



GEMS Challenges – DNA Extraction

SUBJECT

Science--Biology

Suggested grades

6-12

Cautions/concerns

You **must** review safety instructions regarding the use of the rubbing alcohol. Use goggles and gloves and make sure you have a well-ventilated room. Pay attention to the preparation needed (See below)

The Challenge – Extract and examine DNA from strawberries using solutions you prepare.

LEADER ACTIONS**GIRL ACTIONS**

	LEADER ACTIONS	GIRL ACTIONS
INTRODUCTION	Present the challenge—we know that all living things have DNA but we can't see it without powerful microscopes. Do you have any idea how we could see DNA?	Brainstorm options.
BACKGROUND INFORMATION	Ask: What do you know about DNA? Why is DNA important? How do scientists get DNA to study? Write girls' thoughts on board. Refer to Background Information sheet attached.	Remember what you know and share.
ACTIVITY	Divide girls into teams of two. Don goggles. Pass out materials (see attached). Distribute lab sheet (attached) to each team. Read over the instructions, emphasizing the safe use of goggles, gloves, and alcohol solution.	Follow the instructions to extract DNA. When all is completed, clean up the area, being sure to wipe up all extracted materials, and disposing of liquids safely.
CONCLUSION	When all experiments are finished and cleaned up, sit down with girls and review what they learned. Ask: What happened when you added the alcohol? Why would scientists even want to be able to extract DNA?	Talk about what happened in experiment.

LEADER ACTIONS**GIRL ACTIONS**

	<p>Could what we extracted be used to identify or study these strawberries?</p> <p>What else did you notice?</p>	
CAREER CONNECTION	<p>Ask the girls what careers you might explore if you enjoy learning about DNA.</p> <p>Preview and show one of these videos of young women in biology.</p> <p>https://www.youtube.com/watch?v=s3hLe8yv-mw</p> <p>https://www.youtube.com/watch?v=JHX53wwLR9g</p>	Think about possible careers.
REFLECTION	Ask 2-3 girls to reflect on the experience using the GEMS reflection cards.	Reflect and share how the experiment went.

Supplies Needed

Item	Amount Needed
Strawberries	1 per team
Zip-loc bags—quart-size freezer bags are strong	2 per team
Liquid dish soap diluted one-third-strength with water	¼ cup per team
Isopropyl alcohol (at least 90%)	¼ cup per team
Salt packets from restaurants (or saltshaker)	1 per team
Small bathroom cups for soap and alcohol	2 per team
Larger clear plastic cup (at least 8 oz)	1 per team
Plastic spoons	2 per team
Coffee stirrers or long toothpicks	2 per team
Bucket or bowl of ice	1 per club

Preparation Needed:

- Strawberries: Purchase fresh or thawed, green tops on or off.
- Isopropyl alcohol: 99% isopropyl alcohol is best. 90% or 70% (rubbing alcohol) will work also. Keep in ice bucket. **CAUTION: Isopropyl alcohol is flammable and poisonous. Keep away from heat and open flames.**
- Soap solution: Dilute liquid dish soap with water: one-part soap or detergent to two parts water. Keep in ice bucket.

Room setup:

Gloves and goggles

For each group: Pre-package if you can

- 2 zip-loc bags
- 1 strawberry
- 1 plastic spoon
- 1 coffee stirrer or long toothpick
- 1 large clear plastic cup
- 1 salt packet

At a central location (or with the teacher):

- $\frac{1}{4}$ cup cold isopropyl alcohol in a plastic cup—to be given out during the experiment
- $\frac{1}{4}$ cup soap solution in plastic cup—to be given out during experiment
- sponges and towels for cleanup
- bucket or bowl of ice to store alcohol and soap solution

Comments:

- The hardest step is layering the alcohol. Make sure girls DO NOT pour alcohol directly on top of the strawberry mixture at the bottom of the cup. They should tilt the cup and pour the alcohol **SLOWLY** so it flows down the side of the cup and floats on top of the strawberry mess. If the alcohol and water layers mix, the DNA will not precipitate out.

Adapted from Chemistry in the K-8 Classroom, @2007, OMSI

DNA LAB



Team supplies:

- ✚ 2 small Zip-loc bags
- ✚ 1 strawberry
- ✚ ¼ cup diluted soap (your leader will bring this)
- ✚ Salt packet
- ✚ 1 plastic spoon
- ✚ 1 clear plastic cup
- ✚ ¼ cup COLD isopropyl alcohol (your leader will bring this)
- ✚ Coffee stirrers or long toothpicks

Goggles and gloves on please

1. Put your strawberry into one of your zip-loc bags. Close it tightly and smash it gently into a pulp with your fingers.
2. Open the bag.
3. Add one spoonful of the soap mixture into the bag.
4. Tear open the salt packet and pour in about half the packet.
5. Close the bag again and squish it again to mix in the soap and salt.
 - a. Has anything changed in the strawberry pulp?
6. Open the bag. Have the larger clear cup ready.
7. Pour the strawberry mixture into the cup.
8. Your leader will now bring around the alcohol. Tilt your strawberry cup and slowly pour your alcohol down the inside of the cup so it floats on top of the strawberries. If the layers mix, the DNA will not be extracted.
9. Set the cup on the table for a minute. Watch carefully and note what is happening.
10. Lay the other zip-loc bag on the table. Using the coffee stirrer, carefully lift out the extracted DNA and spread it out on the bag. What do you notice?

DNA Extraction Background information:

<https://askabiologist.asu.edu/cell-viewer-game/>

Cell structure:

All living things have cells. These tiny building blocks work together to create simple bacteria as well as more complex organisms, such as people and animals. In complex organisms — such as plants, animals and people — cells are made up of several organelles. These are the parts of the cell that perform various functions and allow for the cell's independent operation. The cells also have different shapes to assist with their functions, such as blood cells compared to fat cells. However, they all share similar parts that allow the cell to do general tasks, such as create energy and protect itself.

Cells have many parts, but the main parts we are concerned with today are the cell membrane, the organelles, and the nucleus, where the DNA is housed. With the help of a special solution, we will break down the layers of the membrane and organelles and break up the protein chains that bind the DNA together.

Why strawberries?

A couple of good reasons: Strawberries are soft and easy to mash. They also have 8 of each type of chromosomes in each cell, as compared to humans who have 2. Other good foods to use are bananas, wheat germ, spinach, broccoli, zucchini, onions, and kiwi fruit. Soak and puree the wheat germ, broccoli, onions, or zucchini before using.

Extraction solutions:

The first solution is the buffer. We combine water, dishwashing soap or shampoo and salt to break down the cells so that the DNA can be released and extracted. The soap/shampoo helps dissolve the fatty layers of the cell membranes. (think washing greasy dishes). The salt helps break up the protein chains that hold the DNA together. Later in the experiment, when you add the second solution, the cold rubbing alcohol, the strands of DNA rise to the top because they do not dissolve in alcohol. We keep it cold to slow down the reaction.