

AICE / AP Biology Lab 3.1: Mitosis In Animal and Plant Cells

In order to investigate the process of mitosis, plant and animal tissues where cells are dividing rapidly must be examined. In animals, the most rapidly growing and dividing tissues are found in the embryonic stages of development. Although most animal tissues continue to undergo mitosis throughout the life cycle of the organism, they do so very slowly when compared to their embryos. Some animal cells, like most plant tissues, rarely replicate after the organism reaches maturity. In plants, these tissues are primarily found in the tips of stems and roots. The root tip plants are exceptionally good places to look for cells undergoing mitosis. Plant root tips consist of several different zones where various developmental and functional processes of the root are performed. The primary region for the formation of new cells is the apical meristem. The root cap offers protection for the rest of the root, the region of elongation is the area where the bulk of cell growth occurs, and the region of maturation is where tissue differentiation occurs.

Objectives

To examine the phases of mitosis, compare plant and animal cell mitosis, and determine the relative duration of each of the phases involved.

Materials Needed

Onion Root tip slide prepared from your own sample
Whitefish/Onion Comparison Slides
Compound Microscope

Procedure

Part A: Observation of Mitotic Phases in Plant & Animal Cells

1. Observe your prepared microscope slide of onion root tip mitosis, first at 100X, then 400X. Using the Plant Mitosis Chart, on the overhead screen, as a guide, identify cells which represent each mitotic phase. *If you are not able to get a good count using your prepared slide, you may use one of the onion tip comparison slides.*
2. In your data section, draw each phase of plant cell mitosis that you see. Write a brief description of each phase below each drawing.
3. Observe the prepared microscope slide of whitefish blastula. Using the Animal Mitosis Chart, included, as a guide, identify each phase of animal cell mitosis. Compare the phases to the plant cell mitosis of onion root tips.
4. Draw each phase of animal cell mitosis that you see. Write a brief description of each phase below each drawing.

Part B: Relative Lengths of Phases of Mitosis

1. Examine at least three fields of view of the apical meristem of the onion root tip at 400X. (you want to count a total of at least 200 cells) In each view, count the number of cells in the various stages of mitosis. This may be done in pairs where one partner observes & calls out to the other partner who records data. Switch roles each time you change field of view. Record this data in Table 3.1.
2. Calculate the total number of cells counted and the percentage of total cells counted for each stage of mitosis. Record this data in Table 3.1 as well.
3. Assuming that it takes an average of 24 hours (1,440 minutes) for onion root tip cells to complete the cell cycle, calculate the amount of time cells spent in each phase of the cycle. Use the formula provided below.

$$\text{Percent of Cells in Phase} \times 1,440 \text{ minutes} = \text{minutes cell spent in phase}$$

Data

Onion Root Tip Mitotic Phases (Copy into data section: Drawing in top row, Brief description in 2nd row)

Interphase	Prophase	Metaphase	Anaphase	Telophase / Cytokinesis

Whitefish Blastula Mitotic Phases (Copy into data section: Drawing in top row, Brief description in 2nd row)

Interphase	Prophase	Metaphase	Anaphase	Telophase / Cytokinesis

Table 3.1 (Copy into your Data section)

	Number of cells				% of total counted	Time in each stage
	Field 1	Field 2	Field 3	Total		
Interphase						
Prophase						
Metaphase						
Anaphase						
Telophase						
Total Cells Counted						

Conclusions (copy & answer in lab notebook))

1. Referring to the percentage of total cells counted in each phase of mitosis, determine which phase takes the longest for the cell to complete, and explain why. Sketch a pie graph of the percentage of cells in each phase to illustrate.
2. What is the relationship between the processes of mitosis and cytokinesis?
3. What are the primary differences between mitosis in plants and mitosis in animals? How does plant mitosis accommodate a rigid, inflexible cell wall?