Lab 5: Cell Division
Pre Lab Test

1. Describe the diference between a germ cell and a somatic cell.

2. Draw and label all parts of the cell cycle.

Define:
3. Diploid

4. Haploid

5. Apoptosis

6. What is the purpose of mitosis and meiosis?

7. How do the cellular products of mitosis differ from meiosis?

Name _____

Lab Objectives:

The Cell Cycle:

- Name and describe each phase and subphase of the cell cycle.
- Be able to describe the behavior of chromosomes at each phase.
- Define terms: apoptosis, cytokinesis, nuclear division, PMAT, sister chromatids, centromere, centriole, homologous pairs, allele, check points, chromatin,

Cell Division:

- Name and describe the phases of Meiosis I and Meiosis II.
- Name and describe the phases of Mitosis.
- Compare Mitosis to Meiosis I
- Compare Mitosis to Meiosis II

The Cell Cycle:

Cells do not live as long as an organism. Different types of cells live for different lengths of time. During the life of a single cell, it will cycle through a recurring pattern of events called the cell cycle.

1. Interphase: prepares cell for division (G1, S, G2)
   - G1: cell growth, the chromosomes has just 1 DNA strand.
   - S: DNA synthesis (DNA replication) which produces a copy of each single strand of DNA so that at the end of S phase there are 2 strands of DNA connected by a centromere.
   - G2: Cell growth and final preparation for nuclear division

2. Nuclear Division: PMAT, the cell's DNA gets separated into 2 separate nuclei although there is still only one cell at the end of this phase.

3. Cytoplasmic Division: Cytokinesis which yields daughter cells. In mitosis, these daughter cells are genetically identical. Meiosis results in daughter cells that are NOT genetically identical.

Draw and label a diagram of the cell cycle below. Include all phases, subphases, and 3 check points. Briefly describe what occurs in each of the phases.

Summary of Mitosis and Meiosis in Animals

	Mitosis	Meiosis
Types of Cells Produced	Yields 2 Somatic Cells	4 Gametes
FUnction	Growth, repair, replacement	Sexual reproduction
Chromosome #	Same as parent cell diploid	½ of parent cell haploid
Genetic Material	Identical to parent cell	Not identical. Has only ½ the genetic material that the parent cell has with new gene combinations.

Where does mitosis occur in the human body?
All somatic cells. (ie: lungs, skin, bone, liver etc).

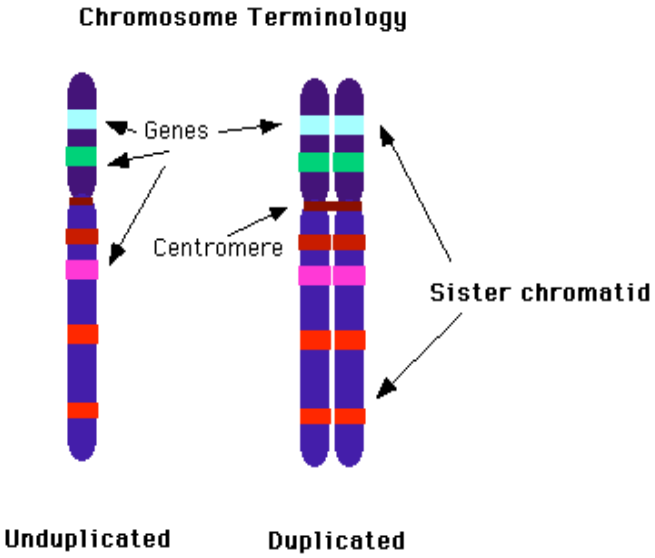
Where does meiosis occur?
Only in the sex organs. Sperm is produced in the testes in males while eggs are produced in the ovaries of females.

<u>Before, we proceed let's clarify some terminology.</u>

- When a single DNA molecule exists alone (not connected to another DNA molecule) it is called an unduplicated chromosome. This is what you'll find during interphase of the cell cycle. The nuclear material will not be distinctly visible.
- When a DNA molecule(and proteins) is not attached to another one then that single molecule of DNA is not a chromatid but an unduplicated chromosome.
- When two DNA molecules are joined together by a centromere, each molecule is called a chromatid. Together, these 2 connected DNA molecules are called a duplicated chromosome. A duplicated chromosome is made up of 2 chromatids.

