

DNA EXTRACTION LAB What does DNA look like?

Overview:

In this lab you will extract or “spool” DNA (genetic material) from strawberry cells. Most of the unusual properties of DNA result from it being such a long thin molecule. Each cell contains approximately six feet of very thin DNA.

Ripe strawberries are producing pectinases and cellulases which are already breaking down the cell walls. Most interestingly, strawberries have enormous genomes. They are octoploid, which means they have eight of each type of chromosome.

The detergent in the shampoo helps to dissolve the phospholipid bilayers of the cell membrane and organelles. The salt helps to keep the proteins in the extract layer so they aren't precipitated with the DNA. DNA is not soluble in ethanol. When molecules are soluble, they are dispersed in the solution and are therefore not visible. When molecules are insoluble, they clump together and become visible. The colder the ethanol, the less soluble the DNA will be in it. This is why it is important for the ethanol to be kept in the freezer or in an ice bath.

Materials (per student group):

1. heavy duty zip lock baggie
2. 1 strawberry (fresh or frozen)
3. 10 ml DNA extraction buffer (soapy, salty water)
4. Filtering Apparatus: cheesecloth, funnel and small beaker
5. Ice cold ethanol
6. clear test tube
7. Glass rod or inoculating loop

Procedure:

1. You will be given a piece of strawberry. Put it in a ziplock bag and squish with your hands for 2 minutes.
2. Add 10 mL of cold extraction buffer to the bag and smush for one minute more.
3. Pour the strawberry mush through a funnel lined with cheesecloth. Allow the fluid to collect in a glass test tube until the test tube is about 1/8th of the way full.
4. Use your cold ethanol and gently layer (trickle the ethanol down the side of the tube, SLOWLY) it onto the solution in the tube. You should see two layers like oil and vinegar make. Do not shake the tube or mix the layers! A white precipitate should start to appear. Slowly add the cold ethanol to the tube until it is half full.
5. Dip a glass rod into the tube where the alcohol and strawberry layers meet. Gently twist the rod and try to catch some DNA on the end of it.
6. It's time to see if we have extracted DNA-so let's **spool!** Slide a thin, clean glass rod (you might need to clean it, rinse with distilled water and dry) into your test tube until it penetrates the interface between the layers. Then **spool** the DNA by rotating your rod while bringing it up and down gently. Do not stir. Large molecules of white DNA will **precipitate** (spool) on the sides of the rod. Reel in a good clump of fibers. These are not single DNA molecules, but huge ropes of thousands of molecules twisted together.
7. Clean Up!

OBSERVATIONS:

Draw the DNA! Relate its chemical structure to how it looks when lots of it is clumped together.

QUESTIONS

1. Match the letter with its purpose in the DNA extraction procedure

_____ Break open the cell

A. Layer cold ethanol over filtered extract

_____ Precipitate the DNA

B. Squish the fruit to a slush

_____ Separate organelles, broken cell wall and membranes from the DNA

C. Filter strawberry extract through cheesecloth

2. The DNA in a human cell weighs approximately 2.0×10^{-12} grams. Calculate how many cells you would need to use to isolate 1 mg (milligram or 1×10^{-3} grams) of DNA, assuming you can get all the DNA out of a cell... Show your work.

3. Do you think human DNA will look the same as strawberry DNA? Explain.

4. Describe two practical applications for being able to extract DNA from cells.

5. **DNA** is soluble in water, but not in ethanol. What does this fact have to do with our method of extraction? Explain what happened when the ethanol came in contact with the strawberry extract.

6. A person cannot see a single cotton thread 100 feet away, but if you wound thousands of threads together into a rope, it would be visible at some distance. How is this statement an analogy to our **DNA** extraction?

7. Would the **DNA** be the same in any cell in the human body?