SPIN into AGRISCIENCE

Leader's guide

GROW NEXT GEN

OHIO SOYBEAN COUNCIL

THE OHIO STATE UNIVERSITY
COLLEGE OF FOOD, AGRICULTURAL, AND ENVIRONMENTAL SCIENCES

Contents

GROW NEXT GEN

GrowNextGen brings agriculture science to the classroom by providing real-world educational tools to engage the next generation workforce. Backed by funding from the Ohio Soybean Council and Ohio soybean farmers, GrowNextGen helps expose students to different career fields in a thriving industry.

For additional information about the Spin into Agriscience program, visit **grownextgen.org/spin**.

Soybean seed necklaces

Materials

- Clear zipper-lock jewelry bag
- 18″ length of yarn
- Cotton ball
- Soybean seed

Procedure

Distribute one set of materials per student.

1. Wet the cotton ball with 1 tsp of water and place in jewelry bag.
2. Place a soybean in the bag and seal.
3. Punch a hole in the bag above the zipper line.
4. Thread the yarn through the hole, then wear around your neck inside your clothing or put in a warm place. Watch your soybean seed germinate—it will begin to grow roots, stem, and immature leaf in 3–5 days.

Here's the science

- During germination, the seed takes up water, resulting in the swelling and softening of the seed coat. This signals the seed to begin growing.
- This initial growth ruptures the seed coat allowing the primary root to emerge. Following this, a plumule shoot forms and grows upward toward the light.
- In the final stage of seed germination, the seed elongates and divides, giving rise to the seedling.

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Cocoa chemistry: Why is NesQuik quick?

Materials

- 2 empty 3-oz plastic cups
- I pipette
- I Tbsp skim milk
- I container baking cocoa
- I container chocolate milk mix (NesQuik™)

Procedure

Distribute one set of materials per student.

1. Turn over the empty cups.
2. Use the pipette to place I large drop of milk on the bottom of one cup.
3. Use your fingers to pinch a small amount of cocoa and sprinkle it on the drop.
4. Now use the pipette to place another large drop of milk on the bottom of the second cup.
5. Use your fingers to pinch a small amount of chocolate milk mix and sprinkle it on the drop. What happens?
6. What you observed when adding chocolate milk mix to milk was a chemical reaction.

Here's the science

Why is NesQuik so quick? Look on the can for the word soy lecithin *("less-a-thin")* in the ingredients label. It comes from soybeans and is what spreads out the water in milk so cocoa can quickly mix in. Soy lecithin was first discovered by African American scientist George Washington Carver doing soybean research in his lab at Tuskegee university.

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Colorful chemistry

Materials

- 1 9" plastic sandwich plate
- 3-oz cup skim milk
- 1 bottle of food coloring
- 1 tsp granular soy lecithin
- Plastic straw

Procedure

Distribute one set of materials per student.

1. Fill the plastic sandwich plate with the 3-oz cup of milk.
2. Place 3 equally spaced drops of food coloring into the milk.
3. Watch what happens when you add a pinch of soy lecithin to each drop of food coloring.
4. The food coloring shows how quickly soy lecithin spreads out the water in the milk. Try sprinkling more lecithin onto the surface of the milk. After a while, the food coloring stops moving. This is because there is no more room for the food coloring to spread.
5. Now carefully blow bubbles into the mix. See how big they get and how long they last.

Here's the science

The food coloring reveals how quickly soy lecithin *("less-a-thin")* gets between the water molecules in milk and spreads them apart. Try sprinkling more lecithin onto the surface of the milk. After a while, the food coloring stops moving. This is because there is no room left between water molecules for the lecithin to go. As for the watery soy lecithin bubbles, they hold water together longer and resist popping just like soap bubbles. Soy lecithin and its properties were first discovered by African American scientist George Washington Carver while doing soybean research in his lab at Tuskegee University.

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Atomic chocolate cake

Materials

- Fork
- 12 oz Dixie insulated cup
- 2 Tbsp flour
- 2 Tbsp sugar
- 1 Tbsp Hershey's® dark unsweetened cocoa powder
- ¼ tsp baking powder
- ⅛ tsp salt (a pinch)
- 1 Tbsp soybean oil (a.k.a. vegetable oil)
- 2½ Tbsp whole milk*
- ¼ tsp vanilla extract
- Whipped topping

Procedure

Distribute one set of materials per student.

