BIO 101 **NAME** _____

LAB 6- MITOSIS & MEIOSIS

OBJECTIVES

- To observe the stages of mitosis in prepared slides of whitefish blastula and onion root tips.
- To gain a better understanding of the process of mitosis in plant and animal cells.
- Name, identify, and describe the events occurring during the phases of the cell cycle
- Relate the process of DNA replication to the process of mitosis
- Describe the structure of a chromosome during the cell cycle
- Describe the functions of centrioles, centromeres, and spindle fibers in mitosis
- Compare the process of cytokinesis in animal and plant cells
- List and explain the principal events of the stages of meiosis.
- Define and explain the following terms: diploid, haploid, homologous chromosomes, alleles, synapsis, tetrad
- Explain and understand the difference between the first and second meiotic divisions
- List and explain the similarities and differences between meiosis and mitosis

INTRODUCTION

Cell division can be broken down into two processes, mitosis and cytokinesis. Mitosis is the process that leads to the equitable (equal) distribution of genetic material into the two nuclei of two daughter cells. Cytokinesis ("cell movement") is the process that leads to the equitable distribution of cytoplasm to the two daughter cells. In short, mitosis is the division of the nucleus, and cytokinesis is the division of the cytoplasm (organelles and fluid).

In this lab you will study these two processes. You will observe prepared slides of onion root tips and of whitefish blastulae, which have been stained to highlight the nuclei. A blastula is an early developmental stage in many animals. It occurs shortly after fertilization and the formation of the zygote. It is the "ball of cells" stage of development.

PREPARATION

Before coming to class, read the chapter on mitosis in your book, and read over this lab. Bring your textbook to lab.

MATERIALS

Prepared Slides

Prepared slides of cross sections of onion root tips

Prepared slides of cross sections of whitefish blastula

OBSERVING PREPARED SLIDES:

- Obtain prepared slides of cross sections of onion root tips and observe. Look for stages of mitosis.

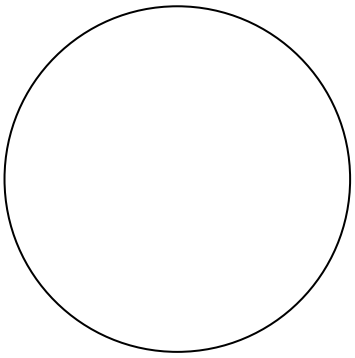
- Obtain prepared slides of cross sections of whitefish blastula and observe. Look for stages of mitosis. Sketch in the circles below each of the phases. Note especially the spindle fibers, made of microtubules.

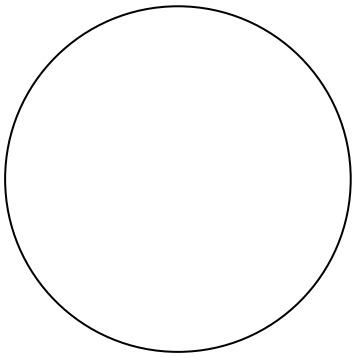
ASSIGNMENT, PART 1: Name: _____

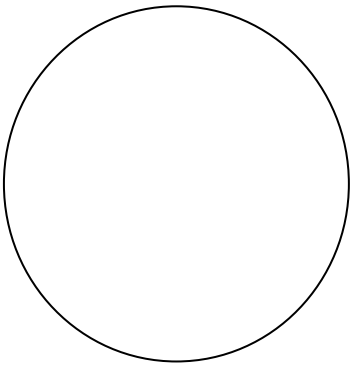
Hand in this lab with your sketches and the answers to the questions at the end of the lab.

DATA: WHITEFISH BLASTULA OR ONION ROOT TIP

Sketch and label each phase in the circles below, from the prepared slides. Note the *total* magnification and specimen!



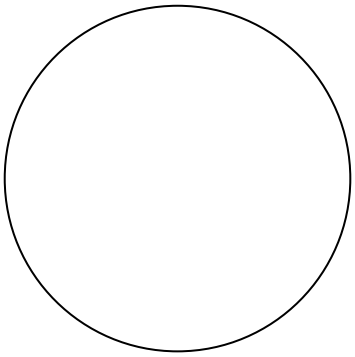


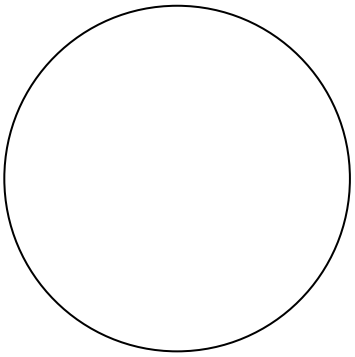


Phase: _____ _____ _____

Mag: _____ _____ _____

Specimen: _____ _____ _____





Phase: _____ _____

Mag: _____ _____

Specimen: _____ _____

1. **<u>Why</u>** did we look at onion ***root tips*** and whitefish ***blastula*** to study the phases of mitosis?

