Spinach DNA Extraction

A Lesson on DNA Extraction

Background Information:

The process for discovering biotechnology begins with a strong foundation of understanding DNA. DNA is found in all living things. DNA is a long, stringy molecule. Sections of DNA are referred to as genes. These genes code for specific amino acids. Amino acids form together to make long changes which are called proteins. These proteins are expressed to give an organism its unique characteristics.

Objectives:

1. Students can explain that desired genes can be inserted into bacteria to be replicated by a process called genetic engineering.
2. Students followed the DNA extraction procedures and isolated DNA with a scoop to retrieve from one sample. Or the student was not able to extract DNA but analyzed the procedures and evaluated where an error in the procedures may have happened.
3. Students can explain function of the restriction enzymes, bacterial plasmids, bacteria and antibiotics during genetic engineering.

Video Needed:

"Genetic Engineering" by MIT K12 Videos
https://www.youtube.com/watch?v=nfC689ElUVk (7:20)

Materials needed:

- 1/2 cup of Fresh Spinach
- 1 cup Ice Cold Water
- 1/4 teaspoon Salt
- 2 tablespoons Liquid Detergent (clear preferred)
- Meat Tenderizer (One Pinch)
- Blender
- Strainer
- Stop Watch or Timer
- Small Stir Stick or Straw
- Ice Cold 90% Ethanol or Isopropyl Alcohol
- Paper Towels

Level: High School

Standards:
Next Generation Science Standards
LS1.B—Growth and Development of Organisms
LS3.A—Inheritance of Traits
LS3.B—Variation of Traits

Activity Description:
Students will actively take part in an experiment to see if they can extract DNA from spinach.

Source:
Oklahoma Department of Agriculture, Food and Forestry
Bringing Biotechnology to Life

Procedure:

1. Blend 1/4 tsp. salt,1 cup ice cold water (no ice) and 1/2 cup fresh spinach together in the blender at high speed until you see formation of a soup like substance.
2. Use a strainer and pour the blended substance into a measuring glass, then discard the pulp. Carefully stir 2 tablespoons of liquid detergent into the liquid and wait for 10 minutes.
3. Slowly and carefully stir in one pinch of meat tenderizer so that the DNA is not broken apart because it will be harder to see.
4. Record the volume of liquid in the measuring cup. Slowly stir in ice cold isopropyl alcohol until you have about the same amount of alcohol as you do the mixture.
5. After adding the alcohol, wait for about 3 minutes. The liquid mixture will turn murky and there will be an appearance of a cobwebby substance which will be the DNA.

Discussion:

Compare your DNA sample with those of other classmates and discuss the following questions:

1. Did everyone's DNA look the same?
2. Why did some people have more DNA?
3. Why is isolating DNA an important process?
4. What do you think scientists can learn from studying DNA?

Questions To Consider:

1. What are genes?
2. What is genetic engineering?
3. What is the role of bacterial plasmids in genetic engineering?
4. What is the role of bacteria in genetic engineering?
5. What is used to separate the desired gene from the other genes after plating the bacteria?

Optional Extension Opportunities:

1. Weigh the spinach prior to testing, and the DNA after separating. Create a class graph evaluating the relationship between weight and amount of DNA collected.
2. Increase the variables (e.g. hot vs cold alcohol, 70% vs. 90% alcohol, type of soap used in buffer, frozen vs. unfrozen samples, etc.) and compare results.