# Onion Mitosis

**Overview** Mitosis is part of the cell cycle, a larger process that living organisms use to repair damage, grow, or just maintain condition. In this experiment, we're going to figure out the time it takes for an onion cell to go through each of the four mitosis states.

**What to Learn** Mitosis is the process of cell division for eukaryotes, or cells with nuclei. It is more complex than cell division for cells without nuclei (prokaryotes). Cells divide to increase their numbers through a process of mitosis, which results in two daughter cells with identical sets of chromosomes. You'll learn how to define the four stages of mitosis while identifying the four stages of mitosis in onion cells using a microscope.

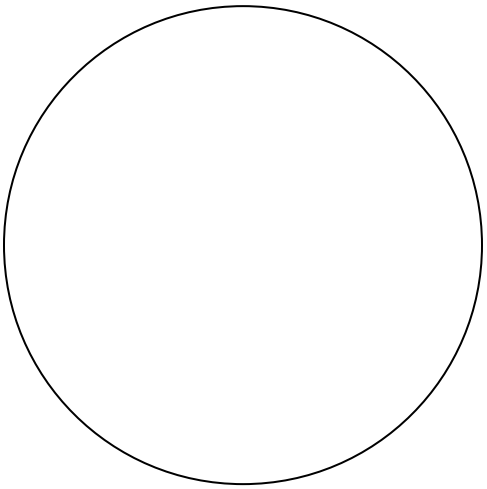
**Materials**

- Compound microscope with slides and coverslip
- Onion (the root tip, not the onion itself) – you can grow your own if you can't find any at the store. Place the bottom of an onion in a glass of water for a couple of days and you'll see the roots grow to the size you need (about 2 cm long).
- Science journal

**Experiment**

1. First, set up your microscope.
2. Next, prepare an onion sample. Take it from the root tip called the meristematic zone, just above the root cap at the very end of the tip.
3. Use the staining technique we show in our Microscope Lab. Cut the sample lengthwise before placing it on the slide.
4. If you want to stop the cell division process while you watch the slide, you'll need to prepare a heat fix mount instead (make sure you don't boil the liquid when you use the candle or you'll ruin your slide). You can add a drop or two of stain after the heat fix and blot the excess with a paper towel. Add a drop of water and a coverslip and you're ready to look.
5. Try different powers of magnification to find the four different stages of mitosis. Count the number of cells found at each stage of mitosis and figure out the percentage. (Total up the number of cells and use this number to divide each count by. Don't forget to multiply by 100 for percentage!)
6. Draw what you see through the microscope and label each sketch:

# Mitosis Microscope Data



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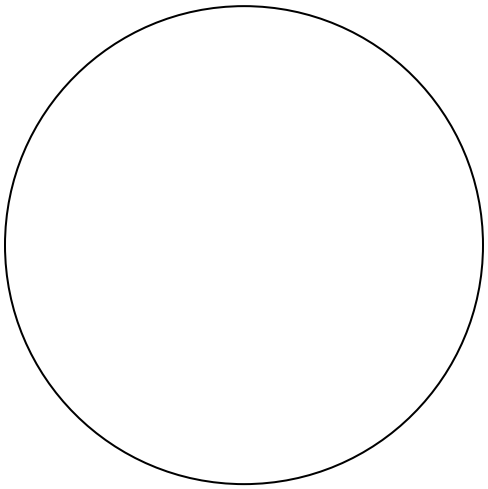

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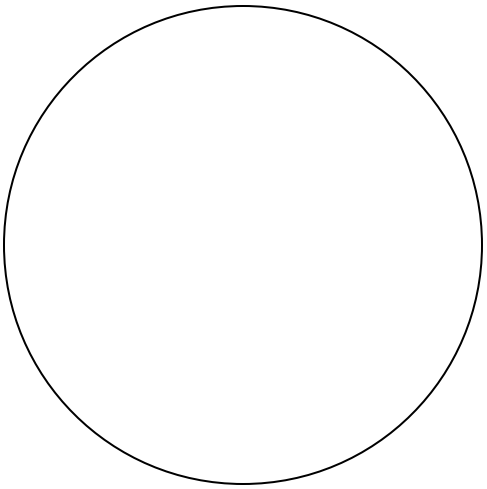

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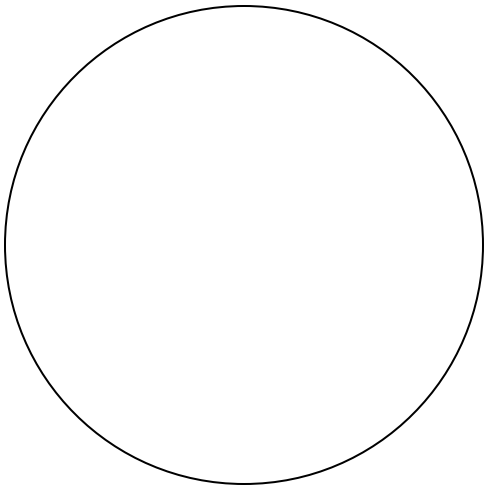

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**Reading**

In eukaryotes there is a nucleus, so a more complex process called mitosis is needed with cell division. Mitosis is divided into four parts, or phases:

Phase 1 – **Prophase:** In this phase the nuclear membrane begins to break down and the DNA forms structures called chromosomes.

Phase 2 – **Metaphase:** In this phase the chromosomes line up along the center of the parent cell

Phase 3 – **Anaphase:** In this phase, the chromosomes break apart, with a complete set of DNA going to each side of the cell

Phase 4 – **Telophase:** In this phase, a new nuclear membrane forms around each of the sets of DNA

The four stages of mitosis (the cell at the top has not started mitosis) lead to two daughter cells.

A little after telophase, the cytoplasm splits and a new cell membrane forms. Once again, two daughter cells have formed. Take a look at this animation for a good overview of mitosis and see if you can identify all the phases.

Cells continue to divide until a protein tells them to stop. As they divide, they become different and specialized, eventually making the tissues and organs found in the many different living things we see every day.

**Exercises**

1. What is mitosis?

2. What are the four stages of mitosis? Briefly describe what happens in each.

3. Out of all four stages of mitosis, which one takes the most time to complete? The shortest time? What happens to the process if we skip metaphase?

**Answers to Exercises: Onion Mitosis**

1. What is mitosis? (The process of cell division for eukaryotes. It is used for cell repair, growth or maintenance.)
2. What are the four stages of mitosis? (Stage 1: Prophase—nuclear structure breaks down and DNA forms chromosomes; Stage 2: Metaphase—chromosomes line up along center of the parent cell; Stage 3: Anaphase — chromosomes break apart with a complete set of DNA going to each side of the cell; Stage 4: Telophase—a new nuclear membrane forms around each new set of DNA)
3. Out of all four stages of mitosis, which one takes the most time to complete? The shortest time? What happens to the process if we skip metaphase? (Prophase. Anaphase. The chromosomes wouldn't line up, so cell division would be unsuccessful.)