



Lesson Title: DNA Extraction!

Grade: 5-7

Duration of Lesson: 1 - 50 minute class

Brief: Students will extract DNA substance from a strawberry.

Materials:

Each student will need one of the following:

- 1 - small zip-lock baggie
- 1 - strawberry (fresh or frozen and thawed)
- 1 - 4 inch square of black paper
- 1 - small clear plastic cup (1 – 2 oz. cup)
- 1 - popsicle stick
- 1 - copy of the student worksheet

Gather these materials for each set of 4 students to share:

- Cheesecloth (double layer cut into 8" squares)
- Funnel - optional
- Small clear plastic cup (4 oz. cup)

Prepare ahead of time to distribute to each student as they are ready:

DNA extraction buffer: 5 ml liquid dishwashing detergent (Ivory), 1.5 g NaCl, and 100 ml water (premix solution prior to conducting experiment). Each student receives 3-5 ml of solution.

Ice-cold 95% isopropyl alcohol (Set alcohol bottle in a bowl of ice). You will need one 12 oz bottle for an entire classroom of 28 students)

Key Terms:

DNA, deoxyribonucleic (pronunciation below), organism, extraction, genetic, chromosomes, and buffering solution.

Standards/Objectives	
<p><u>Montana State Standards:</u></p> <p>Science: Content Standard 2 - Students, through the inquiry process, demonstrate knowledge of properties, forms, changes and interactions of physical and chemical systems. ELE: A, B, C.</p> <p>Language Arts: Content Standard 1: Students know and understand the role of the communication process and demonstrate effective speaking and listening skills. Benchmark Benchmarks 1.4, 1.5, 1.6; 2.6, 2.7, 2.9 Content Standard 4: Students effectively evaluate and create media messages. 4.2 Content Standard 5: Students effectively evaluate and create media messages. Benchmark 5.3, 5.12, and 5.13.</p> <p>Math: Content Standard 1 – Students engage in mathematical processes of problem solving and reasoning, estimation, communication, connections, and applications, and using appropriate technology. Benchmarks 1.1, 1.2, 1.3 Content Standard 5 – Students demonstrate understanding of measureable attributes and an ability to use measurement process. Content Standard 6 – Students demonstrate understanding of an ability to use data analysis, probability, and statistics. Benchmark 6.2</p> <p>Social Studies: Content Standard 3 - Students apply geographic knowledge and skills(e.g., location, place, human/environment interactions, movement, and regions). Benchmark 5.1, 5.2, 5.3, and 5.5</p> <p>Workplace Competencies Content Standard 6 –The foundation for a rewarding life and productive employment is built through exploration and an understanding of life and career choices.</p>	
<p><u>Understanding(s) /Big Ideas:</u></p> <p>All living organisms contain DNA: from bacteria to plants, animals, and humans. DNA is stored in the cell's nucleus and can be extracted.</p>	<p><u>Essential Question(s):</u></p> <p>What steps are used to extract DNA? What is the function of extraction buffering solution?</p>
<p><u>Students will know:</u></p> <p>Students will learn about the process of DNA extraction and will gain an understanding of the presence of DNA in all living organisms. Students will know that DNA is studied and used in developing food crops.</p>	<p><u>Students will be able to:</u></p> <p>Students will be able to explain how DNA is extracted from strawberries.</p>
Performance/Observations	
<p><u>Performance Task(s):</u></p> <p>Students will perform DNA extraction experiment. Students will observe the formation of DNA globules while experimenting. Students will complete the DNA extraction worksheet.</p>	<p><u>Other Evidence:</u></p> <p>Students will reevaluate the DNA after it is dry, making observation of changes. Students will use the key terms in the process.</p>
Learning / Inquiry Activities	
<p><u>Learning Activities:</u></p> <p>Step 1: Inform students that they will be extracting DNA today. Introduce students to the following</p>	

facts:

DNA stands for Deoxyribonucleic (dē-ōk'sē-rī'bō-nū-klā' ĭk) (-klē"- , -nyū-) Acid

DNA is the blueprint for the construction of cells

In cells, DNA is packaged into chromosomes, looking like a twisted ladder

Notes:

Step 2:

Handout the student worksheet, ask students to set it in a place that they can use it for directions and to follow along. Give each student a baggie and a strawberry, tell them to seal the strawberry in the bag and begin squishing the strawberry. Let them know that this breaks down the tissue. Add 3 – 5 ml of buffering solution to each student's baggie of squished strawberries. Students will continue squishing **EXTREMELY GENTLY** for 2 minutes. You may have a Q/A session or let them know what the buffering solution is doing to the strawberry.