Homologous Chromosomes: have the same general kind of gene along their length but the details of the gene on one chromosome may be

slightly different than the corresponding gene on the other chromosome. For example, we each have 2 copies of every autosome. On a given Chromosome there will be a gene for a particular characteristic. Let's say chromosome # 3 contains the gene for hair texture. One of your # 3 chromosomes may code for curly hair while the other may code for straight hair. The same gene is found on each # 3 (because they are homologous pairs) but they may have different alleles for that gene.



Locus: the location /address of a certain gene on a chromosome.

Homologous chromosomes For instance, in a certain spot(usually called a locus) there may be a gene that codes for straight hair. At the same spot or locus on the homologous chromosome will also be a gene for hair texture but it might code for curly hair.

Alleles: an alternate form of a gene. The gene for eye color has numerous alleles (blue, brown, hazel, green etc).

Autosome: chromosomes (#1-22) that are not involved in sex determination. Human diploid cells have 22 pairs of autosomes and 1 pair of sex chromosomes.

Sex chromosomes: chromosomes involved in a major way in sex determination. In humans this is the 23rd pair. The X chromosome is much bigger than the Y chromosome, most of the genes on the X chromosome do not have corresponding genes on the Y chromosome.

Let's take a look at the stages of mitosis, using microscope slides of real cells in the process of division.

CELL DIVISION IN PLANTS & ANIMALS

We examined diagrams of cell division in lecture, but it's always nice to look at the real thing too. Working with your lab partner, take a microscope and the slides of Allium (onion) root tip and whitefish blastula to your desk. Remember the protocols we used for setting up the 'scope and viewing of slides. Also examine the posters/models of mitosis on the side counter to refresh your memory of what happens in each stage of division.

Hints for the Allium root tip slide: Start at low power (4X) and center the tip of the root in your field of view. Get it into clear focus. It's the region just above the root tip that you want to concentrate on, as this region contains cells which are dividing rapidly in living plants and will therefore have cells in all stages of mitosis clearly visible. Increase magnification (do not try to use the oil immersion lens, though) so that you can examine individual cells. Can you ID cells in the major mitotic stages? Note the presence of a cell plate in late telophase. Sketch them below as labeled.

Hints for the whitefish blastula slide: The whitefish is a fish, so an animal. How do its cells differ from that of the onion (in terms of organelles)? A blastula is a teeny ball of cells found during very early embryological development, and its cells are very busy dividing mitotically, producing daughter cells of like DNA. The blastula appears under the 'scope as a pale pink circle (stained to bring out individual cells' chromosomes). That circle is composed of many individual cells—it is not a single cell! So once you have a blastula centered in your field of view and focused clearly, increase the magnification so that you can make out single cells. The blastomeres are in different phases of mitosis. Note the presence of a cleavage furros in late telophase. Can you determine in which mitotic stages these cells are? Good! Sketch each stage as you see it below.

Sketch a plant and an animal cell at each of the following stages of mitosis:

	ONION ROOT CELL	WHITEFISH BLASTULA
LATE PROPHASE:		
METAPHASE		
ANAPHASE:		
TELOPHASE:		

Post Lab 5 Test Questions on Mitosis

1. Mitosis and cytokinesis results in _____ daughter cells.

2. The nuclei in the daughter cells are/ are not genetically identical to the parent cells.

3. Was the parent cell diploid or haploid?

4. If you see a cleavage furrow under high power magnification, you are likely to be looking at
   a) a plant cell during anaphase
   b) a plant cell during telophase
   c) an animal cell during interphase
   d) an animal cell during cytokinesis.

5. Mitosis is cell division in which the number of chromosomes

   _____.

6. What is the purpose of mitosis?

7. How many daughter cells result in one mitotic division?

8. In which phase of mitosis will you see no nuclear envelope?

9. In which phase of mitosis will you see 2 nuclei but only one cell?

10. During which phase is the genetic material not visible?

Post Lab 5 Test Questions on Meiosis

1. Does meiosis begin with a diploid or a haploid cell?

2. Where does meiosis occur?

3. How many daughter cells are produced and are they genetically identical?

4. Are these daughter cells haploid or diploid?

5. How does sexual reproduction result in genetic variation?

6. Meiosis reduces the chromosome number by ½ but fertilization restores the chromosome number. A zygote contains the same number of chromosomes as its parents. Are these exactly the same chromosomes?

7. Describe the difference in chromosome behavior between meiosis I and meiosis II.