How Well Does a Punnet Square Predict Actual Ratios?

Name:_____

In this lab you will make predictions using Punnet Squares, and then use pennies (or chips) to simulate the crosses. The results from the punnett square can then be compared to the actual data.

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 photo shows a person with a short big toe. The following genotypes are possible. Fill in the phenotypes for them

Genotype / Phenotype

T T = _____
T t = _____
t t = _____

Part I

Use a Punnet Square to predict the ratio of offspring in a cross where the parents are both Tt (The Square is set up for you below)

What proportion of the offspring (out of 4) will be:

Short Toe_____ Long Toe _____

***These are your predicted ratios.**

Now you will determine the actual ratios by using pennies (chips) to represent the crosses. You have two pennies. One one side of the penny 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 is going to play the role of female, the other will play the role of male. When the coin is flipped, you are determining what sperm or what egg is being donated to the match.

Practice flips. Flip the two pennies. The results show you what your offspring will be.

Did you get a TT, a Tt or a tt ? _____ What is the phenotype of your offspring (tall or short?) _____

Procedure:

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 your data then summarize as a number)

Gene Combination (Genotype)	Tally	Total
TT		
Tt		
tt		

Phenotypes	Total
Short toe (add TT + Tt)	
Long Toe	

Since you flipped one hundred times, your totals above represent a Percentage. Your proportions from the Punnet Square in your prediction can also represent a percentage. (1/4 = 25 % 2/4 = 50% 3/4= 75% 4/4 = 100%)

Now compare your predicted ratios to your actual Ratios in the chart below.

	Predicted (from the Punnett Square in Part I)	Actual (from the flips)
TT		
Tt		
tt		
Short Toe		
Long Toe		

Would you consider the predicted values to be the same, close to the same, or not at all the same? _____

Part II

You will repeat the procedure for parents that are Tt and tt

1. First make your predictions by setting up a Punnet square for the parents. (This one is not set up for you)

How many are predicted to be:

Short Toe_____

Long Toe_____

**Replace one of your pennies (chips) with a t t penny

Perform the flips with your new set of parents. Record your data in the table below

	Tally	Total
Tt		
tt		

What percentage of your offspring are Tt _____ What percentage are short toes _____

What percentage of your offspring are tt _____ What percentage are long toes _____

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

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

Analysis

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

2. Use a Punnet Square to predict the phenotypic ratios in this cross: T T x T t

Short toe _____

Long toe _____

3. If you used the coin toss method to determine the actual ratios, would it come out the same? Explain your reasoning.

4. What do the pennies or chips represent in the simulation?

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

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