Learning Targets

- To extract DNA from cells using steps and reagents similar to those used in research labs.
- To learn the methods involved in DNA isolation.

Background

All living things have DNA (deoxyribonucleic acid). Found in nearly every cell of the human body, DNA provides the genetic instructions our cells use for growth, development, and maintenance. The information in DNA is stored as a code consisting of four chemical bases: adenine (A), guanine (G), cytosine (C), and thymine (T). The order of these bases creates sequences that code for different proteins that carry out the work of the cells.

Scientists study DNA for a variety of reasons. At Fred Hutch, researchers study DNA from different organisms to understand how cancer develops and to create cellular tools for fighting cancer. In other fields, scientists analyze DNA to solve crimes or engineer microorganisms to produce medicine like insulin. Around the globe, scientists study DNA in hopes of creating tools that can help solve our world’s most pressing issues.

In order to study DNA, scientists must first isolate it from cells. Initially, different detergents and mechanical methods are used to break open, or lyse, cells by breaking apart the lipid layers of the cellular and nuclear membranes. Because DNA is negatively charged, salt buffers are used to neutralize the solution. Enzymes can also be added to help break down cellular proteins that surround and bind to DNA. Next the solution is filtered to separate the DNA from other biomolecules like proteins and fats. Finally, alcohol is added to the solution so that the DNA precipitates, or comes out of solution. This happens because DNA is insoluble in alcohol.

DNA Extraction Buffer Ingredients

(Enough for 100 strawberries)

- 100 ml (3/8 cup) liquid dishwashing soap
- 0.30 g (a pinch) meat tenderizer (contains enzyme papain)
- 15 g (2 teaspoons) salt
- 900 ml (3 ¾ cups) water
Station Inventory
- 10 ml DNA Extraction Buffer
- 5 ml cold ethanol
- 1 empty 15 ml test tube
- 1 strawberry
- 1 plastic bag

- 1 funnel
- 1 test tube rack
- 1 microtube
- 1 wooden stick
- gauze or cheesecloth

Procedure
1. Place one strawberry in a plastic bag and seal it tightly, pressing out the air. Mash the strawberry for 1 minute.
2. Add 10 ml of DNA Extraction Buffer to the bag, seal, and mash the strawberry and buffer mixture for 1 minute. Try to avoid making bubbles.
3. Filter the liquid through a cheesecloth-lined funnel into a collection tube. Try to collect at least 3 ml.
4. Slowly add 5 ml of cold ethanol to the liquid along the side of the tube to create a layer of ethanol on top of the strawberry mixture.
5. Study what’s happening inside the tube. The strawberry DNA will appear as a gooey clear/white substance between strawberry mixture and ethanol layers.
6. Use a wooden stick to collect some of the DNA by slowly twirling the stick back and forth.
7. Place the DNA in a microfuge tube to show your family and friends.

Clean Up
- Rinse out the used tubes and funnel.
- Discard the cheesecloth or gauze and plastic bag.
- Clean up your area and wash your hands.

Concept Check
Answer the following questions in your lab notebook.
1. What do the different components of the DNA Extraction Buffer do?
   a. Dishwashing soap
   b. Meat tenderizer (contains enzyme papain)
   c. Salt
2. This lab claims that the gooey clear/white substance is DNA. Do you agree with this claim? What evidence or reasoning do you have in support of, or against, this claim?