

## Module 4: Cell Biology - Growth and Reproduction

### Authentic Assessment: Onion Root Tip Mitosis Scientific Investigation

Before you begin the scientific investigation below, make sure to download the *Onion Tip Mitosis Scientific Investigation Report*. As you complete this scientific investigation, fill in any needed information on the report template. If you need more information about each section of the report, please visit the Developmental Module.

This scientific investigation is available below or in a printable version.

#### Introduction

DNA is duplicated in eukaryotic cells in the process of mitosis. Mitosis is the process of cellular division responsible for the creation of two identical daughter cells from one parent cell. During the process of mitosis, the chromosomes pass through several phases known as prophase, metaphase, anaphase, telophase, and cytokinesis. Each phase contributes to the orderly distribution of the replicated parent cell's replicated chromosomes.

#### Objectives

In this scientific investigation, you will:

- observe the phases of mitosis in prepared slides of onion (*allium*) tips.

#### Hypothesis

Using the **Procedure and Data Collection** section below, read through the procedural information for this scientific investigation. Based on your understanding of the procedure, develop your own hypotheses which describe your expected results. You should consider the following questions: What phase of mitosis will be observed in the greatest percentage? Explain your answer. Record your hypotheses in the Hypothesis section of your *Onion Tip Mitosis Scientific Investigation Report*.

#### Equipment and Materials

- compound light microscope
- prepared slide of a longitudinal section of *Allium* (onion) root tip.

#### Procedure and Data Collection

1. Obtain a prepared slide of the longitudinal section of *Allium* (onion) root tip and a compound light microscope.
2. Examine the prepared slide under the compound microscope under 400X magnification. Remember, begin with the lowest magnification and focus and readjust the microscope until you have reached 400X magnification. Do not let the objective lens touch the prepared slide.
3. Observe and sketch each of the different steps of mitosis in the **Data** area of your *Onion Tip Mitosis Scientific Investigation Report*.
4. Make a total count of the number of cells in each phase of mitosis in your field of view. Record the data in the **Data** area of your *Onion Tip Mitosis Scientific Investigation Report*.
5. Calculate the percentage of cells found in each phase. To do this, divide the number of cells in a phase by the total number of cells in your field of view. Multiply this number by 100. Record your data in the **Data** area of your *Onion Tip Mitosis Scientific Investigation Report*.
6. The percentage of cells found in each phase is a measure of how long each phase lasts. For example, if 25 percent of the cells are in prophase, then prophase takes 25 percent of the total time it takes for a cell to undergo mitosis. Mitosis in onion cells takes an estimated 80 minutes. Calculate the actual time for each phase using this information and the percentage you determined in step five. To calculate the time of each phase, divide the percentage of cells found in each phase by 100. Then, multiply by 80 minutes. Record your data in the **Data** area of your *Onion Tip Mitosis Scientific Investigation Report*.

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#### Data

Use the table provided in the **Data** section of your *Onion Tip Mitosis Scientific Investigation Report* to record your data from this scientific investigation. The data table is also shown below.

#### Sketches of Mitosis

Prophase	Metaphase	Anaphase	Telophase

#### Data Table

Phase of Mitosis	Count	Percentage	Time (minutes)
Prophase			
Metaphase			
Anaphase			
Telophase			

#### Data Analysis

In the **Data Analysis** section of your *Onion Tip Mitosis Scientific Investigation Report*, provide responses to the following questions. Make sure to completely answer each question.

1. According to your data, which phase of mitosis lasts the longest? Why does this phase require the most time?
2. According to your data, which phase of mitosis takes the least amount of time? Why does this phase require the least time?
3. In this investigation, it was assumed that the percentage of total time that any given phase takes is equal to the percentage of cells in that phase at any moment. Why might this not be true for a small sample of cells?
4. How could you use what you learned to develop a procedure to identify cancerous tissue by counting the number of cells undergoing mitosis?

#### Conclusion

Using the **Conclusion** section of your *Onion Tip Mitosis Scientific Investigation Report*, compose three to four sentences describing an overall conclusion based on your data. Was your hypothesis supported or not, and how do you know? Use the data and notes that you collected from your experience to form your conclusion. Make sure that you include information that you gained from data analysis to support your conclusion.

#### Experimental Sources of Error

On your *Onion Tip Mitosis Scientific Investigation Report*, provide responses to the following questions: Are there any sources of error? If so, what are they, and what could be done to minimize error?