



Activity 5.1.3 Extracting DNA

Purpose

All eukaryotic cells contain a nucleus, which contains deoxyribonucleic acid otherwise known as DNA. DNA is the material that cells use for replication to create new cells with similar characteristics. DNA is the starting point for studying genetics and gene inheritance that will be studied in future activities and projects.

Although you cannot see individual strands of DNA, it is possible to separate DNA from other cellular components and discover evidence of large concentrations of the material. To separate DNA from other cellular components, both physical and chemical methods are employed. The effect of freezing cells is the first physical force applied to break down cell walls. As cells freeze, they expand due to their water content. This ruptures the cell walls and allows you to access the organelle components.

The DNA found in the nucleus of animal and plant cells consist of long threadlike chains of proteins. These microscopic threads number in the millions for even the smallest samples of animal or plant tissue. It is impossible to see the individual components with the naked eye and requires an extremely powerful microscope to see the structure of a DNA molecule clearly. A single strawberry contains millions of DNA molecules and when concentrated into a small area you can spin the threads into a mass large enough to see with the naked eye.

Can you isolate the DNA of a strawberry through a simple investigation? What will you see?

Materials

Per pair of students:

Strawberry
Separation tray
Plastic test tube
Funnel
Plastic sleeve
Plastic baggie
Cheesecloth
Wood splint
Plastic dropper
Graduated cylinder
Cell lysis solution
DNA precipitation solution

Per student:

Safety goggles
Disposable gloves
Pencil
Agriscience Notebook

Procedure

Your teacher has thawed frozen strawberries for you to use. Follow the procedures below to isolate the DNA contained in one strawberry. Be extra careful as you conduct the investigation to prevent damage to the DNA threads during the multiple step separation process. If you are successful, the DNA strands will be very long fibrous threads.

Part One – Predictions

In the space provided on the student worksheet, write three to four sentences answering the following questions.

- Based on what you know, where is DNA located within a cell?

The nucleolus

- What membranes or structures contain the DNA?

The nucleus

- How will physical separation help you to see the DNA?

the parts of strawberry that doesn't contain DNA will be taken out isolating the DNA

- How will chemical separation help you see the DNA?

it will isolate the DNA so you can " spin" the DNA like wool

Part Two – Physical Separation

1. Place a thawed strawberry in a plastic baggie and seal the bag closed.
2. Squeeze the berry with your fingers to make a consistent puree.

Part Three – Chemical Treatment

Place the funnel in cavity "A" of the separation tray.

Place a piece of cheesecloth in the funnel to act as a screen for large pieces.

Measure 10 ml of cell lysis solution in a graduated cylinder.

Pour the cell lysis solution into the plastic baggie with your strawberry puree.

Gently mix the chemical into the puree trying not to create bubbles in the mixture. Cell lysis solution will dissolve the cell membrane and keep the DNA in one piece but free it into solution.

Slowly pour the strawberry mixture into the funnel you set up in Step 2.

Let the solution drip into cavity "A" for a while. The solution that drips into cavity "A" is called lysate and it contains the freed DNA from the strawberry.

Discard the cheesecloth and remove the funnel from cavity "A".

Part Four – Separate the DNA

1. Place the plastic sleeve in cavity "B" of the separation tray.

Fill the plastic test tube half full with DNA precipitation solution.

Place the test tube in cavity "B" supported upright by the plastic sleeve.

Use a plastic dropper and obtain lysate solution from cavity "A" into the dropper.

Hold the test tube at a 45-degree angle and slowly allow 15 drops of lysate solution to slide down the inside surface of the test tube to prevent the two liquids from mixing.

Let the test tube sit undisturbed for three minutes and record observations in Table 2 on the student worksheet. You should see three distinct layers forming. The DNA will slowly rise from the lysate solution into the DNA Precipitation Solution. Describe each of these elements.

Part Five – "Spinning" the DNA

1. Insert a wooden splint into the test tube until the tip is embedded into the DNA layer.
2. Turn and twist the splint gently passing it back and forth between the two layers of liquid. The DNA will wrap around the splint like yarn on a spool. It will look like mucus or egg white.
3. Continue to collect DNA strands on the end of the splint. Gently wring out the excess liquid from time to time by gently pressing the splint against the side of the test tube. Keep twisting the DNA until no more can be captured.

Compare the amount of DNA precipitate you collected with that of other groups. Answer the analysis questions on the student worksheet.

Conclusion

1. Where is DNA located within the cells of animal and plants?

the nucleus

3. What processes were used to separate the DNA from other cellular matter?

using chemicals to dissolve the other parts of the cell

4. Why is DNA important in scientific studies?

it shows a cells genetic material

5. Explain the relative size of DNA molecules.

I don't know

Source: Lab-Aids Incorporated. (2005). *Strawberry DNA extraction kit [Brochure]*. Ronkonkoma, NY: Author.

Name _____

Activity 5.1.3 Student Worksheet

Table 1. *Predictions*

i think it will produce a red goop

Table 2. *Observations*

Analysis Questions

How does the amount of DNA that you collected compare to that of other groups?

ours was larger than others

What are three possible explanations for the differences in the amount of DNA collected?

i added more than I thought there was more DNA in my drops of strawberry

If you prepared a microscope slide with the DNA on your splint, what do you think would be visible?

I don't know