

#6: EUKARYOTIC CELL DIVISION

OBJECTIVES

1. To observe slides of mitotic and meiotic cells and understand the difference and importance of these processes.
2. To distinguish between the different mitotic phases in a plant cell.
3. To compare cytokinesis in plants and animals.
4. To understand the basic process of gamete formation in animal cells (gamete formation in plants will be dealt with in more detail in the lab exercise on flowering plant reproduction).

INTRODUCTION

Cell division is a fundamental and integral part of all life. Mitosis & cytokinesis are coordinated processes that are central to asexual reproduction. These processes allow organisms to expand their cell number and also allows many simpler organisms, such as protists, to increase their population. Meiosis is a form of cell division that is critical to sexual reproduction, perhaps the most important process that promotes variability and evolution. Both mitosis and meiosis are crucial to humans and there are many disorders that are due to abnormalities in these processes. Since it is difficult to study the cell cycle phases (G_1 , S, G_2 , G_0), this lab and study exercise is a straightforward observational activity designed to get you to think about these important processes.

THE DAY BEFORE YOU BEGIN

Using your text, note outlines, and materials from class discussion, define and understand the following terms:

1. chromosome:
2. sister chromatid:
3. centromere:
4. 2n or diploid:
5. 1n or haploid:

6. **cell cycle:** list main the events in each phase

G₁:

S:

G₂:

G₀:

7. **mitosis:**

8. **cytokinesis:**

9. **meiosis:**

10. **recombination** or **crossing over:**

11. **Fill in the “main event” parts of table I** (*not the drawings*)

MATERIALS-SLIDES

1. Onion (*Allium*) Root Tip
2. Whitefish Embryos
3. Mammalian Testis Slides

4. Mammalian Sperm
5. Mammalian Ovary Slides

PROCEDURES, RESULTS & DISCUSSION QUESTIONS

Everyone will work with his or her own microscope. However, you can share materials and discuss the lab with a partner. Focus on the lab activities and if you are limited for time, answer the questions outside of class.

ONION ROOT TIP

1. This is the focus slide for this exercise. Onion have very large thick chromosomes and root tips have a large number of cells in mitosis, so it will be easy to observe all stages of mitosis in these slides. fig. 8.10 on p. 146 in *Enger and Ross* will provide a good reference.
2. View the slide with the naked eye and visualize the small cylindrical root tips. Place the specimen on the stage of the microscope and align one of the root tips these areas under the 4X objective (as always – start at low power. By now you should be fairly adept with the microscope operation; refer to previous labs or get help from your instructor, especially if you're having trouble.)
3. Increase the magnification to 100 X and then 400 X. Use of the oil immersion objective (1,000 X) is generally **not** necessary. Scan the slide and identify all stages of mitosis. Briefly sketch them in the table below; sketch what you see in the microscope (not the book!) or you get an F!

Table I: Sketches and Summary of Mitotic Stages: Sketch the stage as seen in one cell in the space at the left and summarize the main events on the right.

<u>prophase, 400X</u>	<u>main events of prophase</u>
<u>metaphase, 400 X</u>	<u>main events of metaphase</u>

<u>anaphase</u>	<u>main events of anaphase</u>
<u>telophase</u>	<u>main events of telophase</u>

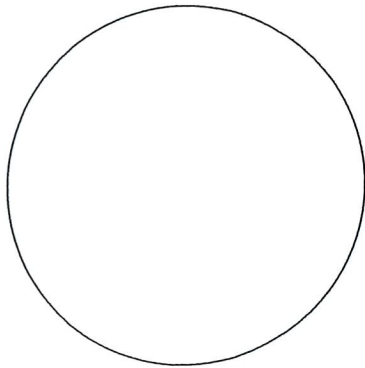
WHITEFISH EMBRYO MITOSIS

1. View a slide of whitefish blastulas with the naked eye. Notice the round masses of tissue; each of these is a separate blastula; a blastula is a fairly early stage of animal development and has many cell in mitosis. Mount the slide on the stage and progress from 40 X to 400 X. Even though the whitefish cells and chromosomes are smaller than the onion, it is still fairly easy to see each of the stages.
2. Scan around Note the different stages of mitosis, as you did with the onion. Notice that the **spindle apparatus** is much more apparent. What is the role of the **spindle**? What is it composed of and where does it originate?
3. What is the major difference in cytokinesis between plants and animals and how is this dealt with in each organism? Explain.

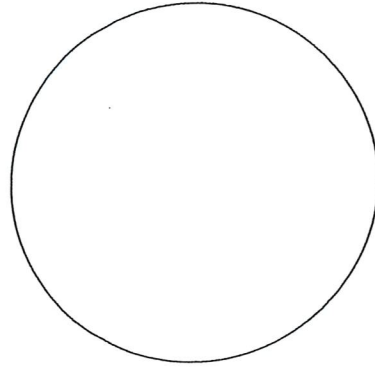
Lab #6 -- Mitosis Lab

Whitefish Mitosis:

Find an example of a cell undergoing the start of cytokinesis and draw it. Find, identify and draw a second stage of mitosis in the whitefish embryos.



_____x



_____x

Additional Discussion Questions:

1. There were many cells in interphase in the onion root tip. Why do you think that is the case? What does this tell you about the amount of time a cell spends in interphase compared to the phases of mitosis?
2. We looked at onion epidermis from the onion bulb earlier this year and did not see chromosomes. Why were we able to see chromosomes in some of the cells in the onion root tip?
3. Taxol is a chemical that is isolated from yew (a type of evergreen/gymnosperm) trees that interferes with microtubules. Taxol is used as an anti-tumor medication. Why is it effective as a chemotherapy drug?