1. Using a fork, mix the dry ingredients in the 12 oz cup: flour, sugar, cocoa powder, baking powder and salt
2. Add the soybean oil (a.k.a vegetable oil), milk and vanilla extract.
3. Mix thoroughly with a fork until smooth.
4. Microwave on high for 60 seconds.
5. Serve while hot; add whipped topping (optional).

Here's the science

Energize this chocolate cake recipe with soybean oil and the power of your microwave oven. Soybean oil, also known as vegetable oil (like Wesson), holds the water and dry ingredients together during baking keeping the cake moist and tasty.

* For better quality cakes with full flavor and less stomach discomfort, use whole milk with A2A2 protein.

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Scratch 'n' sniff soy ink

Materials

- 3 oz plastic cup
- Paper towel
- ⅛ tsp soybean oil (a.k.a. vegetable oil)
- ⅛ tsp granular lecithin
- I package Kool-Aid®
- I tsp water
- Stir sticks
- Paper for stamping
- Rubber stamps or paint brush

Procedure

DIstribute one set of materials per student.

1. Blend water and Kool-Aid® in a 3 oz plastic cup.
2. Add soybean oil and stir well.
3. Add soy lecithin and stir. It is OK if some lumps remain.
4. Fold a full sheet of paper towel in half twice.
5. Pour the contents of the cup into the center of the paper towel. The soy ink is quickly absorbed.
6. Use a rubber stamp or paint brush to print images on paper or stationary. Let dry.
7. Once the ink dries, scratch the surface of the paper. You can smell the Kool-Aid.

Here's the science

In addition to spreading out water, soy lecithin *("less-a-thin")* keeps oil and water from separating especially in soy ink, chocolate bars, creamy italian dressing and other processed foods. Soy lecithin was first discovered by African American scientist George Washington Carver doing soybean research in his lab at Tuskegee university.

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Eco-bot clean-up challenge

Materials

- Eco-bot materials (one Eco-bot per student)
- 11″ × 17″ challenge mat (one per student—additional copies at **grownextgen.org/spin**)
- Straws, plastic cups, cardstock/construction paper
- Clear tape, scissors
- Rice

Procedure

Each student builds an Eco-bot and works in teams of two to solve **the problem:** *Bailey Beach was the site of an unfortunate oil spill and is too hazardous for humans to clean. The EPA has established a containment area to hold the toxic spill in place until the clean-up can occur.* See the video at **grownextgen.org/spin**.

Imagine: Brainstorm possible solutions that might address the problem.

- The EPA has proposed that a special robot, called an "Eco-bot," be used to solve this problem.
- The oil spill has been treated with a special non-toxic CytoSol BioSolvent (actually created from soybean oil) that breaks up oil into small clumps then swept away by robot skimming machines called Eco-bots.
- Have each student assemble their Eco-bot, turn it on, and see how it moves.

Plan: Decide which of the possible clean-up solutions are the most logical or make the most sense.

A containment area has been outlined on the challenge mat to keep the spill contained. Knowing how your Eco-bot

moves, how might your Eco-bot stay within the containment area and work effectively to sweep up the spill?

Create: Working in teams of two, build and test your ideas to see what works best.

- Experiment with "control surfaces" to keep your Eco-bot in the right place (straws, card stock paper, plastic cups or other materials).
- Set up your control surfaces around the containment area and test how your bots travel.
- Sprinkle a small amount of rice to simulate the oil spill treated with CytoSol. Count how many squares of treated contaminant get swept away without touching the bots.
- Demonstrate your solution to other teams of students, shoot a video, or take a photo of the final result.

Improve: Explore how you can use what you've learned to improve or change your design.

Look at others' solutions then combine ideas and Eco-bots to make a better process!

Here's the science

CytoSol is made from soybean oil and is formulated to minimize the spreading of oil spills into the environment. It is the best solution on the market for maximizing the consolidation of crude oil into floating clumps for rapid recovery. These clumps are quickly surrounded by floating containment booms then recovered by robotic skimming machines or wicked up by absorbent pads.

