

## CHAPTER INVESTIGATION

# Mitosis in Onion Root Cells

## Teacher Notes

**TIME** 45 minutes

## TEACHER PREPARATION

## STUDENT DIFFICULTY

**Purpose** Observe and identify the different stages of the cell cycle

**Overview** Students will use a microscope to examine cells from onion root tissue. They will

- draw and label the structures in onion cells at each stage of the cell cycle
- record the stage of each cell in a random area
- calculate the percentage of cells in each stage of the cell cycle

## LAB MANAGEMENT

- Be sure students can correctly identify the stages of the cell cycle.
- Remind students that to take a random sample, they can move the slide on the stage of the microscope while they are not looking through the eyepieces. They can then view the sample that appears in the field of view. The field of view should be completely full with cells. If the random sample ends up near the edge of the slide and some portion of the field of view does not have cells, students should repeat the random sample process to find a new sample to examine.
- Make sure students know how to calculate percentage. Suggest students round percentages so that together they equal 100 percent.

**Safety** Caution students to be careful in handling the slides. Remind them to wipe down the eyepieces of the microscope with alcohol wipes after use.

**Inclusion** If equipment is available, project the microscope image for students who are visually impaired.

**Post-Lab Discussion** Have students evaluate the trends in the results of other groups and identify factors that could account for differences in results. Although the results in different groups should be similar, differences could come from inaccuracies in identifying the stages of the cell cycle, in counting, or in calculating percentages.

Mitosis in Onion Root Cells *continued***ANSWERS****Sample Data****TABLE 1. STAGES OF THE CELL CYCLE**

Sample	Total Cells	Interphase		Prophase		Metaphase		Anaphase		Telophase	
	#	#	%	#	%	#	%	#	%	#	%
1	109	92	84	8	7	5	5	3	3	1	1
2	152	123	81	15	10	6	4	4	3	4	3
3	249	197	79	17	7	12	5	20	8	3	1

**Analyze and Conclude**

1. Most of the cells will be in interphase. About 90 percent of the cell cycle is spent in interphase.
2. Students should use the following formula for calculations: percentage of cells in stage  $x$  24 hours. If students want to calculate the time in minutes, they can do so by multiplying the percentage of cells by 24 hours by 60 min/hour. In a 24-hour period, the majority of the time is spent in interphase.
3. More cells will be in interphase in other parts of the plant.
4. Root tips treated with the product should have a higher percentage of cells that are undergoing mitosis. Drawings will vary but should reflect this idea.

**Extend Your Investigation**

Students should design an experiment in which the effects of the product are the dependent variable. Varying applications of the product (amounts, times) are possible independent variables. A control would be a plant that is not treated with the product.

## CHAPTER INVESTIGATION

# Mitosis in Onion Root Cells

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Mitosis is the process by which a single cell divides into two identical "daughter" cells, each with an identical number of chromosomes as the parent cell. The four stages of mitosis follow each other without interruption, and take place in all living cells.

In this lab, you will examine cells from onion root tissue. Root-tips are regions of active cell division. It is very likely to observe every stage of cell division in root tips. You will examine onion root cells under the microscope and identify the different stages of cell division in the tissue sample. You will also determine how much time is spent in each stage of the cell cycle.

**PROBLEM**

How much time do cells spend in each part of the cell cycle?

**MATERIALS**

- slides of onion root cells
- microscope

**PROCESS SKILLS**

- Observing
- Collecting Data
- Concluding

**PROCEDURE**

1. Obtain a slide of onion root cells. Examine the slide under the microscope using the low-power lens.
2. Find examples of cells in each stage of the cell cycle, including interphase and the stages of mitosis—prophase, metaphase, anaphase, and telophase. Draw and label each cell in the table below. Label structures within the cell.



Mitosis in Onion Root Cells *continued*

**TABLE 2. STAGES OF THE CELL CYCLE**

Sample	Total Cells			Interphase		Prophase		Metaphase		Anaphase		Telophase	
	#	#	%	#	%	#	%	#	%	#	%	#	%
1													
2													
3													

**ANALYZE AND CONCLUDE**

**1. Identify** What patterns exist in your data? In which stage of the cell cycle are most of the cells you examined? How do these data support what you know about the cell cycle?

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**2. Calculate** Find the average percentage of cells in each stage of the cell cycle among the three samples. Assume that a cell takes 24 hours to complete one cell cycle. Calculate how much time is spent in each stage of the cell cycle. (**Hint:** Multiply the percentage of cells in each stage, as a decimal, by 24 hours.)

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**Mitosis in Onion Root Cells** *continued*

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**3. Predict** The cells in the root of an onion are actively dividing. How might the numbers you count here be different than if you had examined cells from a different part of the plant?

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**4. Apply** A chemical company is testing a new product that it believes will increase the growth rate of food plants. Suppose you are able to view the slides of onion root tips that have been treated with the product. If the product is successful, how might the slides look different from the slides you viewed in this lab? Draw some examples of what the treated slides might look like.

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**EXTEND YOUR INVESTIGATION**

Design an experiment that would test the product described in question 4. Assume the product is a liquid that can be added to the soil in which the plant is growing.