

Teacher Guide: A Recipe for Traits

ACTIVITY OVERVIEW

Abstract:

Students create a “DNA recipe” for a dog by randomly selecting strips of paper that represent DNA. They then decode the DNA recipe to reveal the physical traits of their dog and create a final drawing of the organism. Students learn that differences in the DNA recipe lead to different traits by comparing their DNA recipes and dog drawings with the rest of the class to note similarities and differences.

Module:

Introduction to Heredity (Grades 5-7)

Key Concepts:

DNA is similar to a “recipe” for traits in all organisms; DNA is made of small units, differences in the sequence of these small units lead to differences in traits.

Materials:

Student hand-outs, drawing paper, crayons or colored pencils, paperclips or tape, four different colors of paper, envelopes

Prior Knowledge Needed:

Physical traits are observable characteristics that make individuals unique.

Appropriate For:

Ages: 10-13

USA grades: 5 - 7

Prep Time:

30 minutes

Class Time:

45 minutes

Activity Overview Web Address:

<http://gslc.genetics.utah.edu/teachers/tindex/overview.cfm?id=180>

Other activities in the *Introduction to Heredity (Grades 5-7)* module can be found at:

<http://gslc.genetics.utah.edu/teachers/tindex/>

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I. PEDAGOGY

A. Learning Objectives

- Students will understand that genetic traits are the heritable characteristics of an organism.
- Students will learn that DNA is a set of instructions, similar to a recipe that specifies the traits of an organism.
- Students will learn that the DNA “recipe” is made of smaller sub-units.
- Students will easily visualize how differences in DNA result in the inheritance of different traits.
- Students will observe that each organism is a unique combination of traits.

B. Background Information

Basic information students need to understand:

Physical traits are observable characteristics. An organism’s traits are determined by that organism’s DNA. DNA is made of smaller units. Differences in the sequence of these smaller units are what create differences in traits.

More advanced information:

The DNA molecule contains a sequence of four chemical bases, each represented by the first letter of its name: Guanine (G), Adenine (A), Thymine (T) and Cytosine (C). These bases, G, A, T, C are commonly referred to as the “DNA alphabet.” This DNA alphabet encodes a detailed set of instructions for building an organism’s physical traits. The DNA instructions are divided into segments called genes. Differences in the DNA sequence of each gene are what lead to different variations of any given trait. In this activity a gene is represented by a “DNA strip” and the chemical bases are represented by symbols.

To learn more about how cells “read” the DNA alphabet to generate physical traits, see *Additional Resources*.

C. Teaching Strategies

1. Timeline

- One day before activity:
 - Create envelopes containing colored “Dog DNA” from which students will randomly choose DNA strips. (see *Materials Preparation Guide*)
 - Make copies of student pages S-1 through S-3.
 - Gather drawing supplies and tape or paperclips.

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- Day of activity:
 - Distribute the following materials to each student, or group of students:
 - Student Pages S-1 - S-3
 - Tape or paperclips
 - Envelopes containing “Dog DNA” (See *Materials Preparation Guide*)
 - Drawing supplies
 - Carry out the activity as described on student page S-1.

2. Classroom Implementation

- Begin class by reviewing the following:
 - Traits are observable physical characteristics.
 - Though we may share some of the same traits with others, the overall combination of our traits makes us unique. This is true for all organisms.
 - A chemical called DNA determines our traits.
- Read the beginning paragraph of *A Recipe for Traits* (page S-1) as a class.
- Have students work individually or in pairs to complete the activity (pages S-1-S-3).
 - Note: You might need to remind students to leave the DNA strips they choose out of the envelope and tape or paperclip them together in order. The resulting long strip will be their DNA recipe.
- Once students have completed the activity, have them post their drawings on the wall along with the DNA recipe for their dog.

3. Assessment Suggestions

- Ask the students to explain why each of them ended up with a different drawing. You might ask them to use the following words: DNA, differences, sub-units (or genes), traits.

