PENNY GENETICS

HOW WELL DOES A PUNNETT SQUARE PREDICT THE ACTUAL RATIOS?

In this lab you will make predictions using Punnett squares and then use pennies (or chips) to simulate the crosses. You will then compare the **actual ratios** to 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), and **t** is the recessive allele (long big toe). The following genotypes are possible. Fill in the phenotypes for them.

Genotype	*Phenotype (description)*
TT	
Tt	
tt	

Predicted Ratio:

Use a Punnett square to predict the ratio of offspring in a cross where the parents are both **Tt**. The square is set up for you.

CHART A:

	T	***t***
T		
t		

What percentage of the offspring will be:

TT _____ **Short toe** _____

Tt _____

tt _____ **Long toe** _____

These are your predicted ratios.

Actual Ratio:

Now you will determine the actual ratios by using pennies (or chips) to represent the crosses. You have two pennies. On one side of each penny is the letter **T**. On the other side is the letter **t**. ***Each penny represents a parent that has the genotype Tt***. One partner is going to play the role of the female, and the other will play the role of the male. When the coin is flipped, you are determining what sperm or what egg is being donated to the match. When you put the two flipped coins together, you are simulating fertilization.

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

Did you get a **TT**, a **Tt**, or a **tt**? _____

What is the phenotype of your offspring (short or long toe)? _____

To determine the 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 in the second column, then summarize as a number in the third column. Once the total for each genotype has been finalized, use the second chart to determine the total number of each phenotype. These two charts together will show your **actual ratio**.

CHART B:

Gene combination	*Tally marks*	*Total*
TT		
Tt		
tt		

Phenotypes	*Total*
Short toe (add TT and Tt)	
Long toe (tt)	

Comparing Actual to Predicted Ratios:

	Predicted Ratios (from Chart A)	*Actual Ratios (from Chart B)*
TT		
Tt		
tt		
Short Toe		
Long Toe		

Would you consider the actual and predicted results to be:

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

What if the Parents are Tt x tt?

First, make your predictions by setting up a Punnett square for parents with the genotypes **Tt** and **tt**. (This one is not set up for you.)

How many are predicted to be:

Short toe _____ **Long toe** _____

Now replace one of your pennies with a **tt** penny. Perform 100 flips, as before, with your new set of parents and record the data below.

Gene combination	*Tally marks*	*Total*
Tt		
tt		

What percentage are short toes? _____

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. Use a Punnet square to predict the phenotypic ratios in this cross: **TT** x **Tt**.

   Short toe _____

   Long toe _____

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

3. What do the pennies or chips 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?

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