

Name: _____
 Date: _____

Modeling Activity for DNA

Time required: one 50-minute period

Introduction

Deoxyribonucleic acid (DNA) is a complex molecule found in all living organisms. DNA holds the instructions that tell our bodies how to develop and function. DNA is the chemical of which genes are composed. A gene is the basic physical and functional unit of heredity. Genes act as instructions to make molecules called proteins.

In this activity, you will:







- learn the names of the molecules which make up DNA.
- use models to construct a molecule of DNA.

Materials

Molecular Model Set for DNA

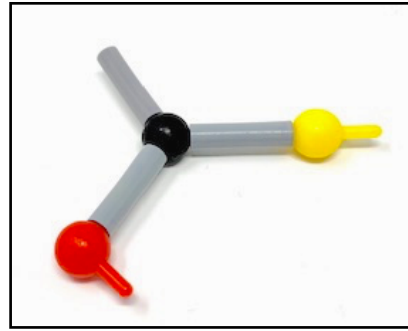
Procedure - Structure of a DNA Molecule

Two important molecules which make up DNA are deoxyribose and phosphoric acid. In addition, there are four different molecules called bases. The names and colors of the models are shown in Table 1.

Deoxyribose	Phosphoric Acid	Bases	
black	red	 adenine yellow	 thymine orange
		 cytosine green	 guanine blue

One deoxyribose, 1 phosphoric acid, and 1 base form a chemical compound called a nucleotide. A nucleotide is named for the base that joins with the deoxyribose. For example, if adenine attaches to deoxyribose, the compound is called an adenine nucleotide.

Figure 1: Adenine nucleotide



Build 2 adenine nucleotides, 2 thymine nucleotides, 3 cytosine nucleotides and 2 guanine nucleotides.

Reading from left to right, build a single strand of DNA in the order of nucleotides shown below.

T-A-C-C-A-G-C-T-G

Deoxyribose and phosphoric acid are joined to form the strand of DNA. Notice that the two ends of the strand of DNA are different from each other. The phosphate group of the first nucleotide, the thymine nucleotide, begins the strand of DNA and is called the 5' (5 prime) end.

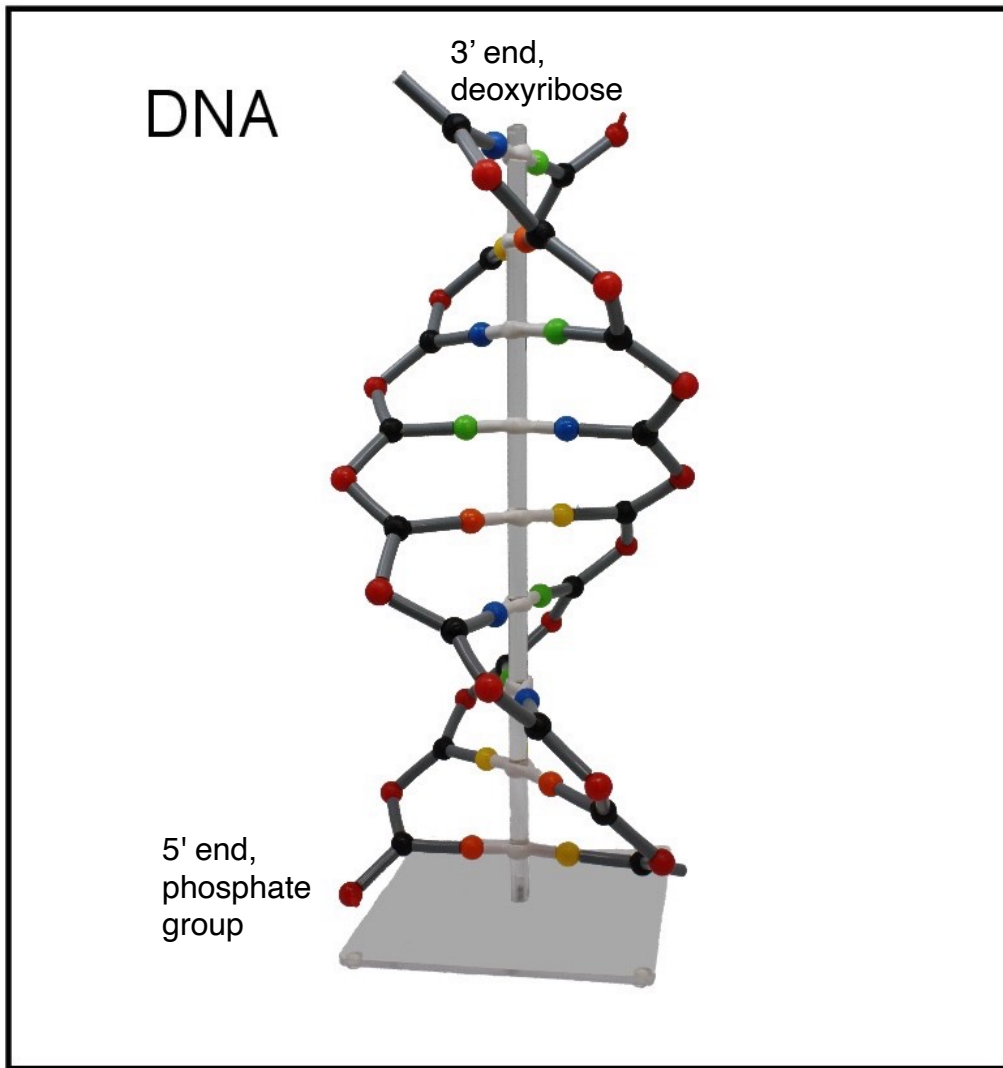
Lay the strand of DNA on a table or floor. Notice that the last nucleotide of the DNA strand, the guanine nucleotide, ends with a deoxyribose molecule. This deoxyribose molecule is called the 3' (3 prime) end of the DNA strand.

Build more nucleotides: 2 adenine nucleotides, 2 thymine nucleotides, 2 cytosine nucleotides and 3 guanine nucleotides.

Beginning with the 3' end of the adenine nucleotide, construct the other half of the DNA molecule. The opposite strand begins with an adenine nucleotide. Continue to build the second strand of the DNA molecule by adding more nucleotides and matching the bases, A-T and C-G. Adenine (yellow) always pairs with thymine (orange). Cytosine (green) always pairs with guanine (blue). Finish the DNA molecule, by connecting the phosphoric acid of one nucleotide with the deoxyribose of the next nucleotide. The order of the bases create a unique DNA molecule.

To display the DNA, screw the acrylic rod into the base. Use the bottom white bond to connect the adenine and thymine bases. The white bond represents the hydrogen bonds between the bases. Continue joining the matched bases using the hydrogen bonds. Your completed model should look like a ladder with matched bases as rungs. Besides being shaped like a ladder, a DNA molecule is twisted. It looks like a spiral staircase.

Figure 2: DNA



Analysis of DNA Molecule

1. How many nucleotides make up the left side of DNA? _____

2. List the four different nucleotides. _____

3. How is each nucleotide alike? _____

4. How is each nucleotide different? _____

5. Name the two molecules that form the sides, or uprights of the DNA ladder?

6. To which molecule does each base attach? _____

7. Is the order of the bases on the left side of the DNA molecule exactly the same from top to bottom as the order of the bases on the right side of the DNA molecule?

Explain your answer. _____

8. Only two combinations of base pairings are possible for the rungs. Name these base combinations or pairs. _____

9. If four guanine bases appear in a DNA molecule, how many cytosine bases should there be? _____

10. If the following are the bases on the left side of a DNA molecule, list the bases that would make up the right side of the DNA molecule.

Thymine _____

Adenine _____

Guanine _____

Cytosine _____

Guanine _____

Adenine _____