

Makeup Lab 3: Cell Cycle: Do Plant and Animal Cells Spend the Same Proportion of Time in Each Stage of the Cell Cycle?

Introduction

The cell cycle is an important process, and we need to understand it to appreciate how animals and plants are able to grow, heal, and reproduce.

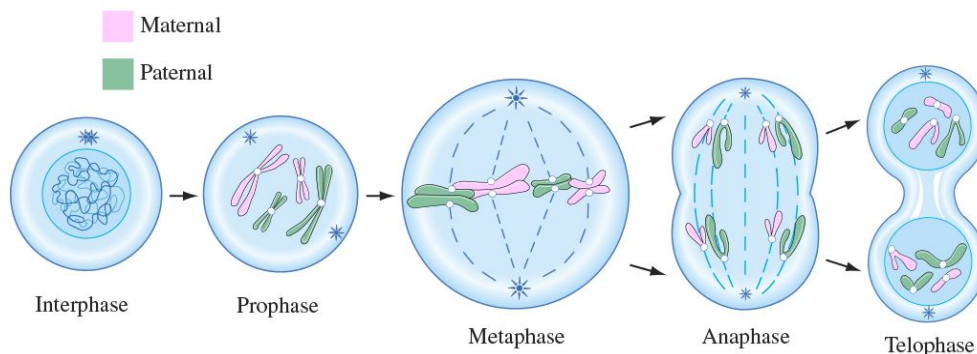
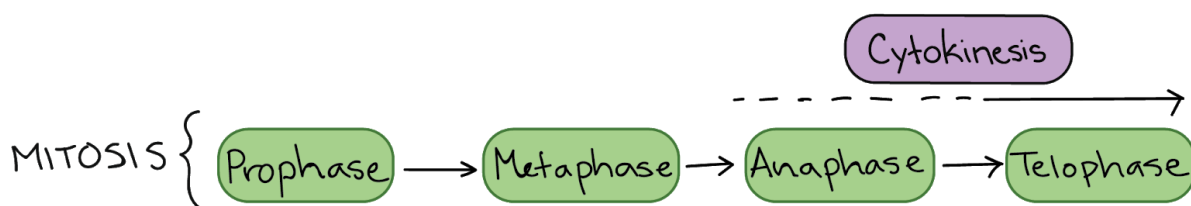
The cell cycle is the name given to the series of events that occur as one cell divides into two cells that are *genetically identical both to each other and to the parent cell*, which then grow to full size. The cell cycle is split into four major stages:

- **Growth Phase**, where normal cellular processes take place and the cell grows to full size.
- **Interphase**, where the DNA is replicated.
- **Mitosis**, where the nucleus divides and sister chromatids are separated
- **Cytokinesis**, where the cytoplasm divides.

All organisms need to produce genetically identical daughter cells. Single celled organisms use this method to reproduce - each of the produced cells is a separate organism. For multicellular organisms, there are three main reasons why cells divide:

1. **Growth** - multicellular organisms can grow in two ways, increasing the size of their cells, or increasing the number of cells - achieved through mitosis.
2. **Repair** - when cells are damaged, they need to be replaced with identical cells capable of doing exactly the same job.
3. **Replacement** - no cell lasts forever. Even the most long lived of cells will need to be replaced at some point. Red blood cells only last three months, skin cells even less. Identical cells are needed to carry on the functions of the cells they are replacing.

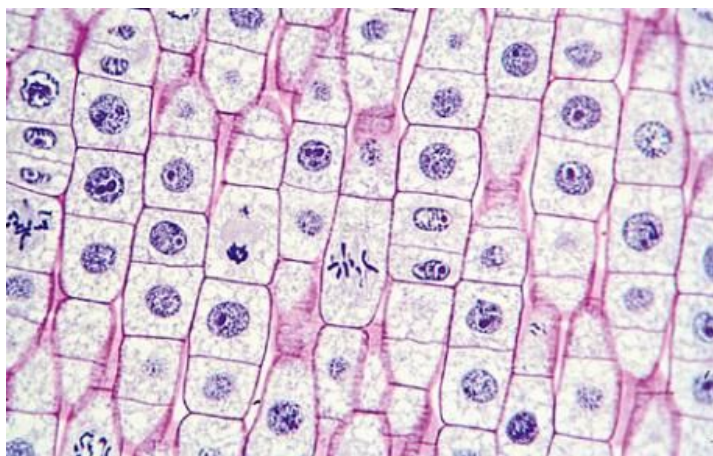
Mitosis consists of four basic phases: prophase, metaphase, anaphase, and telophase. These phases occur in strict sequential order, and cytokinesis - the process of dividing the cell contents to make two new cells - starts in anaphase or telophase.



