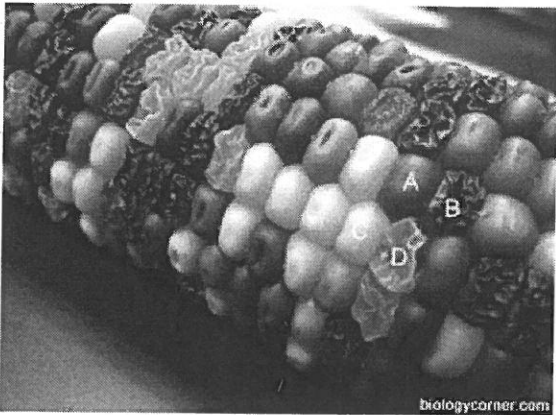


Name: _____

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).

Photos can be substituted: see [Corn Genetics Gallery](#)

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 | Kernal Percentage (divide count by total) | 3. What are the probable phenotypes of the parents with regard to coloration? |
|--------------------|-------------------|---|---|
| Kernal Coloration | | | |
| Purple | | | |
| Yellow | | | |
| Total (for 5 rows) | | | |
| Kernal Texture | | | |
| Smooth | | | |
| Shrunken | | | |
| Total (for 5 rows) | | | |
| | | | 4. What are the probable phenotypes of the parents with regard to texture? |

Dihybrid Cross

5. We will now consider a dihybrid cross, which is a combination of the two monohybrids. Your ear of corn may be a result of a cross between plants that were both heterozygous (PpSs x PpSs). Create a punnett square or use a mathematical system to determine the phenotype ratio. Record what you would expect to get from this cross in the chart below.

Purple & smooth ____ Purple & shrunken ____ Yellow & smooth ____ Yellow & shrunken ____

6. Now count the number of each in your five rows on the ear of corn.

| | Number Counted | Percentage: Number counted / total x 100 |
|-------------------|----------------|--|
| Purple & smooth | | |
| Purple & shrunken | | |
| Yellow & smooth | | |
| Yellow & shrunken | | |
| TOTAL | | |

7. 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**. The table below will help you make the calculations.

| | Expected Number | Observed Number | $[\text{Observed} - \text{Expected}]^2 \div \text{expected}$ |
|-------------------|-----------------|--|--|
| 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.

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?

| df | Good Fit Between Ear & Data | | | | | | Poor Fit | |
|----|-----------------------------|------|------|------|------|------|----------|-------|
| | .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 |

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