Create a plant Teacher Guide

Title: Create a plant

Grade: 3rd

Time: 45 minutes – 1 hour

Lesson Overview: In this lesson, students will use a "decoder wheel," based on the codon wheel used in genetics, to create a drawing of a plant. In addition to learning how to use a decoder wheel, students will learn that genetic code (in this case, colored beads) provides the instructions for the traits (in this case, there are root, stem, leaf, and flower traits). At the end of the lesson, they will share their own plant drawings, which will lead to further discussion about variation.

Next Generation Science Standards (NGSS):

Performance Expectations:

- 3-LS3-1. Analyze and interpret data to provide evidence that plants and animals have traits inherited from parents and that variation of these traits exists in a group of similar organisms.
- 3-LS3-2. Use evidence to support the explanation that traits can be influenced by the environment.

Practices:

Developing and Using Models

● Develop and/or use models to describe and/or predict phenomena.

Analyzing and Interpreting Data

● Compare and contrast data collected by different groups in order to discuss similarities and differences in their findings.

Constructing Explanations and Designing Solutions

● Construct an explanation of observed relationships.

Crosscutting Concepts:

Cause and Effect

● Cause and effect relationships are routinely identified, tested, and used to explain change.

Common Core State Standards (CCSS):

Comprehension and Collaboration:

CCSS.ELA-LITERACY.SL.3.1

Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 3 topics and texts, building on others' ideas and expressing their own clearly.

CCSS.ELA-LITERACY.SL.3.1.D

Explain their own ideas and understanding in light of the discussion.

Vocabulary Acquisition and Use:

CCSS.ELA-LITERACY.L.3.4

Determine or clarify the meaning of unknown and multiple-meaning word and phrases based on grade 3 reading and content, choosing flexibly from a range of strategies.

CCSS.ELA-LITERACY.L.3.5.B

Identify real-life connections between words and their use.

Driving Question:

- Why are organisms different from one another?

Learning Goals/Understandings:

Students will know…

- The following vocabulary terms in context: code, genetic code, organism, sequence, trait, variation.
- Genetic code causes traits in organisms.
- How to use a decoder wheel.

Students will be able to…

- Use a decoder wheel and other materials to complete the worksheet and draw a model of a plant.
- construct an explanation of observed relationships between different inherited information and variations in how different organisms (plants) look.

Materials:

- Green, pink, yellow and blue Pool noodles sliced into 2 inch pieces
- Dowel/string
- Beads in cups
- Container to lay out beads. Scrabble tile holders are recommended
- Codon wheels (decoder)
- Colored pencils/crayons/markers (green, blue, yellow, pink)
- "Create a plant" worksheets
- Computer/projector
- Board and chalk/whiteboard and markers

Sequence of Instruction:

1) Introduce the "code," which are actually slices of pool noodles in four colors. Explain that these pool noodle slices will be the instructions for making a plant and that together, the class will "create a plant" from this genetic code.

2) Select four students to randomly choose three pool noodle slices from a bin and put them, in random order, on a dowel or string. Two more students can hold the dowel or string on each side. (**Teacher note:** These pool noodle slices represent DNA bases. The groups of three represent codons).

3) Explain that each set of three pool noodle slices *codes* for a different part of the plant (code 1 - root, code 2 - stem, code 3 - leaves, code 4 - flowers). During the explanation, spread out the pool noodle slices so that they are in distinct groups of three.

4) Model for students how to code the plant.

- Refer to the data table on the "create a plant" worksheet. In the second column of the data table in the worksheet, color in the circles based on the colors of the first three pool noodle slices. Reiterate that this is the genetic code, also known as DNA, that codes for the root of the plant.

- Color in the rest of the circles on the worksheets, based on the class's plant code on the dowel or string.

