



Learning Lab

DNA Extraction from Strawberries



Background

Have you ever been told you have your parent's eyes or nose? Have you ever thought about how something about your parents got passed on to you? What about why animals always have babies that look like smaller (and cuter) versions of them? The information about how certain parts of you should look or act is passed down through stuff called DNA. It may seem creepy to think that all living things have material that tells them what to be, but this chemical, DNA, is in all living things, including foods you eat! You can even see the DNA in foods you eat just using tools you have at home. Today, you'll just be looking at DNA from strawberries, but scientists use fancier ways of looking at DNA for many cool parts of science, like cloning and making medicines.

Materials

- 1/2 teaspoon salt
- 1/3 cup rubbing alcohol
- 1/3 cup of water
- 1 tablespoon liquid soap (such as dishwashing detergent)
- Metal strainer (or funnel with paper towel, cheesecloth, or coffee filter in it)
- Tumbler-like drinking glass (or plastic cup)
- 3 strawberries
- Large sandwich sized zip-top plastic bag
- Toothpick (or bamboo skewer)



Protocol

*Before you start: put the rubbing alcohol in the freezer and leave it for a couple hours (don't worry, it won't freeze!)

1. Mix salt, water, and soap in a small bowl to make "extraction liquid"
2. Cut off the tops of the strawberries and cut them into halves
3. Put the strawberries in plastic bag, push out all air, and use your hands to mash the strawberries for 2 minutes
4. Add the newly created "extraction liquid" to the bag and mash strawberries again for another minute
5. Pour the mixture through the strainer into the glass until all the liquid is in the glass
6. Take the resulting strawberry juice liquid and very slowly pour the cold rubbing alcohol down the side of the glass
 - It is important to pour alcohol slowly so it forms a layer above the strawberry juice
7. Dip the toothpick into the glass so it lands where the alcohol and strawberry juice meet
8. Stir the toothpick in a circle and twirl it slowly
9. Take out the toothpick and look at the DNA!
 - Hint: it's that white stringy stuff

Understanding the Protocol



STRAWBERRIES



HOUSEHOLD OBJECTS



DNA

We use strawberries instead of other fruits because they have even more DNA! Each little piece of a living thing, known as a cell, has DNA in it. In humans each of these cells have 2 copies of the DNA, but in strawberries each of these have 8 copies of the DNA (scientists call this octoploid). That means strawberries have 4 times as many copies of DNA as humans, making it 4 times easier to see!



Each thing we added to our “extraction liquid” had a specific job in letting us see DNA. We couldn’t have seen the DNA if we hadn’t added each of these liquids!

1. The soap broke apart the outside layer of the cell so we could get to the stuff inside.
2. The salt broke apart the proteins that were holding DNA together and keeping it inside the cell.
3. DNA doesn’t like being in alcohol, so adding alcohol forced DNA to clump together by the edge of the alcohol. This clumping made it possible to see the DNA because it was in larger pieces.

Follow-up Questions

- What does DNA look like in this experiment?
- What do you think DNA looks like under a microscope?
- Where was the DNA in the strawberry?
- Are strawberries the only food with DNA?

What to Do Next

- Try the experiment with different fruits and see if you still get DNA
 - Hint: try foods that are easy to mash, like bananas
- Measure how much DNA you get from different amounts of strawberries using a microscale
 - Does using more strawberries lead to more DNA?
- Try the experiment with different temperature of alcohol
 - Why do you think colder alcohol leads to more DNA being visible?
 - Why didn’t the alcohol freeze?

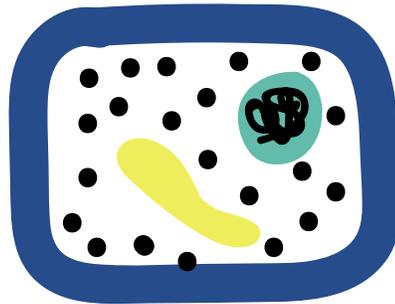


For the Educator in the Room

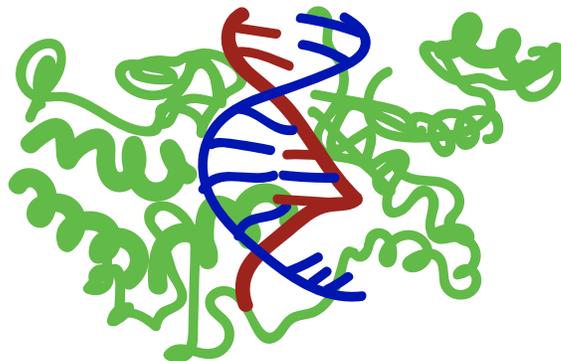
This lab extracts DNA from strawberries, as opposed to other foods, because strawberries contain large amounts of DNA. Each cell in a strawberry contains 8 copies of its genetic information (octoploid), while human cells only contain 2 copies (diploid). The DNA being visualized in this lab is clumps of many copies of DNA from many different cells throughout the strawberries.

Each material in this lab serves a specific role in making DNA visible.

1. The soap serves to dissolve cell membranes to access all the contents of the cell, including DNA.



2. The salt breaks down the protein chains that are holding nucleic acids together to make the DNA even more accessible.



3. The alcohol makes the DNA clump together into visible strands because DNA is not soluble in alcohol. Furthermore, the alcohol is cooled to make it even more difficult for DNA to dissolve in the alcohol.