NAME _____ DATE _____

Evaluate Hardy-Weinberg Data

Essential Knowledge 1.A.1 Natural selection is a major mechanism of evolution.

Challenge Area 1.2 You are able to evaluate evidence provided by data to qualitatively and/or quantitatively investigate the role of natural selection in evolution.

Building Block B Hardy-Weinberg Equilibrium

Goal of tasks

Using the Hardy-Weinberg equation, you will correctly input data from sample scenarios to calculate allele frequencies, evaluate the genetic compositions of populations and determine if a population is in Hardy-Weinberg equilibrium.

For this task you will be evaluated on your ability to

- Determine all variables of the Hardy-Weinberg equation when given population numbers or percentages.
- Accurately manipulate the equation and calculate the square root of a value or square a value when using the Hardy-Weinberg equation in each scenario.
- Calculate and compare allele frequencies for sample populations to determine if a population is in Hardy-Weinberg equilibrium.

Tasks summary

You will be working both in a group and individually to evaluate population problems by correctly applying Hardy-Weinberg values and calculating Hardy-Weinberg frequencies.

Task 1: Practice using Hardy-Weinberg (Group)

1. Your teacher will divide the class into groups of three students each.
2. Using the set of four population cards provided, discuss the descriptions and your strategies to solve these population problems with other students in your group.
3. Record your group's calculations and responses to the questions below in the space provided.
    - **Population 1**: What is the frequency of the recessive allele in this population?

- **Population 2**: Use the Hardy-Weinberg equation to predict what portion of the population would be heterozygous for the white coat color**.** Don't forget to support your prediction.

- **Population 3**: How many people would be expected to be susceptible to poison ivy in this population?

- **Population 4**: What is the frequency of the HYPP dominant allele in this herd?

Check your understanding

Based on your work with the population cards, can you answer the questions below?

☐ How does the equation represent Hardy-Weinberg equilibrium?

☐ How would you use the Hardy-Weinberg equation to determine if a population has evolved?

Task 2: Hardy-Weinberg scenarios (Group)

Complete the Hardy-Weinberg scenarios that follow.

1. Severe combined immunodeficiency disorder (SCID) is a recessive, inheritable, genetic disorder. This trait was found in 9% of the 100 foals in a herd of Arabian horses. Using the Hardy-Weinberg equation, calculate the values that follow for the foal population.

TABLE: Hardy-Weinberg Scenario #1

Hardy-Weinberg variable	Value		Value
p		% Homozygous dominant	
q		% Heterozygous	
p^2		% Homozygous recessive	
2pq		# of Homozygous dominant organisms	

Hardy-Weinberg variable	Value		Value
q^2		# of Heterozygous organisms	
		# of Homozygous recessive organisms	

2. In horses, grey coat color is determined by a dominant allele. A ranch has a herd of 50 horses. In this herd, 42 are grey. Determine each of the values below for this herd:

TABLE: Hardy-Weinberg Scenario #2

Hardy-Weinberg variable	Value		Value
p		% Homozygous dominant	
q		% Heterozygous	
p^2		% Homozygous recessive	
2pq		# of Homozygous dominant organisms	
q^2		# of Heterozygous organisms	
		# of Homozygous recessive organisms	

3. Ten years later, through random mating among members of the same herd, the number of horses at this ranch has increased to 125 horses. In this larger herd, 87 horses have the dominant trait and are grey in color. Using the Hardy-Weinberg equation, determine each of the values that follow for this herd:

TABLE: Hardy-Weinberg Scenario #3

Hardy-Weinberg variable	Value		Value
p		% Homozygous dominant	
q		% Heterozygous	
p^2		% Homozygous recessive	
2pq		# of Homozygous dominant organisms	
q^2		# of Heterozygous organisms	
		# of Homozygous recessive organisms	

4. Compare the allele frequencies for the two herds (Scenario #2 versus Scenario #3). Explain why the horse population is or isn't in Hardy-Weinberg equilibrium.

5. Based on the results of question #4, provide a possible explanation for the change in allele frequencies after ten years.

Check your understanding

Based on your work with the Hardy-Weinberg scenarios, can you answer the questions below?

- ☐ What does it mean for a population to not be in Hardy-Weinberg equilibrium?
- ☐ How does your strategy to solve the problem change when you start with a known percentage of recessive phenotypes versus number of organisms that have a dominant allele?
- ☐ Does your strategy change if you start with known percentage of population that are heterozygous?