

# Strawberry Breeding and Genetics

Name \_\_\_\_\_

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## Part 1: Strawberry DNA Extraction Lab

DNA carries the genetic code for all living organisms, including humans and strawberries. Each cell in a plant or animal has a nucleus with multiple chromosomes. Each chromosome contains DNA with multiple genes. In this lab you will extract from a red, juicy, sweet food crop (strawberries) and compare/contrast your methods to that of an actual DNA analyst scientist.

### Materials Needed

- 1 strawberry
- mortar and pestle
- 10 mL (2 tsp) dish detergent
- 125 mL (1/2 cup) water
- 5 g (1 tsp) salt (non-iodized)
- rubber band
- coffee filter
- 2 plastic cups
- tray of ice
- masking tape and marker for labeling
- 91% cold isopropanol (rubbing alcohol)
- popsicle stick or coffee stir stick

### Lab Procedures

1. Place one strawberry into the mortar and grind it with the pestle.
2. In a cup, mix the water, dish detergent, and salt. Add the solution to the strawberry in the mortar. Continue to grind the mixture.
3. Label a second cup with your name. Place a coffee filter inside the cup and use a rubber band to hold it in place.
4. Pour the strawberry mixture into the filter and place the cup in the tray of ice. **It's important to keep the mixture COLD while it slowly filters.**
5. While waiting for the mixture to filter, watch Video 1: DNA Extraction from Part 2 of your worksheet. Answer follow-up questions 1-4.
6. After the mixture has filtered, **SAVE** the filtered liquid (which contains the DNA) in the cup. Discard the coffee filter and strawberry remains in the trash.
7. Gently add an amount of isopropanol (rubbing alcohol) equal to the amount of filtered liquid to the cup. Remember to layer the isopropanol on top of the clear liquid rather than mixing the two layers together. Watch and wait. Bubbles will begin to form and a white stringy substance will become visible. This precipitate (the solid that forms when a chemical is added to a solution) is the DNA!
8. Place the cup back into the ice tray and check on it in 10 minutes. If you don't stir the layers, a large "glob" of strawberry DNA will form. (Leave the cup on ice for as long as possible.)
9. Pick up the DNA using a popsicle stick or coffee stir stick.
10. Clean your lab station and equipment and watch Video 2: In the Lab from Part 2 of your worksheet. Answer follow-up questions 5-10.

# Strawberry Breeding and Genetics (continued)

## Part 2: Lab Video Questions

**Video 1:** DNA extraction found here: <http://passel.unl.edu/ge/step-4-dna-testing/dna-extraction/>

*This video describes the process of DNA extraction from plant cells in the lab.*

1. What type of tissue is best used from plants for DNA extraction?  
*Young leaf tissue that has been frozen*
2. In what ways are the cells broken up in order to release the DNA from the nucleus? (Hint: there are two methods listed in the video.)  
*Cells are crushed using a tool resembling a drill and a solution made of buffer, salt, and detergent is added.*
3. In what substance is DNA soluble (definition: able to be dissolved)?  
*Water*
4. Alcohol and water mix, but alcohol and DNA do not mix. What happens as a result?  
*DNA molecules will precipitate (come out of solution) and form a solid material inside the test tube.*

**Video 2:** In the Lab found here: <http://passel.unl.edu/ge/step-4-dna-testing/in-the-lab/>

*This video features Justin Rosenbohm, a DNA analyst, as he demonstrates the techniques used in his lab for DNA extraction of plant material. His process of extraction can be summarized into four steps. Answer the questions below while watching the video. Hints are given as to the video times for each step.*

5. What was the first step in DNA extraction by the DNA analyst? Did you do anything like this? Explain. (Hint: 0:00- 0:38)  
*He uses a shaker to emulsify, pulverize, or puree the leaf tissue. This breaks down the cell walls to access the DNA. Students did this by crushing the strawberry in the mortar.*
6. What was the second step? Did you do anything like this? Explain. (Hint: 0:38- 1:13)  
*He loads the leaf tissue into the centrifuge to separate the solid components from the liquid. Students did this by pouring the mixture in a filter and waiting for the liquid to drain out.*
7. What was the third step? Did you do anything like this? Explain. (Hint: 1:15- 1:26)  
*He adds isopropanol to the lysate (the fluid made of the lysed cells) to help precipitate out the DNA. Students did this when they added rubbing alcohol to the filtered liquid.*
8. What was the fourth step? Did you do anything like this? Explain. (Hint: 1:27- 1:50)  
*He adds metal beads to the sample. These will be used as a handle to move the DNA around. Students used a popsicle stick or coffee stir stick to manipulate their DNA.*
9. What is the end goal of PCR? (Hint: 2:30-3:01)  
*PCR amplifies the DNA or makes copies of sections of the DNA.*
10. What process does the DNA analyst use to see the bands of DNA?  
*He uses gel electrophoresis to view bands of DNA that are present in the sample.*

## Strawberry Breeding and Genetics (continued)

### Part 3: Post-Lab Reflections and Analysis

1. Compare your results with other groups. Did you notice any differences? Describe what you observed and hypothesize what could have resulted in the differences.

*Answers may vary depending on the differences observed, if any. Differences may result from differences in the size of the strawberry, how fully it was crushed, different methods of filtration, adding alcohol, etc.*

2. What did the DNA look like?

*Answers may vary. Ideally, it formed a white or cloudy mass that stuck together.*

3. Describe what happened when the isopropanol came in contact with the strawberry mixture.

*Answers may vary. Ideally, the water and the isopropanol separated in the cup and the DNA came out of solution (precipitated) to form a white substance.*

4. A person cannot see a single cotton thread 100 feet away, but if you wound thousands of threads together into a rope, it would be visible at some distance. How is this statement an analogy to our DNA extraction?

*Answers may vary. DNA in one cell is similar to a single cotton thread which is difficult to see. In our experiment, we extracted the DNA from many cells which is similar to winding thousands of threads together to make a rope. This made the DNA of the strawberry easier to see.*

5. Would the DNA be the same in any cell in the strawberry? Explain. (Hint: Remember that strawberry started out as one fertilized cell.)

*Yes, the strawberry developed through a process of cell division. A single fertilized cell divided into two identical daughter cells, each with the same genetic material. This process repeated for the growth and development of the strawberry. All cells will contain the same blueprints for growth and development known as DNA.*

6. Why would a scientist want to extract DNA? Give three reasons.

*Answers may vary. Accept all reasonable answers.*