Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Period\_\_\_Date\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Taking the Mystery out of DNA: Extracting DNA from a banana**

**LAB SAFETY REVIEW:**

1. Conduct yourself in a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_manner at all times in the science room.

**Horseplay, practical jokes, and pranks will NOT be tolerated.**

2. Ask your teacher questions if you do not understand the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

3. Do not touch anything in the science room without \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_from the teacher.

4. Do not conduct any \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ that you have thought up.

5. Never eat, drink, chew gum, or \_\_\_\_\_\_\_\_\_\_\_\_\_anything in the science room.

6. Keep hands away from \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

while using science materials or when working with either chemicals or animals.

7. Consider all \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_used in the science room to be dangerous. Do not touch or smell any chemicals unless specifically instructed to do so.

8. Handle all \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_with care. Never pick up hot or broken material with bare hands.10.

**BACKGROUND: Fill out the background section using your notes.**

Chromosomes are made of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_. A sequence of DNA is called

a \_\_\_\_\_\_\_\_\_\_\_\_. All living things have deoxyribonucleic acid (DNA). DNA is a molecule that

carries our genetic information (on genes). The structure of DNA is called a \_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_. The ‘rungs’ of a DNA double strand are made of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

and the sides are made of alternating \_\_\_\_\_\_\_\_\_\_\_\_\_\_and \_\_\_\_\_\_\_\_\_\_\_\_\_\_. The

complementary base-pairs are (use letters)\_\_\_ to \_\_\_\_ and \_\_\_\_ to \_\_\_\_.

The information in DNA tells our bodies how to develop, grow, and work. It also controls many of the features that make an organism unique. These instructions are in segments of DNA called genes. All of these instructions fit within tiny packages within our cells, so does this mean that DNA is too tiny for anyone to ever really see or touch?

“Many scientists use electron, scanning tunneling and atomic force microscopes to view individual DNA molecules,” said Michael W. Davidson, curator of the National High Magnetic Field Laboratory at Florida State University. But even with these advanced technologies, DNA appears as a string rather than the individual nucleotides made of phosphate, sugar and the base molecules. ***DNA is only about 50 trillionths of an inch long and 0.0000002 mm thin.*** ***THINK***: If we remove DNA from **many** banana cells, do you think we will be able to view it without a microscope?

DNA extraction is the first step that scientists take to study DNA. It allows them to find genetic disorders, study the causes of cancer and look for treatments, and even create genetically engineered organisms (GMOs) like tomatoes that stay fresh longer.

**QUESTIONS**:

* In this lab, the investigator will explore the following scientific questions:
  1. Is there DNA present in a banana cells?
  2. Given your prior knowledge of cell parts, can a simple lab technique be developed to isolate DNA from plant cells?

**HYPOTHESIS:** If a simple lab technique is followed, then DNA \_\_\_\_\_\_\_be isolated from a banana.

**MATERIALS**:

Small piece of a banana cold rubbing alcohol (isopropyl alcohol)

½ cup warm water coffee filter

1 tsp. salt test tube

½ tsp liquid dishwashing soap wooden stirrer

1/8 tsp meat tenderizer 150 ml beaker

250 ml beaker 50 ml beaker

pipette

**PRE-LAB QUESTIONS:**

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**Cell Separation—Table Salt.** By blending the banana sample and table salt (& water), you will be separating the cells. This is due to both the physical process of swirling (agitating) the cells in the beaker and the chemical process of adding salt to the solution. The salt causes the precipitation (suspension of solid particles) to form proteins and carbohydrates located in the banana, further helping to separate the cells.

**1. Why do we add salt in procedure?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

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**Cell and Nuclear Membrane Destruction—Detergent.** The cell membrane is composed of lipids (fats) and proteins. The detergent acts on these lipids like it does with other fats (think of how detergent works with bacon grease on a dirty frying pan) and captures the lipids and proteins. In the process of capturing these molecules, the cell membrane is lysed (or broken), destroying the membrane and releasing the parts of the cell into the solution.

**2. Name two reasons that we add soap.**

**First\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Second.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

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**DNA Unwind—Meat Tenderizer.** Meat tenderizer acts as an enzyme when interacting with the solution. DNA, which is usually contained in the cell as long strands wrapped around proteins, needs to be unwound in order to be completely separated from the proteins and other cell contents. The meat tenderizer acts like an enzyme in that it cuts out the proteins from the DNA-protein complex.

**3. Name two reasons we add enzymes (meat tenderizer)?**

**First\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Second \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

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**Separation of DNA from Solution—Rubbing Alcohol.** At this point of the procedure, the DNA has been released from the cell and freed from the proteins it usually accompanies, but it is mixed in with all of the other cell components in the solution. To separate and isolate the DNA from all of the other cell “junk,” you can add rubbing alcohol to the solution that forms a layer on top of the solution. This addition will cause the DNA to precipitate (cause a solid-**DNA**- to separate out from the solution) and rise up into the alcohol layer.

**4. Why do we add alcohol in procedure?\_\_\_\_\_\_\_**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**5. Where in the test tube do you look for DNA?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**6. Based on what you know about DNA, describe what you *think* the banana DNA will**

**look like in the test tube.\_\_\_\_\_**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**7. Do you think the banana DNA in your test tube would look like your DNA?\_\_\_\_\_\_\_**

**8. Explain why they would look similar or different?**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**9. Why are we able to see the banana’s DNA? (see the background information) \_**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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Procedures:

1. Obtain a fresh piece of peeled banana and place it in the 250 ml beaker.

2. With the plastic spoon, mush it up for about one minute.

3. Fill the 150 ml beaker with 120 ml of warm water.

4. Add ONE teaspoon of salt and stir until dissolved.

5. Add the salt/water mixture to your banana beaker:

6. Stir the banana and the salt/water mixture.

7. Add ½ tsp dishwashing liquid to the banana beaker and **GENTLY** mix, trying not to make it

foam up.

8. Place the coffee filter on the banana beaker, securing the top of the filter around the lip of the beaker with a rubber band.—**SEE PICTURE 1 BELOW.**

9. Pour the banana mix into the filter a little bit at a time to avoid breaking the filter. Let it sit until most of the liquid runs through the filter into the beaker. This can take a while.

10. Remove the rubber band and **GENTLY** squeeze more of the liquid into the banana beaker. Do **NOT** allow any of the banana to go into the liquid.

11. Thrown away the used coffee filter—BE CAREFUL NOT TO DRIP IT ON THE FLOOR ON THE WAY TO THE GARBAGE!!

12. Raise your hand and I will come and add the meat tenderizer to your banana mixture.

13. ONE person from your group: fill each test tube to the line nearest the bottom of the test tube with the banana beaker mixture

14. Tilt the banana beaker and SLOWLY, with a pipette, add the rubbing alcohol down the side of the test tube to the next line indicated on your test tube.

BE CAREFUL—DO NOT POUR TOO FAST.

15. Alcohol is less dense than water, so it floats on top.

Look for clumps of white stringy stuff where the water and alcohol layers meet or the stringy stuff may float to the top of the alcohol layer.

Observe the clumps of tangled DNA molecules! **SEE PICTURE 2 BELOW**.

16. You can collect the banana DNA--GENTLY pour it in to an Eppendorf tube and close the lid tightly.

17. 14. Clean up your station:

\*Rinse test tube with clean water from the sink.

\*Rinse the 250 ml beaker

\*Rinse the plastic spoon

Make sure your station looks just like it did when you first sat down at this lab.





Picture 2

Picture 1