II. ADDITIONAL RESOURCES

A. Activity Resources linked from the online Activity Overview at:

<http://gslc.genetics.utah.edu/teachers/tindex/overview.cfm?id=180>

- Website: *Tour of the Basics*. An introduction to basic genetics including: DNA, genes, chromosomes, proteins, heredity and traits.
- Website: *Transcribe and Translate a Gene*. See how cells “read” DNA to assemble an organism’s physical traits.
- Book: *Double Talking Helix Blues*. By Joel Herskowitz. An engaging overview of major DNA and genetics concepts. Includes music to accompany the book.
- Books: *DNA is Here to Stay, Amazing Schemes Within Your Genes, Have a*

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Nice DNA and Gene Machines. All by Dr. Fran Balkwill. Nicely illustrated books covering DNA and Genes for grades 4-5. Nicely illustrated books covering DNA and Genes for grades 4-5.

III. MATERIALS

A. Detailed Materials List

- Student handouts (S-1 through S-3)
- Drawing supplies such as: blank paper, colored pencils, crayons, markers
- Tape or paper clips
- Colored paper (four different colors) to make “Dog DNA” strips
- Envelopes to contain colored “Dog DNA” strips

B. Materials Preparation Guide

To prepare “Dog DNA” envelopes for a class of 28:

1. Make eight copies each of *DNA Strips A, B, C, and D* (see *Teacher References*) on colored paper choosing one color for each type of DNA Strip.

Ex.	<i>DNA Strips A</i> (page 5)	8 copies on Blue
	<i>DNA Strips B</i> (page 6)	8 copies on Green
	<i>DNA Strips C</i> (page 7)	8 copies on Yellow
	<i>DNA Strips D</i> (page 8)	8 copies on Red

2. Cut out the DNA strips on each page (a paper-cutter works well)
3. Place two DNA strips of each color in an envelope. The envelope should contain eight DNA strips total (four different colors).
4. Repeat step three until you have assembled 28 “Dog DNA” envelopes.

Note: This is the minimum number of DNA strips per envelope that you need to carry out the activity. Adding more DNA strips of each color increases the variety of possibilities for each trait.

IV. STANDARDS

A. U.S. National Science Education Standards

Grades 5-8:

- Content Standard C: Life Science - Reproduction and Heredity; every organism requires a set of instructions for specifying its traits.
- Content Standard C: Life Science - Reproduction and Heredity; the characteristics of an organism can be described in terms of a combination of traits.

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V. CREDITS

Activity created by:

