# Pre-Lab Information

Purpose: To understand the processes of mitosis and meiosis in eukaryotic cells

Time: Approximately 90 minutes

Question: How do eukaryotic organisms grow and reproduce?

Summary: In this lab, you will gather data about the frequency of mitotic stages in eukaryotic cells. You will then use statistical analysis to analyze this data. Finally, you will construct a model to show how heritable information is passed from one generation to another generation through meiosis.

# Safety

* Behavior in the lab needs to be purposeful.
* Tie back long hair, roll up sleeves, and secure loose articles of clothing.
* Handle materials carefully. If something breaks, report it to your teacher immediately.
* Wipe up any spills when it is safe to do so.
* Report all accidents—no matter how big or small—to your teacher.

# Lab Procedure

1. **Gather materials.**

|  |  |
| --- | --- |
| * Prepared onion root tip slides * Compound light microscope * Calculator | * Formula sheet * Modeling materials |

1. **Observe root cells.**
   1. You should have two prepared slides: an onion root grown under normal conditions and one where the onion tip has been treated with lectin.
   2. Place the onion cells grown under normal conditions under your microscope. Observe the cells on high magnification.
   3. Look for an area that is well stained and where the cells are easy to see. For the field of view, count the cells in interphase and the cells in mitosis.
   4. Repeat for two other fields of view. To find a new field of view, you will need to move the microscope slide to a new location that includes a new group of cells. Record all data in Table A and calculate the total number of cells as indicated in Table A. This is your control.
   5. Then, repeat the steps for the onion root treated in lectin. Record all data in Table B and calculate the total number of cells as indicated in Table B.
2. **Analyze your results.**
   1. Assume that your control experiment totals represent the expected number of cells in interphase and mitosis. Using the total values, calculate the percent of cells from the control group that was in interphase and mitosis. Round off percentages to the nearest whole number and record the values in Table A.
   2. Record the total observed number of lectin cells in interphase and mitosis (from Table B) in the Observed column of Table C.
   3. Use the calculated percentages from the control (from Table A) and the total number of lectin cells (from Table B) to determine the expected number of cells for the lectin group in Table C. Round off the expected values to the nearest whole number and record these values in the Expected column of Table C.

Here is an example to help with this step:

|  |  |
| --- | --- |
| **Type of Data** | **Values** |
| Control data | 75% interphase and 25% mitosis |
| Lectin data | 180 cells in interphase and 20 cells in mitosis |
| Expected value for chi square table for interphase | 200 (all lectin cells) x 0.75 (the percent expected to be in interphase based on control) = 150 cells |
| Expected value for chi square table for mitosis | 200 (all lectin cells) x 0.25 (the percent expected to be in mitosis based on control) = 50 cells |

* 1. Complete Table C. Round off (o – e)2/e values to the nearest hundredths.
  2. Compare the results of your observations to the critical values of the chi-square distribution.

1. **Clean up your area.** 
   1. Return unused materials and dispose of any trash according to your teacher’s directions.
2. **Model meiosis.**
   1. Obtain modeling materials from your teacher.
   2. Using your materials, model the following and sketch each model. The starting cell is a diploid with 6 total chromosomes (2n = 6). Your model must show the correct number of chromosomes at each stage of meiosis. Different colors must be used to represent the maternal and paternal chromosomes. For each stage of meiosis, you must state if the cell is haploid or diploid and include major division events.

Meiosis 1 (include crossing over and independent assortment)

Meiosis 2

1. **Clean up your area.** 
   1. Return unused materials and dispose of any trash according to your teacher’s directions.

# Data

Record your data either in your lab notebook or in the space below.

**Table A: Onion Root Tip Cell Data (Control)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Field of View** | **Interphase**  **(# of Cells)** | **Mitosis**  **(# of cells)** | **Total** |
| 1 |  |  |  |
| 2 |  |  |  |
| 3 |  |  |  |
| Total |  |  |  |
| **Percentage of Cells in Interphase and Mitosis** | | | |
| % Cells in Interphase | |  | |
| % Cells in Mitosis | |  | |

**Table B: Onion Root Tip Cell Data with Lectin**

|  |  |  |  |
| --- | --- | --- | --- |
| **Field of View** | **Interphase**  **(# of Cells)** | **Mitosis**  **(# of Cells)** | **Total** |
| 1 |  |  |  |
| 2 |  |  |  |
| 3 |  |  |  |
| Total |  |  |  |

**Table C: Calculation of Chi-Square Value**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Cell type** | **Observed (o)** | **Expected (e)** | **(o – e)** | **(o – e)2** | **(o – e)2/e** |
| Interphase |  |  |  |  |  |
| Mitosis |  |  |  |  |  |
|  |  |  |  |  | Sum = \_\_\_\_\_\_ |

# Follow-Up Questions

Answer the following questions:

1. Write a null hypothesis for the effect of lectin on onion cells.
2. Use your data to either support or reject your null hypothesis. Be sure to give numerical evidence from your data table in your answer. Explain what accepting or rejecting your null hypothesis means about the effect of lectin on the growth of onion root tips.
3. What process can be added to your meiosis model to better show how heritable information is passed from one generation to another? Explain your answer.