MITOSIS

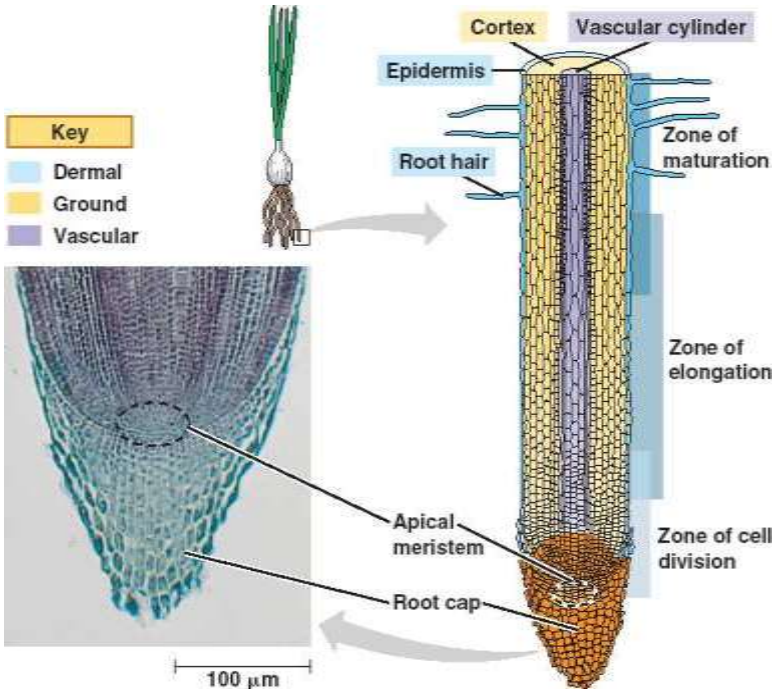
INTRODUCTION

All new cells come from previously existing cells. New cells are formed by the process of cell division, which involves both division of the nucleus (karyokenesis) and division of the cytoplasm (cytokinesis).

Mitosis typically results in new somatic (body) cells. Formation of an adult organism from a fertilized egg, asexual reproduction, regeneration, and maintenance or repair of body parts are accomplished through mitotic cell division.

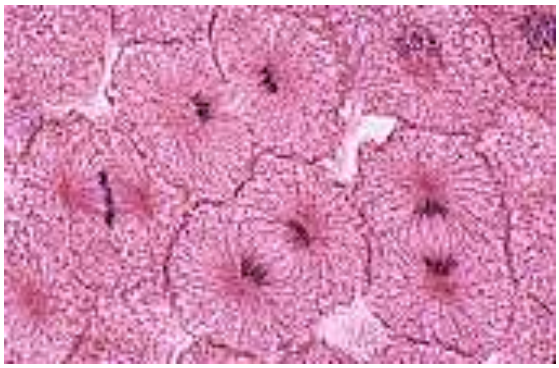
Where does one find cells undergoing mitosis? Plants and animals differ in this respect. In higher plants, the process of forming new cells is restricted to special regions called **meristems**. These regions usually occur at the tips of stems or roots. In animals, cell division occurs anywhere new cells are formed or as new cells replace old ones. However, some tissues in both plants and animals rarely divide once the organism is mature.

You will be using prepared slides to observe the different phases of mitosis in an onion root tip and an *Ascaris* worm blastula.



Roots consist of different regions. The **root cap** functions in protection. The **apical meristem** is the region that contains the highest percentage of cells undergoing mitosis. The **region of elongation** is the area in which growth occurs. The **region of maturation** is where root hairs develop and where cells differentiate to become xylem, phloem, and other tissues.

WE WILL BE USING THE **ZONE OF CELL DIVISION** (JUST ABOVE THE APICLA MERISTEM) AND THE **ZONE OF ELONGATION** FOR OBSERVING AND COUNTING OUR CELLS.



Animal blastula (developmental stage of an embryo) is an active mitotic stage.

OBSERVATIONAL DRAWINGS

1) Create a two column table in your journal. Onion on the left side and Ascaris on the right side.
2) Each row will contain a drawing of a single cell of each of the following phases:
    a. Interphase
    b. Prophase
    c. Metaphase
    d. Anaphase
    e. Telophase/Cytokinesis
3) The focus of each drawing is to include (if they are present): DNA, cytokinetic features (cell plate or cleavage furrow), and nuclear membrane.

TIME FOR CELL REPLICATION

To estimate the relative length of time that a cell spends in various stages of cell division, you will examine the meristemtatic region of a prepared slide of the onion root tip. The length of the cell cycle is approximately 24 hours for cells in actively dividing onion root tips.

Since you are working with a prepared slide, you cannot get any information about how long it takes a cell to divide. What you can determine is how many cells are in each phase. From this, you can infer the percentage of time each cell spends in each phase.

1) Observe every cell in one high-power field of view and determine which phase of the cell cycle it is in:
    a. Interphase, Prophase, Metaphase, Anaphase, Telophase
    b. Working in pairs makes this faster and easier. Count at least 200 cells over several fields of view.
2) Create a data table with the phases as the rows and columns for: Total number of cells, class total number of cells, percent of total cells counted, and time in each stage.
3) CALCULATE the percentage of cells in each phase based on the class data. Show your work.
4) Consider it takes, on average, 24 hours (1440 minutes) for onion root tip cells to complete the cell cycle. CALCULATE the number of minutes spent in each phase. Show your work.
5) Again using the class data, calculate the amount of time spent in mitosis as compared to interphase.
6) Verbalize the time spent in each stage data from your table.
7) Create a pie chart of the onion root tip cell cycle using the class data.

ANALYSIS

1) How does mitosis differ in plant and animal cells?
2) Is the centrosome necessary for mitosis? Defend your answer.
3) If your observations had not been restricted to the area of the root tip that is actively dividing, how would your results have been different when calculating the time spent in each phase?