Overview of Meiosis

Meiosis is a form of cell division that leads to the production of **gametes**. **gametes**: egg cells and sperm cells
- contain half the number of chromosomes of an adult body cell
Adult body cells (**somatic cells**) are **diploid**, containing 2 sets of chromosomes.
Gametes are **haploid**, containing only 1 set of chromosomes.

Overview of Meiosis

**Sexual reproduction** includes the fusion of gametes (**fertilization**) to produce a diploid **zygote**.
Life cycles of sexually reproducing organisms involve the alternation of haploid and diploid stages.
Some life cycles include longer diploid phases, some include longer haploid phases.
Features of Meiosis

Meiosis includes two rounds of division – meiosis I and meiosis II.

During meiosis I, homologous chromosomes (homologues) become closely associated with each other. This is synapsis. Proteins between the homologues hold them in a synaptonemal complex.
Features of Meiosis

**Crossing over**: genetic recombination between non-sister chromatids - physical exchange of regions of the chromatids

**Chiasmata**: sites of crossing over

The homologues are separated from each other in anaphase I.

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Features of Meiosis

Meiosis involves two successive cell divisions with no replication of genetic material between them.

This results in a reduction of the chromosome number from diploid to haploid.
The Process of Meiosis

Prophase I:
- chromosomes coil tighter
- nuclear envelope dissolves
- homologues become closely associated in synapsis
- crossing over occurs between non-sister chromatids
The Process of Meiosis

Metaphase I:
- terminal chiasmata hold homologues together following crossing over
- microtubules from opposite poles attach to each homologue, not each sister chromatid
- homologues are aligned at the metaphase plate side-by-side
- the orientation of each pair of homologues on the spindle is random
The Process of Meiosis

Anaphase I:
- microtubules of the spindle shorten
- homologues are separated from each other
- sister chromatids remain attached to each other at their centromeres
The Process of Meiosis

Telophase I:
- nuclear envelopes form around each set of chromosomes
- each new nucleus is now haploid
- sister chromatids are no longer identical because of crossing over

Meiosis II resembles a mitotic division:
- prophase II: nuclear envelopes dissolve and spindle apparatus forms
- metaphase II: chromosomes align on metaphase plate
- anaphase II: sister chromatids are separated from each other
- telophase II: nuclear envelope re-forms; cytokinesis follows
Meiosis vs. Mitosis

Meiosis is characterized by 4 features:
1. Synapsis and crossing over
2. Sister chromatids remain joined at their centromeres throughout meiosis I
3. Kinetochores of sister chromatids attach to the same pole in meiosis I
4. DNA replication is suppressed between meiosis I and meiosis II.

Meiosis vs. Mitosis

Meiosis produces haploid cells that are not identical to each other. Genetic differences in these cells arise from:
- crossing over
- random alignment of homologues in metaphase I (independent assortment)

Mitosis produces 2 cells identical to each other.