

Fruit DNA Extraction

PURPOSE

In forensic science, DNA is usually extracted from human cells to identify unknown parentage, crime scene suspects, missing victims and to investigate genetic diseases. In this exercise, your class will be able to extract DNA from fruit to see what it looks like. This process is similar to what a scientist must do before they can use the information contained in DNA to solve crimes. The exercise takes approximately **30 minutes**. Students can work in pairs or small groups as needed.

MATERIALS

Safety: Review MSDS sheet for alcohol. Indirectly vented chemical splash goggles, gloves and aprons should be worn. Do not eat fruit.

- Isopropyl (rubbing) alcohol (90%) (Caution: extremely flammable, keep away from sparks and flame)
- Liquid dish soap (not dishwasher detergent)
- Table salt
- Powdered meat tenderizer (optional)
- Coffee filters (circular) or cheesecloth
- Distilled or bottled water
- Cups of crushed ice or ice water
- Fruit: strawberries, kiwi, or bananas (**check for allergies first**)
- Ziploc *freezer* bags (small, quart size)
- Small paper or plastic cups (e.g. bathroom cups)
- Test tubes or centrifuge tubes (must have caps)
- Plastic transfer pipettes or eyedroppers (optional)
- Paper clips

TEACHER PREPARATION

Prepare DNA extraction solution: Mix 100 mL liquid dish soap, 15 grams table salt, and distilled or bottled water to make a final volume of 1000 mL. This will be enough for about 40 individual experiments. Label with ingredients and date.

Aliquot isopropyl alcohol: Aliquot alcohol into *clear* test tubes or centrifuge tubes (15 ml or smaller). Fill tubes about 1/3 full (i.e. 5 ml or less). Label and keep these tubes capped and on ice or in the fridge until ready for use. You will need one tube for every student or pair of students.

Place at each student station: Ziploc bag, piece of fruit, coffee filter, small cup, paper clip, ice cup containing tube of cold alcohol, and plastic pipette (optional).



Objectives

- Demonstrate how DNA is extracted from cells.
- Develop an interest in forensic science.
- Visualize DNA.



Why 90% alcohol?

DNA is insoluble in alcohol so the higher the alcohol content, the more DNA you will precipitate. You can find 90% alcohol at any drug store. However, the experiment will work with 70% alcohol as well.

Fact Files

Ploid What?

We use fruit for this exercise because they are often polyploid, meaning they have more than two copies of every chromosome in each cell (i.e. lots of DNA). Strawberries are actually octoploid; they have eight copies in every cell! Humans are diploid, having two copies of every gene.

LESSON PLAN

Engagement

Inform your students that they are going to be extracting, or isolating, DNA from fruit. Ask your students what they know about DNA. What does it do? What color is it? Where is it found? What else do you wonder about DNA? How do scientists isolate DNA from different samples such as fruit? What steps do they think are involved?

Exploration

1. Have the students place a strawberry, piece of banana, or kiwi slice into the sealable freezer bag. Seal bag and mash well for one minute.
2. Pour two to three tablespoons of extraction soap solution into the bag. Add two or three shakes of powdered meat tenderizer (optional). Seal the bag and mash together for 1 minute.
3. Set up the filtration apparatus: Place a coffee filter or triple layered cheesecloth over a small paper or plastic cup. Make sure the cheesecloth or filter creates a pocket deep enough to hold the mixture and covers the rim of the cup. Secure with a rubber band if needed.
4. Open up the bag and slowly pour the mixture into the filter. **Do not overflow (use only as much as needed to fill the filter).**
5. When most of the mixture has filtered through (about 3-5 minutes), discard the cheesecloth or filter. If the mixture is very thick, more extraction solution or some water can be added and the mixture can be *gently* stirred to aid in filtration.
6. *Slowly* pour or pipette some of the strained fruit mixture (i.e. the juice collected in the bottom of the cup) over the tube of cold alcohol until it is about 1/2 full. *Pour juice slowly down the sides of the test tube, do not pour it in all at once.* The mixture will sink to the bottom of the tube and the alcohol will sit on top. Allow the test tube to sit *undisturbed* on the counter or on ice for two to three minutes.
7. Observe occasionally, and look for the DNA precipitating into the alcohol. This tends to occur at the boundary between the two layers. The DNA will appear as clear-to-whitish, stringy clumps in the alcohol and may even collect and float to the top of the tube.
8. Dip a straightened paper clip into the test tube and twirl it around gently to collect some DNA. If the DNA is gently stirred at the interface between the ethanol and juice solution, it may continue to form fibers.

Go Online!



For: Great DNA resources

Visit: <http://www.dnai.org>



Results of strawberry DNA extraction, with DNA floating in top layer.

Photo: www.mysciencebox.org

Fact Files

Did you know?

If you unwound the DNA from just one of your cells, it would be about **six** feet long! If you unwound the DNA in your entire body, it would stretch to the sun and back about **400** times!