

DO TRY THIS AT HOME: a Jump Series

STEAM HOME EXPERIMENT



The most important scientific tools are not expensive or fancy. And they are something you already possess! We're talking about your natural curiosity, your sense of exploration and your love for the unknown. With these tools, you can turn your world into your very own science lab every day. To get you started, Jump Simulation has created mini-lessons you can do at home based on the popular Jump STEAM Mini-Med program. Have fun and make sure to ask your parents for help if you need to.

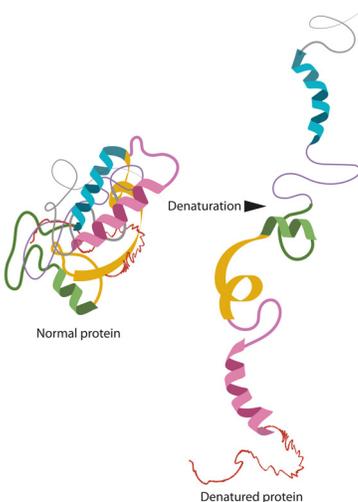
PROTEINS AND ACID

QUESTION:

Can we turn ordinary kitchen ingredients like milk and vinegar into plastic items?

ANSWER:

Yes! Proteins are the working units of your body. Proteins can provide structure, recognize and transport other molecules and even move your muscles. In milk, there are two main proteins, casein (commonly referred to as curds) and whey.



Proteins are made up of long chains of molecules called amino acids. The chains are wound together to form a very specific shape, but you can think of them like a spool of yarn. Sometimes when a protein comes into contact with an acid, it causes the protein to denature or unwind. Different proteins are easier or more difficult to unwind than others. You can think of this like pulling the yarn out of the spool.

Sometimes, after a protein is denatured, it will start to wind back together but it cannot reform the orderly structure it originally had. You can think of this like wadding the unwound yarn up. This is what happens when an acid, like vinegar, is added to milk.

When vinegar is added to milk it causes only the casein protein to denature. The whey proteins remain wound together. After the casein proteins denature, they stick together and form very long chains. As the chains grow and stick together, we start to see them as "curds". The denatured casein clumps have another unique property. When dry, the casein forms a hard plastic-like material!

➔ **WHAT YOU'LL NEED:** 2% milk (1 cup), vinegar (4 Tbsp.), cookie cutter or mold, stirring stick, paper towels, cups (2), paper plate



1 OBSERVE: Denatured casein proteins or curds can be used to create a type of plastic.

2 QUESTION: Can we prove this by separating the casein proteins from the whey proteins in milk?

3 HYPOTHESIS: We can use vinegar to denature the proteins in milk and create a plastic-like material.

4 EXPERIMENT

- Optional: Warm milk in microwave (20-30 sec)
- Mix vinegar into milk and stir together
- When clumps begin to form, strain the casein curds by pouring through a paper towel into the second cup
- Use fresh paper towels to squeeze casein curds and remove as much of the liquid as possible
- On the paper plate, press the casein pieces into the desired shape using a cookie cutter or mold, or create your own shape by hand
- Leave your casein creation to dry (24-48 hrs)
- For extra durability, once casein creation is dry, apply a coat of mod podge
- Special Effect:** If you want your casein to glow under a black light try adding the ink from a highlighter to the vinegar before step B, or painting your creation with laundry detergent before step G.

5 COLLECT, ANALYZE AND REPORT DATA

- How did the appearance of the milk change when you added the vinegar?

SOMETHING TO CONSIDER

Vinegar is an acid, but it is not the only acid you can find in your house. Many fruit juices are acidic too. Do you think you could perform this experiment using lemon juice? What about orange juice? Test it out for yourself!

WANT MORE? Take a look at all of the Jump STEAM courses we have coming up at jumpsimulation.org/STEAM

Made possible through the generous support of

