Meiosis

This kind of cell division, which produces gametes containing half the number of chromosomes as a parent's body cell, is called meiosis (mi OH sus). Meiosis occurs in the specialized body cells of each parent that produce gametes. Meiosis consists of two separate divisions, known as meiosis I and meiosis II. Meiosis I begin with one diploid (2n) cell. By the end of meiosis II, there are four haploid (n) cells.

These haploid cells are called sex cells (gametes). Male gametes are called **sperm**. Female gametes are called **eggs**. When a sperm fertilizes an egg, the resulting zygote once again has the diploid number of chromosomes.

The Phases of Meiosis

Interphase

during interphase, the cell replicates its chromosomes.

Prophase I

The DNA of the chromosomes coils up and a spindle forms. As the DNA coils, homologous chromosomes line up with each other, gene by gene along their length, to form a four-part structure called a tetrad. A tetrad consists of two homologous chromosomes, each made up of two sister chromatids. The chromatids in a tetrad pair tightly. In fact, they pair so tightly that non-sister chromatids from homologous chromosomes can actually break and exchange genetic material in a process known as crossing over. Crossing over can occur at any location on a chromosome, and it can occur at several locations at the same time.

Metaphase I

During metaphase I, the centromere of each chromosome becomes attached to a spindle fiber. The spindle fibers pull the tetrads into the middle, or equator, of the spindle. This is an important step unique to meiosis. Note that homologous chromosomes are lined up side by side as tetrads. In mitosis, on the other hand, they line up on the spindle's equator independently of each other.

Anaphase I

Anaphase I begin as homologous chromosomes, each with its two chromatids, separate and move to opposite ends of the cell. This separation occurs because the centromeres holding the sister chromatids together do not split as they do during anaphase in mitosis. This critical step ensures that each new cell will receive only one chromosome from each homologous pair.