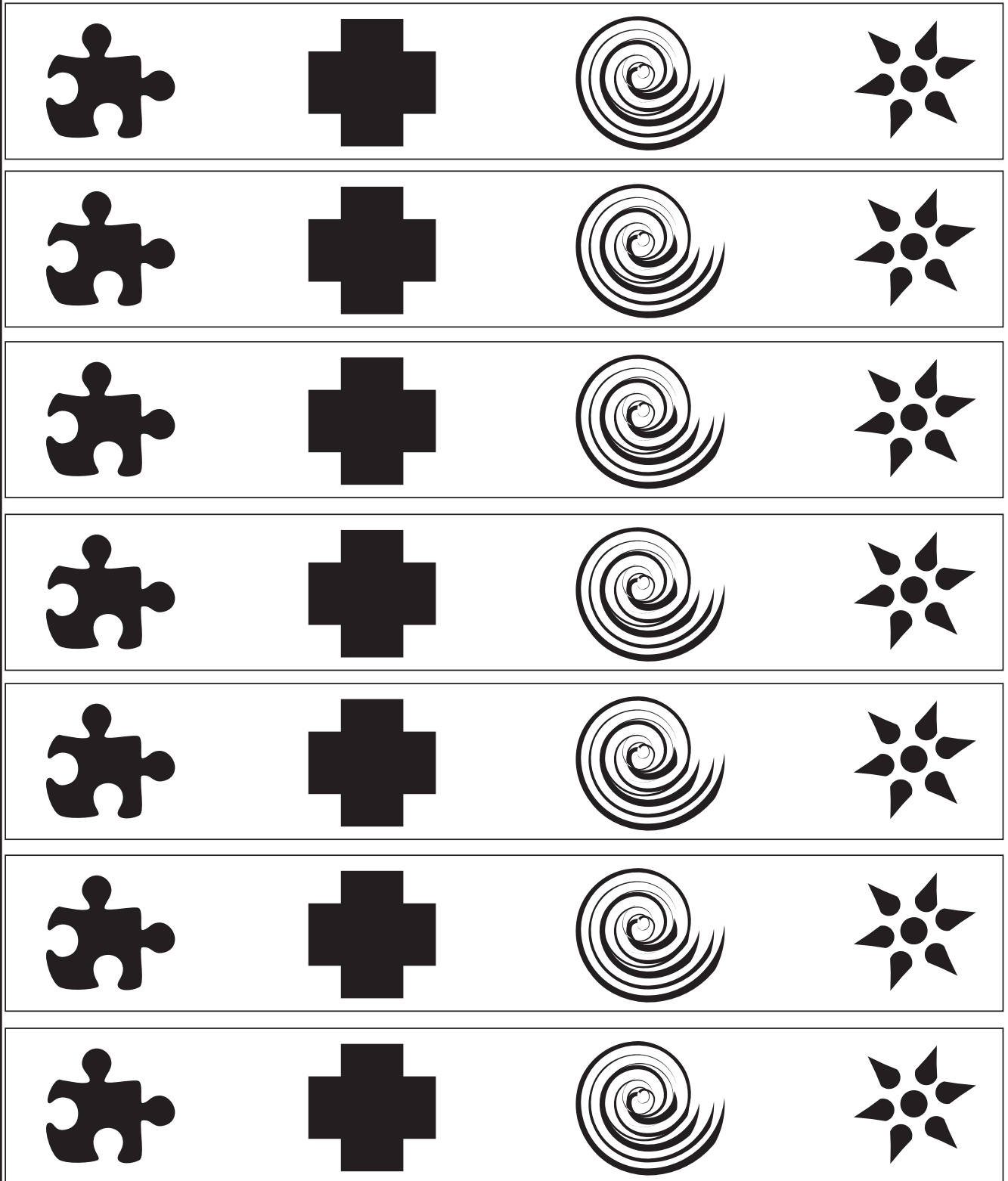
Molly Malone, Genetic Science Learning Center
Steven Kiger, Illustrations

