

# Encoding Information in DNA

**Estimated Time: 45 minutes**

## SUMMARY

In this activity, students learn about how complicated information can be encoded using binary code and then the four DNA bases and use them to send and receive coded messages using DNA. They then extract DNA from cells in a form that they can see. Finally, explore the prediction of genetic traits using Punnett Squares in the final activity.

## WHAT YOU'LL LEARN

- How to encode and decode binary code
- How DNA is used to create the proteins that make up organisms
- How to extract DNA in a visible form
- How to predict genotypes and phenotypes of offspring with Punnett Squares

### Materials Used

#### DNA Extraction

- Fruit or Vegetable
- Plastic sandwich bag
- 15mL ice cold 90% isopropyl alcohol or 95% ethylalcohol
- Small funnel
- Meat tenderizer
- 1 clear medicine cup
- 1 small cup (Dixie, a beaker, or another medicine cup)
- ¼ tsp dish soap
- 1 toothpick
- Cheesecloth or coffee filter
- 1 tsp salt

### Resources Used

- DNA to Protein Video – <https://www.youtube.com/watch?v=oefAl2x2CQM>
- Punnett Square Video – <https://www.youtube.com/watch?v=i-0rSv6oxSY>
- Giving Directions Video – <https://www.youtube.com/watch?v=Ct-IOOUqmyY>

## WHAT TO DO

### DNA Extraction

1. Cut up the fruit or vegetable with the knife, and place the pieces in a zippered, plastic bag.
2. Add enough warm water to the plastic bag to make a slurry (like thick soup) of the fruit/vegetable.
3. Prepare your extraction solution using 1 tsp salt and 2 mL dish soap in about 4 tsp water. Add to your bag and gently mix.
4. Place the funnel in the cup or beaker, and filter the solutions using cheesecloth or a coffee filter. While holding the funnel and cheesecloth in place, slowly pour the fruit from the plastic bag into the cheesecloth and filter the fruit mixture into a beaker or cup.
5. Add a pinch of meat tenderizer to the filtered material to cut up the DNA and stir gently. Be careful! If you stir too hard, you'll break up the DNA too much, making it harder to see.
6. Tip the cup at an angle. SLOWLY pour 15 mL (1 Tbsp) of chilled 95% ethyl alcohol or 90% isopropyl alcohol down the side of the cup so that it forms a layer on top of the water/fruit or veggie/detergent solution. Do not mix the two layers together. The alcohol precipitates the DNA out of solution, separating it from the other cell components. DNA is soluble in water but not in alcohol.
7. White, stringy or filmy DNA will appear at the interface of the two layers. DNA stands for deoxyribonucleic acid. It makes up our chromosomes and contains the "blueprint for life."
8. Use a stir stick to spool (twirl) the DNA on to the skewer or stick to collect the DNA. If you want to keep the DNA, store it in more ethyl or isopropyl alcohol in a sealed tube or bottle, such as a microcentrifuge tube, or let it dry on paper. You can make a DNA necklace by attaching the tube to a string.

### TIPS

- DNA can be extracted from human mouth cells as well. You can alter the activity to work for human cells by sloshing water or sports drink around your mouth for 10-15 seconds and spitting into a medicine cup with extraction solution (2 drops of dish soap in 4 tsp water and a tsp of salt ONLY if you sloshed with water), stirring gently, and skipping to step 6. This also requires less materials.