



Fruit Salad—Hold the DNA, Please

Overview

Students will extract DNA from ripe fruit.

Introduction

All the genetic information for a living organism is contained in its DNA, which is housed in the nucleus of its cells. DNA is made up of nucleotides and a sugar phosphate backbone that bond together in a double-helix form. It is a very long molecule made of millions of nucleotides. Between two individuals only small portions of their DNA will differ. Scientists have investigated specific pieces of DNA that tend to differ more between individuals. These pieces are called markers, and are used to compare various individuals in criminal investigations. Since each organism's DNA is different, it functions like a molecular fingerprint. Investigators make use of this individuality to positively identify biological organisms, from plants to humans.

Some examples of DNA uses for forensic identification:

- Match suspect's DNA to DNA evidence left at crime scenes
- Clear persons wrongly accused of crimes
- Identify crime and catastrophe victims
- Establish paternity and other family relationships
- Identify endangered and protected species (could be used for prosecuting poachers)
- Detect bacteria and other organisms that may pollute air, water, soil, and food
- Match organ donors with recipients in transplant programs
- Determine pedigree for seed or livestock breeds

In a case of a stolen plant, investigators may be able to match the DNA of a plant confiscated from a suspect to evidence from that plant left at the crime scene (e.g., flowers or fruit of the plant).

In this lab, students will isolate DNA, the “thread of life,” from ripe fruit.

Motivation

DNA is the material that contains the genetic information for living organisms. Your DNA is specific only to you. DNA tests can be used to prove innocence in criminal trials. What if DNA could be stolen? In this lab, we'll suck the DNA right out of living cells!

Objectives

At the completion of this laboratory students should be able to

1. Extract and observe DNA.
2. Discuss the role of DNA in the cell.
3. Discuss the how the individuality of DNA is useful in crime scene investigation.

Materials

- Cell lysis buffer (CLB)- composed of salt, detergent and water
- Banana or strawberry
- Mortar and pestle
- Pipette
- Graduated cylinder
- Cheesecloth or coffee filter
- Ice-cold ethanol
- Glass stir rod

Associated California State Biology Standards

- 1c. Students know that the nucleus is the repository for genetic information in plant and animal cells.
- 2e. Students know DNA (deoxyribonucleic acid) is the genetic material of living organisms and is located in the chromosomes of each cell.
- 7a. Select and use appropriate tools and technology (including calculators, computers, balances, spring scales, microscopes, and binoculars) to perform tests, collect data, and display data.

Procedure

1. Student groups should prepare the “cell lysis buffer” (CLB) by adding one spoonful of salt and five drops of detergent to 100 mL of water. The detergent breaks down the lipids in the plasma membrane and the nuclear membrane. The salt neutralizes the charged phosphates in the backbone of the DNA, allowing the DNA to clump together instead of going into solution in the charged water. DNA is not soluble in ethanol, so it precipitates to the interface.
2. Have students mash either a small slice of *ripe* banana or strawberry to a paste with a mortar and pestle. Ripe fruit is used because its cells have already begun breaking down.
3. Students should then add an equal volume of CLB to the fruit paste and mix.
4. Have students filter this mix through several layers of cheesecloth into a tall glass graduated cylinder.
5. To the opaque liquid, students should slowly layer ice-cold 95% ethanol. The precipitate that comes out of solution at the interface is the chromatin, which is the DNA and associated proteins. Students can spool this DNA/protein mix onto a glass rod. Students may wish to take it off the rod to roll it between their fingers.

Evaluation

The following questions are listed under the Analysis section of the student handout and maybe used as part of a report, class discussion or assessment.

1. Describe the material isolated in the lab.
2. Where does DNA live in our cells?
3. From what molecules are DNA made?

Extension Activities

1. Similar isolations to the one above can be performed with a calf thymus (available from a butcher).
2. Students can use household materials to make models of the structure of DNA.

Name: _____

Student Sheet: Fruit Salad—Hold the DNA, Please

Procedure

1. Prepare the “cell lysis buffer” (CLB) by adding one spoonful of salt and five drops of detergent to 100 mL of water.
2. Mash either a small slice of *ripe* banana or a strawberry to a paste with a mortar and pestle.
3. Add an equal volume of CLB to the fruit paste and mix.
4. Filter this through several layers of cheesecloth into a tall glass graduated cylinder.
5. To the opaque liquid, slowly layer 95% ethanol. The DNA will come out of solution at the interface, and you can spool it onto a glass rod. You may wish to take it off the rod with your finger and roll it.

Evaluation

On a separate sheet of paper please complete the following:

1. Describe the material isolated in the lab.
2. Where does DNA live in our cells?
3. From what molecules are DNA made?