FAMILY GUIDE OF ACTIVITIES & FUN THINGS TO DO AT HOME

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Strange Matter is produced by the Ontario Science Centre and is presented by the Materials Research Society, a not-for-profit scientific association founded in 1973 to promote interdisciplinary goal-oriented research on materials of technological importance. Membership in the Society consists of more than 12,500 scientist from industry, government, academia and research laboratories in the United States and nearly 50 other countries. The Materials Research Society has received funding from the National Science Foundation, Alcan, Dow Chemical, Ford Motor Company and 3M Foundation in conjunction with its presentation of Strange Matter.

HANDS-ON EXPERIMENTS TO DO WITH MOM, DAD OR ANOTHER ADULT

Here are a few activities to help you think about materials in new ways!

YOU WILL NEED

- ❑ Calcium fortified orange juice
- ❑ Gaviscon™ liquid antacid
- ❑ Bowl

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- ❑ Plastic squeeze bottle with narrow spout (a clean, empty mustard bottle will work)
- ❑ Pencil
- ❑ Paper towels

Pour about a cup of orange juice fortified with calcium into a bowl. Pour the Gaviscon™ liquid antacid into the squeeze bottle. Add a squirt of the Gaviscon™ to the orange juice. Watch what happens. Use a pencil to "catch" your gooey worms and place them on the paper towels. (**Don't eat these gooey worms.** Throw them in the garbage when you're finished playing. And don't forget to wash your hands after you've done any experiment.)

Flexible worms form instantly as the Gaviscon™ (a material called a polymer) reacts with the calcium in the orange juice. Polymers are the "building blocks" of plastics, Styrofoam, polyesters, adhesives and many other things in our material world, including many foods we eat. New bonds are formed between the chains of molecules so they can't slide and become rigid. The longer the worms stay in the calcium solution, the more rigid they become.

YOU WILL NEED

- ❑ 1 cup of cornstarch
- ❑ 1/2 cup of water
- ❑ Large bowl
- ❑ Shallow pan (like a cookie sheet with sides, or a cake pan)
- ❑ Food coloring (optional)
- ❑ Spoon

Pour the cornstarch into the bowl. Start adding water and mix with your hands until you get a mixture about as thick as mayonnaise. Add food coloring if you want. Touch the goo. Does it feel wet or dry? Squeeze some in your hand to make a lump. Is the surface wet or dry? Roll some in your hands to make a ball. Now stop rolling and lift your hand up. What happens? Stir it slowly. Now stir it quickly. Bang it with a spoon. Pour some goo into the flat cake pan. Now slap it with your hand. Does it splatter?

Is this Crazy Goo a liquid? Or is it a solid?

Your Crazy Goo is something called a "non-Newtonian fluid". It doesn't have the usual