Telophase I

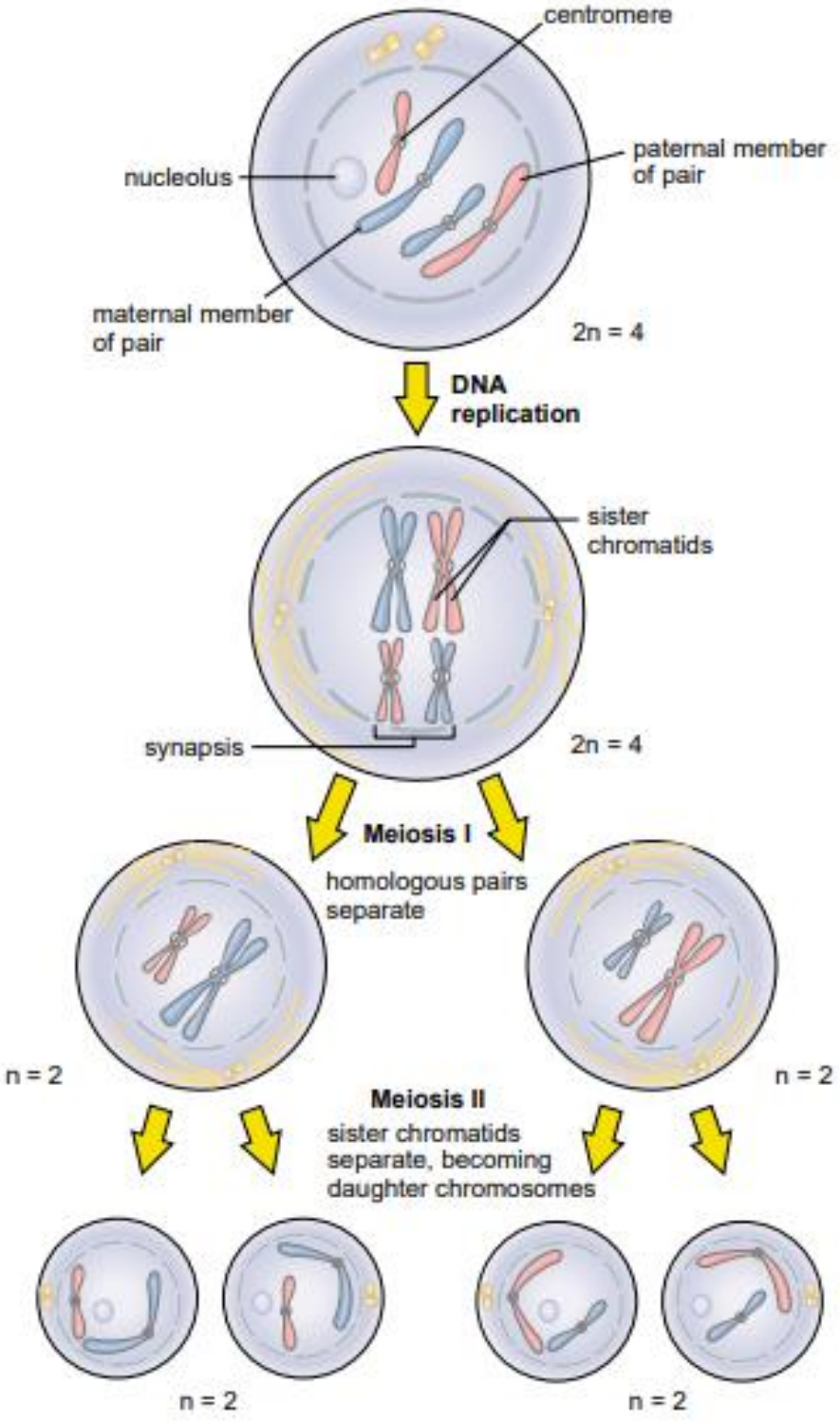
Events occur in the reverse order from the events of prophase I. The spindle is broken down, the chromosomes uncoil, and the cytoplasm divides to yield two new cells. Each cell has half the genetic information of the original cell because it has only one chromosome from each homologous pair. However, another cell division is needed because each chromosome is still doubled.

Meiosis II

Meiosis II consists of prophase II, metaphase II, anaphase II, and telophase II. During prophase II, a spindle forms in each of the two new cells and the spindle fibers attach to the chromosomes. The chromosomes, still made up of sister chromatids, are pulled to the center of the cell and line up randomly at the equator during metaphase II. Anaphase II begins as the centromere of each chromosome splits, allowing the sister chromatids to separate and move to opposite poles. Finally, nuclei re-form, the spindles break down, and the cytoplasm divides during telophase II. The events of meiosis II are identical to those you studied for mitosis except that the chromosomes do not replicate before they divide at the centromeres.

At the end of meiosis II, four haploid cells have been formed from one diploid cell. Each haploid cell contains one chromosome from each homologous pair. These haploid cells will become gametes, transmitting the genes they contain to offspring.

Mitosis	Meiosis
1) It occurs in somatic cells.	1) It occurs in germ cells.
2) Nucleus divides only once.	2) Nucleus divides twice.
3) Two daughter cells are formed.	3) Four daughter cells are formed.
4) Daughter cells are diploid.	4) Daughter cells are haploid.
5) It occurs more frequently.	5) It occurs less frequently.
6) Daughter cells form somatic organs.	6) Daughter cells form gametes.
7) There is only one prophase, one metaphase one anaphase and one telophase.	7) There are two of each phase
8) Number of chromosomes are not changed in the daughter cells.	8) Number of chromosomes are reduced to half.
9) No crossing over in chromosomes.	10) Crossing over occurs chromosomes.


centromere
nucleolus
paternal member of pair
maternal member of pair
2n = 4
DNA replication
sister chromatids
synapsis
2n = 4
Meiosis I
homologous pairs separate
n = 2
n = 2
Meiosis II
sister chromatids separate, becoming daughter chromosomes
n = 2
n = 2