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**DNA Extraction**

**from Strawberries**

**Introduction**
Have you ever wondered how scientists extract DNA from an organism? All living organisms have DNA, which is short for deoxyribonucleic acid; it is basically the blueprint for everything that happens inside an organism’s cells. Overall, DNA tells an organism how to develop and function, and is so important that this complex compound is found in virtually every one of its cells. In this activity you’ll make your own DNA extraction kit from household chemicals and use it to separate DNA from strawberries.

**Background**

Whether you’re a human, rat, tomato or bacterium, each of your cells will have DNA inside of it (with some rare exceptions, such as mature red blood cells in humans). Each cell has an entire copy of the same set of instructions, and this set is called the genome. Scientists study DNA for many reasons: they can figure out how the instructions stored in DNA help your body to function properly, they can use DNA to make new medicines or genetically modify crops to be resistant to insects, they can solve who is a suspect of a crime, and can even use ancient DNA to reconstruct evolutionary histories!

To get the DNA from a cell, scientists typically rely on one of many DNA extraction kits available from biotechnology companies. But in general, the science behind DNA extraction is easy, and extraction can be completed using everyday materials. During a DNA extraction, a detergent mixture will cause the cell to pop open, or lyse, so that the DNA is released into solution. Remember, all cells have a cell membrane that separate the cell’s contents from the outside work. Eukaryotic cells, such as those that make up plants, animals, and people, keep their DNA in a special compartment within the cell, called the nucleus. This nucleus also has a membrane that needs to be popped open. Then alcohol added to the solution causes the DNA to precipitate out of solution and become visible. In this activity, strawberries will be used because each strawberry cell has eight copies of the genome, giving them a lot of DNA per cell. (People, for example, only have two genome copies per cell.)

**Materials**

* Strawberries
* Hot water *(not boiling)*
* Dishwashing liquid
* Salt
* Measuring spoons
* Mortar and pestle
* Coffee filter
* Beaker
* Stirring rod
* 50ml conical tube
* Rubbing alcohol (91%)

**Preparation**

* Chill the rubbing alcohol in the freezer right away. *You will need this later.*
* Remove and discard the green tops from the strawberries.

**Procedure**

1. Mix 1/4 teaspoon of salt, 4 tablespoons of hot water, and 1 teaspoon of dishwashing liquid in the beaker using your stirring rod. This is your extraction liquid. Transfer this liquid to your mortar. *Why do you think there is detergent in the extraction liquid?*
2. Place 1 large-sized strawberry into the mortar. Grind/smash the strawberry with the pestle for 5 minutes. *How do the smashed strawberry look? How do you think the detergent and salt will affect the strawberry cells?*
3. Place a coffee filter in the empty beaker. *It helps to fold the filter over the sides of the beaker.*
4. Pour the strawberry mixture from the mortar into the coffee filter. Let it drip through the filter and into beaker until there is very little liquid left in the filter (only wet pulp remains). *Why is this step important? How does the filtered strawberry liquid look?*
5. Pour the filtered strawberry liquid from the beaker into the 50ml tube.
6. Tilt the tube and very slowly pour the ice-cold alcohol down its side. Pour until the alcohol until the alcohol/strawberry mixture reaches the 40ml marking on the tube, forming a layer. *Do mix/shake strawberry liquid and alcohol together*.
7. Observe the mixture inside of the jar. The strawberry DNA will appear as gooey clear/white stringy stuff. *Do you see anything in the tube that might be strawberry DNA? If so, where in the tube is it?*
8. Dip the stirring rod into the jar where the strawberry liquid and alcohol layers meet and then pull up the skewer. *Did you see anything stick to the skewer that might be DNA? Can you spool any DNA onto the skewer?*

**Observations and results**

* Were you able to see DNA in the tube when you added the cold rubbing alcohol?
	+ Was the DNA mostly in the layer with the alcohol and between the layers of alcohol and strawberry liquid?
* When you added the salt and detergent mixture to the smashed strawberries, the detergent helped lyse (pop open) the strawberry cells, releasing the DNA into solution, whereas the salt helped create an environment where the different DNA strands could gather and clump, making it easier for you to see them.
* After you added the cold rubbing alcohol to the filtered strawberry liquid, the alcohol should have precipitated the DNA out of the liquid while the rest of the liquid remained in solution.
* You should have seen the white/clear gooey DNA strands in the alcohol layer as well as between the two layers. *A single strand of DNA is extremely tiny, too tiny to see with the naked eye, but because the DNA clumped in this activity you were able to see just how much of it three strawberries have when all of their octoploid cells are combined!*