

Hands-on Genetics Activity 3

Topic: DNA Extraction from Cheek Cells

Learning Objective:

After completing the lesson, the group will be able to observe their own DNA. Students will learn the simple method of DNA extraction and will be able to explain the rationale of each step. Students will be able to explain why DNA extraction is important to scientists and how it could be used in genetics.

Alignment with NGSS Grades 3-5

Science and Engineering Practices

Planning and Carrying Out Investigations

- Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of phenomenon or test a design solution.
- Make predictions about what would happen if a variable changes.

Analyzing and Interpreting Data

- Compare and contrast data collected by different groups in order to discuss similarities and differences in their findings.

Crosscutting Concepts and Connections to Engineering, Technology, and Applications of Science

Patterns

- Patterns can be used to support an explanation.

Structure and Function

- Different materials have different structures which can sometimes be observed.

Connections to the Nature of Science

Scientific Investigations Use a Variety of Methods

- Science investigations use a variety of methods, tools and techniques.

Scientific Knowledge is Based on Empirical Evidence

- Science findings are based on recognized patterns.
- Science uses tools and techniques to make accurate measurements and observations.

Materials:

95% Isopropyl Alcohol (**Must be cold**. Possibly have ice/salt bath), Cyro Tubes

(107-1), Plastic Test Tubes (107-1), Test Tube Lids (107-8), Coffee Stirrer (208-10), Dixie Cups

(114-shelf), 0.9% salt water (2 teaspoons of table salt dissolved in 1 quart/liter of water), 25%

detergent solution (1 volume of detergent mixed with 3 volumes of water), copies of Activity

Detailed Description:

Preparation:

1. Prepare the 0.9 percent salt solution (2 teaspoons of table salt dissolved in 1 quart/liter of water)
2. Pour 10ml of salt solution in dixie cups; one for each student
3. Prepare 25 percent detergent solution (1 volume of detergent mixed with 3 volumes of water)
4. Fill large labeled test tubes with 1 teaspoon (5ml) of detergent solution; one for each student
5. Fill labeled test tube with 2 teaspoons (10ml) of rubbing alcohol and seal; one for each student. Store in the fridge. The alcohol needs to be cold for the extraction to be successful.

Directions:

1. Have students swirl the 10ml of salt solution in their mouths for 30 seconds. This will remove dead cells lining the mouth.
2. Have students spit their solution back into their dixie cup and then pour it into the large test tube containing the detergent solution
3. Students should then cap the test tube and GENTLY rock it on its side for 2-3 minutes.
IMPORTANT: Don't shake the test tube or mix it too vigorously. DNA will break into smaller fragments and will be harder to see later on.
4. After 3 minutes, have students uncapped their tube, slightly tilt it and carefully pour the chilled alcohol down the side of the test tube. The alcohol and the detergent should form two distinct layers with the alcohol sitting on top.
5. Have students let the tube stand for one minute. Then, have them use the coffee stirrer to slowly move some of the isopropyl alcohol into the soap layer. DNA will start to precipitate out of the soap solution. Students can use the pipette to suck up the fragments and move into a cyro tube.
6. Students can transfer the DNA into a small tube, filled with isopropyl alcohol, and take it home.

Activity will allow students to see their DNA and bacterial DNA clumped together.

How will you conclude the lesson to enforce the learning objective?:

Why are we using the detergent? What does it do to the cell? What's the size of DNA molecules? Why can't you see one individual strand of DNA? The white strands that are becoming visible contain many DNA strands clumped together.

What science process skills will this lesson exercise?

Observing, Inferring

Safety precautions:

Isopropyl Alcohol- Assist students when pouring and instruct care.

Activity

DNA contains the instructions for making you. How you look, what blood type you have, even your tendency to get some diseases. It is found inside the nucleus in just about every single cell of your body. In this activity, you'll break away the membrane around the cell and its nucleus so that you can see your very own DNA.

Procedure

1. This procedure will collect some of the cells that line the inside of your mouth. These cells are from your cheeks. Swirl and gurgle 2 teaspoons (10 ml) 0.9% salt water in your mouth for 1 minute.
2. Spit the water into your cup. Pour this into a large test tube containing 1 teaspoon (5 ml) 25 percent liquid detergent.
3. Cap tube and gently rock it on its side for 2–3 minutes. The detergent will break open the cell membrane to release the DNA into the soap solution. Do not be too vigorous while mixing! DNA is a very long molecule. Physical abuse can break it into smaller fragments, a process known as shearing.
4. Open and slightly tilt the tube and pour 1 teaspoon (5 ml) fluid ounces of the chilled 95 percent ethanol down the side of the tube so that it forms a layer on the top of your soapy solution.
5. Allow tube to stand for 1 minute.
6. Place a coffee stirrer into the tube to slowly move some of the isopropyl alcohol into the soap layer. DNA will start to precipitate out of the soap solution.
7. Use the pipette to suck up the DNA fragments and move into a cyro tube containing the rest of the isopropyl alcohol. Your DNA should stay solid in this solution.