Cell Cycle Simulation

Name:	

Go to the cell cycle simulation on Biology Simulations.

Experimental Question: How do the selected treatments affect the rate of mitosis in an onion root tip?

Treatment I:

Select one of the root treatments available to test (do not choose control, that will automatically be part of your experiment).

Treatment I:	

Write the *null hypothesis*. The null hypothesis is often used for statistical testing and states that there is not a significant difference between the two groups.

Null Hypothesis:	

Procedure:

1. Record the number of cells in interphase and the number of cells dividing for a control sample.
2. Select the treatment you are testing and click “Prepare New Sample.”
3. Record the number of cells in interphase and the number of cells dividing for the experimental sample.

Data:

	Control	**Experimental**
Interphase		
Mitosis		

Make a graph comparing your experimental and control samples.

Analysis:

You will use a chi-square test to determine if the experimental treatment differs significantly from the control. The chi-square equation uses the variables **o** and **e** representing the **observed** and **expected** values.

$$\chi^2 = \sum \frac{(o-e)^2}{e}$$

The Σ symbol means that you will do the equation for each group and then add those values together. For this lab, you have *four groups*; Interphase and Mitosis for the control and the experimental treatment.

1. The **observed** values come directly from the results recorded in the Data section. Record these values in the observed column in the step 3 chart.
2. Use the chart below to find the expected values.
    a. The following values come from the recorded data:
        i. CI = Control Interphase
        ii. CM = Control Mitosis
        iii. EI = Experimental Interphase
        iv. EM = Experimental Mitosis
    b. Because the simulation produces the same number of cells for both samples, the **total** number of cells counted using this procedure is 200.
    c. Use the Expected Guide to calculate the expected values and record them in the Expected Values chart.
    d. After calculating the expected values, record them in the expected column in the Step 3 chart.

Expected Guide	Control	Experimental
Interphase	$\frac{(CI+EI)(CI+CM)}{total}$	$\frac{(CI+EI)(EI+EM)}{total}$
Mitosis	$\frac{(CM+EM)(CI+CM)}{total}$	$\frac{(CM+EM)(EI+EM)}{total}$

Expected Values	Control	Experimental
Interphase		
Mitosis		

3. Complete the chart.

	Observed (o)	Expected (e)	$o - e$	$(o-e)^2$	$\frac{(o-e)^2}{e}$
Control Interphase					
Control Mitosis					
Experimental Interphase					
Experimental Mitosis					

4. To find your chi-squared value, add the numbers in the final column.

$\chi^2 =$	

This test has **1 degree of freedom**. Based on the data in the arrangement in the chart (ignoring the row and column labels, df = (rows - 1)(columns - 1). In this lab, there are 2 rows (Interphase and Mitosis) and 2 columns (Control and Experimental).

$$df = (2-1)(2-1) = 1$$

For this lab, use a **p-value of .05**. The p-value represents the likelihood that a difference between the observed and expected is due to chance.

5. Use the p-value, df, and the chart below to find the critical value.

Critical Value:	

Chi-Square Table

p value	Degrees of Freedom							
	1	2	3	4	5	6	7	8
0.05	3.84	5.99	7.81	9.49	11.07	12.59	14.07	15.51
0.01	6.63	9.21	11.34	13.28	15.09	16.81	18.48	20.09

The **critical value** is the threshold for defining if a difference is significant or not. The null hypothesis is rejected if the chi-square value is greater than or equal to the critical value.

Conclusion:	

Discussion: Based on your results and research, write an explanation of what is happening to cause the results you observed.

Treatment II:

Select another root treatment to test.

Treatment II:	

Null Hypothesis:	

Repeat the procedure from Treatment I.

Data:

	Control	Experimental
Interphase		
Mitosis		

Make a graph comparing your experimental and control samples.

Analysis:

	Observed (o)	Expected (e)	$o - e$	$(o - e)^2$	$\frac{(o-e)^2}{e}$
Control Interphase					
Control Mitosis					
Experimental Interphase					
Experimental Mitosis					

$\chi^2 =$	

Critical Value:	

Conclusion:	

Discussion: Based on your results and research, write an explanation of what is happening to cause the results you observed.