# DNA: It's Berry Special

**Extract DNA from a strawberry using materials around the house while exploring biology and chemistry concepts!**

## Materials

- Fresh strawberry
- Water
- Dish soap
- Salt
- Rubbing alcohol (70% or higher). 100% acetone or a nail polish remover can be used as a substitute
- Ziploc bag
- Coffee filter, cheesecloth, or fine mesh strainer
- Clear plastic or glass cup/jar/bottle
- Popsicle stick or tweezers

## Concepts to Explore

- Cell parts and structure
- Hydrophobic and hydrophilic interactions
- Polarity
- Solubility and Precipitation

## Activity Format

- Have students write down ***detailed observations*** and include ***drawings*** as they work through the activity

- Students may answer the focus questions using the "**Claim, Evidence, Reasoning**" format:
  - Claim that answers the question
  - Evidence from students' data
  - Reasoning that involves a rule or scientific principle that describes why the evidence supports the claim

## Procedure

1. Put the bottle of rubbing alcohol in the freezer.
2. Make your soap solution by combining 6 Tbsp of water, 2 tsp of dish soap, and ¼ tsp of salt. Stir until the salt dissolves.
3. Mash the strawberry in the ziploc bag. Be careful not to break the bag!
4. Add the soap solution and another pinch of salt to the bag and mash up your strawberry some more.
5. Filter the contents of the ziploc bag through a coffee filter into a cup
6. Slowly add 1-2 teaspoons of the chilled rubbing alcohol to the cup. The white stringy stuff that floats to the top is strawberry DNA! Use a popsicle stick or tweezers to remove the strawberry DNA from the cup.

## Focus Questions

**PreK-2**

1. What happened to the strawberry when you mashed it in the bag with soap, water, and salt?
2. DNA is found in all living things. What did the strawberry DNA look like? Do you think all DNA looks like this?
3. What do you wonder about what rubbing alcohol does to a strawberry?
4. Sketch what you think is going on between the soap, water, rubbing alcohol and strawberry

**Elementary**

1. DNA is found in all living things. Why might it be useful to extract DNA from a living organism?

2. What do you think happens to the strawberry when it is mashed with soap, water, and salt? Do you think you would be able to get the DNA out of the strawberry by just using one of these ingredients? Why or why not?
3. Even though the DNA was there, you couldn't see it until the rubbing alcohol was added. What do you think the rubbing alcohol does to the strawberry mixture?
4. What types of substances mix together more easily? What types of substances don't mix together easily? Explain your answer by sketching a diagram showing the interaction between
    a. A soap molecule and a water molecule
    b. A DNA molecule and water molecule
    c. A DNA molecule and an alcohol molecule

**Middle School**

1. Why might it be useful to extract DNA from a living organism?
2. Create a continuum for DNA, water, rubbing alcohol, soap, and salt, where substances near each other on the continuum are more likely to dissolve in each other and those farther apart will not. Why do you think we needed to use all of these ingredients in a stepwise manner to extract the DNA?
3. Is the DNA what you thought it would look like? What do you think the rubbing alcohol does to the strawberry mixture so that we can see the DNA at the end?
4. How are hydrophobic and hydrophilic interactions relevant to how the strawberry DNA was extracted? Explain your answer by sketching a particulate diagram showing the interaction between
    a. A soap molecule and a water molecule
    b. A DNA molecule and water molecule
    c. A DNA molecule and an alcohol molecule

**High School**

1. A soap molecule contains a hydrophobic head and a hydrophilic tail. Based on what you know about the structure of a cell membrane, why is using soap an essential step for our strawberry DNA extraction?
2. Knowing that there is water in a cell nucleus, what can you deduce about the solubility of DNA in water? How might this explain why the strawberry DNA was not visible until the rubbing alcohol was added?
3. Knowing that water is polar and that salt exists as $Na^+$ and $Cl^-$ ions when dissolved in water, how do you think adding salt impacts the solubility of various protein chains that are bound to DNA? Why do you think this is an important step in our DNA extraction method?
4. How are intermolecular forces related to solubility? Explain your answer by sketching a particulate diagram showing the intermolecular forces between
    a. A soap molecule and a water molecule
    b. A DNA molecule and water molecule
    c. A DNA molecule and an alcohol molecule

**Design/Extension Opportunities**

- How does varying the ratio of soap, water, and salt affect the DNA extraction?
- Attempt to extract DNA from other fruits or foods.

**Photo References**