- Explain that the order, or sequence, of each code, matters. Hand out "decoder wheels" and model for students how to use the decoder wheel to find the message or trait for the root. (**Teacher note:** In genetics, this is called a codon wheel.) Encourage students to follow along with their own decoder wheels:

- o Put writing utensil in the center of the decoder, on the color of the first circle. Trace to the color of the second circle. Finally, trace to the last circle's color. Read what trait is at the end of that line. (For example, if the codon was "blue, yellow, pink," the root trait would be "3 red triangles.")

- o Draw the plant part on the board. Therefore, in this case, the plant's root would consist of 3 red triangles.

- o Repeat with the remaining 3 traits, until the class plant is drawn on the board. (**Teacher note:** Vary support based on how well students are responding to using the decoder wheel. Students should be more comfortable using the decoder independently by the time they get to the last trait.)

*****Suggestion:** Laminate the decoder wheels and use dry erase markers for easy reuse. Alternatively, circles, with triangle cutouts that correspond to the size of the final color on the decoder could be attached to the wheel with brass fasteners and spun for easy reading.

5) Students code plants independently, with randomly chosen beads. (**Teacher note:** A cup/bag of beads in each of the four colors could be given to a group of students at each table to share.)
- • Students will follow the directions on the "create a plant" worksheet. (**Teacher note:** Mention that students can name their plants, just as scientists name plants and other organisms that they discover. Ask students to compare their 12 beads with those of students sitting next to them and discuss how there is variation.)
- • Teacher will circulate and assist as needed.

6) Students share their plant drawings and discuss. Depending on time and teacher preference, students can share their drawings with the class via a gallery walk, in groups at their tables, or with the whole class, individually.

(**Teacher note:** At some point during the sharing process, stress how even though the students used the same building blocks (beads) for the code, there was *variation* among students' plant drawings. Discuss the reasons for that variation (The various combinations of beads meant different genetic codes and therefore different messages or traits; variation also came from the "environment," since students might have drawn their shapes differently or used a different shade of the same color – different interpretations and available colors also contribute to the variation).
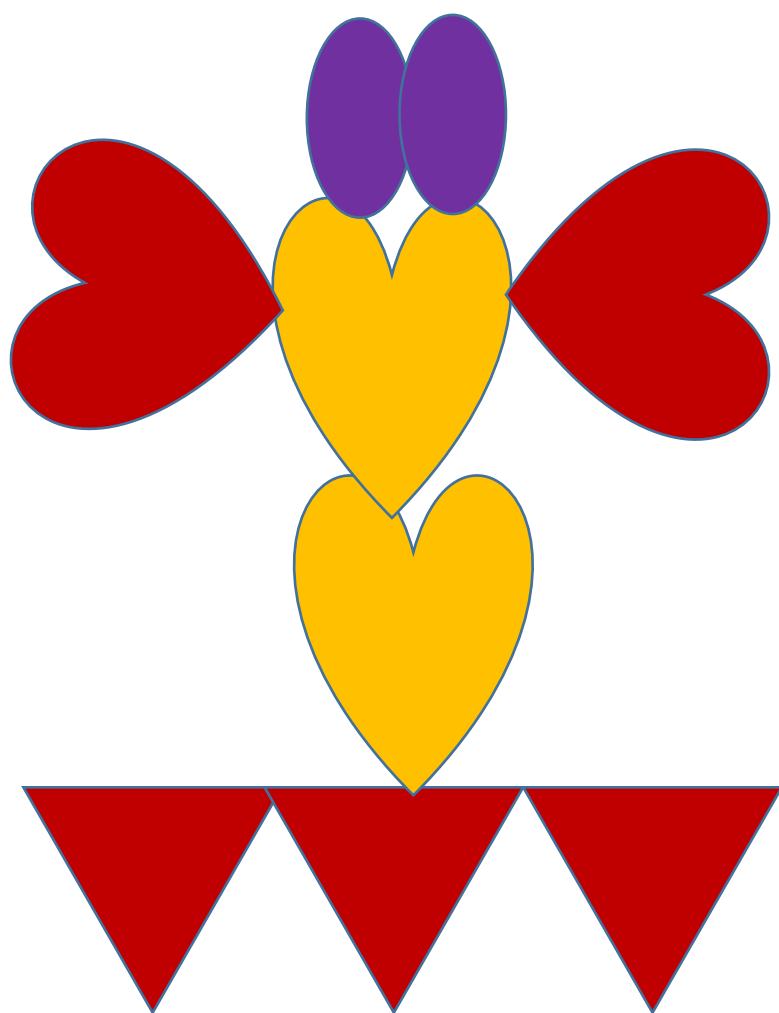
Assessment:
Students will be assessed based on the following:
- • Completed "Create a Plant" worksheets
- • Answers to questions
- • Participation in discussions
- • Observations