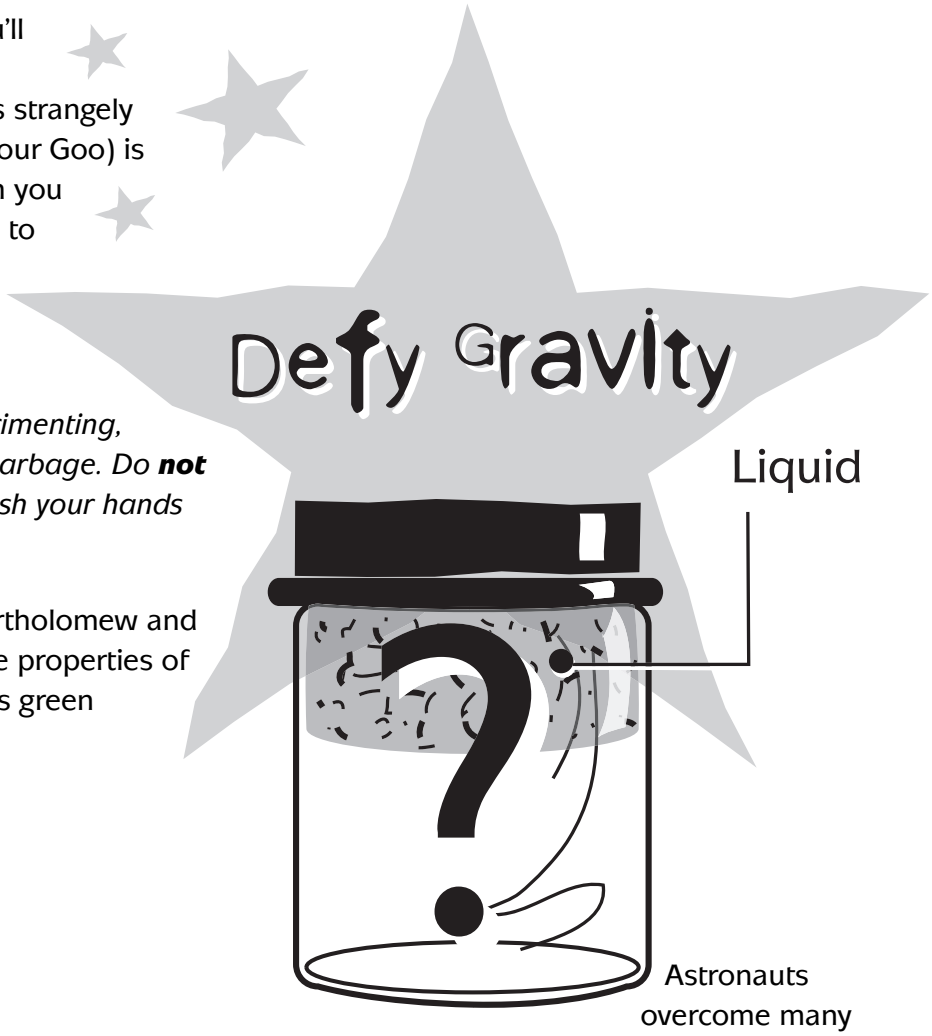
properties of a liquid like water. When you slap it with your hand, it doesn't splatter.

Quicksand is like your Crazy Goo. The faster you move, the more stuck you'll become. Another "non-Newtonian fluid" that behaves strangely (but not in the same way as your Goo) is ketchup! What happens when you try shaking the ketchup bottle to get the ketchup out? Does it come out faster or slow down?

When you have finished experimenting, throw your Crazy Goo in the garbage. Do ***not*** *rinse it down the sink. And wash your hands after experimenting.*

Read the Dr. Seuss book, "Bartholomew and the Oobleck" and compare the properties of your Crazy Goo with the King's green slime.

MAKE YOUR OWN FERROFLUID



Astronauts overcome many challenges in space.

Imagine trying to control the flow of a liquid in zero gravity. What problems would you encounter?

Here on earth, gravity can be big a problem. Your challenge is to defy gravity! Discover a way to hold a liquid in place at the top of a jar (not at the bottom where it usually stays because of gravity) when the jar is right side up.

You will combine solids and liquid to produce a new material and to investigate the properties and performance of the new material you have produced. And you'll discover how strange

matter can solve problems for astronauts in space.

YOU WILL NEED

- ❑ Baby oil
- ❑ Extra-fine steel wool (without soap)
- ❑ Small jar with tight-fitting metal lid
- ❑ Scissors
- ❑ Teaspoon
- ❑ Non-metal stirring stick (like a Popsicle stick)
- ❑ A strong magnet
- ❑ Safety glasses

PROCEDURE

1. Place a sheet of paper on your table.

2. Use scissors and cut across the steel wool to make the tiniest particles possible.

3. Cut up enough steel wool fibers to make about a teaspoonful of particles.

4. Carefully use the paper as a funnel to pour your steel wool particles into the jar.

5. Add a small amount of oil to the jar, just enough to cover the steel wool particles.

6. Stir with a non-metal stirring stick, mixing the particles into the oil.

7. Put the lid on the jar. Make sure it is on tightly.

8. Hold the magnet near the side of the jar. Observe what happens.

9. Decide if you want to add more oil to make your mixture more fluid.

10. Move the magnet around and see what happens to the mixture.

11. Take the magnet away from the side of the jar and observe what happens to the mixture.

12. Slowly bring the magnet closer to the side of the jar.

13. Try the magnet at different locations and distances and observe the material inside the jar.

14. Occasionally shake the jar to stir up the mixture.

15. Use the magnet to create different effects.

16. Try adding more oil and/or more filings. Observe how this new mixture reacts to the magnet. Are there changes from your original concoction?

