

## BUILDING LINEAR AND PLASMID DNA MODELS

### Primary Learning Outcomes:

**Students will learn the structure of DNA in plant, animal and bacterial cells. Students will learn the chemical make-up of a DNA molecule.**

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### High School Georgia Performance Standards

SCSh4 Students use tools and instruments for observing, measuring, and manipulating scientific equipment and materials.

SB1 Students will analyze the nature of the relationships between structures and functions in living cells.

SB2 Students will analyze how biological traits are passed on to successive generations.

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### Middle School Georgia Performance Standards

S7CS4 Students will use tools and instruments for observing, measuring, and manipulating equipment and materials in scientific activities.

S7L2 Students will describe the structure and function of cells, tissues, organs, and organ systems.

S7L3 Students will recognize how biological traits are passed on to successive generations.

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### Materials:

- The kit provides the model DNA pieces (enough for 7 groups of 4)

Randomly distribute the following sequences to the groups. These sequences will also be used in the "Coding for amino acids" lab.

**ATGCCGTCGTTACAA**

**ATGCCGCGATCGTTA**

**ATGCCGCGACAAATT**

**Additional tips:**

- Review day 1's activities and notes over DNA.
- With middle schoolers, assign each student in the group a job while building the model. This helps to avoid problems with group work and materials being lost.  
For example: Student 1: In charge of Cytosine & Phosphates  
Student 2: Adenine & Sugar
- The model kit contains instructions and summary questions on transcription of DNA starting on page 3, if you would like your students to learn this concept.

## BUILDING LINEAR AND PLASMID DNA MODELS

DNA (Deoxyribonucleic Acid) connects all life. All living things have DNA in them. The DNA molecule resembles a ladder and is made up of six parts; a sugar, a phosphate group, and four nitrogen bases. A nucleotide of DNA consists of a phosphate, a sugar and one of the four bases. You will use the materials provided to construct two DNA molecules. The first model of these molecules will be a typical linear double-helix molecule as found in animal or plant cells. Then your group will connect it to become a plasmid or circular DNA molecule found in bacteria.

### PROCEDURE

1. Your pieces represent the following DNA molecule parts:

Black pentagon - Sugar  
White tube- Phosphate  
Yellow tube- Guanine  
Orange tube- Adenine  
Blue tube- Thymine  
Green tube- Cytosine  
White rods-Hydrogen bond

2. You will use one of the following sequences to build the DNA molecule:

ATGCCGTCGTTACAA  
ATGCCGCGATCGTTA  
ATGCCGCGACAAATT

3. Construct one side of the "ladder" alternating 15 sugar and phosphate molecules to make the DNA backbone.

4. Using the sequence above, attach the first base (C - green tube) to the first sugar in the DNA strand. Attach each successive base to only the sugars.
5. Construct another matching sugar-phosphate strand. At this point you should have two sugar-phosphate strands (white pieces connecting the black sugars)
6. Once you've finished assembling the first half of the molecule, begin constructing the complementary half, connecting them with the hydrogen bond pieces.
7. Make sure you match the appropriate bases based on the sequence above. (*Remember thymine & adenine are partner nucleotides as well as guanine & cytosine.*)
8. When you've finished, carefully twist your model to represent the double-helix structure of DNA.
9. After you have studied your DNA model, carefully connect the two ends together to create a circle. Plasmids are circular.