Student Handout

Taking the Mystery out of DNA: Extracting DNA from Strawberries

Introduction

DNA, or deoxyribonucleic acid, is found in the cells of all living things. It is the master code or blueprint for the organism. During cell division, this code is copied and passed to new cells. DNA also controls all cellular activities through its role in protein synthesis.

Today, we'll be extracting DNA from a banana. To do this, we must release the DNA from the cell by breaking apart, or lysing, the cellular and nuclear membranes. This is performed by mashing the banana and adding a detergent/salt solution. The DNA is then cleansed with the meat tenderizer. This contains an enzyme that breaks apart proteins. Lastly, we add alcohol, allowing the DNA to uncoil and precipitate out.

Student Background Knowledge

To prepare for this lab activity, students should find a diagram or image of a plant cell in their book or on-line references. Make a sketch of this cell in the space below. Then label your sketch to show the location of the DNA and the location of the membranes that will be lysed during this procedure. Also label the location of the cell wall, a structure that is strong but leaky (this wall will not really be affected by the steps in our procedure).

Vocabulary

DNA: Deoxyribonucleic acid, the molecule that cells contain, carries genetic information allowing for reproduction and cell division.

Lysing: In this case, the act of breaking open the cell membranes to expose the contents.

Membrane: "A living layer that cells produce to organize and contain life's processes. Membranes in a banana cell include the cell membrane to separate each cell from its environment and the nuclear membrane, to contain the DNA within each cell"

Precipitate: Formation of a solid during a chemical reaction.

Safety Considerations

Be careful when working with chemicals. As always, do not place any laboratory materials in your mouth. Although some materials may be safe to eat under other circumstances, never consume food during a lab without teacher permission. Also, be extremely careful when handling laboratory glassware. Tell your instructor if something breaks. Do not clean it up by yourself.

Materials Checklist

	Fresh banana piece (peeled, about 2 cm cube)
	Mortar & pestle
	2 beakers
	Graduated cylinders – 10 ml & 100 ml
	Cheesecloth
	Funnel or rubber band
	Glass stirring rod
	Solubilizing solution [made of 10%detergent and10% non-iodized salt in water. You will need 20 ml
	Meat tenderizer solution 5% meat tenderizer in distilled water. You will need 5 ml
	Cold Ethanol. You will need 6 ml
	Screw-capped test tube and rack to hold the test tube (optional)

Procedure

1. Obtain a piece of banana that is peeled and measured to the right size..Mash it with the mortar and pestle.
2. Combine the mashed banana with 20 ml of detergent/salt solution in a beaker and stir.
3. Strain the mixture into the second beaker through a piece of cheesecloth. After a few minutes (or after approximately 10-15 ml of liquid has collected), discard the cheesecloth together with the banana mush inside the cloth.
4. Record the appearance of the liquid that you have collected.:

_____

5. Add 5 ml of meat tenderizer solution to the banana solution and stir gently.

6. Place the glass stirring rod into the liquid. Pour 6 ml of cold ethanol into the beaker of banana solution by allowing the ethanol to run down the rod.
7. Describe your observations after the ethanol has been added to the solution.:

_____

8. Carefully swirl the glass rod in the floating DNA. You may be able to see small "threads" of DNA wind onto the rod.
9. Record your results in the space below
10. After your observations have been recorded, wash the glassware.

Results

Draw the liquids and solids as these appear in your beaker. Describe the appearance of the DNA (color, texture, quantity, how well it sticks to the rod, etc).. Label the DNA in your drawing

Extract DNA from a Banana
Student Data Sheet

Name: _____ Date:_____

1. What are the parts of DNA?

2. Would DNA from a different source look different? Why or why not?

3. Why does DNA appear as a viscous material?

4. Why would a solution become more viscous after lysis of cells?

5. How long is the DNA in an individual cell and how does the length of DNA compare to the size of a cell?

6. What are the roles of each of the components in the lysis solution?

7. Why use banana as a source of DNA?

8. What are some other materials that would be a good source of readily isolated DNA? Can you propose any biological materials that would NOT be such good sources for DNA?

9. Name some parts from the banana cells that became trapped in the cheesecloth and discarded:

   Name some parts of the banana cell that passed through the cheesecloth and were collected in the solution:

10. The smallest thread that can seen by the human eye is about 0.02 mm thick. Yet the diameter of the DNA double helix is much, much thinner: only about 2 nm. Can you estimate how many strands of DNA double helix would have to bundle together to add up to a diameter large enough to see? Hint: remember that it takes 1000 nm to equal one micrometer, and it takes 1000 micrometers to equal one mm.