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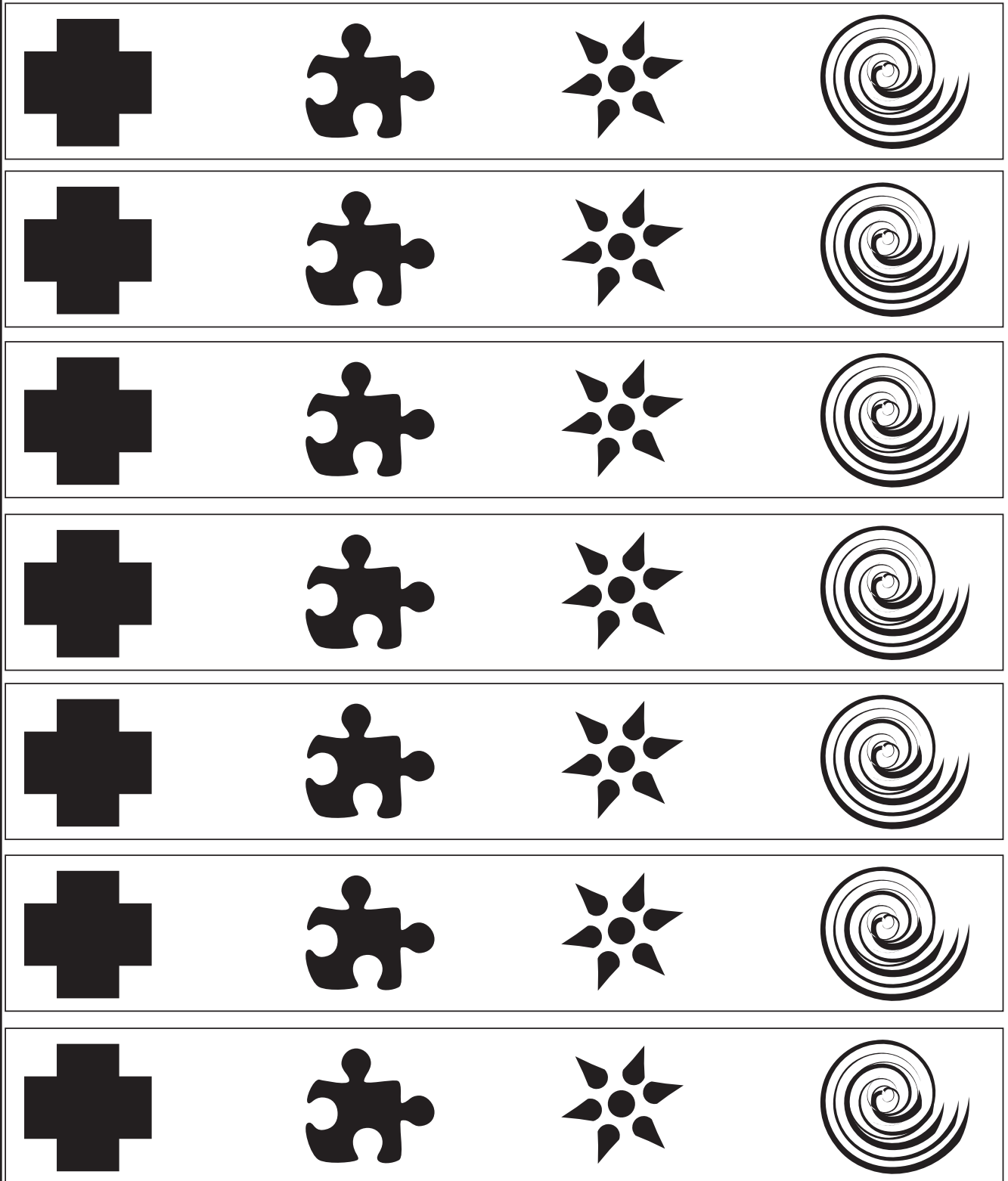
Teacher Reference: A Recipe for Traits

DNA Strips A








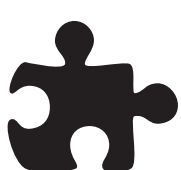



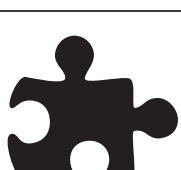
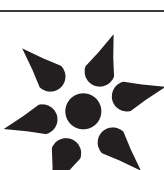

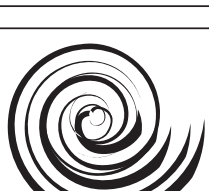
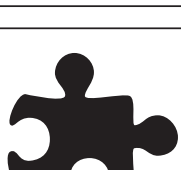
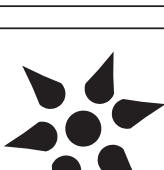
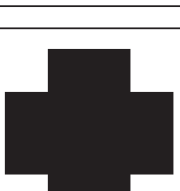
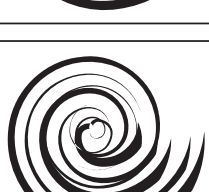
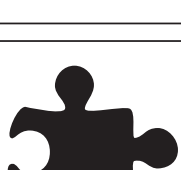

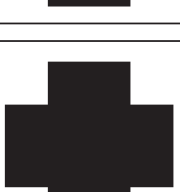
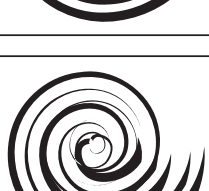
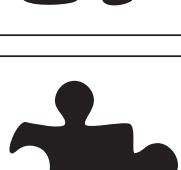


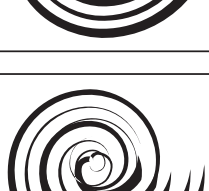
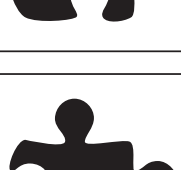