Note:

Crushing the strawberries breaks open the strawberry cells, where the DNA is stored. The soap in the buffering solution breaks down the cells, allowing the DNA to be released. The salt in the buffering solution makes the DNA molecules stick together, and the salt also helps separate the proteins that are being released from the cells.

Notes:

Step 3:

Ask students to place the cheesecloth over a 4 oz. plastic cup (you may have them use a funnel in the cup if you feel it is necessary). Lay the cheesecloth over the funnel and ask one student to hold it firmly along the rim of the funnel. The cheesecloth should be gently pushed down into the funnel or the plastic cup about 1 inch.

Each group of 4 students should pour their mixture onto the cheesecloth that is stretched over the funnel or cup; wait until most of the liquid has seeped through (about 3 minutes). The liquid will be clear of any debris and a nice red color. Remove the cheesecloth and discard. Have each student fill their small clear plastic cup one quarter full of the filtered mixture and leave it set on the table.

Inform students that they will now be performing the final steps to extracting DNA!

Next, gently add one pipette (eye dropper) of ice-cold 95% isopropyl alcohol to each small

cup. Ask students to observe the reaction and gently stir with their popsicle stick, the DNA should be floating right on top of the strawberry mixture. It will look like a white globule and will be stringy. If it is not, add a little more isopropyl alcohol and gently stir again. This will release any DNA.

Notes:

Step 4:

Ask students to place the DNA on the black paper. After observing and the DNA and discussing the DNA ask students to spread the DNA on the black paper until it is very thin. Let them know that when the DNA dries there will be some changes. This is part of the excitement of agriculture science. This is a good time to talk more about being an FFA member and what type of exciting learning opportunities you have experienced.

Notes:

Student Worksheet:

Name: _____

Date: _____

Strawberry DNA Extraction

Today you will extract the DNA out of a strawberry. DNA contains the genetic material that codes every living thing.

Materials you will be using:

1 heavy-duty zip-lock baggie

1 strawberry (fresh or frozen and thawed)

Cheesecloth

Funnel (optional)

1 medium size clear plastic cup

Test tube or small clear plastic cup

Pipette or eye dropper

DNA extraction buffer (Ask your teacher what is in the DNA extraction buffer and why)

Ice-cold 95% isopropyl alcohol

1" – 4" square of black paper

Procedure to follow

1. Place one strawberry in a zip-lock baggie.
2. Smash strawberry for 2 minutes.
3. Your teacher will add 3 – 5 ml extraction buffer to the bag.
4. **GENTLY ROCK MIXTURE BACK AND FORTH** for one to two minutes.
5. You will be asked to pour your mixture onto a piece of cheesecloth that has stretched over a plastic cup or over a funnel that is sitting in a plastic cup. Do this carefully. After all the clear liquid has been caught in the plastic cup, discard the fiber and crushed berry pulp that are still in the cheesecloth.
6. Get your small plastic cup and fill $\frac{1}{4}$ full. **Do not shake!**
7. Your teacher will add isopropyl alcohol to your small plastic cup. Gently stir

and observe! **Do not shake!**

8. You will see the DNA floating on top of the strawberry mixture or sticking to your popsicle stick. It is a small cloudy- stringy white material or white ball. (If you do not see the DNA, let your teacher know.)
9. Using the tip of the popsicle stick, gently remove the DNA from the tube.
10. Place the DNA on the black paper, observe the DNA.

Conclusion Questions

1. Why did you have to smash the strawberry to retrieve the DNA?
2. What purpose did each of the elements in the extraction solution serve?

Salt

Water

Detergent

3. Describe what the DNA looked like when it was first formed.
4. Describe what the DNA looked like then it was dry.

Scientists use DNA to research and improve our crops. They strive to put DNA which contains disease resistant qualities into plants to help plants keep disease resistant and for other reasons. If you liked this experiment you might be interested in a career in biotechnology.

Montana Department of Agriculture

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