology

Materials List

A small bowl for each liquid to be tested	Fat-free milk
3 colors of food coloring	2% milk
Dish soap	Heavy cream
Tooth picks	Chocolate milk
Room temperature whole milk	Water

Discuss….What do the students know about milk? Have they ever cooked or made anything using milk? What are some of milk's unique properties? Use the Background information to fill in any gaps in the student's understanding.

Predict….What do the students think will happen when the dish soap comes in contact with the milk? Will this reaction be the same or different in different kinds of milk?

Experience "What to Do"- What is the plan for the investigation?

Pour a cup of milk into the bowl and let settle.
Place three drops of each color into the milk making sure they do not overlap each other.
Observe the food color before proceeding with the activity.
Dip the toothpick into the dish soap. Touch the soap coated toothpick to the milk in the middle of the bowl. Observe.

Share …Ask students to describe what they observed happening after each drop of food coloring was added to the bowl of milk. Did the fat content of the milk change how the food color behaved BEFORE the soap was added? (Food color is less dense than milk with a fat content; it floats on the surface.) Ask students to describe what they observed when they first touched the milk with the soap covered toothpick. Ask students to describe what they observed after the dish soap being introduced.

Reflect …**Analyze and interpret the data and results. Discuss among the group.**
What other questions do you have now that you have conducted this experiment?
Will other types of milk react the same? (chocolate milk, fat-free milk, heavy cream?) Repeat the experiment using various types of milk.
Does the temperature of the milk make a difference? Repeat the experiment using cold and hot (not boiled or scorched) milk.

Generalize …**to real world examples. Construct explanations.**
Which type of milk created the most movement? Why?
What temperature of milk created the most movement? Why?

Apply …**outside the classroom or club meeting.**
How can we use the information we just learned in cooking?

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