PART 1: MITOSIS & CYTOKINESIS

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 functions of centrioles, centromeres, and spindle fibers in mitosis
- Compare the process of cytokinesis in animal and plant cells

INTRODUCTION

Somatic cell reproduction can be broken down into several processes, among them are interphase, mitosis, and cytokinesis. A somatic cell undergoing cellular division can spend about 90% of its time in interphase. This phase prepares the cell to divide into two daughter cells by replicating the cytoplasm and DNA, the genetic material. Mitosis is the process that leads to the equitable distribution of genetic material into the two nuclei of the two daughter cells. Cytokinesis ("cell movement") is the process that leads to the equitable distribution of cytoplasm to the two daughter cells. In short, interphase is the duplication of the cellular contents, mitosis is the division of the nucleus, and cytokinesis is the division of the cytoplasm.

In this lab you will study mitosis and cytokinesis. You will observe prepared slides of onion root tips and of whitefish blastulae, which have also been stained to highlight the nuclei. A blastula is a 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 of cross sections of onion root tips  Prepared slides of cross sections of whitefish blastula

OBSERVING PREPARED SLIDES

2. Obtain prepared slides of cross sections of whitefish blastula and observe. Look for stages of mitosis.
3. Using either set of slides, sketch in the circles provided each of the phases. Note especially the spindle fibers, made of microtubules. Label the cell components visible in your drawings!

CLEAN-UP

Put slides away correctly, and put microscope away correctly.
ASSIGNMENT
1. Hand in this lab with your sketch pages (below) and the answers to the questions.

DATA
Sketch and label each phase in the circles below. Note the total magnification!

Specimen: __________  __________  __________
Phase: __________  __________  __________
Magn: __________  __________  __________
DATA
Sketch and label each phase in the circles below. Note the total magnification!

Specimen: __________
Phase: __________    __________    __________
Magn: __________    __________    __________

Questions to answer:
1. Why did we look at onion root tips and whitefish blastula to study the phases of mitosis?

2. In what other regions of a plant or animal would you expect to find mitosis occurring?
PART 2: MEIOSIS

OBJECTIVES:
- List and explain the principal events of the stages of meiosis.
- Define and explain the following terms: diploid, haploid, homologous chromosomes, alleles, 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
Meiosis consists of two nuclear divisions (meiosis I and meiosis II) and results in the production of four daughter cells, 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.

ASSIGNMENT
Hand in this lab with your sketches and attached answers to the questions.

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, microtubules, cytokinesis, centrosomes, tetrad, spindle.

Questions to answer (on a separate page)
1. How does the arrangement of chromosomes differ when comparing metaphase I of meiosis and mitosis?
2. What happens to the sister chromatids during anaphase I of meiosis?
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 in meiosis?
5. How does metaphase II of meiosis compare to metaphase of mitosis?
6. How many cells were formed due to the process of meiosis? How many cells were formed during the process of mitosis?
7. List three major differences between meiosis and mitosis.
Exercise B – Observations of Meiosis in Floral Reproductive Structures

Using the slides of Lilium anthers and ovules observe and draw the phases of meiosis. Due to the coordination of the stages of meiosis, you will not be able to see all of the phases. Identify and draw as many as you can.

Sketch and label each phase in the circles below, from Lilium anther slides. Note the total magnification!

Questions to answer:

1. What function does meiosis serve in Lilium anthers? In what types of animal tissues would you expect to observe meiosis occurring?