

## **M&M Base Pairing**

**By Jenna Atkins and Kara Juhl**

### **Activity Description:**

In this activity, students will learn about the bases that make up DNA and how certain bases pair with other bases (adenine pairs with thymine and guanine pairs with cytosine). Students will gain a basic understanding of the reasoning behind these pairings (a special type of bonding called hydrogen bonding occurs best between A/T and C/G, so each pair fits together like a puzzle). Additionally, students will understand when the DNA sequence changes, it can cause changes in one's physical or behavioral traits.

The activity will be delivered in the form of a worksheet and M&Ms. The worksheet will have a DNA base key, in addition to sample DNA sequences. The worksheet will also have space for students to create their own DNA sequence. By the end of the activity, students should know what the 4 types of DNA bases are, which bases pair together, that our DNA contains important information, and that changes to our DNA sequence can cause new traits.

### **Suggested Age Group:**

Suitable for ages 6-12

### **Learning Goal:**

Understanding Heredity: Understand that traits can be physical (e.g., eye color, height) or behavioral (e.g., preference for certain activities).

Making Connections: Understand basic terminology related to genetics (DNA, base, base pairing, DNA sequence).

### **Academic Standards:**

The Next Generation Science Standards (NGSS) are a set of academic standards developed by educators, policymakers, and content experts. The content area this activity will address is 3-LS3-1 Heredity: Inheritance and Variation of Traits.

### **Background Information:**

Basic understanding of the presence of DNA in living organisms and how to identify traits is required for this activity.

The following are vocabulary words relevant to this activity:

**DNA**- a molecule that contains all of the information needed to create and maintain a living thing

**Base**- a building block of DNA of which there are 4 types: adenine, thymine, guanine, and cytosine

**Base Pairing**- the process in which adenine always pairs with thymine and guanine always pairs with cytosine under normal conditions

**DNA Sequence**- the order of bases in a given segment of DNA

**Trait**- a physical or behavioral characteristic determined by one's DNA

### **Brainstorming Questions:**

- What are examples of traits that you can see versus traits you cannot see?
- How do we get new traits because of changes in our DNA?
- How do traits and variation help make each person unique?
- Why is it useful to gain new traits or lose old ones?

### **Materials List:**

- Regular M&Ms (5 blue, 5 green, 5 yellow, and 5 orange per student)
- Small disposable paper cups (one per student)
- Printed M&M Base Pairing Worksheet (one per student)

## Procedure:

1. Set up M&Ms by placing them in small disposable paper cups for each student. Have each student wash their hands. **(5 minutes- before starting activity)**
2. Explain DNA, bases, and base pairing to students, preparing them for the first part of the activity (sorting M&M bases into their appropriate pair using the M&M base key and provided DNA sequence(s)). **(5 minutes)**
3. Pass out one worksheet and one cup of M&Ms to each student. Tell students to only touch their personal cup of M&Ms. **(3 minutes)**
4. Give students time to complete the first part of the worksheet while walking around to help and asking them brainstorming questions. **(10 minutes)**
5. Regroup and debrief the first part of the activity, confirm proficiency in base pairing and explain how one of the provided sequences codes for one particular trait while the other sequence codes for a different trait (example: one sequence codes for long arms while the other codes for short arms). **(5 minutes)**
6. Explain the second part of the worksheet, have them flip over and create their own DNA sequence using As, Ts, Cs, and Gs. **(2 minutes)**
7. Have students complete the M&M base pairing activity again on the sequence of their creation (optional: have students exchange worksheets to try base pairing others' sequences). **(5 minutes)**
8. Regroup and debrief overall activity- check for understanding on primary concepts (see Activity Description section) and answer any questions. **(5-10 minutes)**
9. Allow students to enjoy M&Ms **at the end of the activity.**

**(Total Activity Time= 40-45 minutes)**

## Assessment:

The activity will be assessed first by having the students create their own DNA sequence and practice base pairing in the second part of the worksheet. This will confirm their understanding of genetic terminology such as DNA, base, and base pairing.

Additional assessment will occur during the final debriefing activity where instructors can ask questions related to the activity's primary concepts. Students can answer questions about traits and how changes in the DNA sequence can create clear differences in physical and/or behavioral characteristics.

## Facilitator's Notes:

- One optional strategy in the event students finish base pairing early during the second portion, is to have students exchange worksheets to try base pairing each other's sequences
- On a white board, it is helpful to write out at least the DNA bases (A, T, C, and G) with lines connecting the bases that pair together. Additionally, it is helpful to write out the important vocabulary and definitions relevant to the activity for students to reference.
- To ensure understanding of the core concepts (the 4 DNA bases and which pairs they form), feel free to ask students the following after they complete the first part of the activity and at the very end:
  - o What are the 4 DNA bases?
  - o What are the pairs they form?