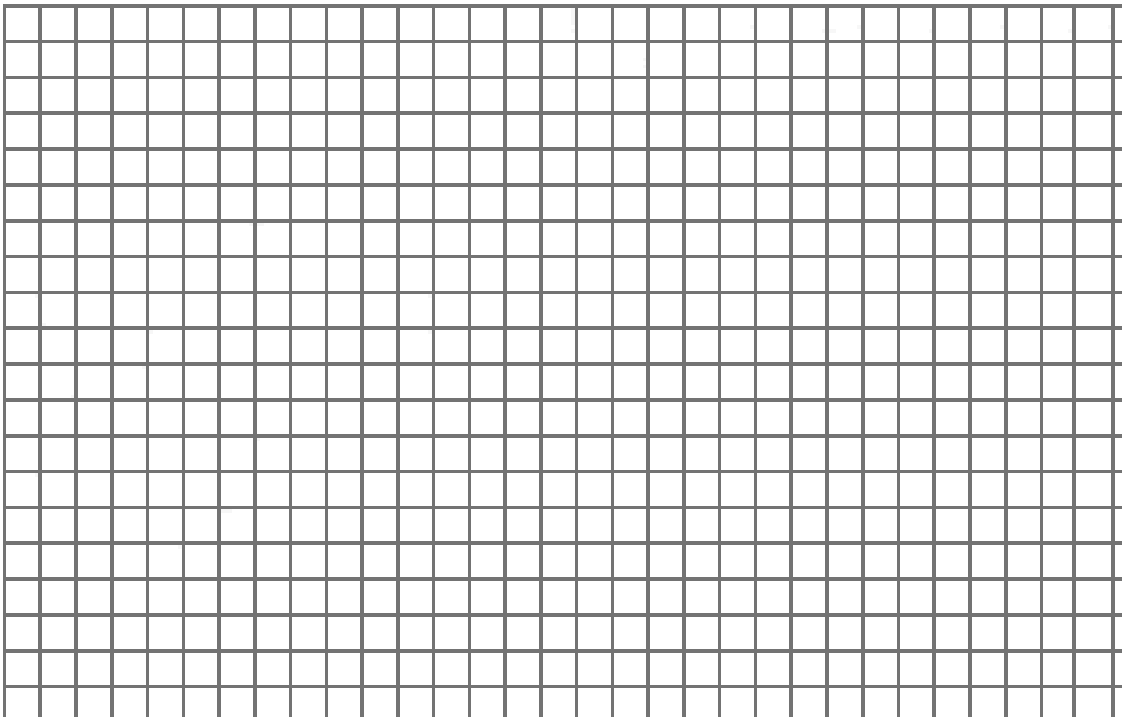
ASSIGNMENT, Part 2:

A. Examine a portion of the *Alium* root tip within the Zone of Elongation (see instructor for explanation). You will need at least **50 cells** to scan for the last part of this exercise. For 50 cells, determine which phase of the **cell cycle** the cell is in. (Remember, the cell cycle includes: Interphase, Prophase, Metaphase, Anaphase, Telophase, and cytokinesis. For a cell in cytokinesis, count it as Telophase). Place the data in the chart below.

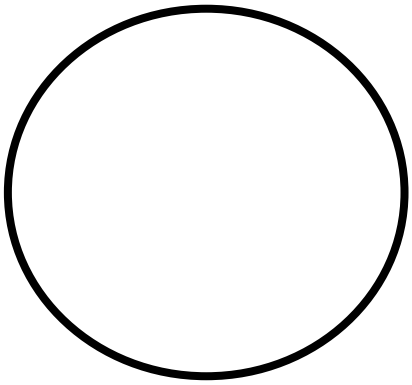
B. Determine the percentage of time each cell will spend in the different phases of the cell cycle. Divide the "Number of Cells" for each phase of the cell cycle by the total number of cells and multiply by 100 to determine the percentage. Place these values (the percents) in the chart below.

Stage of Mitosis	Number of Cells	Percent of time in each stage
Interphase		**_____%**
Prophase		**_____%**
Metaphase		**_____%**
Anaphase		**_____%**
Telophase		**_____%**
Total number of Cells		**=_____ 100%**

2. Use the 'graph paper' below to graph the data you have just collected.



3. In the circle below, construct a well-labeled **pie graph** to display the same data as above.



4. Of the stages of the **cell cycle,** which one takes the most time to complete? How can you explain your results?

5. Of the four stages of **mitosis**, which one takes the most time to complete? Explain.

6. For mitosis, which is the shortest stage in duration? How can you explain your results?

MEIOSIS PART III

INTRODUCTION

Meiosis consists of two nuclear divisions (meiosis I and meiosis II) and results in the production of four daughter nuclei, each of which contains only half the number of chromosomes (and half the amount of DNA) characteristic of the parental cells.

During meiotic reduction of the chromosome number to half, however, chromosomes are not just divided into two sets at random. In diploid organisms, chromosomes occur in matched pairs called **homologous chromosomes**. These are identical in size, shape, location of their centromeres, and types of genes present. One member of each homologous pair is contributed by the "male" parent and one is contributed by the "female" parent during the process of sexual reproduction. Meiosis provides as precise a mechanism as possible for separating these homologous chromosomes so that daughter cells carry one member, or homologue, of each chromosomal pair.

PROCEDURES

Exercise A – Simulation of Chromosomal Events During Meiosis

- Using the beads and magnets we will walk through a simulation of the meiotic divisions focusing primarily on the events of the nuclear divisions in class.

- You should be familiar with the following terms: homologous chromosomes, sister chromatids, centromere, kinetochore, microtubules, synapse, cytokinesis.

Answer the following questions regarding mitosis and meiosis.

1. How does the arrangement of chromosomes differ when comparing metaphase of meiosis I and mitosis?

2. What happens to the sister chromatids during anaphase of meiosis I?

3. Compare the amount and arrangement of genetic material in each cell following telophase I of meiosis and telophase of mitosis?

4. How does metaphase II differ from metaphase I?

5. How does metaphase II compare to metaphase of mitosis?

6. How many cells are formed due to the process of meiosis? How many cells are formed during the process of mitosis

7. List **three** major differences between meiosis and mitosis?