

STEAM Subject: Biology
Lab: Strawberry DNA Extraction
Grades: 4-8

Learning objective:

Students will learn where DNA is stored and how to extract it from strawberries.

ENGAGE:

Ask your student what they already know about DNA. They may say it's in your blood or it comes from your parents. Refer to the following information for additional background on DNA.

Movie Connection:

If you have ever watched the movie *Jurassic Park*, you may remember an animated sequence featuring “Mr. DNA.” He explains that DNA is a molecule shaped like a twisted ladder, and that it acts as a blueprint for a living thing. View the video here: <https://www.youtube.com/watch?v=h58IRIVHhGc>

In the movie, scientists clone dinosaurs from dinosaur DNA. Although this is impossible for various reasons- including that no intact dinosaur DNA has been found in the real world- it alludes to the power of DNA. Cloning does exist today, and it is a process that involves taking DNA from one organism to create another genetically identical individual. An accurate takeaway from *Jurassic Park* is that DNA controls what a living thing looks like.

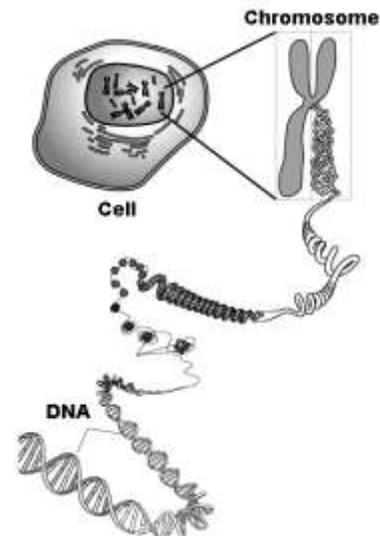
EXPLORE:

What is DNA and where is it stored?

Your body is made up of cells- around 75-100 trillion!
There are different types of cells that make up different parts of your body. Blood cells make up your blood, muscle cells make up your muscles, and so on.

How do each of those cells know what to do in your body? Each cell contains a copy of your DNA. The DNA molecule serves as a set of instructions for how your body should look and operate.

DNA contains genes, which are portions of DNA that control specific traits or characteristics- like hair color, skin tone, and even blood type. Image credit and more information on DNA: <https://www.koshland-science-museum.org/sites/all/exhibits/exhibitdna/intro02.jsp>



What are some traits that you have? (example: brown eyes, blonde hair, freckles)

All living things have cells and DNA- from monkeys to jellyfish, mushrooms to strawberry plants. If it's alive, it has DNA.

What traits or characteristics would strawberry DNA code for?

-Juiciness, redness, sweetness

Strawberry DNA Extraction Activity



Students will participate in an experiment in which they use various household items to extract DNA from strawberries.

Materials needed per student:

- 1 Zip-lock bag (snack, sandwich, or quart size)
- Dish Soap
- 3 Strawberries
- A small clear cup or beaker
- Pipette or tweezers
- Isopropyl/Rubbing Alcohol (chilled)
- 1 coffee filter or thin mesh strainer
- Measuring cups and spoons ($\frac{1}{3}$ cup, $\frac{1}{2}$ cup, 1 tablespoon, $\frac{1}{2}$ teaspoon)

Reference video, step-by-step instructions, and image credits:

<https://www.youtube.com/watch?v=67KXatgoNKs>

<http://stem-works.com/external/activity/583>

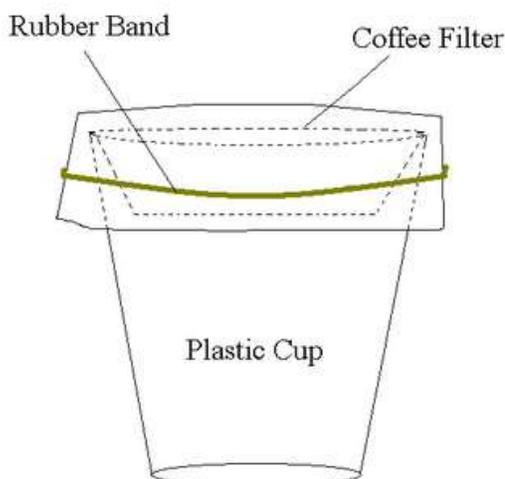
<https://mr-hester.weebly.com/strawberry.html>

Procedure:

1. First place the isopropyl alcohol in the freezer. You will need it to be ice cold.
2. Create a buffer solution in a cup: You will add 1 tbsp (approximately 15 mL) of dish soap into $\frac{1}{3}$ cup of water. Add $\frac{1}{2}$ tsp of salt. Gently stir- you do not want this mixture to get bubbly.

3. Place your strawberries into your Zip-lock bag and zip tightly, avoid trapping excess air.
4. Use your fingers to carefully squeeze and mush your strawberries into a liquid consistency.
5. Add 3 tbsp (45 mL) of your buffer solution into the bag and reseal it. Mix the liquified strawberries and buffer solution by mashing the contents together. Avoid shaking as it will cause bubbles.
6. Once you have an even consistency, pour the mixture through a coffee filter or fine mesh strainer. Place a coffee filter on top of a clear cup or beaker. Use a rubber band to secure it to the top of the cup or have someone help you to hold it in place. Unzip one end of the bag and pour all the contents through the filter.

Filtration Apparatus



7. Remove and throw away the filter containing the leftover clumps of strawberry on top. Pour your pink strawberry solution into a small clear cup or beaker (smaller, narrower cups or beakers work best).
8. Add $\frac{1}{2}$ cup of ice-cold isopropyl alcohol to your cup and hold the mixture at eye level. You should see two layers form- the pink strawberry mixture at the bottom and the clear alcohol layer on top. You should see bubbles getting stuck on a cloudy substance in the clear layer- this is the DNA rising to the top. Leave this for a minute and watch a small DNA cloud start to form.
9. Once you see the DNA, spool it together with a pipette, tweezers, or a fork and try to take it out of the liquid. Note: the DNA is a stringy slimy texture.

EXPLAIN:

- In this experiment, we used steps involving various chemical substances and tools to break DNA out of cells and force the DNA to rise to the top. We used a buffer solution containing dish soap to break open the cells and release DNA into the solution. You may already know that dish soap is good at breaking down food residue on dishes, but it can also break down cell membranes. We used a filter so that the microscopic DNA molecules could pass through and leave the chunky

bits of strawberry behind. We then added alcohol which causes DNA molecules to stick together and form a visible clump (or cloud) of DNA.

Review STEM Vocabulary:

- **Cell:** the basic structural unit for all organisms. Cells are small compartments that hold the biological equipment necessary to keep an organism alive and successful.
- **DNA:** A molecule that acts like a set of instructions for how your body looks and operates. DNA stands for Deoxyribonucleic Acid
- **Traits:** Characteristics that are controlled by your DNA
- **Gene:** A segment of DNA that controls a trait. For example, you have genes that control your eye color.

EVALUATE:

DNA is microscopic- and supposedly looks like a ladder- so why do we see a cloudy goopy substance?

You are seeing a clump of many individual copies of DNA- but they have all been compacted due to the addition of the alcohol. If you looked at this substance's molecular structure you would see the ladder shape, but it is way too small to see with your eyes.

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