

## Dihybrid Cross Simulation

In this activity we'll simulate a dihybrid cross by tossing two coins - a nickel and a quarter. The nickel will represent the gene for seed color, and we'll assign "heads" to be the dominant allele, Y (yellow), and "tails" will represent the recessive allele, y (green). The nickel will represent the gene for seed shape, and we'll assign "heads" to be the dominant allele, R (round), and "tails" will represent the recessive allele, r (wrinkled). Two coins together will represent the chromosomes of one parent in the cross. Two additional coins will represent the chromosomes of the other parent.

### Procedure

- a) Are the parents pure-breeding or hybrids for seed color and seed shape?
  - b) How many alleles does each parent donate to the offspring for each trait?
  - c) What are the possible gametes that the parents can produce?
1. Flip all 4 coins and record the results in the data by placing a mark in the Flip Outcome column in the appropriate row. For example if you got heads on each nickel and a heads and a tails on the two dimes you would place a mark in the second row.
  2. Repeat step 1 nineteen more times, recording the results.
  3. Determine the number of individuals which had each of the four possible phenotypes: yellow and round seeds, yellow and wrinkled seeds, green and round seeds, and green and wrinkled seeds.
  4. Convert your data to the smallest ratio by dividing each of them by the smallest of the numbers.
  5. Pool your data with the class. Calculate the class totals and then convert the data to the smallest ratio by dividing each of them by the smallest of the numbers.
- d) We have just demonstrated that in a dihybrid cross the phenotypic ratio in the offspring is 9:3:3:1. Were your data or that of the class closer to the ideal ratio? Why was this so?
  - e) Why are we able to use a coin toss to represent the assortment of alleles into gametes?

Table 1: Flip outcomes and resulting phenotypes

Genotype	Phenotype	Flip Outcome	Total
Nickel: 2 Heads (YY) Dime: 2 Heads (SS)			
Nickel: 2 Heads (YY) Dime: 1 Head, 1 Tail (Ss)			
Nickel: 1 Head, 1 Tail (Yy) Dime: 1 Head, 1 Tail (Ss)			
Nickel: 1 Head, 1 Tail (Yy) Dime: 2 Heads (SS)			
Nickel: 1 Head, 1 Tail (Yy) Dime: 2 Tails (ss)			
Nickel: 2 Heads (YY) Dime: 2 Tails (ss)			
Nickel: 2 Tails (yy) Dime: 2 Heads (SS)			
Nickel: 2 Tails (yy) Dime: 1 Head, 1 Tail (Ss)			
Nickel: 2 Tails (yy) Dime: 2 Tails (ss)			

Table 2: Individual and class phenotypic ratios

	yellow and round seeds	yellow and wrinkled seeds	green and round seeds	green and wrinkled seeds
Number of offspring (individual)				
Smallest ratio (individual)				
Number of offspring (class)				
Smallest ratio (class)				