$\qquad$

## Monohybrid Crosses and the Punnett Square

## Introduction

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.

## Objective:

In this investigation, you will use a Punnett Square to predict the possible genotypes and phenotypes and their ratios from a monohybrid cross.

## Materials:

- red beans
- white beans
- 2 small paper bags (one labeled male and the other labeled female)


## Procedure:

1. Each group of 2 students will pick up 2 paper bags filled with 15 red (R) beans and 15 white (r) beans. This represents 2 heterozygous parents ( $\mathrm{Rr} \times \mathrm{Rr}$ ).
2. One student in the group will be in charge of the male bag and the other student will be in charge of the female bag.
3. At the same time, each student will reach into their bag and pull out one of the beans. The only possibilities that can be made from this selection are: RR (homozygous red), $\operatorname{Rr}$ (heterozygous red), or rr (homozygous white). Record the resulting genotype and phenotype in the data table.
4. Return the beans back into the bag and conduct the same process 14 more times ( 15 total trials).

## Data Table:

| Trial | Offspring's <br> GENOTYPE | Offspring's PHENOTYPE |
| :--- | :--- | :--- |
| 1 |  |  |
| 2 |  |  |
| 3 |  |  |
| 4 |  |  |
| 5 |  |  |
| 6 |  |  |
| 7 |  |  |
| 8 |  |  |
| 9 |  |  |
| 10 |  |  |
| 11 |  |  |
| 12 |  |  |
| 13 |  |  |
| 14 |  |  |
| 15 |  |  |

## Analysis and Conclusions

1. What is the dominant trait?
2. How do you know it is dominant?
3. Fill in the Punnett Square below using the parents given in the procedure: Male $\qquad$ X Female $\qquad$

4. What is the genotypic ratio?
5. What is the phenotypic ratio?
6. If tall pea plants $(\mathrm{T})$ are dominant over short pea plants $(\mathrm{t})$, then what would be the resulting offspring if a heterozygous tall plant were crossed with another heterozygous tall plant?
7. Dimples in humans are caused by a dominant trait. The absence of dimples is caused by a recessive trait. Cross a homozygous dimpled person and a homozygous person without dimples.
8. Mr. and Mrs. Hopkins have ears of normal size, yet the sizes of their children's ears range from large, to normal, to small. How would you explain these differences?
