



CHILDREN'S MUSEUM HOUSTON

Photograph 51



Photo © [Robin Stott](#) (cc-by-sa/2.0)

Description

Celebrate the incredible work of Rosalind Franklin, British biophysicist and crystallographer, whose X-ray of DNA led to the discovery of its complex structure! Construct a model of DNA to learn about its chemical make-up and unique shape.

Background

“DNA” stands for *Deoxyribonucleic Acid*. DNA is very long molecule (*polymer*) that contains instructions for making...you! Each cell in your body contains a copy of your entire set of instructions, or *genetic code*.

DNA has a unique shape known as a *double helix*. This means that it is made of two strands bonded together in the shape of a spiral staircase. See Fig.1.



Fig.1: Double helix structure of DNA Image by Image by PublicDomainPictures from Pixabay

In this activity, you will observe the first photograph ever taken of DNA. This photograph is an X-ray image taken by Rosalind Franklin and was the first of its kind. The diffraction pattern in this image helped scientists such as Franklin, James Watson, and Francis Crick to learn more about the interesting shape of DNA.

In the second part of this activity, you will create a model of DNA using wooden toothpicks and a variety of candy.

The sides of the ladder are made of phosphate (Twizzlers) and deoxyribose sugar groups(toothpicks). This gives DNA a **sugar-phosphate backbone**. Attached to each sugar group is a pair of nitrogen bases. These make up the rungs, or center part of the ladder's structure. There are four nitrogen bases, which always match up in the same pairs: Adenine matches with Thymine, and Guanine matches with Cytosine. The order of these bases determines the code that can be used to make proteins in your body. Every organism has a unique genetic code. There are even slight differences in the DNA of identical twins!

Let's celebrate the one-of-a-kind DNA in your cells and the efforts of Rosalind Franklin who took the first X-ray image that led to the discovery of DNA structure!

Materials

- Wooden toothpicks (round with pointed ends work best)
- Scissors
- 2 Twizzler strands
- Green, yellow, red, and purple gumdrops
 - Green – will represent the nitrogen base Guanine
 - Yellow – will represent the nitrogen base Cytosine
 - Red – will represent the nitrogen base Adenine
 - Purple – will represent the nitrogen base Thymine

Procedure

1. Use the following link to observe the X-ray of DNA known as “Photograph 51” and learn about the contributions of Rosalind Franklin: <https://askabiologist.asu.edu/Rosalind-Franklin-DNA>

This photograph was taken by Rosalind Franklin and was the first of its kind. The diffraction pattern in this image helped scientists such as Franklin, James Watson, and Francis Crick to learn more about the interesting shape of DNA.

2. Create a model of DNA:
 - a. Obtain 6 pairs of gum drops (nitrogen bases). Slide them onto 6 toothpicks as pairs (1pr per toothpick). Guanine (green) must always be paired with Cytosine (yellow). Adenine (red) must always be paired with Thymine (purple). It also does not matter which base is on the left or right side of the toothpick. It also doesn't matter how many G-C pairs to A-D pairs are on your model. You just need a total of 6.
 - b. Obtain 2 Twizzlers to act as part of the backbone of your DNA molecule. Poke the toothpicks through Twizzlers on each side, so that you create a ladder shape. The sides of the ladder will be formed by the Twizzlers and the rungs of the ladder will be formed by the toothpicks and gum drops.
 - c. **Have an adult** cut the pointed ends of the toothpicks so that they do not stick out pas the sides of Twizzlers in your model.
 - d. Carefully twist the model so that it resembles a spiral staircase. You've created a model of a DNA molecule!

Description of Model:

The sides of the ladder-like structure are made of phosphate (Twizzlers) and deoxyribose sugar groups(toothpicks). This gives DNA a **sugar-phosphate backbone**. Attached to each sugar group is a pair of nitrogen bases. These make up the rungs, or center part of the ladder's structure. There are four nitrogen bases, which always match up in the same pairs: Adenine matches with Thymine, and Guanine matches with Cytosine. The order of these bases determines the code that can be used to make proteins in your body. Every organism has a unique genetic code. There are even slight differences in the DNA of identical twins!

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Questions

- How much of your DNA is passed on to you from your mother? From your father?
- Which physical traits did you inherit from your parents? (i.e. Do you have your mother's eye color, or your father's hair type?) How did you come to receive these traits?