

Name: _____ Date: _____

Student Exploration: Building DNA

Vocabulary: double helix, DNA, enzyme, mutation, nitrogenous base, nucleoside, nucleotide, replication

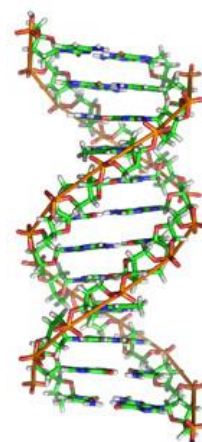
Prior Knowledge Questions (Do these BEFORE using the Gizmo.)

DNA is an incredible molecule that forms the basis of life on Earth. DNA molecules contain instructions for building every living organism on Earth, from the tiniest bacterium to a massive blue whale. DNA also has the ability to **replicate**, or make copies of itself. This allows living things to grow and reproduce.

1. Look at the DNA molecule shown at right. What does it look like?

This shape is called a **double helix**.

2. Based on this picture, how do you think a DNA molecule makes a copy of itself? (Hint: Look at the bottom two “rungs” of the ladder.)

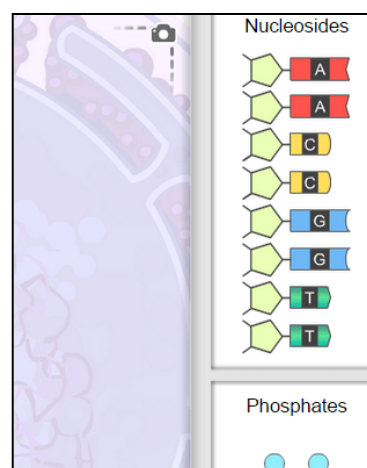


Gizmo Warm-up

The *Building DNA* Gizmo™ allows you to construct a DNA molecule and go through the process of DNA replication. Examine the components that make up a DNA molecule.


1. What are the two DNA components shown in the Gizmo?

2. A **nucleoside** has two parts: a pentagonal sugar (deoxyribose) and a **nitrogenous base** (in color). When a nucleoside is joined to a phosphate, it is called a **nucleotide**.



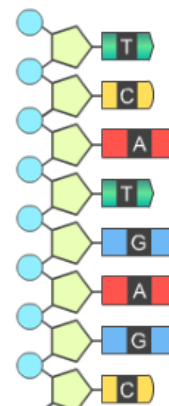
How many different nitrogenous bases do you see? _____

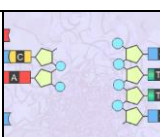
Note: The names of these nitrogenous bases are adenine (red), cytosine (yellow), guanine (blue), and thymine (green).

Activity A: Build a DNA molecule	<u>Get the Gizmo ready:</u> <ul style="list-style-type: none"> If necessary, click Reset to start the building process. 	
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Question: What is the structure of DNA?

- | | Left side | Right side |
|---|----------------------------|------------|
| 1. <u>Build</u> : Follow the steps given in the Gizmo to construct a molecule of DNA. (Note: For simplicity, this DNA molecule is shown in two dimensions, without the twist.) | _____ | _____ |
| | _____ | _____ |
| Stop when the hint reads: "The DNA molecule is complete." In the spaces at right, list the sequence of nitrogenous bases on the left-hand side of the DNA molecule and the right-hand side. | _____ | _____ |
| | _____ | _____ |
| 2. <u>Take a picture</u> : Click the camera (📷) to take a snapshot of your DNA molecule. Right-click the image and select Copy Image . Paste the image into a blank document, and label this image "Original DNA molecule." | _____ | _____ |
| | _____ | _____ |
| 3. <u>Explain</u> : Describe the structure of the DNA molecule you made. | | |
| A. What makes up the sides of the DNA molecule? _____ | | |
| B. What makes up the "rungs" of the DNA molecule? _____ | | |
| 4. <u>Fill in</u> : Write the name of the nitrogenous base that joins to each of the bases below: | | |
| Adenine (A) joins to _____ | Thymine (T) joins to _____ | |
| Cytosine (C) joins to _____ | Guanine (G) joins to _____ | |
| 5. <u>Practice</u> : The left side of a DNA molecule is shown. Draw a complementary right side of the molecule. | | |
| 6. <u>Challenge</u> : This DNA strand consists of eight pairs of nitrogenous bases. How many different sequences of eight bases can you make? Explain how you found your answer. | | |
| _____ | | |
| _____ | | |



Activity B: DNA replication	<u>Get the Gizmo ready:</u> <ul style="list-style-type: none"> Be sure the hint reads: "The DNA molecule is complete." If not, click Reset and build a new DNA molecule. 	
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Question: How does DNA make a copy of itself?

1. Observe: An **enzyme** is a protein that facilitates certain cell processes. Click **Release enzyme** to release **DNA helicase**. What does this enzyme do to the DNA molecule?

2. Observe: Click **Release enzyme** to release **DNA polymerase**.

A. Notice that two groups of **Nucleotides** appear on the right. What are the *three* parts of a nucleotide? _____, _____, _____

B. Drag one of the nucleotides to a corresponding nitrogenous base on one of the two strands. What is the role of DNA polymerase in this process? _____

3. Build: Complete the two molecules of DNA by dragging nucleotides to their corresponding locations. When you have finished, compare the two completed daughter DNA molecules.

What do you notice about the two molecules? _____

4. Take a picture: Click the **camera** to take a snapshot of the DNA molecules, and paste the image into your document. Label this image "Daughter DNA molecules."

How do these molecules compare to the original? _____

5. Think and discuss: Why is DNA replication such an important process? _____

6. Extend your thinking: Sometimes errors called **mutations** occur during DNA replication. What are some of the possible consequences of mutations?