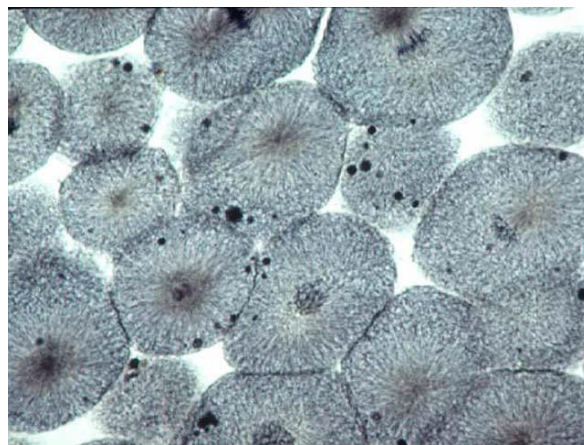
*Read the linked article from Khan Academy for more information on the cell cycle and mitosis. <https://www.khanacademy.org/science/biology/cellular-molecular-biology/mitosis/a/phases-of-mitosis>

The figure below provides pictures of plant and animal cells in various stages of the cell cycle.

The cell cycle of (a) plant cells and (b) animal cells



(a)



(b)

The picture of the plant cells was taken from the cells in the tip of an onion root. The roots of plants are good for studying the cell cycle because they are constantly growing and, as a result, many of the cells in the tip of the root are in the process of dividing. To create the picture in the figure (a) above, a very thin slice of onion root was placed onto a microscope slide. The root was then stained with a dye that made the chromosomes visible. These photos provide us with a clear view of the various stages of the cell cycle, yet this information tells us little about how long a cell spends in each stage and if the amount of time in each stage is different for plants and animals.

To figure out how long cells spend in each stage of the cell cycle, we need to look at the proportion of cells in a given area that are in each phase. From this information you can then determine the relative amount of time a cell spends in each stage. The portion of cells in each phase should correspond closely with the amount of time spent by each cell in each phase.

Your Task

Determine the proportion of time animal and plant cells spend in each phase of the cell cycle. The guiding question of this investigation is: **Do plant and animal cells spend the same proportion of time in each stage of the cell cycle?**

Materials

You may use any of the following materials during your investigation:

- Picture from a slide of an onion root tip
- Picture from a slide of a whitefish blastula
- Microscope

Getting Started

To answer the guiding question, you will need to design and conduct an investigation. You will be presented with pictures from slides (see last page) that you can use to see the cells in the tip of an onion root and in a whitefish blastula. Both pictures will have cells in various stages of the cell cycle. To accomplish this task, you must determine what type of data you will need to collect, how you will collect it, and how you will analyze it.

To determine what type of data you need to collect, think about the following questions:

- What type of measurements or observations will you need to record during your investigation?
- How will you quantify any differences or similarities you observe in the different cells?

To determine how you will collect your data, think about the following questions:

- How will you determine how many cells are in each stage on each slide (i.e., how many cells are in interphase, how many cells are in metaphase, and so on)?
- How will you make sure that your data are of high quality (i.e., how will you reduce error)?
- How will you keep track of the data you collect and how will you organize the data?

To determine how you will analyze your data, think about the following questions:

- What type of calculations will you need to make? (Hint: You will need to determine the number of cells in each stage and the total number of cells you counted and use those numbers to predict how much time a dividing cell spends in each phase.)
- What type of graph could you create to help make sense of your data?

Report

Once you have completed your research, you will need to prepare an investigation report that consists of four sections (be sure to have section headings):

1. Introduction: Give some background information on the topic. Explain what question were you trying to answer and include a hypothesis. (Background info, research question and hypothesis)
2. Procedure: What did you do during your investigation and why did you conduct your investigation in this way? (How you collected and analyzed data)
3. Data: Include a data table and/or graph to show your results. Be sure to include a title for your table or graph with labels for the variables.
4. Conclusion: What is your argument? (Claim - Evidence - Reasoning)

Your report should answer these questions in two pages or less. The report must be typed, and any diagrams, figures, or tables should be embedded into the document. Type your report on Google Docs (12 point font, double-spaced) and share it with your teacher. Your report will be graded based on the rubric in the class syllabus.

Onion Root Tip Slide



Whitefish Blastula Slide

