

Strawberry Breeding and Genetics

Student Name _____

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.

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?
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.)
3. In what substance is DNA soluble (definition: able to be dissolved)?
4. Alcohol and water mix, but alcohol and DNA do not mix. What happens as a result?

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)
6. What was the second step? Did you do anything like this? Explain. (Hint: 0:38- 1:13)
7. What was the third step? Did you do anything like this? Explain. (Hint: 1:15- 1:26)
8. What was the fourth step? Did you do anything like this? Explain. (Hint: 1:27- 1:50)

9. What is the end goal of PCR? (Hint: 2:30-3:01)

10. What process does the DNA analyst use to see the bands of DNA?

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.

2. What did the DNA look like?

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

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?

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

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

Part 4: Applying Genetic Testing to Agriculture

So we've extracted DNA from a strawberry, but how is this process used in the real world? Often DNA extraction is just one of many steps that researchers use to breed better agricultural crops like strawberries. RosBREED is a research project focused on developing and applying modern DNA tests and related breeding methods to deliver new cultivated varieties of rosaceous crops (including strawberries) in 22 U.S. breeding programs.

Read the article "Breeding Strawberries" (<http://fruitgrowersnews.com/article/breeding-strawberries/>) and discuss the following questions. Think critically as answers are not always found directly in the article.

1. How is genetic testing beneficial to strawberry breeders?
2. What are three traits that would be beneficial for strawberry growers?
3. What are three traits that would be beneficial for strawberry consumers?
4. Draw and label a diagram showing the relationships between chromosomes, genes, DNA, proteins, and traits which illustrates your understanding of how genes of a seedling result in genetic traits of the plant.
5. Why do you think is it valuable to incorporate genetic material from wild strawberries when breeding new cultivated varieties?