Name _____ Class _____ Date _____

Investigative Lab 11

Berry Full of DNA

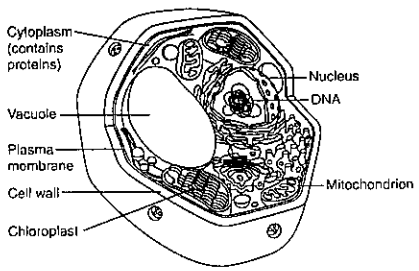
Exploring Properties of Strawberry DNA

Question What properties of DNA can be observed in a test tube?

Lab Overview In this investigation you will break open strawberry cells, prepare a filtered extract containing strawberry DNA, and separate out molecules of DNA in a test tube.

Background Every cell in a strawberry contains eight copies of each of its chromosomes. As a result, strawberries contain large amounts of DNA. After this lab, you will never eat a strawberry again without thinking of how much DNA is in it! Strawberry DNA is easy to extract because strawberries are easy to mash, and ripe strawberries produce enzymes that contribute to the breakdown of cell walls. To extract the DNA, you will first break strawberry cells apart mechanically, by crushing them. Next, you will add detergents to dissolve the cell's plasma membranes. A filtering step then removes cell organelles, broken cell walls, membrane fragments, and other cell debris. The result will be a red-colored solution containing DNA and other small dissolved molecules such as sugars and proteins. When cold ethanol is layered on top of this solution, molecules of ethanol repel the DNA molecules, and the DNA clumps together. A ropelike clump of many DNA molecules forms that is large enough to see with the unaided eye.

Prelab Activity Observe this sketch of a plant cell. Notice that the DNA is located inside the nucleus. Afterward, answer the Prelab Questions on the next page.



Plant Cell

Prelab Questions

1. To isolate strawberry DNA, you must separate it from other cell materials. Some of the lab steps you will use are listed in the left column below. Match the letter of each lab step with its effects on strawberry cells and enter your answers in the spaces provided.

Lab Steps	Effects on Strawberry Cells
a. Mash the fruit to a slush.	____ breaks open the cells
b. Filter the strawberry extract.	____ dissolves plasma membranes
c. Add detergent solution.	____ clumps DNA together
d. Layer cold ethanol over filtered extract.	____ separates organelles and cell debris, such as fragments of cell walls and membranes, from DNA and small dissolved molecules such as proteins and sugars

2. If a molecule of DNA is invisible even under a microscope, how will you be able to see the strawberry DNA you extract?

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3. Why do you think the clump of DNA molecules has a ropelike shape?

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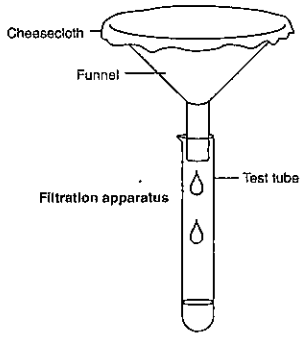
Materials

- self-sealing plastic freezer bag
- strawberry
- 10 mL detergent solution
- filtration apparatus: cheesecloth, funnel, and test tube
- ice-cold ethanol
- test tube (clear plastic or glass)
- stirring rod or inoculating loop
- test tube rack (optional)
- microcentrifuge tube (optional)

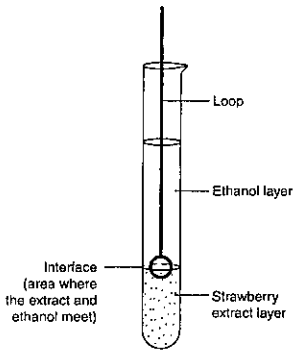
Procedure

1. Place one strawberry in a self-sealing plastic freezer bag. Press the air out of the bag, and seal it carefully. Mash the bagged strawberry with your fist for 2 min.
2. Add the detergent solution to the bag. Press the air out carefully and seal the bag.
3. Mash the bagged strawberry for 1 min.
4. Set up your filtration apparatus as shown below. If a test tube rack is available, place the test tube securely in the rack. **CAUTION:** *Handle glassware carefully to avoid breakage.*



5. Pour the liquid extract into the filtration apparatus, and let it drip directly into the test tube, as shown above.
6. When the test tube is about 1/8 full, remove the funnel. Discard any extra mashed strawberry pulp with the cheesecloth.
7. Slowly drizzle cold ethanol along the side of the test tube, until the test tube is about half full of liquid. The ethanol should form a separate layer on top of the filtered extract.

8. Dip the loop or rod into the tube to where the ethanol and extract layers meet, as shown below. Gently twirl the loop or rod. Keep the tube at eye level so that you can see what is happening. Observe the characteristics of the DNA as it precipitates (clumps together). If a microcentrifuge tube is available, place some of the DNA you prepared into the tube. Be sure to cap the tube tightly. This will give you an opportunity to examine the DNA closely.



Analysis and Conclusions

1. Describe the DNA you extracted. How was the appearance of the DNA similar or dissimilar to what you have learned in Concept 11.2 about DNA structure?

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2. A person cannot see a single strand of cotton thread from 30 meters away, but if thousands of threads are wound together into a rope, the rope can be seen at some distance. How is this statement an analogy to the DNA extraction you did?

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3. DNA dissolves in water, but not in ethanol. Explain what happened when the ethanol came in contact with the strawberry extract during the DNA extraction.

4. In order to study human genes, scientists must first extract the DNA from human tissues. Would you expect the method of DNA extraction for human DNA to be the same as the method you used to extract DNA from strawberries? Why or why not?

5. List two possible scientific questions that could be explored by studying strawberry DNA.

Extension

Strawberry cells are octoploid (each cell contains eight sets of chromosomes), whereas banana cells are triploid (each cell contains three sets of chromosomes). Which do you predict will yield a greater quantity of DNA—5 g of strawberry tissue or 5 g of banana tissue? With permission from your teacher, do the following experiment to test your prediction.

With a laboratory balance, measure 5 g of strawberry tissue and 5 g of banana tissue. Place each sample in a separate, self-sealing plastic bag. Repeat the DNA extraction procedure to compare the relative amounts of DNA in each sample.