Create a Plant Example
The code, selected at random from a bin:
Blue, yellow, red   yellow, blue, yellow   blue, blue, yellow red, yellow, red

Code 4 (Flowers)
Red, yellow, red
Decoded: 2 purple ovals

Code 3 (Leaves)
blue, blue, yellow
Decoded: 2 red hearts

Code 2 (Stem)
yellow, blue, yellow
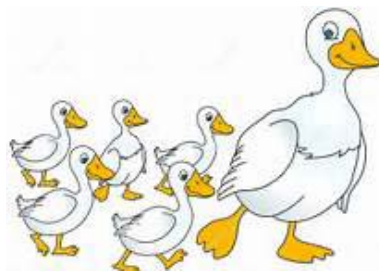Decoded: 2 yellow hearts

Code 1 (Root)
Blue, yellow, red
Decoded: 3 red triangles

Vocabulary for Genome Project

Term	Definition
Adult	The final stage of an organism's life cycle. *A butterfly is the **adult** form of a caterpillar.*
Acquired traits	A characteristic or behavior that is gained from the environment (ex. Scars, broken horns, learned behaviors) *Spiderman acquired his superpowers when a radioactive spider bit him.*
Adaptation	A structure of behavior that enables an organism to survive in its environment.
Behavioral Traits	The way an organism acts to help it survive.
Characteristics	Distinguishing trait, quality or property. The words we use to describe an organism. Hair color, eye color, and height are examples of characteristics.
Code	A sequence of symbols that have meaning.
Expression	What is seen when a code is read (decoded). *The expression of the genetic code in a plant was see as pointy leaves.*
Function	The action or job of a part (structure).
Genetic Code	A sequence of symbols that cause traits in an organism. *The genetic code determines if a human has brown or blue eyes.*
Heredity	The passing of traits from parents to their offspring.
Inherit	To receive traits from a parent.
Inherited Trait	A characteristic passed from parent to offspring *Superman inherited his superpowers from his parent on his home planet, Kypton.*
Instinct	An adaptation that an animal is born with and that controls its behavior (ex. Hibernation, migration, web spinning, nest building).
Learned Traits	Behaviors that are influence by the environment *Batman had to learn to be a superhero by studying.*
Offspring	The babies produced by parents.
Organism	A living thing.
Parent	One that creates offspring.
Pattern	Similar characteristics in organisms.

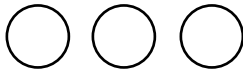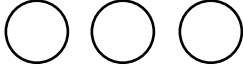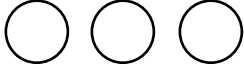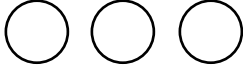| Reproduce	To make new individuals or organisms of the same kind.
Sequence	A connected series.
Structure	A part of a whole organism.
Variation	A different form of a structure of a feature of the same kind of living thing.

