

Name: _____ Date: _____

Activity 5 – Squishy Strawberry Science

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<https://www.scientificamerican.com/article/squishy-science-extract-dna-from-smashed-strawberries/>

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Key concepts

DNA

Genome

Genes

Extraction

Laboratory techniques

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. During a DNA extraction, a detergent will cause the cell to pop open, or lyse, so that the DNA is released into solution. Then alcohol added to the solution causes the DNA to precipitate out. 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. (Most organisms only have one genome copy per cell.)

Materials:

- Rubbing alcohol
- Measuring cup
- Measuring spoons
- Salt
- Water
- Dishwashing liquid (for hand-washing dishes)
- Glass or small bowl
- Cheesecloth
- Funnel
- Tall drinking glass
- Three strawberries
- Resealable plastic sandwich bag
- Small glass jar (such as a spice or baby food jar)
- Bamboo skewer, available at most grocery stores. (If you use a baby food or short spice jar, you could substitute a toothpick for the skewer.)

Procedure:

- Put the strawberries into a resealable plastic sandwich bag and push out all of the extra air. Seal the bag tightly.
- With your fingers, squeeze and smash the strawberries for two minutes. *How do the smashed strawberries look?*
- Add three tablespoons of the extraction liquid you prepared to the strawberries in the bag. Push out all of the extra air and reseal the bag. *How do you think the detergent and salt will affect the strawberry cells?*
- Squeeze the strawberry mixture with your fingers for one minute. *How do the smashed strawberries look now?*
- Pour the strawberry mixture from the bag into the funnel. Let it drip through the cheesecloth and into the tall glass until there is very little liquid left in

the funnel (only wet pulp remains). *How does the filtered strawberry liquid look?*

- Pour the filtered strawberry liquid from the tall glass into the small glass jar so that the jar is one quarter full.
 - Measure out one half cup of cold rubbing alcohol.
 - Tilt the jar and very slowly pour the alcohol down its side. Pour until the alcohol has formed approximately a one-inch-deep layer on top of the strawberry liquid. You may not need all of the one half cup of alcohol to form the one-inch layer. Do not let the strawberry liquid and alcohol mix.
 - Study the mixture inside of the jar. The strawberry DNA will appear as gooey clear/white stringy stuff. *Do you see anything in the jar that might be strawberry DNA? If so, where in the jar is it?*
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- Dip the bamboo skewer 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?*
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- Extra: You can try using this DNA extraction activity on lots of other things. Grab some oatmeal or kiwis from the kitchen and try it again! *Which foods give you the most DNA?*
 - Extra: If you have access to a milligram scale (called a balance), you can measure how much DNA you get (called a yield). Just weigh your clean bamboo skewer and then weigh the skewer again after you have used it to fish out as much DNA as you could from your strawberry DNA extraction. Subtract the initial weight of the skewer from its weight with the DNA to get your final yield of DNA. *What was the weight of your DNA yield?*
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- Extra: Try to tweak different variables in this activity to see how you could change your strawberry DNA yield. For example, you could try starting with different amounts of strawberries, using different detergents or different DNA sources (such as oatmeal or kiwis). *Which conditions give you the best DNA yield?*

Observations and results

Were you able to see DNA in the small jar 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. (When you added the salt and detergent mixture, you probably mostly just saw more bubbles form in the bag because of the detergent.) 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! (“Octoploid” means they have eight genomes.)