

Classic Lab 11

How long does each phase of the cell cycle last?

Have you ever considered what happens to you when you have an injury or you are in the middle of a growth spurt? What exactly is going on at the cellular level? Whether you are injured or you are growing, cells are busy growing and dividing during their cell cycle. During this investigation, you will be exploring each phase of the cell cycle by asking questions such as "What happens in each phase?" and "How long does each phase last?"

The cell cycle has a series of phases: interphase (which includes two growth phases and a DNA synthesis phase), mitosis, and cytokinesis. Mitosis can be broken into four different stages: prophase, metaphase, anaphase, and telophase. Each of these phases takes a different amount of time.

In this lab, you will be examining onion root cells under a microscope. You will find that different cells of the onion are at different stages in the cell cycle. Your job will be to count the number of cells representing each phase of the cell cycle. The cell cycle for onion root tips is about 24 h (or 1440 min). You will use the number of cells engaged in each phase as an indicator of how much time the cell spends in that phase.

Objectives

- Use a microscope to identify cells in an onion root tip.
- Identify the different stages of the cell cycle in onion cells.
- Count the number of cells in each stage of the cell cycle.
- Calculate the amount of time cells spend in each stage of the cell cycle.

Materials

microscope
colored pencils
calculator
prepared slide of onion root tip cells undergoing cell division

Safety Precautions



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Procedure

1. Read and complete the lab safety form.
2. Familiarize yourself with the stages of the cell cycle. Sketch out the phases of cell division to help you identify those stages when you see them under a microscope.
3. Work with a partner and set up your microscope. One partner will act as the Observer and use the microscope to locate onion cells. The second partner will act as the Recorder and will tally the stages as the Observer calls them out.
4. Obtain a prepared onion root tip slide from your teacher and focus on it under low power.
5. Wait for instructions from your teacher. You will be timed during your observation of this onion cell.
6. Switch to high power and locate the region of active growth, just above the root cap.
7. The Observer should start with one long column of cells on the left side of the field of view. Identify the stage of mitosis that the cell is in. Call out the stage to your partner. Complete five to seven columns of cells. Then switch jobs with your partner.
8. The Recorder uses tally marks (in sets of five) to record the stages in **Table 1** as the partner calls them out.
9. Total the number of cells you find of each type. Put that number in the *Your Total* column of **Table 1**.
10. Wait until all your classmates have finished, and place their data (including your own) in the *Class Total* column of **Table 1**.
11. Calculate the percentage of each stage. Record this information in **Table 1**.
12. Assuming it takes 24 h for a cell to complete the cell cycle, calculate how long each stage takes (in hours). Hint: You will need to use your percentages for this calculation. Record your answers in **Table 1**.

Data and Observations

Table 1

Cell Cycle Data							
Stage	Description	Tally Marks	Your Total	Class Total	Total	Percent of Total	Time of Stage
Interphase							
Prophase							
Metaphase							
Anaphase							
Telophase							

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Data and Observations continued

1. In the space below, sketch and label an example of each stage of the cell cycle you observed.

Analyze and Conclude

1. Which stage of the cell cycle did you observe most often?

2. What process must take place before mitosis can begin?

3. Why might each stage of mitosis last a different amount of time? Explain.

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4. What can you infer about the relative length of time that each stage lasts?

5. What marks the completion of telophase? Describe any structures that you saw that indicate the end of that phase.

6. **Error Analysis** What are possible sources of error in your experiment?

7. Explain how the cell cycle can be described as multiplying by dividing.

Inquiry Extensions

1. Interphase and mitosis are similar in plant and animal cells, except that the centrioles appear during prophase in animal cells. Predict whether animal cells or plant cells spend a longer time in mitosis. Design an experiment to test your prediction.
2. Why is it important for you to think about mitosis and consider the amount of time cells spend in each phase? What does the cell cycle have to do with your life?