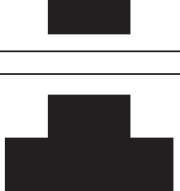

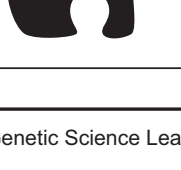
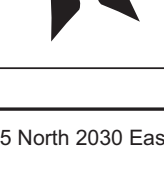
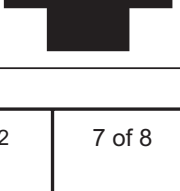
Teacher Reference: A Recipe for Traits

DNA Strips B































Teacher Reference: A Recipe for Traits

DNA Strips C

Teacher Reference: A Recipe for Traits

DNA Strips D

A RECIPE for Traits

A chemical called DNA makes a recipe for traits in all organisms. DNA is made of small units (like recipes are made of words, and words are made of letters). Differences in the sequence of these smaller units are what make differences in traits (just like a different sequence of letters make different words, and a different recipe).

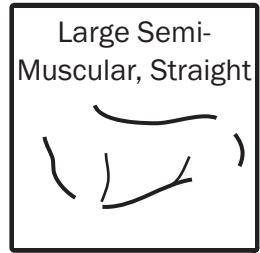
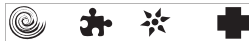
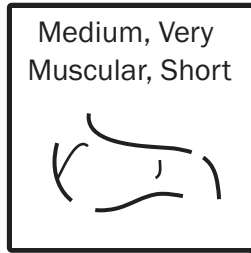
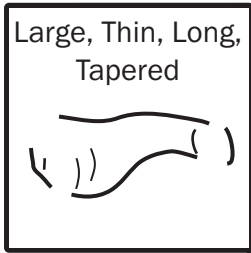
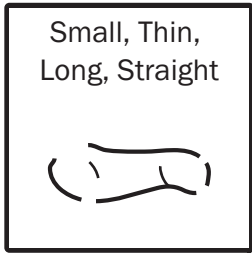
Use the Dog Traits Key and the directions below to create and read a DNA recipe to make a drawing of a dog.

Directions:

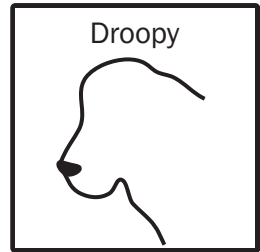
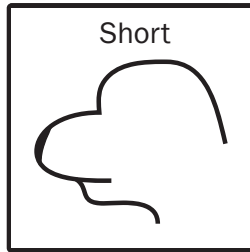
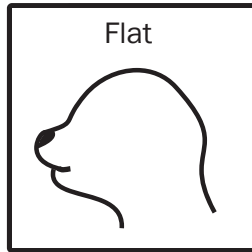
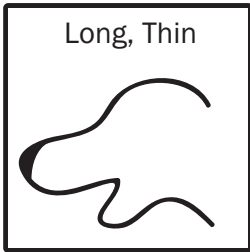
1. Make sure you have an envelope containing “Dog DNA”
2. Determine the Body Shape of your dog by picking a piece of Dog DNA out of the envelope.
3. On the **Dog Traits Key**, circle the picture for Body Shape that matches the DNA piece that you picked.
4. Set the piece of DNA aside and repeat steps 1-3 for the next trait on the key.
5. After circling the matching picture, paperclip or tape the second piece of DNA to the first to make one long strip. This will become the DNA recipe for your entire dog.
6. Repeat these steps for each of the traits listed on the Dog Traits Key.
7. When you have finished, draw your resulting dog, with all of its circled traits together, on a separate piece of paper.

When you have finished, hang the picture of your dog up along with its DNA recipe (the DNA pieces you chose attached in a long strip). Is your dog different or the same as others in the class?

