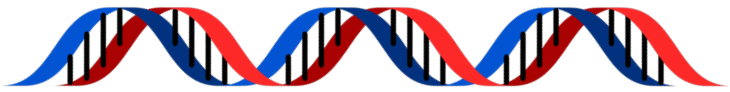
DNA extraction



Please assemble the following supplies for our Skype A Scientist experiment.

Consumables

- 2-5 strawberries (fresh or thawed from frozen)
  Kiwi or banana will also work
- 1 quart-sized resealable plastic bag (e.g., Ziploc)
- 1/2 cup of 99% isopropyl alcohol
  Note: 70-95% isopropyl or ethyl alcohol will also work. You will need a way to keep this frozen until use with a freezer or a bowl/bucket of ice.
- 1/2 cup of cold water
- 1/2 teaspoon of Kosher or table salt
- 2 tablespoon of liquid dish washing detergent
- Optional: 1/8 teaspoon of meat tenderizer OR pineapple juice OR lens cleaning solution

Equipment

- Qtip, wooden skewer, coffee stirrer, or straw
- Funnel with cheesecloth, small strainer, or coffee filter
  A rubber band or hair tie may help
- 1 tablespoon, 1 teaspoon, and 1 measuring cup
- 2 plastic or glass cups
  Ideally one cup is tall, narrow, and transparent. Plastic or glass test tube will also work if you have a stand or an extra set of hands.
- Towel for spills

Adapted from:
1) https://omsi.edu/sites/all/FTP/files/chemistry/NH-PDF/NH-C19-DNAExtraction.pdf
2) https://learn.genetics.utah.edu/content/labs/extraction/howto/
3) https://www.scientificamerican.com/article/squishy-science-extract-dna-from-smashed-strawberries
4) https://www.genome.gov/Pages/Education/Modules/StrawberryExtractionInstructions.pdf
5) https://www.childrensmuseum.org/blog/real-science-strawberry-dna-extraction

Brooke Wolford, PhD

Experimental Protocol

(this is like a recipe)

Before the experiment, thaw your fruit if frozen, and place the isopropyl alcohol in the freezer.

1. Harvest Cells. Remove the green tops from 3-5 strawberries. Place them in a bag and seal it shut. Try to get the extra air out when sealing. Use your hands to squish them into a pulp.

2. Create extraction buffer in a measuring cup or large cup. Mix 1/2 cup of cold water, 2 tbsp of detergent, 1/2 tsp of salt. Optional to add meat tenderizer or alternative.

3. Cell lysis. Slowly pour extraction buffer into the bag and reseal it. Knead the strawberries until the mix is the consistency of a smoothie. Try to minimize making soap bubbles. Do not shake.

4. Assemble a strainer, cheesecloth with funnel, or coffee filter above your transparent cup. Pour the mixture in your bag through to filter out chunks of strawberries. You may need to squeeze your filter and be patient. Try to get as much of the liquid mixture in your cup as possible.

5. DNA precipitation. Hold your cup at a 45° angle and slowly pour 1/2 cup of cold isopropyl alcohol down the side of the cup. The goal is to have about an inch of alcohol sitting on the strawberry mixture which contains the DNA. Let sit for a few minutes. Swirl gently. White polymers should precipitate out, that is the DNA. Use your skewer or other tool to fish the DNA out of the mixture.

A virtual experiment can be found at https://learn.genetics.utah.edu/content/labs/extraction/

Concepts

1. **What is DNA?**

The code with information for how plants and animals look and function.

2. **Where is DNA in the cell?**

In the nucleus.

3. **How are strawberry and human cells different?**

Strawberries have plant cells, which have a cell wall and a cell membrane, but human cells are animal cells which only have a cell membrane. Strawberries have 8 copies of their genome (octaploid), but humans have 2 copies of their genome (diploid). The human genome is longer (as measured by bases) than the strawberry genome. Read more about the strawberry genome: https://www.nature.com/articles/s41588-019-0356-4.

4. **What does mashing the strawberries do?**

This breaks the cell wall in a process called “mechanical disruption.”

5. **What do we call when the DNA rises up out of the mixture/ solution?**

This is the process of a solid forming from a liquid which we call precipitation. Not to be confused with rain! The DNA is the “precipitate.”

6. **What does the extraction buffer do?**

The detergent breaks the cell membrane and nuclear membrane through a process called “cell lysis.” Enzymes in things like meat tenderizer and contact lens solution break down proteins. The salt makes the DNA less soluble in water, so more likely to precipitate.

7. **What happens if we use a banana or room temperature alcohol?**

This is like changing a variable in the experiment. Make a hypothesis about what might happen. Then, compare your results to someone who did not change that variable, and see how the results differ.