# Candy DNA

## Introduction

DNA is a polymer formed from units called nucleotides. Each nucleotide is a molecule composed of three basic parts: a phosphate group, a sugar group (called deoxyribose), and a nitrogen-containing base (called a nitrogenous base). The phosphate group and sugar groups form the two backbones of the molecule. DNA contains four different nitrogenous bases: adenine, thymine, cytosine, and guanine. They usually are represented by the letters: A, T, C, and G.

These bases pair together: A always pairs with T, and C always pairs with G bases. These bases are connected by hydrogen bonds. Each base in the pair is also connected to a sugar compound in the DNA backbone.

In this activity, students will learn about the basic structure of DNA and the rules of base pairing by building a model of DNA out of licorice and gum drops.

***Grade Level:*** 7 – 9
***Time Needed:*** One class period

## Learning Objectives

After completing this lesson, students will be able to:

1. Describe the structure of the DNA molecule
2. Explain the rules of base pairing

## Materials (per student group)

- ☐ 2 pieces of licorice
- ☐ 12 toothpicks
- ☐ 12 red gum drops
- ☐ 12 green gum drops
- ☐ 12 purple gum drops
- ☐ 12 blue gum drops
- ☐ 5 paperclips
- ☐ Masking Tape

### Next Generation Science Standards (NGSS)

As a result of activities for grades 7-9, all students will learn content in these areas:

***Topics***

- **HS-LS2:** Inheritance & Variation of Traits
- **MS-LS2:** Growth, Development & Reproduction of Organisms

***Performance Expectation***

- **HS-LS3-1:** Ask questions to clarify the relationships about the role of DNA and chromosomes in coding the instructions for characteristics traits passed from parents to offspring.
- **MS-LS3-1:** Develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism.

***Dimension***

**Practices:**

- Developing and Using Models

**Disciplinary Core Ideas:**

- **LS3.A:** Inheritance of Traits
- **LS1.A:** Structure and Function

**Cross-Cutting Concepts:**

- Patterns
- Structure & Function

## Instructional Process

### *Prior to Class:*

Gather the appropriate amount of licorice sticks, gumdrops, toothpicks, paperclips, and masking tape for each group and place them into a paper bag.

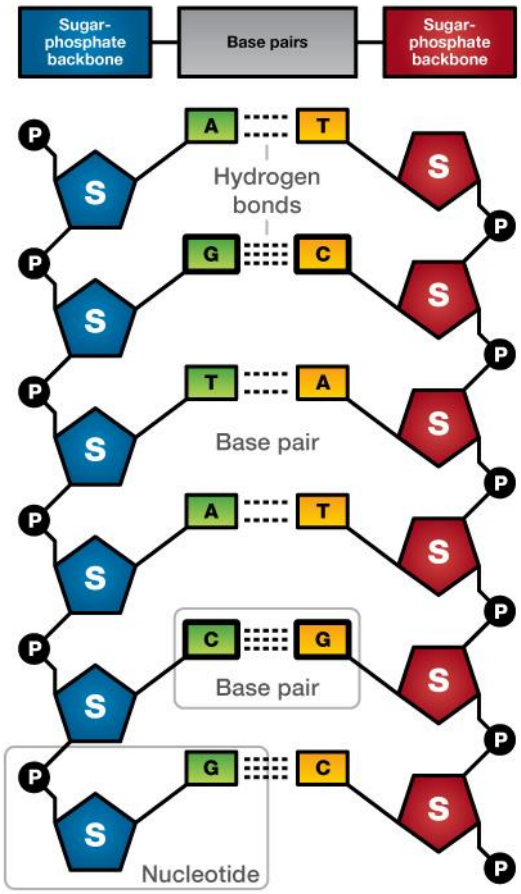
### *Day of Class:*

1. Begin by providing an overview of the structure of the DNA molecule and its specific components (i.e. phosphate, deoxyribose and nitrogenous bases).
2. During your discussion, review the rules of base pairing.
3. Pass out copies of the Candy DNA Student Activity Sheet.
4. Tell students to follow the instructions to build their own model of DNA.
5. Allow student approximately 30 minutes to build their model.
6. When each group has finished their construction, assess each model by checking the bases and their complementary pairs. Give students one point for each correct pair and three points for a correctly displayed double helix.
7. Discuss any errors with the group. If possible, let them correct their errors and resubmit for an improved score.
8. After you have assessed each model, allow students to eat their model!

# Candy DNA – Student Sheet

## Introduction

DNA is a polymer formed from units called nucleotides. Each nucleotide is a molecule composed of three basic parts: a phosphate group, a sugar group (called deoxyribose), and a nitrogen-containing base (called a nitrogenous base). The phosphate group and sugar groups form the two backbones of the molecule. DNA contains four different nitrogenous bases: adenine, thymine, cytosine, and guanine. They usually are represented by the letters: A, T, C, and G.




These bases pair together: A always pairs with T, and C always pairs with G bases. These bases are connected by hydrogen bonds. Each base in the pair is also connected to a sugar compound in the DNA backbone.

In this activity, students will learn about the basic structure of DNA and the rules of base pairing by building a model of DNA out of licorice and gum drops.