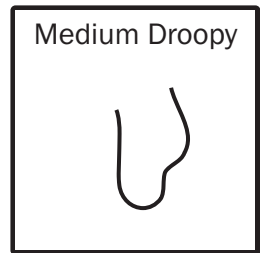
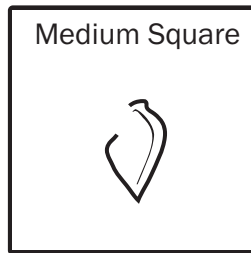
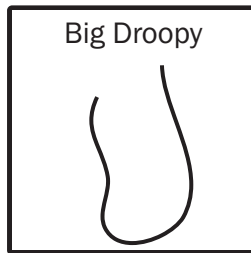
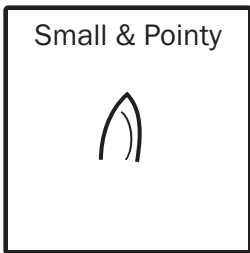
BODY SHAPE



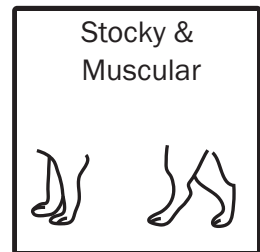
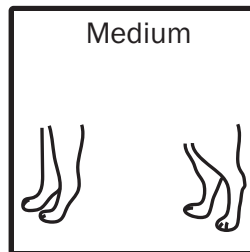
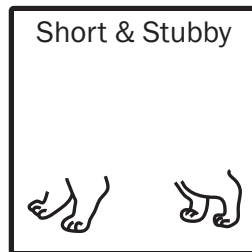
HEAD SHAPE



EARS



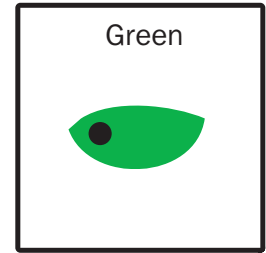
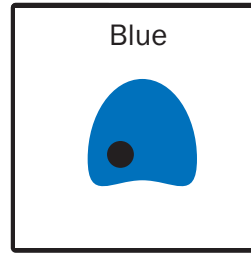
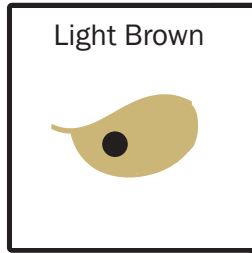
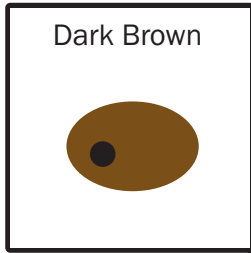
LEGS



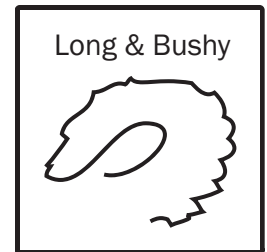
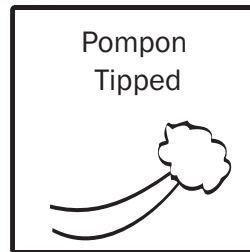
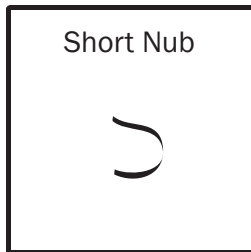
DOG Traits Key

DOG Traits Key

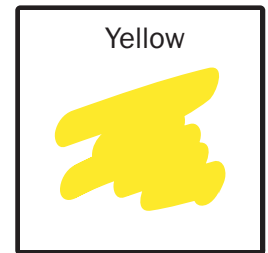
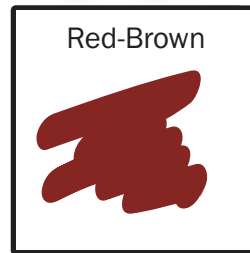
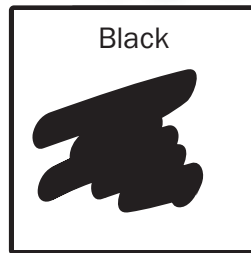
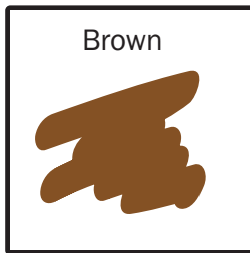
Eyes



Tail



coat color



Hair

