Bio I
Lab: Observing Mitosis

Introduction

All cells undergo a process of growth and division called the cell cycle. The cell cycle consists of three major stages:

1. **Interphase**, in which the cell grows and, at the end, the cell's DNA replicates. The majority of the cell's life is spent in interphase.
2. **Mitosis**, during which the replicated genetic material separates into two separate nuclei, Mitosis is further divided into for stages: **prophase**, **metaphase**, **anaphase**, and **telophase**. Two identical nuclei result from mitosis.
3. **Cytokinesis**, the last stage of cell division, is the division of the cell cytoplasm between the two newly formed cells. The cell cycle results in the formation of two genetically identical daughter cells from the division of a parent cell.

Materials

microscope
prepared slides of *Allium* (onion) root tip and Whitefish

Procedure

1. Review the visible characteristics of each stage of mitosis. Make a list of these characteristics to aid you in your observations. REMEMBER: Do not count the cells that are in interphase or cytokinesis.

   - **Prophase:** The chromatin appears as a mass of thick threads. These threads are the replicated chromosomes, which have coiled up and shortened. Each chromosome now consists of pair of chromatids, which are duplicates of the original chromosomes. The chromatids are held together by a centromere. In late prophase, the nuclear membrane cannot be seen, but the chromosomes are distinctly visible as pairs of chromatids in the central region of the cell.

   - **Metaphase**: In metaphase, the chromosomes line up across the equator of the cell. A mass of fibers called a spindle has formed between the poles of the cell and the mass of chromosomes. A spindle fiber from each pole attaches to each chromosomes (pair of chromatids).

   - **Anaphase**: The centromere of each chromatid pair divides during anaphase. The chromatids move along the spindle fibers toward the poles of the cell. Each chromatid in the pair of chromatids moves toward opposite poles of the cell.

   - **Telophase**: In this stage, the chromatids (now called chromosomes) have formed distinctive clumps at each pole. A new nuclear membrane forms around each clump of chromosomes, which uncoil and return to the chromatin network seen in interphase. The new cell walls grow to form the two new, identical daughter cells.

2. Using middle power on your microscope, focus on the apical meristem of the onion root tip. This is the area just behind the root cap.
3. Switch to high power. Examine the apical meristem carefully and chose a sample of at least 50 cells to classify. Look for a group cells that seems to be actively dividing. The cells will appear to be in rows, so it should be easy to keep track of them. Go to high power to examine individual cells.
4. For each of the cells in your sample, identify the stage of mitosis, and place a mark in the Tally Marks column of your DATA TABLE, next to the appropriate stage. Count the tallies for each stage, and fill in the Count column of the DATA TABLE.
5. Calculate the percentage of cells found in each stage, and enter the figure under Percent in the DATA TABLE.

$$\frac{\text{Number in a Stage}}{\text{Total Sample Number}} \times 100$$

6. Mitosis in *Allium* normally takes about 80 minutes at room temperature. You calculate the amount of time each stage takes. This is because the percentage of the cells in a particular stage of mitosis is equal to the percentage of 80 minutes that the stage takes. From this information, calculate the amount of time each stage of mitosis takes. Record your answers in the DATA TABLE. For example: If there were 8 percent of the cells in metaphase, then 8 percent of 80 minutes would be 6.4 minutes. This would be the amount of time that metaphase takes 80 minutes x .08 = 6.4 minutes

Data Table: Observations of *Allium* (onion) Root Tip and Whitefish

Stage	Tally Marks	Total Count	Percent	Time (minutes)
Prophase				
Metaphase				
Anaphase				
Telophase				

Analysis

1. If a parent cell had 6 chromosomes, how many during each phase listed below?

Phase	# of Chromosomes	# of Chromatids
Prophase		
Metaphase		
Anaphase		
Telophase		
G_1 Interphase		
G_2 Interphase		

2. Draw each phase of mitosis (prophase, metaphase, anaphase, telophase) in a cell that has 2N = 4 chromosomes. Show the following in your drawings: chromosomes, spindle fibers, chromatin, centrioles, and nuclear membrane. Place each phase on the provided notecards.