A Very Berry DNA Extraction

AREA OF SCIENCE: Genetics

TIME TO COMPLETE: About 1 Hour

Every living thing (including you!) is made of cells. Every single cell contains DNA, which is a material that carries genetic information. Your DNA carries genes that define your physical characteristics, like the color of your eyes and hair.

DNA stands for "deoxyribonucleic acid," but that's quite a mouthful, so you can think of it as "Decoding Nature's Actions."

Why do forensic scientists study DNA? While most of a person's DNA is similar or identical to the DNA of others, about 0.1% is completely unique to that person. This unique part of a person's code, often called a DNA "fingerprint," is a powerful tool used by crime scene investigators. When investigating the scene of a crime, investigators collect things like saliva, blood, skin and hair. DNA fingerprints can be extracted from these things and used as clues to help identify people and solve crimes.

In this experiment, you'll extract DNA from strawberry cells. Strawberries are especially rich in DNA*, but you can use other fruits and vegetables as well. The extracted DNA will look like long, thin, tangled threads.

Other fruits and veggies to try:

- kiwis
- zucchini
- tomatoes
- apples
- peaches
- peas
- onions
- plums
- pears

Don't try this with watermelons and bananas since they don't produce very good results.

* **Why are strawberries so rich in DNA?** Each strawberry cell contains eight chromosomes, which is more than what many other fruit cells have. "Octo" means "eight" in Latin, which is one of the reasons why scientists use the word "octoploid" to describe strawberry cells.

MATERIALS: Included

small rubber bands


filter


test tube with cap


test tube rack

MATERIALS: From Home


strawberry (kiwis, plums or tomatoes also work well)


salt


water


¼ teaspoon


tablespoon

ice cold rubbing alcohol (isopropanol)

liquid dish soap


2 small cups


scissors


toothpick or craft stick


heavy-duty zipper storage bag

Instructions

Get out your lab notebook! Scientists take lots of notes as they conduct experiments.

Step 1

Place the rubbing alcohol in the freezer for at least 30 minutes. Keep it cold until you use it in the experiment.

Step 2

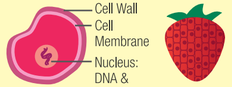
Blend 1 tablespoon of water with ¼ teaspoon of soap in a cup. Add a pinch of salt. The soap in this mixture will open up the cell, while the salt helps untangle the DNA.

Step 3

Mash your berry. Place it in a bag and seal the bag closed. Mash the strawberry with your fist and knead it with your fingers for about 2 minutes. Make sure there are no large chunks. Be careful not to break the plastic. You can also use a rolling pin if you have one!

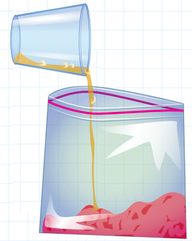
What's going on?

Soap breaks down fatty oils. Think about how much cleaner dishes get when you use soap to wash them. The thin membranes surrounding strawberry cells contain fatty molecules called lipids. The soapy solution dissolves the lipids, which exposes the insides of the cells' nuclei. These insides include DNA! The salt breaks apart protein chains in the nuclei and allows the DNA to separate from the proteins.



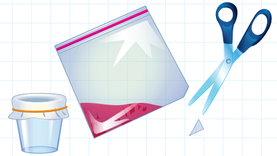
Step 4

Open the bag and add your soap mixture to the mashed strawberry. Seal the bag and use your hands to mix everything together for 1 minute.



Step 5

Filter the DNA. Wrap the filter over the top of your second small cup and secure it with a rubber band. Make a small dent in the filter to collect the goop from the bag. Snip a corner of the bag and pour your mixture onto the filter. You may want to do this over the sink.



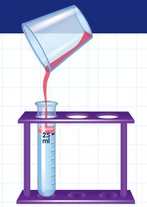
In your lab notebook, record the color of the liquid and estimate how much drained through the filter and into your cup.

Step 6

Let the mixture drain through the filter for at least 10 minutes. You'll have liquid in the bottom of your cup. Don't worry if there's not a lot of liquid. Remove the filter and throw it away.

Step 7

Assemble your test tube rack and place the test tube inside.

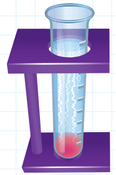


Step 8

Get the alcohol out of the freezer. The colder the alcohol is, the more DNA you're likely to see. Make sure you do this next part with an open window nearby (alcohol vapors can be harmful). Measure and pour about 25ml of rubbing alcohol into your test tube. Then carefully pour in your strawberry mixture. Put a cap on your test tube and wait 5–10 minutes.

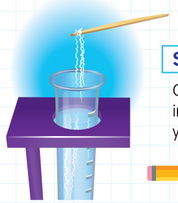
What's going on?

When salt dissolves in water, it becomes invisible to the naked eye. DNA also dissolves in water, but in this experiment, the cold alcohol causes it to "un-dissolve," or "precipitate." The DNA strands float above the layer of water, which is denser and heavier than the alcohol.



Step 9

See where the layer of filtered strawberry touches the layer of alcohol? Look for very thin, white threads forming there. That's the strawberry's DNA! It may look like feathers, small balls or wispy clouds. You may need to wait 5–10 minutes before you see the DNA float to the top.



Step 10

Collect the DNA. Slowly dip the end of your toothpick into the tube and carefully gather the DNA strands on your toothpick.

What does the DNA look like? Record your observations in your lab notebook.

DISCOVER MORE

- Ask an adult to help you research & conduct an experiment where you extract DNA from your cheek cells.
- Check current events for scientific discoveries about DNA.
- Learn how scientists use DNA beyond forensics. Doctors look for differences in DNA that can lead to treatments and prevention of disease.