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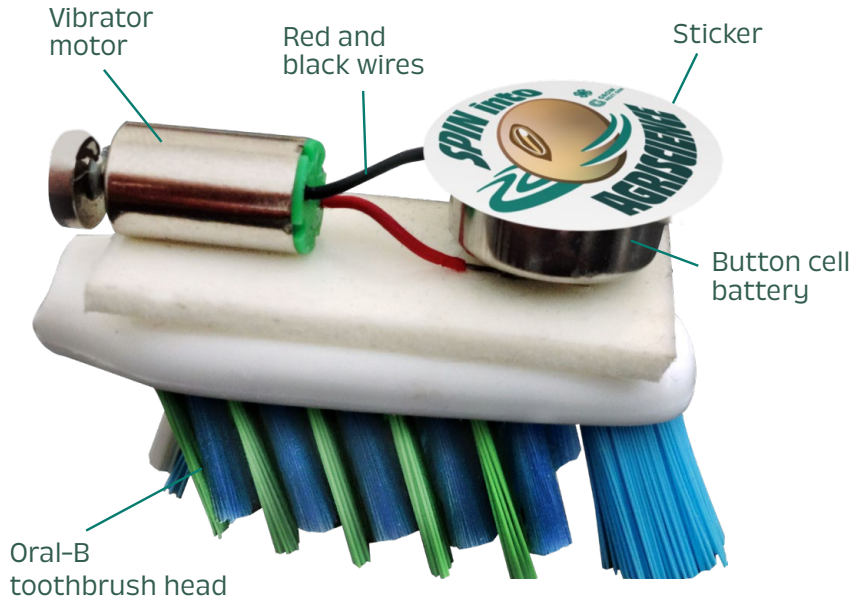
Assemble your Eco-bot

1. Remove the backing from one side of the 3 cm piece of foam tape and firmly stick it on the flat side of the toothbrush head.
2. Remove the backing from the other side of the tape and gently push the motor on top of it with the rotating part hanging off the back- end of the toothbrush. This will allow the motor to spin without touching the tape. The wires should be positioned toward the head of the toothbrush.
3. Gently push the watch battery (+) side up onto the tape with the red wire underneath.
4. Turn the Eco-bot on by pressing the black wire onto the battery with a "Spin Into AgriScience" sticker on top.



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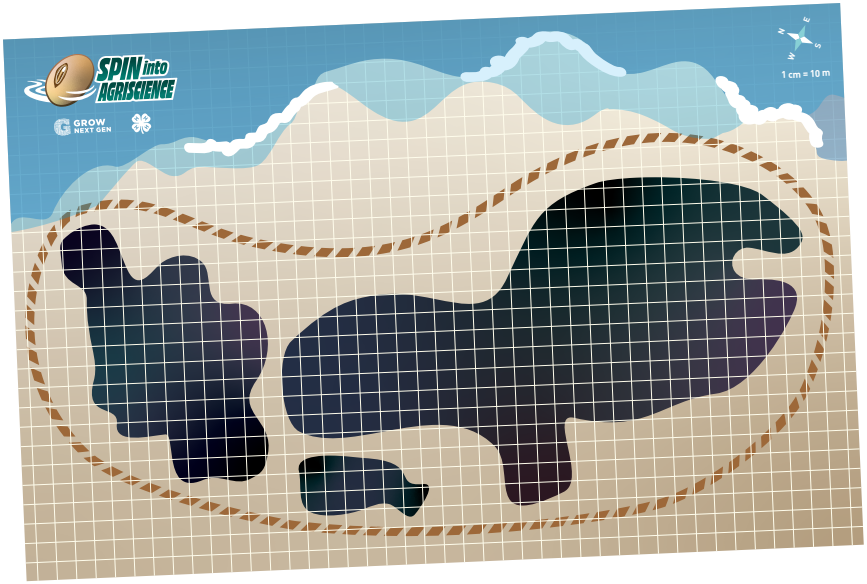
Eco-bot resources

For downloadable full-sized (11″ × 17″) copies of the Eco-bot challenge mat, visit **grownextgen.org/spin.**



To order additional Eco-bots, visit **BrownDogGadgets.com.**

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