MORE FAMILY FUN

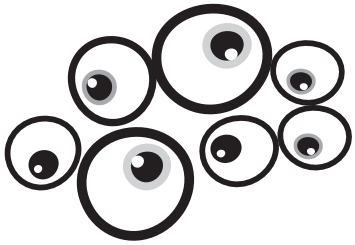
SOCK OF STUFF

Young children can use their “smart fingers”, (their sense of touch), to identify materials without looking at them! Fill a large clean wool sock with a few small objects made of different materials. For example, a Popsicle stick, a penny, a piece of sponge, some fleece fabric, a rubber band, etc. Have your child reach into the sock and touch all the objects (but don’t peek!). Then ask your child to use their “ smart fingers” to find a material that is stretchy. And then find something that is hard, something that is bendable, something that is squishy, something that feels cold, something that doesn’t feel cold, etc. Kids can also try to guess what each material is and what it could be used for. Examine the materials outside the sock, too!

SCAVENGER HUNT FOR MATERIALS

Look around you. Everything you see is made of something. That something is a material. Survey your home for materials! How many different materials can you find? Have a scavenger hunt looking for different materials. “I spy something that is stretchy.”

MATERIALS SCIENTIST’S EYES



Look around at all the different materials that make up our world. Instead of seeing the “object”, see the “materials” the object is made from. For example, a pencil is made up of wood, paint, lead, rubber, and metal. Why are the materials used chosen for each object? What are the properties that make those materials right for that object? Could the object be made using other materials?

OUR MATERIAL WORLD

Think of a material, (for example, rubber). Now imagine a world without that material. Take turns describing different scenarios about how life would be different without that material. What would we use for tires on cars and bikes? How would it change the “feel” of the ride?

BOOKS FOR KIDS AND PARENTS

BRYANT-MOLE, Karen. **Materials (Images)**. Parsippany, NJ: Silver Press, 1997.

COOPER, Christopher. **Matter**. London, Eng.: Dorling Kindersley, 2000.

GLOVER, David. **What is it made of?** London, Eng.: Dorling Kindersley, 2001.

GOLD, Carol. **Science Express: an Ontario Science Centre Book of Experiments**. Toronto: Kids Can Press, 1991.

GORDON, Maria and GORDON, Mike. **Fun with Materials**. Austin, TX: Raintree Steck-Vaughn, 1996.

HENCH, Larry L. **Boing Boing the Bionic Cat**. Westerville, Ohio: American Ceramic Society, 2000.

HENCH, Larry L. **Boing Boing the Bionic Cat and the Jewel Thief**. Westerville, Ohio: American Ceramic Society, 2001.

MURPHY, Pat, et al. **The Science Explorer: an Exploratorium Science-at-Home Book**. New York: Henry Holt and Co., 1996.

SEUSS, Dr. **Bartholomew and the Oobleck**. New York: Random House, 1949.

MOVIES / VIDEOS

Flubber, An absent-minded scientist invents a unique polymer that saves his school from financial disaster. Starring Robin Williams (1997).

Also, check out the original **Flubber** movies with Fred MacMurray, **The Absent-minded Professor** made in 1961 and **Son of Flubber** in 1963!

WEB SITES TO EXPLORE TOGETHER

STRANGE MATTER

The official Web site of the STRANGE MATTER EXHIBITION.

www.STRANGEMATTEREXHIBIT.com

THE CHALLENGE OF MATERIALS

This site features quizzes, a matching game, and lots of information about materials and materials science, including choosing the right material for the job and materials that have changed our lives.

http://www.sciencemuseum.org.uk/on-line/challenge/

ZOOM IN AND ZOOM OUT / POWERS OF 10

Start 10 million light years away from the Earth and zoom in through successive orders of magnitude until you reach the subatomic universe inside a single oak leaf - an amazing trip!

http://micro.magnet.fsu.edu/primer/java/scienceopticsu/powersof10/

MACROGALLERIA

Billing itself "a cyberwonderland of polymer fun", this site offers information on how and where polymers are used, how they are made, and how materials scientists study them.

http://www.psrc.usm.edu/macrog/index.htm

MICROWORLD: EXPLORING THE STRUCTURE OF MATERIALS

A Web site for older kids that includes biographies of materials scientists, profiles of kids interested in materials science, and close-up examination of materials such as Kevlar.

http://www.lbl.gov/MicroWorlds/

MICROSCAPE VIRTUAL LABORATORY
Take an extremely close-up look online at stuff from around your house − like a penny or the tip of a ball point pen.

http://www.msa.microscopy.com/MicroScape/MicroScapeVL.html