Penny Genetics
How Well Does a Punnett Square Predict the Actual Ratios?

In this lab you will make predictions using Punnett Squares, you will then use pennies (or chips) to simulate the crosses. Then compare the Actual Ratios with the Predicted Ratios. The trait you are looking at is the gene that codes for a short big toe in humans. **T** represents the dominant allele (short big toe), **t** is the recessive allele, long big toe. The following genotypes are possible. Fill in the phenotypes for them

Genotype	Phenotype
TT	
Tt	
tt	

CHART A

PREDICTED RATIO

Use a Punnet Square to predict the ratio of offspring where both parents are **Tt** (The square is set up for you.)

	T	**t**
T		
t		

What percentage of the offspring (out of 100) will be:

T T _____ Short Toe ___

T t _____

t t _____ Long Toe ___

*These are your **predicted ratios.**

ACTUAL RATIO

Now you will determine the actual ratios by using pennies to represent the crosses. You have two pennies. One side is the letter T, on the other side is the letter t. **This penny represents a parent that has the genotype T t**. A second penny represents the other parent. One partner will play the role of female, the other will play the role of male. When the coin is flipped, you are determining what sperm or egg is being donated. When you put them together, you are simulating fertilization.

CHART B

ACTUAL RATIO: To determine Actual Ratios, **you will flip your coins 100 times,** recording in the table below how often each combination came up. (Use tally marks to record data then summarize as a number)

Gene Combination	Tally Marks	Total	Class Total
TT			
Tt			
tt			

These two charts show actual ratios

Phenotypes	Total
Short Toe (TT &Tt)	
Long Toe	

Comparing Actual to Predicted Ratios

	Predicted Ratios (chart A)	Actual Ratios (chart B)
TT		
Tt		
tt		
Short Toe		
Long Toe		

Would you consider the actual and predicted ratios the (circle)

a. SAME b. CLOSE TO THE SAME c. NOT CLOSE AT ALL

Part II: What if the Parents are Tt x tt?

1. First make your predictions by setting up a Punnet square for the parents.
(This one is not set up for you) **Tt x tt**
How many are predicted to be: Short Toe _____ Long Toe _____

**Replace one of your pennies (chips) with a t t penny.
Perform 100 flips with your new set of parents. Record data.

	Tally	Total
Tt		
tt		

Compare the **Predicted Ratios** of the cross to the **Actual Ratios**.

	Predicted (from Square)	Actual (from flips)
Short toe		
Long toe		

What percentage are short toes? _____

What percentage are long toes? _____

Analysis

1. Use a Punnet Square to predict the phenotypic ratios in this cross: **T T x T t**
Short toe _____
Long toe _____

2. Would you expect the coin toss method to give a similar ratio as the punnett square above? Explain.

3. What do the pennies represent in the simulation?

4. When you toss the coin to see which side lands up, you are actually simulating what part of the process of sexual reproduction?

5. When you put the two coins that are flipped together, you are simulating what part of the process of sexual reproduction?

6. Why are the Predicted Ratios rarely the same as the Actual Ratios?

7. Why are Punnett squares useful for determining the probabilities of phenotypes in the offspring?

8. How does the class total compare to your total? Is it similar, different? Which one is more accurate? Why?