# Heading

Title

**Introduction**

**Purpose** To observe the results of a simple monohybrid cross.

**Discussion**

## Monohybrid crosses are the first step to understand Mendelian genetics. A sperm or egg carries only one allele for each inherited character because allele pairs separate (segregate) from each other during the production of gametes (Meiosis). This statement is called the law of segregation. The fusion of gametes at fertilization creates allele pairs once again. A cross between two individuals differing in a single character is a Monohybrid Cross. The Parent (P) generation yields the first filial (F1) generation (offspring).

Alleles are alternative versions of genes that account for variations in inherited characters. For each character, an organism inherits two alleles, one from each parent. The alleles can be the same or different. A Homozygous genotype has identical alleles. A Heterozygous genotype has two different alleles. If the alleles of an inherited pair differ, then one determines the organism’s appearance and is called the Dominant Allele.

The other has no noticeable effect on the organism’s appearance and is called the Recessive Allele. The Phenotype is the appearance or expression of a trait. The Genotype is the genetic makeup of a trait. The same phenotype may be determined by more than one genotype.

A monohybrid test cross is the process by which you cross two organisms that are heterozygous for a given trait. In such a case, by the law of dominance and by using the Punnett square, you know that the proportion of the offspring produced will be 25% homozygous dominant, 50% heterozygous and 25% homozygous recessive.

## Scientists use a grid-like tool (Punnett Square) to make predictions about various genetic problems. The Punnett Square shows only the probability of what might occur and not the actual results. Probability is the chance of something occurring. If one wants to flip a coin 100 times, since there are 2 sides to the coin, he would expect 50 heads and 50 tails. If he flips the coin 100 times, he may actually get 60 heads and 40 tails. Prediction is one thing, and actually getting the predicted results is another. The Punnett Square only shows the chances of what might occur each time the event is undertaken.

**Hypothesis**

If two heterozygous parents are crossed (monohybrid cross), then the offspring will show a 3:1 phenotypic ratio and a 25% homozygous dominant, 50% heterozygous dominant, and 25% homozygous recessive.

## Materials 2 Brown Paper Bags

## 1 Bag of White Beans 1 Bag of Red Beans

(Note: *The beans should be close to the same size*)

**Procedures**

1.Obtain the 2 brown paper bags and label one “Female” and the other “Male”. (The bags conceal the beans you will place in them.)

2. Add 15 red beans to each bag.

3. Add 15 white beans to each bag.

4. The bags represent 2 heterozygous parents (Rr x Rr).

## 5. Define the following terms before proceeding:

Punnett square –

genotype –

phenotype –

homozygous –

heterozygous –

trait –

dominant –

recessive -

6. Reach into each of the bag at the same time and pull out ONE bean from each bag.

* The only possibilities that can be made from this selection are: RR (homozygous red), Rr (heterozygous red), or rr (homozygous white).
* Record the resulting genotype and phenotype in the data table.

7. Return the beans back into the bag. Gentle shake the bag to mix the beans. Repeat the same process 14 more times (15 total trials).

* Record the resulting genotype and phenotype in the data table.

**Calculations and Data**

1. What is the genotype of each parent?

Male \_\_\_\_\_ Female \_\_\_\_\_

2. What is the phenotype of each parent?

Male \_\_\_\_\_ Female \_\_\_\_\_

3. Complete the data table based on your procedures:

|  |  |  |
| --- | --- | --- |
| Trial | Genotype of Offspring | Phenotype of Offspring |
| 1 |  |  |
| 2 |  |  |
| 3 |  |  |
| 4 |  |  |
| 5 |  |  |
| 6 |  |  |
| 7 |  |  |
| 8 |  |  |
| 9 |  |  |
| 10 |  |  |
| 11 |  |  |
| 12 |  |  |
| 13 |  |  |
| 14 |  |  |
| 15 |  |  |

4. Fill in the Punnett Square below using the parents given in the procedure:

Male \_\_\_\_\_ Female \_\_\_\_\_

|  |  |  |
| --- | --- | --- |
| gametes |  |  |
|  |  |  |
|  |  |  |

5. What is the genotypic ratio of the offspring?

6. What is the phenotypic ratio of the offspring? \_\_\_\_\_

7. Do these ratios confirm the expected monohybrid test cross?

**Conclusions**

**Address Hypothesis** (*was it confirmed or not?*)

**Analysis**

Skip this section for this lab and answer the questions in the next section.

**Questions**

1. What type of cross is shown in this experiment. What is the expected outcome?

2. Name the “generations” that are involved in this lab.

3. Distinguish the Punnett Square from probability.

4. If a homozygous red male is crossed with a homozygous white female, what offspring would be expected in terms of genotype and phenotype?

Homozygous red 🡪 \_\_\_\_\_ Homozygous white 🡪 \_\_\_\_\_

? % \_\_\_\_\_offspring 🡪 \_\_\_\_\_

|  |  |  |
| --- | --- | --- |
| gametes |  |  |
|  |  |  |
|  |  |  |