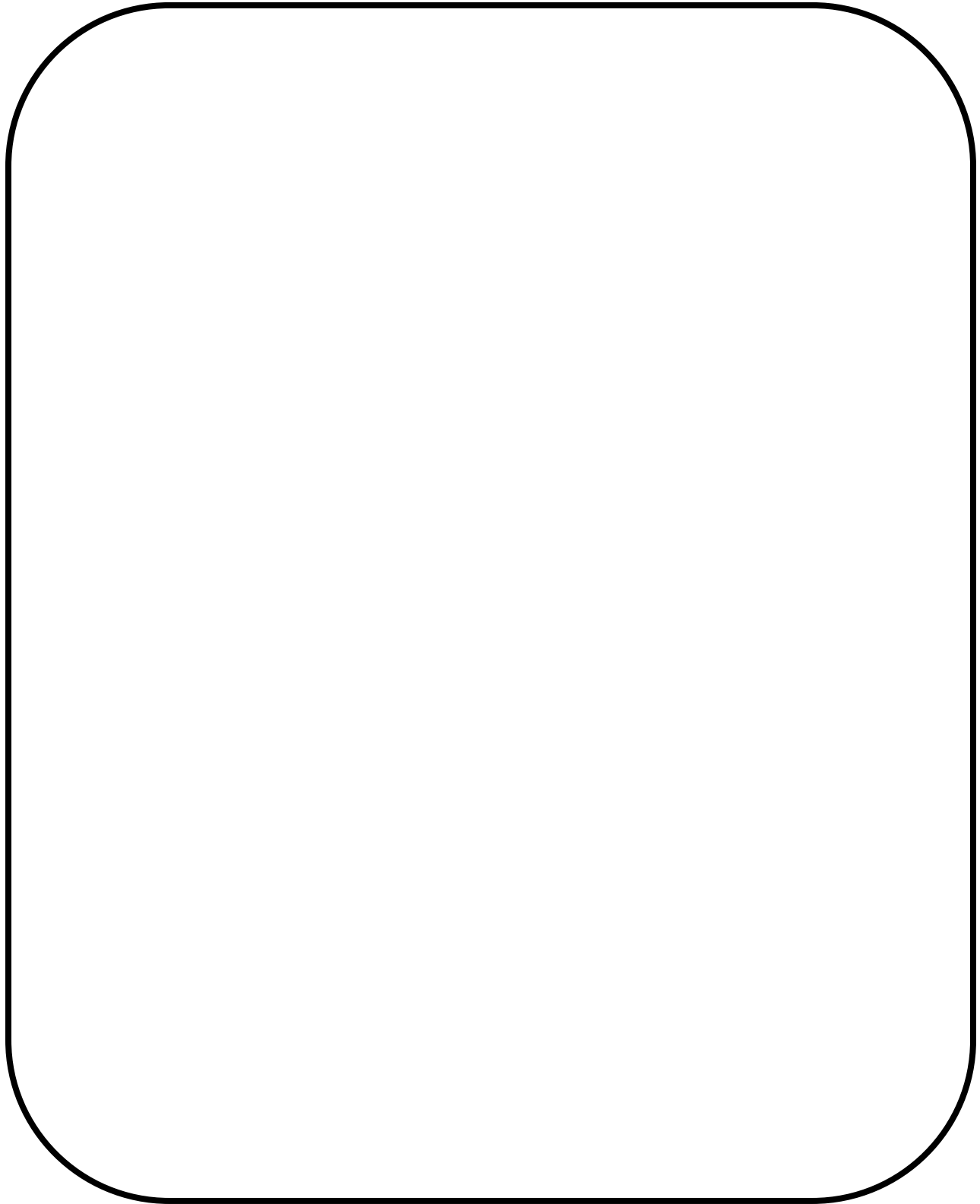# Create a Plant

Name_____

Directions:

- Take 12 beads from the bag and put them on your wooden holder. The beads can be any colors.
- Slide the beads into groups of 3.
- Use the decoder wheel to read the sets of 3 and write the message (trait) in the data table.
- Use the message (traits) to create a model of your unique plant.

Data Table

	Plant Part	Genetic Code (DNA)	Message (Trait)
Code 1	Root	◯ ◯ ◯	
Code 2	Stem	◯ ◯ ◯	
Code 3	Leaves	◯ ◯ ◯	
Code 4	Flowers	◯ ◯ ◯	

Name: _____

Create a model of your plant here: