

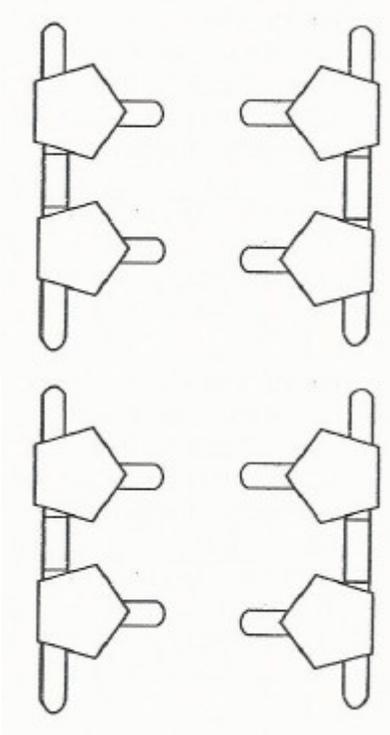
# Activity: Deoxyribonucleic Acid (DNA) & Replication

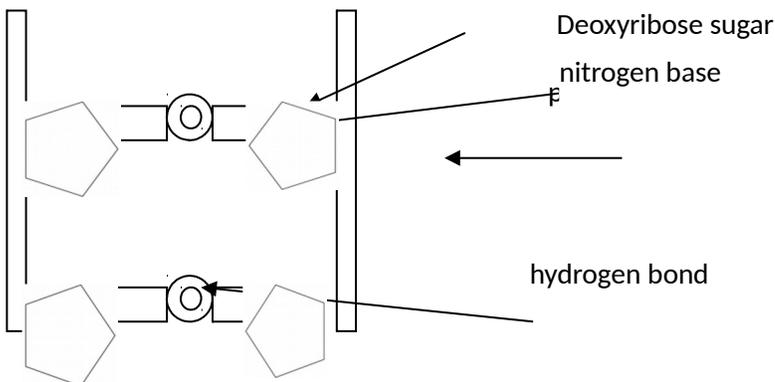
## Materials:

- 16 black, deoxyribose molecule pieces
- 14 white, phosphate molecule tubes
- 4 red, guanine base tubes
- 4 blue, thymine base tubes
- 4 green, adenine base tubes
- 4 black, cytosine base tubes
- 8 hydrogen bonding plugs

## PART ONE: Building a DNA molecule

1. Open your Ziploc baggie and quickly count to make sure the correct amounts of pieces are present.
2. Build a DNA molecule:

- i. Connect 4 phosphate tubes (white) and 4 deoxyribose sugar molecules (black pentagons) in a straight chain so that the third open bonding site on each sugar is facing the same direction.
- ii. Make a second chain the same as the first, setting the chains parallel to each other like rail road tracks on the table, so the empty bonding sites face each other. Use the diagram to the right to assist you. 
- iii. The open bonding site on each nucleotide's sugar is filled by a nitrogen base found in this order:  
**guanine (red), thymine (blue), guanine (red), adenine (green)**
- iv. The nitrogen bases on the second chain will be arranged depending on the first strand's pattern. The nitrogen base guanine always pairs with cytosine, and thymine with adenine. Match the corresponding nitrogen base to the second chain previously made.



- v. Use the hydrogen bonding plugs (clear pieces) to connect the two chains at their complementary nitrogen bases. You have now completed a model showing a portion of a DNA molecule.

3. DNA does not exist in the ladder shape that you see now. Instead, hold the ladder at each end and twist it to ) make a spiral structure. This structure is called a **double helix**, and is a trademark characteristic of DNA strands.

**Answer the following on the activity worksheet provided:**

- A. Using the diagram provided on the worksheet page for this activity colour each of the parts found within a DNA molecule using the colour key provided. When you are done make sure to label each of the nitrogen bases using the capitol letter (A), (G), (C) or (T).
- B. Using the diagram provided on the worksheet page of a partially labeled DNA strand indicate what nitrogen base would match with the nitrogen base provided according to the base matching rules.
- C. The shape of DNA molecule is called a “double helix.” Describe this shape in your own words.

**PART TWO: Replicating a DNA molecule**

1. Using the DNA model you constructed in part 2, break the hydrogen bonds between the bottom two nitrogen bases causing the DNA to “unzip” into single strands called the original strand. The hydrogen bonds are broken by a protein called helicase.
2. Continue to break the hydrogen bonds for the next two bond, leaving the top two connected.
3. **Free nucleotides** (leftover nitrogen base tubes you still have in your baggie) are able to connect to the hydrogen bonds found on the unzipped DNA. Attach nitrogen bases and hydrogen bonds (where needed) using the paring guidelines. The strand that is created from using the leftover nucleotides is called the complimentary strand.
4. Compare the DNA strand with your original. DNA replication allows DNA to be efficiently passed from generation to generation of organisms with a very small chance of error.

**Answer the following on the activity worksheet provided:**

- D. How is a DNA molecule replicated? In bullet form, give 3 steps or points on how DNA is replicated. You can use the information given in the part 2 steps of the activity or refer to page 177 in your textbook and look under figure 2.
- E. Hereditary information is carried in the DNA of an organism, and genetic traits are passed from generation to generation through reproduction. How does the DNA replication process ensure information is transmitted accurately?
- F. Explain how humans are different from each other and how with all the people in the world there are no two humans that are identical unless they are identical twins.

**\*\*\*Count the pieces and place them back into the Ziploc baggie\*\*\***