

Mitosis in Onion Root Tip Cells Lab

A quick overview of cell division

The genetic information of plants, animals and other eukaryotic organisms resides in several (or many) individual DNA molecules, or **chromosomes**. For example, each human cell possesses 46 chromosomes, while each cell of an onion possesses 8 chromosomes. All cells must replicate their DNA when dividing. During **DNA replication**, the two strands of the DNA double helix separate, and for each original strand a new complementary strand is produced, yielding two identical DNA molecules. DNA replication yields an identical pair of DNA molecules (called sister **chromatids**) attached at a region called the **centromere**.

DNA replication in eukaryotes is followed by the process called **mitosis** which assures that each daughter cell receives one copy of each of the replicated chromosomes. During the process of mitosis, the chromosomes pass through several stages known as **prophase, metaphase, anaphase and telophase**. The actual division of the cytoplasm is called **cytokinesis** and occurs during telophase. During each of the preceding stages, particular events occur that contribute to the orderly distribution of the replicated chromosomes prior to cytokinesis.

The objectives of this lab exercise are for you to:

Better understand the process and stages of mitosis.

I. Viewing mitosis in onion root tips.

Why use onion roots for viewing mitosis?

The roots are easy to grow in large numbers.

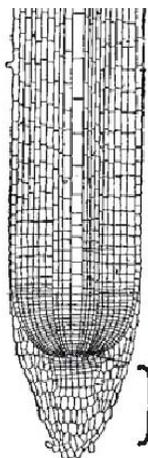
The cells at the tip of the roots are actively dividing, and thus many cells will be in stages of mitosis.

The tips can be prepared in a way that allows them to be flattened on microscope slide (“squashed”) so that the chromosomes of individual cells can be observed.

The chromosomes can be stained to make them more easily observable.

Regions of Onion Root tips

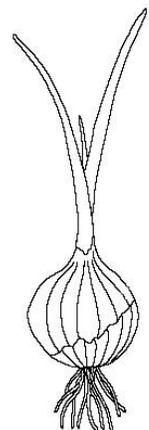
There are three cellular regions near the tip of an onion root.



In the **region of cell elongation**, cells are increasing in size, but not dividing.

The **region of cell division** (or **meristem**) is where cells are elongation actively dividing but not increasing significantly in size.

The **root cap** contains cells that cover and protect the underlying growth region as the root pushed through the soil.

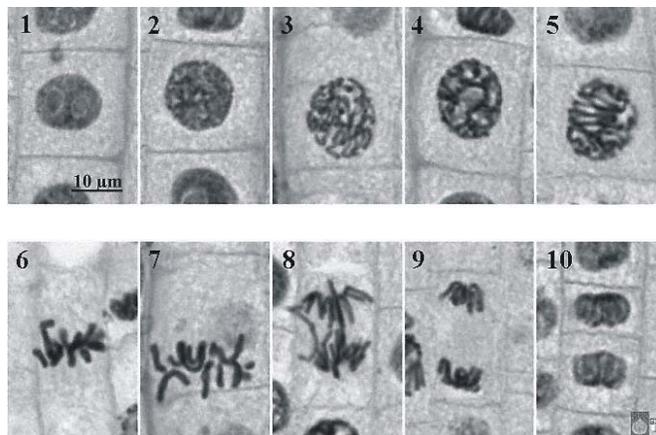


Viewing Chromosomes

Chromosomes generally are not visible as distinct entities in nondividing cells, since the DNA is uncoiled, but the process of mitosis is facilitated by **supercoiling** of the chromosomes into a highly compacted form. Supercoiled chromosomes can be visualized in cells, particularly if they are treated with a DNA-specific stain.

Observations of onion root tip.

Scan the microscope under the 10x objective. Look for the region that has large nuclei relative to the size of the cell; among these cells will be found cells displaying stages of mitosis. Examples are shown in the figure below. Switch to the 40X objective to make closer observations. Record your observations in the table provided.



Mitosis and the cell cycle

While making your observations, consider the relative number of cells actually involved in mitosis. Some of these cells are still involved in the **cell cycle**, which encompasses all of the processes involved in cell replication. Cells that are actively dividing but not yet in mitosis are said to be in **interphase**, during which time the DNA is copied and the cell is otherwise preparing for replication. Some root cells have ceased dividing and are only increasing in size, whereas others have reached their final, mature size and function, and are said to be in the **G₁ stage**.

Name(s): _____

Class: _____

Results: Onion root tip cells Lab

1. Find and draw a cell showing each stage of mitosis.

Prophase

Metaphase

Anaphase

Telophase

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2. What is a distinguishing **visible** feature of each stage of mitosis?

Prophase: _____

Metaphase: _____

Anaphase: _____

Telophase: _____

3. Many of the cells of the root meristem are not undergoing mitosis; rather they are in a stage called

_____.

4. What processes occur in interphase, which is prior to the onset of mitosis?

5. Once cell division ends, the cells will exist in the cell cycle and enter the _____ stage. Why is it incorrect to say that these cells are “resting”?