Name Class \_\_\_\_\_\_\_\_\_ Due Date \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Lab 9: Extracting DNA**

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**Purpose**

What properties of DNA can you observe when you extract DNA from cells?

**Introduction**

All living organisms contain DNA, even the food we eat. Deoxyribonucleic acid is a nucleic acid that contains the genetic instructions used in the development and functioning of all known living organisms. DNA consists of two long polymers of simple units called nucleotides, with backbones made of sugars and phosphate groups joined by weak hydrogen bonds. Attached to each sugar is one of four types of molecules called nitrogenous bases. These bases are adenine (A), thymine (T), cytosine (C), and guanine (G) which always pair the same way, A-T and G-C. It is the sequence of these four bases along the backbone that encodes information. This information is read using the genetic code, which specifies the sequence of the amino acids that makes up a protein. Therefore DNA is the instructions for making proteins. DNA is located within the nucleus or nucleiod region of all cells.

The native wild or wood strawberry, *Fragaria vesca,* has only two sets of chromosomes (diploid), but the grocery store strawberry, *Fragaria ananassa*, has eight sets of chromosomes (octoploidy) and will supply an abundance of DNA. Ripe strawberries also contain enzymes (pectinases and cellulases) that help break down cell walls which makes it easier to extract DNA.

In this lab, you will extract the DNA from a strawberry. You must crush the strawberry to break apart its cells and cell walls, and then add a DNA extracting solution (lysis buffer). This solution contains detergent to dissolve the cell membranes and NaCl (salt) that will remove any proteins bound to the DNA. You will then use a filter to remove the solids from the mixture. The solution that you collect will contain DNA, proteins, sugars, and other dissolved molecules. You will use ethanol to isolate the DNA from the other dissolved molecules in the solution.

**Materials**

* Strawberry
* Detergent and NaCl (lysis buffer)
* 25ml graduated cylinder
* Coffee filter
* Zip-lock bag
* Beaker
* Test tube (medium sized)
* Test tube rack
* Chilled 95% ethanol
* Stirring rod

**Pre-Lab Predictions**

1. Why do all strawberry cells need DNA?

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2. If you observe a cell nucleus under a compound microscope, you will not see a molecule of DNA. Why will you be able to see the DNA you extract? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

3. Use what you know about DNA to predict some of the physical properties of DNA.

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4.How could you determine what percentage of a strawberry’s mass is DNA?

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**Procedure**

1. Obtain a fresh strawberry. If the green leaves (sepals) on the strawberry have not yet been removed, remove them
2. Place the strawberry in a zip seal plastic bag. Press the air out and seal it.
3. Gently mash the bagged strawberry with your fingers for 3 minutes. **Don’t break the bag**
4. Add 10 ml of lysis buffer to the bag. Press the air out carefully and seal the bag
5. Mash the bagged strawberry with the lysis buffer for 2 minutes.

**CAUTION**: Mix carefully, the fewer bubbles created the better your results.

1. Use a rubber band to secure a coffee filter around the top of the beaker. Allow the filter to sit 1-2cm below the top of the beaker.
2. Cut one of the bottom corners of your baggie off and squeeze the strawberry pulp along with the liquid into the prepared beaker with the coffee filter. Gentle use the glass pipette to mix the solution, be sure not to puncture the filter.
3. Rinse the pulp with water to ensure you obtain as much DNA as possible (5-10ml H2O)
4. Discard the baggie, coffee filter and the strawberry pulp into the trash can
5. Place the filtrate into a test tube
6. Slowly drizzle ice-cold ethanol along the side of the test tube until DNA begins to appear, It will look somewhat like cotton candy fibers
7. Slowly twirl your glass stirring-rod in the test tube to accumulate the precipitate.
8. Keep the test tube at eye level so you can see what is happening! Pay attention to the characteristics of the DNA as it precipitates

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Now match the procedure with what it is doing to help isolate the DNA from the other materials in the cell.

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| --- | --- |
| \_\_\_\_\_1. Break open the cell | A. Squish the fruit to a slush |
| \_\_\_\_\_2. Dissolve cell membranes | B. Filter your extract through coffee filter |
| \_\_\_\_\_3. Precipitate the DNA (clump the DNA together) | C. Mix in the lysis buffer |
| \_\_\_\_\_4. Separate organelles, broken cell wall, and membranes from proteins, carbohydrates, and DNA | D. Layer cold alcohol over the extract |

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 **Observations**

Sketch what the DNA looked like in the test tube and describe its appearance

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**Analyze and Conclude**

**Discussion Questions (FULL SENTENCES)**

1. **Infer** Why do you think that most DNA is stored in the nucleus of a cell and not in the cytoplasm? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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1. Water is the main ingredient in the detergent solution. Ethanol is a type of alcohol. What can you conclude about the solubility of DNA in water and alcohol? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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1. **Predict** Do you think it would be easier or harder to extract DNA from animal cells than from plant cells? Explain your answer. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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1. A person cannot see a single cotton thread four classrooms away. But if you wound thousands of threads together into a rope, it would be visible at the same distance. How is this statement an analogy to our DNA extraction

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1. Since the strawberries were once living, and we extracted DNA from them, what does this mean about the foods you eat??

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1. What was the purpose of mashing up the strawberries, the lysis buffer and the filter?

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1. Genes are found on chromosomes, and genes control traits. Give at least two examples of traits that are expressed in the strawberry.

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