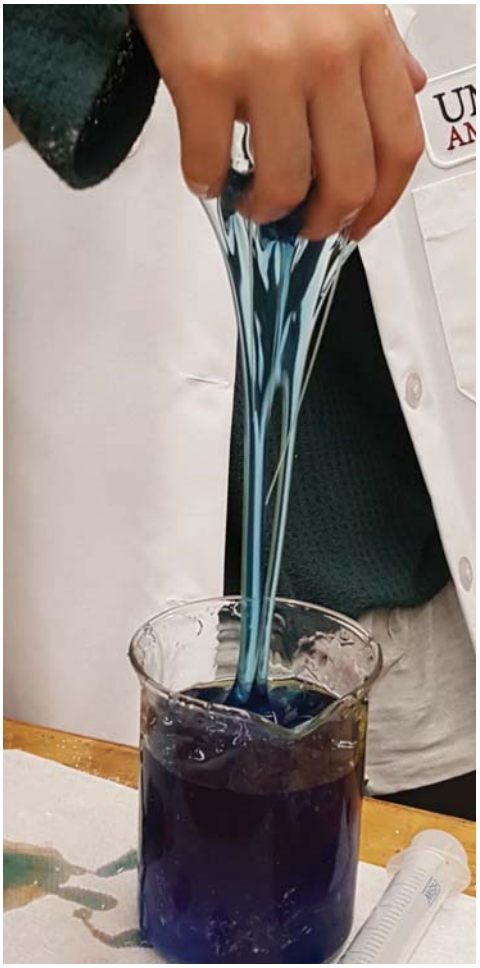
Super Slippery Elastic Liquid Goo

The liquid in this experiment is so much fun we ran out of adjectives. Here we will experiment with a liquid that stretches like a rubber band, flows like a liquid and feels like a super slippery slimey goo. Put that all together and we have a non-Newtonian viscoelastic liquid which presents properties of a viscous liquid and properties of an elastic solid. Liquids with similar properties are present in many common houshold objects like dish soap, shampoo, latex paint, and toothpaste. They can also be found in a number of foods and even bodily fluids like saliva and snot.

What you will need to get started

- Gravi-Goo powder from Steve Spangler Science
- Water
- Food coloring
- Two 0.5L or 1L bottle with screw tops
- Clear plastic 8oz cups
- Probes – Plastic spoons, scissors, fingers
- Clean up - Paper towels and a little water



Making the Goo

1. Mix 5g of the Gravi-Goo with 150ml of water and let it stand for an hour.

2. Add some food coloring for fun.

3. The super slippery elastic liquid goo or SSELGoo for short can be stored in the bottles.

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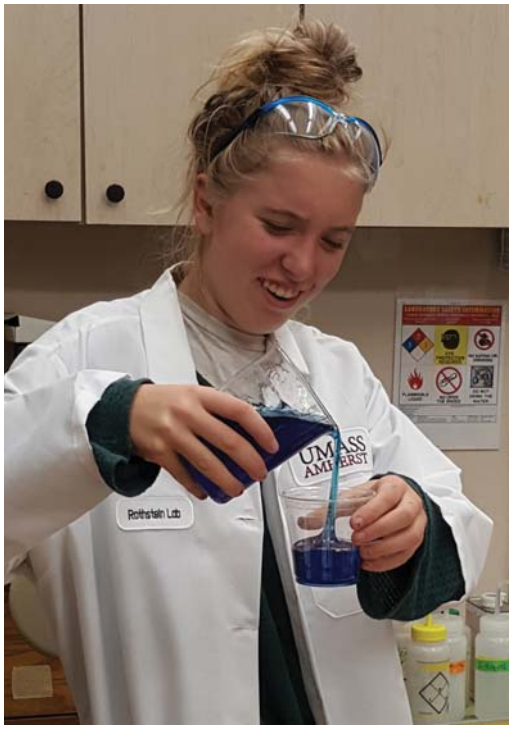
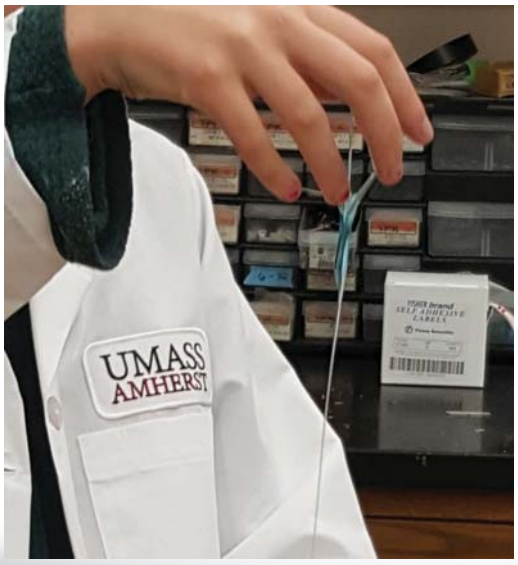
K12 Outreach Activities

Science is FUN!

Let's experiment!



1. Stick a probe into the SSELGoo. Swirl it around, pull it out of the liquid. Is it sticky? How does if feel between your fingers? Try to get it off the probe? Does it come off easily? Try shaking it hard. Does this remind you of anything? Think gross.
2. Place some of the SSELGoo into a plastic cup. Now transfer this SSELGoo from one cup to another. What do you notice? What happens if you try to stop pouring?
3. Can you maintain a long continuous stream of the SSELGoo between two cups or does it break into drops? Would the same be possible with water? Try it with water and see.
4. Using a pair of scissors, cut this long stream of SSEL-Goo as you pour it. What do you see? What happens to the upper part of the stream? How about the lower part?
5. Now transfer the SSELGoo as fast as you can from one cup to another. Is the goo just a huge blob as it moves quickly into the cup? Why is this happening?



More experimental fun

1. Non-Newtonian liquids like this slippery goo are actually found in many places around you. Can you think of a few examples? What are some of your favorite slimy stuff?
2. Try playing with a few non-Newtonian liquids at home. For example, take some liquid soap into your hands. As you squeze the bottle, it comes out just like the slippery goo you see here but rubbing the soap between your hands transforms it into a liquid that is quite easy to spread.

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How does it work?

The SSELGoo is a unique material composed of a polymer called polyacrylamide which can be easily dissolved in water. Polymers are very large molecules which can have thousands or even millions of carbon molecules connected together to form a long chain. Think about a piece of spaghetti or a length of rope. When the solid polymer powder is added to water, the polymers behaves like sponges as they suck up the water. In the process, the polymer mixes into the water, expands throughout the solution becomes entangled with itself like the spaghetti on your plate. If you deform the polymer solution slowly, the polymer chains can slowly slide past each other as they unentagle and the polymer solution tends to act like a very viscous (thick) liquid. As you deform the polymer solution more quickly, the polymer chains align with the flow making the solution less viscous (thick) and accounting for the change in how it feels. If you deform the polymer solution too quickly, the polymer chains don't have time to slide past each other, but insteady they deform and stretch like molecular rubber bands and make the polymer solution act like an elastic solid. This is where the name viscoelastic fluid comes from. It is part viscous liquid and part elastic solid!

This SSELGoo can also be classified as a non-Newtonian fluid. Viscosity is a measurement of the resistance to flow when a shear flow is applied. Newtonian fluids have a constant viscosity that depends only on their composition. Examples ranging from low viscosity to high include: air, water and molasses. Non-Newtonian fluids, like this polymer solution, have a different viscosity based on the rate at which you deform or probe them. Additional examples of non-Newtonian fluids include: quicksand, shampoo and mucus.