## Materials (per student group)

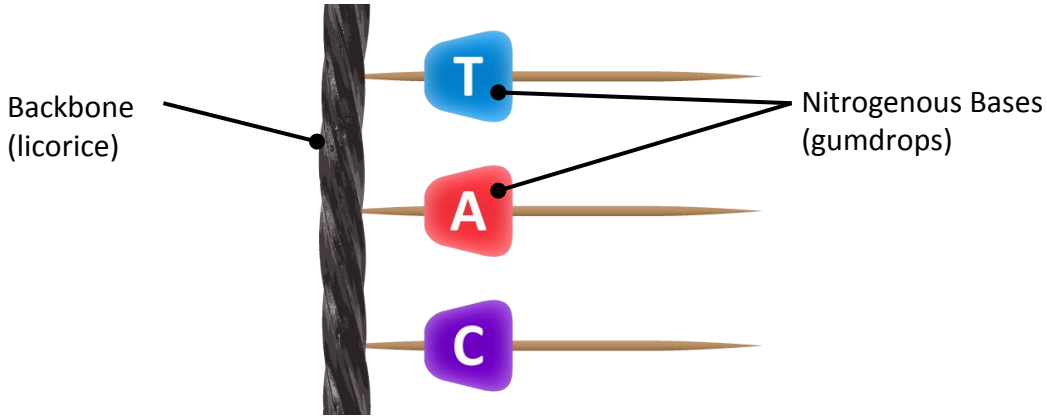
- ☐ 2 pieces of licorice
- ☐ 12 toothpicks
- ☐ 12 red gum drops
- ☐ 12 green gum drops
- ☐ 12 purple gum drops
- ☐ 12 blue gum drops
- ☐ 5 paperclips
- ☐ Masking Tape

## Procedure

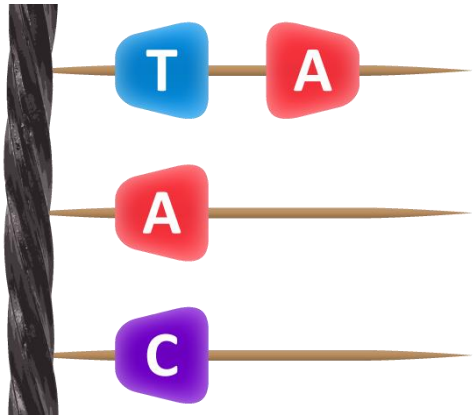
1. **Assemble one side (backbone) of your DNA molecule.**
   Take one of your pieces of licorice and lay it flat on a paper towel. This will be your one backbone (the phosphate group and sugar) of your DNA molecule.

2. **Add your nitrogenous bases.**
   Your nitrogenous bases are your gum drops. Red will represent Adenine (A), blue will represent Thymine (T), green will represent Guanine (G) and purple will represent Cytosine (C). You will add your nitrogenous bases to the licorice backbone in the following sequence:

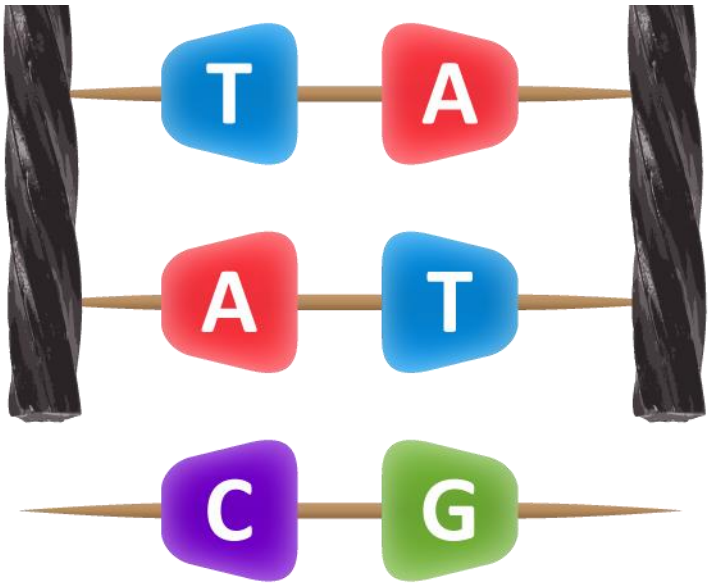

   Place the first gumdrop (Thymine = blue gum drop) on the end of a toothpick, so that the point of the toothpick goes all the way through. Anchor the toothpick into the licorice backbone. Add the remaining bases in the appropriate order.



3. **Match the nitrogenous base pairs.**
   Select the appropriate colored gumdrop for the matching nitrogenous base on the other end of each toothpick. For example, the first base was Thymine, so the matching base would be A (or the red gum drop). Remember that A always pairs with T and C always pairs with G.




4. **Complete your DNA model.**
   Attach the other backbone (licorice) so your model looks like a ladder.




5. **Make a double helix.**
   Carefully twist your DNA molecule so that it looks like a double helix.

6. **Label your model.**
   Straighten your paper clips. Make a "flag" out of small pieces of masking tape and attach them to each paper clip. Stick them into parts of your model and use them to label the following parts of your DNA:

   - DNA Backbone
   - Adenine
   - Thymine
   - Guanine
   - Cystosine


7. **Show your teacher your model.**
   When completed and labeled, take your model to your teacher to have it evaluated.

## Follow-Up Questions

1. Looking at your model, what can you conclude about the number of adenine molecules compared to the number of thymine molecules? What about guanine to cytosine?

2. What does the sequence of bases in a DNA molecule represent, or what does DNA code for?

3. What structure(s) in the nucleus of the cell is DNA found?

4. Where does the sequence of bases that is found within your DNA come from?

5. What would happen to the final product produced from your DNA sequence if the first C in your sequence was changed to a T? What about if the first T was changed to a C?