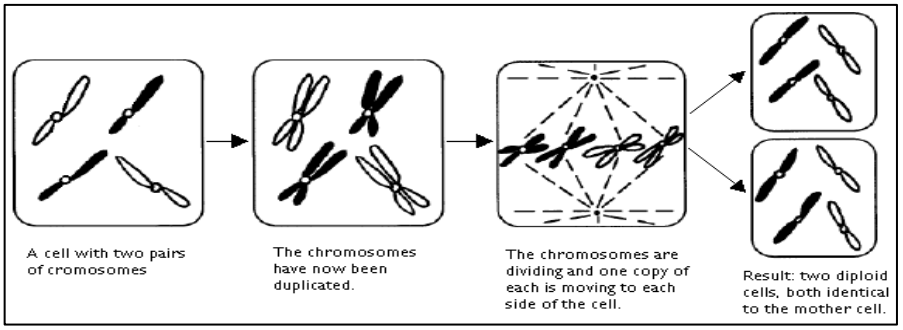
Advisement Teacher & Room #_____

Student Name_____Tutor:_____ *Biology Tutorial #10*

Biology Teacher's Name_____Period_____

CA State Standard 2a – Students know meiosis is an early step in sexual reproduction in which the pairs of chromosomes separate and segregate randomly during cell division to produce gametes containing one chromosome of each type.

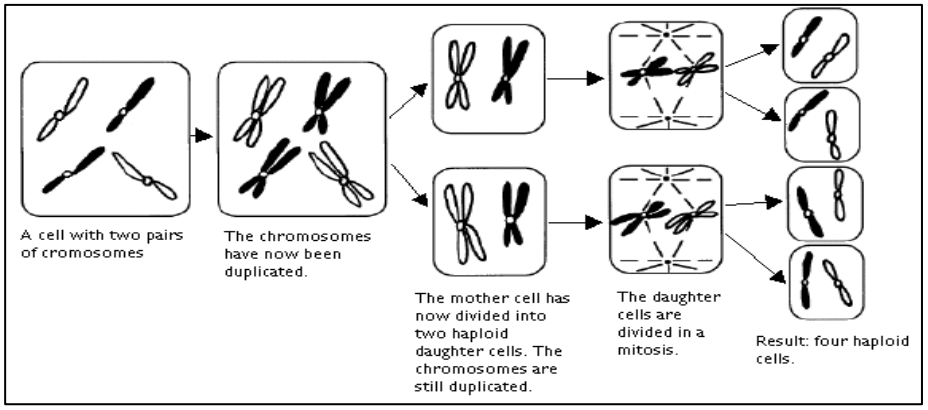
Mitosis and the Cell Cycle



In the 1800's, careful microscopic observations revealed that cells reproduce by division of preexisting cells. During the type of cell division called **mitosis**, the chromosome content of the cell remains constant. As a result, the daughter cells of mitosis are genetically identical (**clones**) to each other and to the parent cell. The 4 phases are Prophase (DNA short and thick), Metaphase (chromosomes at middle), Anaphase (chromosomes pulled to opposite sides) and Telophase (cytoplasm is divided). Most unicellular and some multicellular organisms reproduce by mitosis, and mitotic divisions are responsible for building the bodies of multicellular organisms from a single-cell embryo.

Meiosis and Reproduction

Humans have 46 chromosomes or 23 HOMOLOGOUS pairs: 23 maternal (mom) chromosomes and 23 paternal (dad) chromosomes



The other type of cell division is meiosis. Each chromosome is replicated before meiosis begins.

There are 2 phases of Meiosis: meiosis I and meiosis II. At the start of meiosis I, each chromosome consists of a pair of sister **chromatids** joined at a centromere. At the end of meiosis I, the **homologous chromosomes** separate and are distributed to two daughter cells (law of independent assortment). During meiosis II, the centromere is split, sister chromatids separate and are distributed to two daughter cells (law of segregation).

Reduction division

During meiosis the numbers of chromosomes are reduced so that the daughter cells only contain half as many chromosomes as the mother cell, one chromosome from each pair. These cells with a single set of chromosomes are said to be **haploid.** Cells which have sets of double chromosomes, that is, all chromosomes in pairs, are called **diploid**. In higher organisms only **gametes**, reproductive cells like eggs and sperms, are haploid. If the gametes were not haploid the number of chromosomes would double itself in each generation. Remember, just 1 extra chromosome causes Down's Syndrome!

The Consequences of Meiosis

When meiosis occurs, the chromosome complement found in gametes and offspring differ from one another and from their parents for three reasons: (1) maternal and paternal homologs exchange segments during **crossing over**; (2) maternal and paternal homologs are mixed when chromosomes separate at the end of meiosis I; and (3) outcrossing, or the mating of unrelated individuals, produces more vigorous offspring than the parents are in terms of growth, survival, and fertility individuals. Meiosis leads to genetic differences among offspring and between parents and offspring. According to the disease-resistance hypothesis, meiosis exists primarily because genetically diverse offspring are better able to resist diseases and parasites. The most "fit" species will survive.

Answer the following questions:

1. What is the function of meiosis?

2. How is meiosis important for ensuring that offspring produced by sexual reproduction will have the correct number of chromosomes for that species?

3. During meiosis, chromosomes line up randomly and separate. How does random segregation promote genetic diversity?

4. What is the fundamental difference between mitosis and meiosis?
   a) Mitosis involves two cell divisions, whereas meiosis only involves one.
   b) Meiosis occurs in prokaryotes, and mitosis occurs in eukaryotes.
   c) The number of chromosomes doubles in meiosis, whereas they stay the same in mitosis.
   d) The number of DNA molecules per cell is cut in half in meiosis but remains constant in mitosis.

5. If a cell has a diploid number of 50, how many chromosomes are present in the nucleus at the beginning of meiosis and then how many chromosomes are present in each resulting cell at the end of meiosis?
   a) beginning – 50, end – 25
   b) beginning – 50, end – 100
   c) beginning – 25, end – 50
   d) beginning – 50, end – 50

6. When a sperm and egg combine, the resulting embryo has
   a) all of the genetic information from the mother and all of the genetic information from the father.
   b) half of the mother's genetic information and half of the father's.
   c) all of the mother's genetic information and none of the father's.
   d) all of the mother's genetic information but only half of the father's.

7. Which of the following is the leading hypothesis to explain why many organisms reproduce sexually?
   a) Sexual reproduction produces many offspring, much faster than asexual reproduction.
   b) The offspring that result from sexual reproduction all have the same genetic composition as their parents, and thus are most able to survive.
   c) The offspring that result from sexual reproduction are genetically variable, and some of them can fight off diseases more easily than others can.
   d) Sexual reproduction does not require as much energy as asexual reproduction, because two partners are involved.

8. Identify and draw the 4 phases of cell mitosis. Label all parts.
