Name _____

CORN GENETICS & CHI SQUARE ANALYSIS

In this exercise, you will examine an ear of corn and determine the type of cross and genes responsible for the coloration and texture of the corn kernels like the one show below. There are four grain phenotypes in the ear. Purple and smooth (A), Purple and Shrunken (B), Yellow and Smooth (C), Yellow and Shrunken (D).

Monohybrid Cross

1. Count the number of purple and yellow kernels in five of the rows on your ear of corn and record the number on the chart. Be sure to use the same five rows for each calculation.
2. Count the number of smooth and shrunken seeds on the same five rows and record on the chart.

	Number of Kernels	Kernel Percentage (divide count by total)
Kernel Coloration		
Purple		
Yellow		
Total (for 5 rows)		
Kernel Texture		
Smooth		
Shrunken		
Total (for 5 rows)		

3. What are the probable genotypes of the parents with regard to coloration? Show the Punnett square to support your guess.

4. What are the probable genotypes of the parents with regard to texture? Show the punnett square to support your guess.

Dihybrid Cross

5. We will now consider a dihybrid cross. Your ear of corn may be a result of a cross between plants that were both heterozygous for color and texture (PpSs x PpSs). Determine the expected amount of each type of seed and convert to a percent (ex. 9/16 = 56%) - you may need to do a Punnett square

Purple & smooth _____ Purple & shrunken _____

Yellow & smooth _____ Yellow & shrunken _____

7. Now count the number of each in your five rows on the ear of corn (observed numbers)

	Number Counted	Percentage: Number counted / total	Percentage estimated from from Punnett Square
Purple & smooth			
Purple & shrunken			
Yellow & smooth			
Yellow & shrunken			
TOTAL			

8. Did you obtain a 9:3:3:1 ratio? To determine if the deviations from your observed data are due to chance alone or if the data is significantly different, you need to use a chi square test.

Chi Square Test

	Expected Number	Observed Number	[Observed - Expected]^2 ÷ expected
Purple & smooth	Total x 9/16 =		
Purple & shrunken	Total x 3/16 =		
Yellow & smooth	Total x 3/16 =		
Yellow & shrunken	Total x 1/16 =		
		CHI SQUARE VALUE ========> (add the numbers from the rows above)	

9. Now determine if your chi square value is a good fit with your data. Your degrees of freedom (df) is the number of possible phenotypes minus 1. In your case, 4 - 1 = 3. Find the number in that row that is closest to your chi square value. Circle that number.

Good Fit Between Ear & Data							Poor Fit	
df	**.90**	**.70**	**.60**	**.50**	**.20**	**.10**	**.05**	**.01**
1	**.02**	**.15**	**.31**	**.46**	**1.64**	**2.71**	**3.85**	**6.64**
2	**.21**	**.71**	**1.05**	**1.39**	**3.22**	**4.60**	**5.99**	**9.21**
3	**.58**	**1.42**	**1.85**	**2.37**	**4.64**	**6.25**	**7.82**	**11.34**
4	**1.06**	**2.20**	**2.78**	**3.36**	**5.99**	**7.78**	**9.49**	**13.28**

10. Explain what it means to have a "good fit" or a "poor fit". Does your chi square analysis of real corn data support the hypothesis that the parental generation was PpSs x PpSs?

SHOW ALL WORK!

Chi Square Problem Set

1. Problem: A large ear of corn has a total of 433 grains, including 271 Purple & starchy, 73 Purple & sweet, 63 Yellow & starchy, and 26 Yellow & sweet.

Your Tentative Hypothesis: This ear of corn was produced by a dihybrid cross (PpSs x PpSs) involving two pairs of heterozygous genes resulting in a theoretical (expected) ratio of 9:3:3:1.

Objective: Test your hypothesis using **chi square** and **probability** values.

2. Problem: In a certain reptile, eyes can be either black or yellow. Two black eyed lizards are crossed, and the result is 72 black eyed lizards, and 28 yellow-eyed lizards.

Your Tentative Hypothesis: The black eyed parents were Bb x Bb.

Objective: Test your hypothesis using chi square analysis. In this set, because only two values (traits) are examined, the degrees of freedom (*df*) is 1. **SHOW ALL WORK!**

3. Problem: A sample of mice (all from the same parents) shows

58 Black hair, black eyes	**16 Black hair, red eyes**
19 White hair, black eyes	**7 White hair, red eyes**

Your tentative hypothesis: (what are the parents?)

Objective: Use a chi square analysis to support your hypothesis**.**