

DNA Extraction from Fruit

(Adapted from Isolation of DNA from Onion—Woodrow Wilson 1993)

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Purpose

To allow students to observe the DNA found in plant cells. This activity may be used from elementary science to high school biology courses.

Background

All food you eat comes from plant or animal sources. All plants and animals are composed of cells, which have basically the same parts. The DNA is contained within the nucleus of the cell. To release the DNA you will have to get through three barriers—cell wall, plasma membrane and nuclear membrane. The toughest barrier is the cell wall. How can you break through a plant cell's barriers to release the DNA? There are also proteins called DNase enzymes that can break down genetic material. How can you prevent this damage? The following experiment will answer these questions.

Materials

- Fruit (small piece)
- Coffee filter
- Table salt
- 2000ml beaker
- wooden sticks
- 250ml beaker
- rubber band
- water
- meat tenderizer solution
- ice cold alcohol (95% Ethanol or 92% Isopropanol)
- test tubes
- *Palmolive* dish soap
- blender

Procedure

1. Premix for students a solution of salt, *Palmolive* dish soap and water in 2000ml beaker. Solution should be 10% detergent and a shake of salt in the water.
2. Premix meat tenderizer solution. Dissolve 5 g meat tenderizer in 95 ml distilled water.
3. Choose a fruit, any kind will do. However, kiwi, mango and strawberry have been found to yield the most DNA.
4. Cut a small piece of fruit, peel any tough skin and take out large seeds. Cut into small pieces.
5. Place fruit in blender and pour soap/salt solution over fruit. Cover blender and press *puree*. Puree for about 30 seconds until fruit is completely mashed. Stop the blender.
6. Filter the liquid through a coffee filter (a rubber band holds the filter nicely on the beaker).

7. Pour filtrate into a test tube (about 1 inch is enough) and place on ice for about 5 minutes. The secret is to keep the filtrate and alcohol ice cold. If filtrate is moving too slowly through the filter paper, as can be the case with bananas, you can dilute the extract with tap water.
8. Add 10 ml of the meat tenderizer solution and stir to mix.
9. Gently pour about 1 inch of ice-cold ethanol down the side of the tube. [For ethanol, use 2 inches; use 1-inch isopropanol.] The alcohol will layer on top of the filtrate. Observe.
10. Soon the DNA can be seen precipitating out of solution. There will be three layers: bottom = fruit filtrate; middle = DNA strands; and top = alcohol. The DNA will look like white strings or mucus. You can use a glass rod or wooden stick to spool the DNA.
11. Show your teacher your results.
12. Clean up your mess by washing the test tubes and beaker. Throw away the filter paper.

Questions

1. What fruit did you use to extract DNA?
2. Does the amount of DNA differ when extracted from different fruits? To answer this question, you might need to compare your DNA sample to someone else's.
3. Describe how a large DNA molecule is enclosed compactly within the nucleus of a cell.
4. Which of the procedures that you used allowed the "release" of DNA from the nuclei of the fruit cells?
5. Why did you use the blender to puree the fruit?
6. What was the purpose of pouring the salt/soap solution over the fruit before pureeing?
7. What was the purpose of adding the meat tenderizer solution to the strained mixture before adding the ethanol?
8. Do you think there would be a difference between using fresh, frozen or canned fruit? Why or why not?
9. What other plant tissues could be used to extract DNA? Do you think this same procedure could be used to extract DNA from animal cells? Explain.

TEKS Correlations

Grades 5&6

Field and Laboratory Investigations

- Demonstrate safe practices during field and laboratory investigations

Scientific Inquiry: Field and Laboratory

- Collect information/data: observe and measure
- Plan and implement descriptive and simple investigations

Tools

- Demonstrate repeated investigations increase reliability of results

Living Systems: Structure s & Functions

- Identify how structure complements function

Grade 7 & 8

Field and Laboratory Investigations

- Demonstrate safe practices during field and laboratory investigations

Scientific Inquiry: Field and Laboratory

- Collect data: observe and measure
- Plan and implement descriptive and simple investigations
- Analyze, review, critique scientific explanations

Biology

Field and Laboratory Investigations

- Demonstrate safe practices during field and laboratory investigations

Scientific Inquiry: Field and Laboratory

- Collect data: observe and measure with precision
- Organize, analyze, evaluate, make inferences, predict trends from data
- Communicate valid conclusions

Critical Thinking, Problem Solving & Decision Making

- Analyze, review, critique scientific explanations
- Evaluate biological models

Metabolic Processes & Energy Transfers

- Compare structures and functions of biomolecules

Cells: Basic Structures of Life

- Identify Parts of prokaryotic and eukaryotic cells
- Investigate and identify cellular processes - function of parts, synthesis of molecules

Growth & Development: Cells, Tissues, Organs

- Compare cells from parts of plants and animals

Nucleic Acids & Genetics

- Describe the components of DNA