**Meiosis and Sexual Reproduction - Chapter 14 (pp. 470-475)**

In **mitosis**, the number of chromosomes in the nucleus of the parent cell is the same as the number of chromosomes in each new daughter cell. In **meiosis**, the number of chromosomes in the daughter cell is only HALF of what it was in the parent cell.

**Meiosis** – a special type of cell division that occurs in reproductive organs, producing cells called gametes (sperm and egg)

**The Function of Meiosis (Obj. 7)**

* to reduce the number of chromosomes from diploid to haploid (reduction division)
* this is necessary because gametes (sperm and egg) are produced during meiosis
* if the number of chromosomes were not reduced we would have 46 + 46 = 92 chromosomes per cell when the sperm and egg fuse... this could cause deformities, or result in the zygote dying.
* for sexual reproduction to occur, there is a fusion of the nuclei of gametes (sex cells).
* A sperm and egg combine to form a zygote (genetically different from both parents)
* in humans, the sperm and egg each have 23 chromosomes
* the sex cells have half the genetic information as a normal cell
* these cells are referred to as **haploid** (only contains one copy of each type of chromosome that the **diploid** parent cell contains
* haploid = n
* diploid = 2n
* In humans, a sperm would have ‘n’ chromosomes (23) – 22 **autosomes** and one **sex chromosome (X or Y)**
* then the zygote would have ‘2n’ (2 X 23 = 46) – or 23 pairs.

During meiosis…

* Chromosomes replicate once
* Each cell divides twice
* after first division, no replication occurs.
* Original cell produces four cells (daughter cells)
* All daughter cells are haploid

Each cell has 2 copies of a gene (one from mother, one from father) – these matching chromosomes that code for a trait (i.e., eye color) are said to be homologous chromosomes. If a cell contains both of the chromosomes (like our somatic cells do), they are considered diploid.

**Stages of Meiosis: (pic. P. 472)**

* Both first and second meiotic divisions are divided into stages similar to mitotic stages.
* Both have prophase, metaphase, anaphase, and telophase
* Interphase occurs before meiosis, similarly to mitosis

**Meiosis I**

**Prophase I:**

* chromosomes have replicated, producing two sister chromatids (same as mitosis)
* pairs of chromatids do not move independently to equator
* lines up with its homologous pair - fastened at centromeres - **synapsis**
* group of four chromatids - **tetrad**
* chromatids may twist around each other, causing an exchange of segments - **crossing over**
* **crossing over**- the process in which pieces of homologous chromosomes are exchanged during synapsis in the first meiotic division – allows for genetic variation. (p. 473)
* at this time, nuclear membrane disappears and spindles form.
* at end of prophase I, homologous chromosome pairs are moving toward the equator.

**Metaphase I**

* tetrads are fastened to spindle fibers at their centromeres and are lined up on the equator

**Anaphase I**

* homologous chromosomes of each tetrad separate – moving to opposite ends of cell
* **disjunction** - the separation of homologous chromosomes during anaphase I of meiosis.
* (instead of single-stranded chromatids moving, like in mitosis)
* the chromosomes at each pole are haploid (half as many as original cell)
* however, they are double-stranded (still have their sister chromatids).

**Telophase I**

* end of first meiotic division: cytoplasm divides - two daughter cells
* half the number of the original (parent) cells chromosomes, but each chromosome is in replicated form (double stranded)
* sometimes, nuclear membrane reforms and short interphase follows (no replication here)
* in most cases, cells immediately begin second division (basically same as mitosis).

**Meiosis II**

**Prophase II**

* double-stranded chromosomes move toward the middle of the cell

**Metaphase II**

* centromeres of sister chromatids fasten to spindles, chromosomes line up on equator

**Anaphase II**

* Centromeres divide, two chromatids separate and move to opposite ends of cell.

**Telophase II**

* Both daughter cells divide, forming four haploid cells. In each cell chromosomes return to interphase state (chromatin), and nuclear membrane reforms.
* Contain HALF the chromosomes as the original parent cell, but four cells have formed.