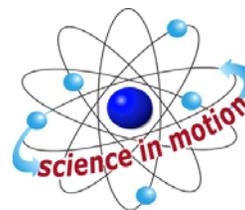


STRAWBERRY SMASH: DNA EXTRACTION IN A BAG



Westminster College

STANDARDS

- **3.2.7.B**
- **3.3.7.A, 3.3.7.B**
- **3.2.10.B**
- **3.3.10.A, 3.3.10.B**

INTRODUCTION

DNA is found in the nucleus of all cells. It has two major functions. It is responsible for passing along the genetic traits (genes) from parent to offspring. It also directs the manufacture of proteins within a cell for specific jobs. DNA is a very long, sticky and extremely thin molecule. There is approximately 7 feet (~2 meters) of DNA inside of every human cell! Under normal circumstances, this DNA is carefully packaged into the nucleus of a cell. To release the DNA, both the cell membrane and the nuclear membrane of the cell must be broken. The DNA must be separated from the other components of the cell. This separation is partly accomplished because of the chemical properties of DNA; it is soluble in water (cytoplasm), but not in cold ethanol.

In this lab, you will be isolating DNA from a strawberry. Strawberries mash easily, making it easier to break the cell walls open. Ripe strawberries produce proteins called pectinases and cellulases which help break down the cell walls. In addition, store-bought strawberries have a lot of DNA. They are octoploid, or have 8 sets of each chromosome in every cell.

To release the DNA from the strawberry cells, first you will manually smash the strawberry. You will also use a lysis buffer that contains salt and detergent (soap). The detergent is important for disrupting the cell and nuclear membranes. It also disrupts the proteins in the cell, some of which would try to degrade (break apart) the DNA. When the DNA is released, the salt binds to it making it insoluble in ethanol. When the cold ethanol is added, the salt-bound DNA will precipitate (fall out) from the solution in long strands, allowing you to spool it onto a glass rod.

GUIDING QUESTIONS

- Where is DNA found?
- What is the function of DNA in the cells?
- What components of the lysis solution help extract the DNA from the cells?
- What are some of the properties of the DNA molecule?

MATERIALS

1 Strawberry	Sealable bag
Lysis buffer	Cheesecloth, folded to have 2-4 layers
50 mL beaker	Test tube
10 mL pipet	Pipet pump
Glass stirring rod or bamboo skewer	95% ethanol, ice cold

PROCEDURE

1. Obtain a single strawberry. Remove the green petals and place the strawberry in a sealable bag. Seal the bag and smash the strawberry inside the sealed bag for about 5 minutes. Be careful NOT to break the bag.
2. Use a pipet to add 10 mL of the Lysis buffer containing the salt and detergent. Reseal the bag, removing as much of the air from the bag as possible. Mix the buffer and the smashed strawberry well (about 2 minutes). **Note:** You will obtain better results if you keep air bubble formation to a minimum.
3. Place the folded piece of cheesecloth over the 50 mL beaker. Cut a corner of the bag and squeeze the strawberry/lysis buffer solution onto the cheesecloth and filter any juice into the beaker below. Be careful not to get any chunks of strawberry into the filtered solution in the beaker.
4. Transfer the filtered strawberry solution into a test tube, filling it about 1/3 of the way.
5. Carefully pour 10 mL of ice cold 95% ethanol using a 10 mL pipet into the test tube at a 45° angle. **It may help to slowly drip the ethanol down the side of the tube.** The ethanol should form a clear layer on top of the filtered DNA juice solution (see Figure 1). Do this carefully, as you will get the best results if the ethanol and the DNA juice solution do not mix. Observe what happens where the ethanol and filtered strawberry solution meet.

Figure 1. Ethanol layered on top of strawberry DNA solution



6. Slowly lower a glass stir rod (or bamboo skewer) and rotate the rod to collect your DNA. If you do this carefully, the DNA should stick to the glass rod in long, sticky strands. The DNA may be clear to a pale white color.

REFERENCES

University of Georgia, The Science Behind our Food Project, Strawberry DNA Extraction Lesson Plan, (2006).
<http://apps.caes.uga.edu/sbof/main/lessonPlan/StrawberryDNAExtra.pdf>

Carnegie Institution for Science, CASE: Carnegie Academy for Science Education, Berry Full of DNA, First Light Science Program, 1530 P St. NW, Washington D.C., 20005
http://carnegieinstitution.org/first_light_case/horn/DNA/BERRYteacDNA

Irene Salter, (2006) My Science Box, Genetics & Evolution Box, DNA Extraction.
<http://www.mysciencebox.org/book/export/html/340>

Darrell Causey, Jr. (2007) Science Teacher 411. Strawberry DNA Extraction.
http://scienceteacher411.com/berry_dna.pdf

Extraction Image (Figure 1) from:

http://www.carolina.com/showVideo.do?imgcode=/local/products/detail/211338_a_bit.jpg

Carolina Biological. DNALC Strawberry DNA Extraction Kit.. Developed in collaboration with the Dolan DNA Learning Center, Cold Spring Harbor Laboratory.

CREDITS

Special thanks to Leah Ann Williams of New Castle High School, New Castle, PA for providing the basic instructions for this protocol. This lab was revised and adapted for Science in Motion from the above references by Dr. Stephanie Corrette-Bennett.

DATA SHEET

Name: _____

Group: _____

Date: _____

OBSERVATIONS

1. Describe what you see at the interface of the ethanol and the DNA mixture.

2. Describe the appearance of the extracted DNA.

QUESTIONS

1. Match the correct procedure with the function.

PROCEDURE

- A. Filter strawberry slurry through cheesecloth
- B. Mash strawberry with salty/soapy solution
- C. Initial smashing and grinding of strawberry
- D. Addition of ethanol to filtered extract

FUNCTION

- ___ To precipitate DNA from solution
- ___ Separate components of the cell
- ___ Break open the cells
- ___ Break up proteins and dissolve cell membranes

2. Why is soap added to the strawberry cells?

