

# The DNA Molecule Model

**DNA (deoxyribonucleic acid) is the genetic material of living organisms and is located in the chromosomes of each cell. What is its structure?**

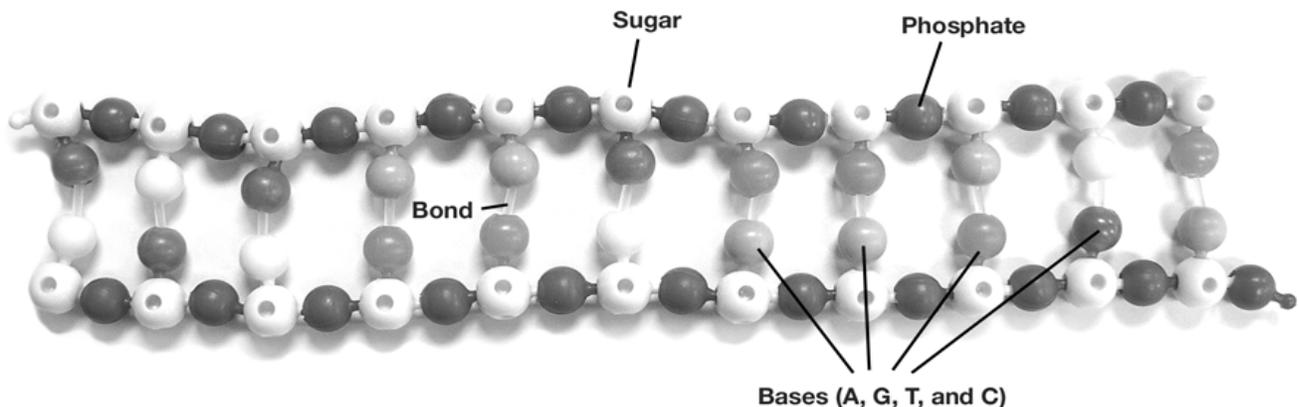
Deoxyribonucleic acid (DNA) is the hereditary molecule. DNA is made of individual units called nucleotides. Nucleotides are the building blocks of DNA. Each nucleotide is made of a phosphate group, a sugar (deoxyribose), and a nitrogen base.

- The phosphate and sugar form the sides of the molecule.
- Each rung contains a pair of *bases* held together by hydrogen bonds.
- There are four bases: thymine (**T**), adenine (**A**), guanine (**G**), and cytosine (**C**). **T** and **A** always pair up and **G** and **C** always pair up.

In this investigation you will model the structure of DNA using beads to represent the different parts of the DNA molecule.

## Materials

- Red pop beads
  - White pop beads
  - Yellow pop beads
  - Green pop beads
  - Orange pop beads
  - Blue pop beads
  - Clear plastic connectors
- Gather the required materials. Use Table 1 as a key for creating your DNA model.



**Table 1: DNA model components**

| Pop bead color | Molecule                |
|----------------|-------------------------|
| Red            | <b>Phosphate group:</b> |
| White          | Sugar (deoxyribose)     |
|                | <b>Bases:</b>           |
| Blue           | Cytosine ( <b>C</b> )   |
| Orange         | Guanine ( <b>G</b> )    |
| Yellow         | Adenine ( <b>A</b> )    |
| Green          | Thymine ( <b>T</b> )    |

- Begin by creating two phosphate-sugar “backbones” that will provide the framework on which to build each strand of your DNA molecule. Connect alternating white and red pop beads. Each backbone should contain 10 red pop beads and 11 white pop beads.
- Repeat step 1 to create the second phosphate-sugar backbone.
- Attach a **base** to each sugar on **one** of the phosphate-sugar backbones. We will call this the **original DNA strand**. At this point, the order of the bases does not matter. Use blue to represent Cytosine (**C**), orange to represent Guanine (**G**), yellow to represent Adenine (**A**) and green to Thymine (**T**) (see **Table 1**).



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- Draw a sketch of your DNA molecule in **Figure 1**. (Draw it untwisted and color code it.)

**Figure 1: DNA molecule sketch. (5 points)**



- Hold the model from the top, and gently twist the DNA ladder to the right. You should see that the DNA looks like a spiral staircase. The model now represents the helical structure of DNA. Your teacher may instruct you to take your model and attach all the DNA models together to make a longer strand of DNA. Do not do this until instructed by your teacher.

**Thinking about observations (You do NOT need to write in complete sentences.) (2 pts. each)**

1. Which molecules make up the backbone of the DNA molecule? \_\_\_\_\_
2. Why is DNA called "deoxyribose nucleic acid"?  
\_\_\_\_\_  
\_\_\_\_\_
3. What type of bond keeps the bases paired together? \_\_\_\_\_
4. Which base always pairs with adenine? \_\_\_\_\_
5. Which base always pairs with cytosine? \_\_\_\_\_