

# Biology AP/IB Lab: Genetics – Mono & Dihybrid Crosses

Name: \_\_\_\_\_ Date: \_\_\_\_\_ Score: \_\_\_\_\_

Biologists like other scientists, construct conceptual models to explain biological processes. In this investigation you will use mathematical models of monohybrid and dihybrid crosses to predict the outcome corn breeding experiments. These models are tested using a nonbiological system (bead-bag genetics) and a biological one (kernels on natural corn cobs). Afterwards you will use the Chi Square Test to determine the probability of your outcomes.

## Part One: Monohybrid Cross

1. First, you will calculate the frequencies of the expected genotypes and phenotypes of  $F_1$  and  $F_2$  generations. Two alleles are **R** for red and **r** for brown.

Assume the parental generation genotypes are **RR** and **rr**.

What would be the genotype of their offspring ( $F_1$ )? \_\_\_\_\_ Their phenotype? \_\_\_\_\_

Mating between members of the  $F_1$  generation produces the  $F_2$  generation. Show this cross

\_\_\_\_\_ X \_\_\_\_\_

The possible gametes from one parent are \_\_\_\_\_ or \_\_\_\_\_, while the gametes from the other parent are \_\_\_\_\_ or \_\_\_\_\_.

These parents can produce offspring ( $F_2$ ) with three possible genotypes: \_\_\_\_\_, \_\_\_\_\_ and \_\_\_\_\_. Their proportions/ratios would be \_\_\_\_\_, \_\_\_\_\_ and \_\_\_\_\_.

Their phenotypes would be \_\_\_\_\_ and \_\_\_\_\_, while their proportions/ratios would be \_\_\_\_\_ : \_\_\_\_\_

2. You will now simulate a bead-bag cross of these  $F_1$  offspring. Put an equal number (100 red “**R**” and 100 brown “**r**” beads in a bag. Mix up your beads.
3. Without looking pull out two beads. Record their color (allele) combination in the table below. Replace the beads back in the bag.
4. Repeat this process 99 more times. You will produce a total of 100 hundred  $F_2$  offspring.

F<sub>2</sub> offspring of a monohybrid bead-bag cross

Genotype	Tally Marks	Total	Proportion (%)	
			Actual	Expected
(Homozygous Dom)	_____	_____	_____	_____
(Heterozygous)	_____	_____	_____	_____
(Homozygous Rec)	_____	_____	_____	_____

Use the Chi Square Test to determine the likelihood of your bead-bag outcome. *Complete the table.*

Genotype	Observed	Expected	$o - e$	$(o - e)^2$	$(o - e)^2/e$

Number of outcomes: \_\_\_\_\_ Degrees of Freedom: \_\_\_\_\_

Value of  $\alpha^2 =$  \_\_\_\_\_ Probability value P: \_\_\_\_\_

Is the Null hypothesis accepted? \_\_\_\_\_ Do the results match the expected? \_\_\_\_\_

**Part Two: Dihybrid Cross**

You will now simulate a dihybrid cross. In addition the above alleles (red & brown), you will use a blue "B" and green "b" alleles. In a second bag place 100 blue beads and 100 green beads.

1. What would be the genotypes of two parents with one being homozygous for Red/Blue and the other homozygous Brown/Green?

\_\_\_\_\_ X \_\_\_\_\_

What would be the genotype of their offspring? \_\_\_\_\_ Their phenotype? \_\_\_\_\_

Now consider crossing these F<sub>1</sub> offspring.

\_\_\_\_\_ X \_\_\_\_\_

What gametes would each produce?

\_\_\_\_\_

