Teachers: **Ms. Lee**
Subject: **6th Grade Science**

Unit 4: Genes & Heredity

Topic: DNA & Traits

Lesson Title: A Recipe for Traits

LG: I can create a dog with specific traits to model how traits are derived from decoded genes.

Background Information: This lesson is modified from A Recipe for Traits from Teach.Genetics, developed by Genetic Learning Science Center as part of the University of Utah Health Sciences.

Standard(s):
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. [Clarification Statement: Emphasis is on conceptual understanding that changes in genetic material may result in making different proteins.] [Assessment Boundary: Assessment does not include specific changes at the molecular level, mechanisms for protein synthesis, or specific types of mutations.]

Sci. & Engineering Practices:

- ☐ Asking questions
- ☑ ~~Developing and using models~~
- ☐ Planning and carrying out investigations
- ☐ Analyzing and interpreting data
- ☑ ~~Using mathematical and computational thinking~~
- ☐ Constructing explanations
- ☐ Engaging in argument
- ☐ Obtaining, evaluating, and communicating information

NGSSS Crosscutting Concepts:

- ☐ Patterns
- ☑ ~~Causes and effects~~
- ☐ Scale, proportion, and quantity
- ☐ System & system models
- ☐ Energy & Matter
- ☑ ~~Structure & function~~
- ☐ Stability & Change

Student Population:

- Nest Classrooms (ICT): up to 5 students on the autism spectrum, up to 20 gen-ed students.
- Horizon Classroom (ICT + Para): up to 25 gen-ed students and students with IEP, a group of 8 students on the autism spectrum push in.

Key Concepts:

- An organism's phenotype (observable characteristics) is determined by its genetic makeup and environmental factors.
- A gene is a section of DNA that encodes a specific trait of an organism based on the specific arrangements of nucleotides (adenine, cytosine, guanine, and thymine), which are building blocks of the DNA.

Misconceptions:

- All genes are the same sizes.

Materials:

- ☐ Slides
- ☐ Handout
- ☐ Laptop for displaying slides
- ☐ DNA strips
- ☐ Create-a-dog template
- ☐ Color pencils, markers
- ☐ Environmental Factor Cards

• All mutations are harmful. **Differentiated Supports:** • Heterogeneous Small Group to reduce student:teacher ratio • Guided notes via Interactive handout	

Do Now 5 min + 3 min Debrief	**Prompt:** "If you want to bake a batch of chocolate chip cookies, what would you need? You probably need some chocolate chips, flour, sugar, butter and eggs. And maybe some nuts or rolled oats if you like. But, how do you know how to make it? By using a recipe! A recipe contains the instructions for how to put all the ingredients together to make the cookies. Now let's say instead of making chocolate chip cookies, you wanted to make a person! What would you need?" **Purpose:** Get students to think about DNA's role in creating an organism. **Debrief:** Ask students "Where is the recipe that tells us how to combine all the ingredients to make a human?" The Do Now prompt is modified from the introduction in this lesson: https://www.teachengineering.org/lessons/view/cub_biomed_lesson09
Announcements (1 minute)	Provide reminders about approaching deadlines or upcoming events.
Mini Lesson - DNA & Recipe for Traits	Introduce the concepts of genes and traits. Introduce the Build-a-Dog activity by stating the objective, expectations, and steps to follow. Answer any questions students may have about the activity.
Build-a-Dog	Students may work independently or in pairs: 1. One person will reach into the brown bag and pull out a DNA part. 2. Look at the decoding guide, identify the FIRST trait your dog has by matching the DNA part to it.Place a check to the matching trait. 3. Pull out a second DNA part. Repeat step 2. Glue the second DNA part to the first one. ORDER is important. 4. Repeat until you have all 8 traits. 5. Create a drawing of your dog based on the 8 traits decoded from the DNA segments. 6. Each team is assigned a random environment card. Students will sketch the environment onto their dog template. 7. Students evaluate which of their dog's traits are advantageous and which are disadvantageous in the environment they've been assigned.
Gallery Walk & Closing	1. Students display their work at their tables. When the teacher says Go, students may walk around to check out other team's dogs and environmental analysis to leave feedback or questions using Post-It Notes. 2. After the Gallery Walk, students will clean up their work area and return all supplies neatly to where they belong before dismissal.

Extension: In the following lessons, we can simulate mutation by swapping out a segment of DNA for a random trait. Students will sketch their mutated dog and evaluate the impacts of the mutation on their dog's survivability in the environment they have been assigned.

Connection to Arts Standards:
After reviewing the standards for Visual Arts, the standard that is more relevant to this lesson is **VA:Cr2.3.6a:** Design or redesign objects, places, or systems that meet the identified needs of diverse users. Students are designing a dog that meets the criteria of the decoded DNA sequence. Even though the traits are specified, students still get to interpret and decide what the traits look like, how to translate it into a visual work of art. Students also have to figure out how to incorporate different traits into a single artwork, which requires experimentation through sketching and revising before the final product. Students can explore different media (color pencils, markers) to construct their drawings.