March 2003

SeaWorld/Busch Gardens Genetics

4-8 Classroom Activities

What's My Color?

OBJECTIVE

The student will complete a basic punnett square to predict the eye color in Clydesdale horses.

BACKGROUND

The teacher will select two different colors of eggs to use during this activity. The eggs represent a physical trait, such as the eye color of Clydesdale horses. The egg halves represent a maternal and paternal end (top and bottom of egg). The four pieces of candy inside the egg represents the four phenotypes possible from the parental genotypes on the outside of the egg. (See **PREPARATION** next page before beginning activity.)

ACTION

1. Distribute one prepared egg to each student. Instruct the students not to open their eggs.
2. Explain that the egg represents a trait for Clydesdale eye color. Brown eye color is dominant over blue eye color. Blue eye color is only expressed if the genotype is homozygous recessive (bb). Brown eye color is expressed with homozygous dominant (BB) and heterozygous genotypes (Bb). Additionally, explain that each half of the egg represents each parent's genotype for that particular trait.
3. Ask the students to complete a Punnett Square to predict the four possible phenotypes of the offspring inside the egg. Write the Egg Key (see **PREPARATION**) on an overhead projector (for example: BB= yellow egg, Bb= yellow egg with sticker, bb= blue egg) for students to refer to. Remind students that each half represents a parent.
4. Allow 5-10 minutes for students to complete their punnett squares.
5. Using an overhead projector, show all the possible genotype crosses and their corresponding punnett squares on the "What's My Color? Teacher's Guide." (cover bottom)
6. Instruct students to identify which punnett square matches their egg.
7. Begin with the first punnett square (Option A) and ask the students to stand if this punnett square matches their egg. Ask the standing students to predict the four possible phenotypes inside their eggs. What is the probability that the Clydesdale offspring will have blue eyes? Brown eyes? Check the students' answers by uncovering that option's answer below. Next, have the students reveal the answer inside the egg. Repeat this step until all the possible punnett squares have been reviewed.

PREPARATION

After selecting the two egg colors, break apart several eggs (but not all) and match them with the opposite color. For example, if blue and yellow are the egg colors; make some all yellow, some all blue, and some half yellow and half blue.

Next, decide which color will be dominant and which will be recessive. For example: yellow is dominant and blue is recessive.

Identify all the possible genotype crosses and complete a punnett square for each. For example: BB x BB, BB x bb, bb x bb, Bb x Bb, Bb x bb, and Bb x BB.

Next, correspond the eggs to each of these punnett square types.
Note: Because both heterozygous and homozygous dominant genotypes will express the same phenotype (Bb and BB= brown eyes), the teacher must denote a heterozygous (Bb) portion of an egg in some way. This can be done by placing a sticker on the portion of the egg that you wish to represent a heterozygous genotype.

Fill the eggs with the four possible phenotypes. The phenotypes (color of the candy) should be the direct outcome of the punnett square. See the summary to the right for the outside parental genotypes and color candy they should have inside.

Lastly, create an Egg Key which the students will use to correspond their egg colors to their genotype. For example: BB= yellow egg, Bb= yellow egg with sticker, bb= blue egg.

MATERIALS

For each student:

- one plastic egg (like eggs available during spring)
- 4 pieces small candy to match egg colors (M&Ms or jelly beans are suggested)

For class:

- overhead projector
- package of small stickers
- egg key (created by teacher)
- "What's My Color? Teacher's Guide" copied to a transparency for overhead

*Activity adapted from "Easter Egg Genetics" from Access Excellence Activities Exchange. http://www.gene.com/ae/atg/released/0256-AnneBuchanan/index.html

Sample genotype summary using colored eggs and candy

BB x BB = whole yellow egg with 4 yellow candies

bb x bb = whole blue egg with 4 blue candies

Bb x Bb= whole yellow egg (with stickers on each half of the egg to denote heterozygous) with 3 yellow candies and 1 blue candy.

BB x bb = half yellow egg and half blue egg with 4 yellow candies

Bb x bb = half yellow egg (with sticker on yellow half to denote heterozygous) and half blue egg with 2 blue and 2 yellow candies.

Bb x BB= whole yellow egg (with sticker on one half of the egg to denote heterozygous) with 4 yellow candies inside.

VOCABULARY

allele: Alternative form of a gene.

dominant: An allele that determines phenotype even when heterozygous.

genetics: The science of heredity; the study of heritable information.

gene: One of many discrete units of hereditary information located on the chromosomes and consisting of DNA.

genotype: The genetic make-up of an organism.

heterozygous: Having two different alleles for a given trait.

homozygous: Having two identical alleles for a given trait.

monohybrid Cross: A breeding experiment that employs parental varieties differing in a single character.

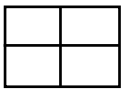
phenotype: The physical traits of an organism.

Punnett Square: A diagrammatic representation of a particular cross used to predict the progeny of the cross.

recessive: An allele that is not expressed in the heterozygous condition.

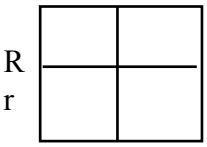
HOW TO SET UP A PUNNETT SQUARE

1. To set up a Punnett square, draw a large square, and then divide it into 4 equal squares.

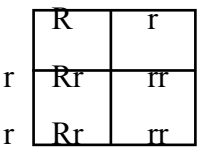


2. Determine the genotypes of the parent organisms. Sometimes the cross is already specified.(For example, cross the following genotypes: RR & rr.) However, many times genetic vocabulary must be understood to determine the genotypes of the cross. That is, cross a white flower with one that is heterozygous for red flower color. Red is dominant and white is recessive. Heterozygous always means one of each letter (Rr). The only way for a white flower color to be expressed is if it is homozygous recessive (rr).

3. Split the letters of the genotype for each parent and put them outside the punnett square.One parent's genotype will be split on top of the punnett square and the other will be split to the left of the punnett square.



4. Determine the possible genotypes of the offspring by filling in the punnett square. This step is accomplished by taking a letter from the left and matching it with a letter from the top. Repeat this step until all four boxes of the punnett square are complete.



Option A

	B	B
B	BB	BB
B	BB	BB

Option B

	B	b
B	BB	Bb
b	Bb	bb

Option C

	b	b
b	bb	bb
b	bb	bb

Option D

	B	b
b	Bb	bb
b	Bb	bb

Option E

	B	B
b	Bb	Bb
b	Bb	Bb

Option F

	B	b
B	BB	Bb
B	BB	Bb

Option A

0% probability that Clydesdale offspring will have blue eyes.
100% probability that Clydesdale offspring will have brown eyes.

Option B

25% probability that Clydesdale offspring will have blue eyes.
75% probability that Clydesdale offspring will have brown eyes.

Option C

100% probability that Clydesdale offspring will have blue eyes.
0% probability that Clydesdale offspring will have brown eyes.

Option D

50% probability that Clydesdale offspring will have blue eyes.
50% probability that Clydesdale offspring will have brown eyes.

Option E

0% probability that Clydesdale offspring will have blue eyes.
100% probability that Clydesdale offspring will have brown eyes.

Option F

0% probability that Clydesdale offspring will have blue eyes.
100% probability that Clydesdale offspring will have brown eyes.