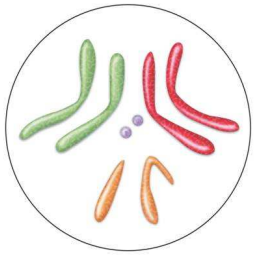
11-4 Meiosis

Each organism must inherit a single copy of every gene from each of its "parents."
Gametes are formed by a process that separates the two sets of genes so that each gamete ends up with just one set.

Chromosome Number

All organisms have different numbers of chromosomes.
A body cell in an adult fruit fly has 8 chromosomes: 4 from the fruit fly's male parent, and 4 from its female parent.



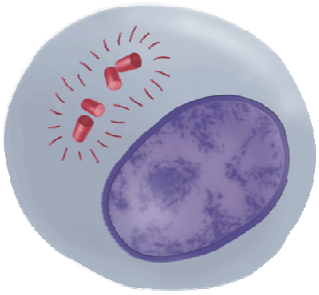
These two sets of chromosomes are **homologous**.
Each of the 4 chromosomes that came from the male parent has a corresponding chromosome from the female parent.
A cell that contains both sets of homologous chromosomes is said to be **diploid**.
The number of chromosomes in a diploid cell is sometimes represented by the symbol 2N.
For *Drosophila*, the diploid number is 8, which can be written as 2N=8.
The gametes of sexually reproducing organisms contain only a single set of chromosomes, and therefore only a single set of genes.
These cells are **haploid**. Haploid cells are represented by the symbol N.
For *Drosophila*, the haploid number is 4, which can be written as N=4.

Phases of Meiosis

Meiosis is a process of reduction division in which the number of chromosomes per cell is cut in half through the separation of homologous chromosomes in a diploid cell.
Meiosis involves two divisions, meiosis I and meiosis II.
By the end of meiosis II, the diploid cell that entered meiosis has become 4 haploid cells.

Interphase I

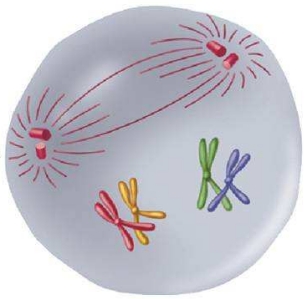
Cells undergo a round of DNA replication, forming duplicate chromosomes.



MEIOSIS I

Prophase I

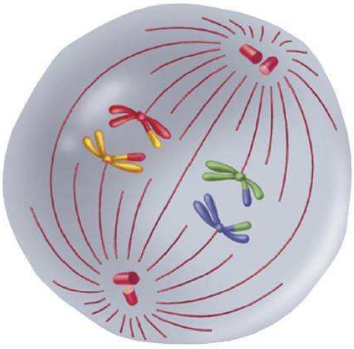
Each chromosome pairs with its corresponding homologous chromosome to form a **tetrad**.
There are 4 chromatids in a tetrad.



When homologous chromosomes form tetrads in meiosis I, they exchange portions of their chromatids in a process called **crossing over**.
Crossing-over produces new combinations of alleles.

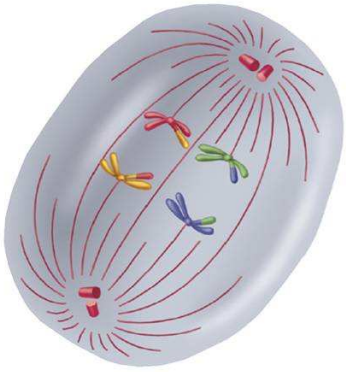
Metaphase I

Spindle fibers attach to the chromosomes.



Anaphase I

The fibers pull the homologous chromosomes toward opposite ends of the cell.

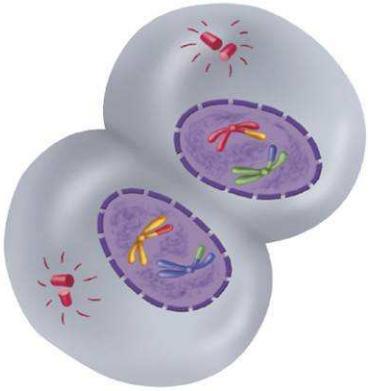


Telophase I and Cytokinesis

Nuclear membranes form.

The cell separates into two cells.

The two cells produced by Meiosis I have chromosomes and alleles that are different from each other and from the diploid cell that entered Meiosis I.



MEIOSIS II

The two cells produced by meiosis I now enter a second meiotic division.

Unlike meiosis I, neither cell goes through chromosome replication.

Each of the cell's chromosomes has 2 chromatids.

Prophase II

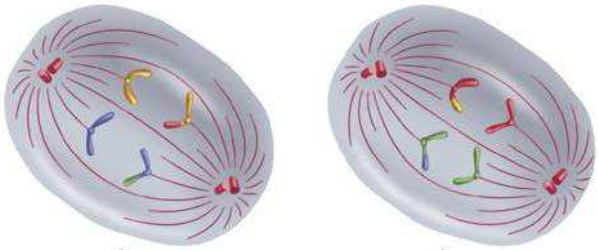
Meiosis I results in two haploid (N) daughter cells, each with half the number of chromosomes as the original cell.

Metaphase II

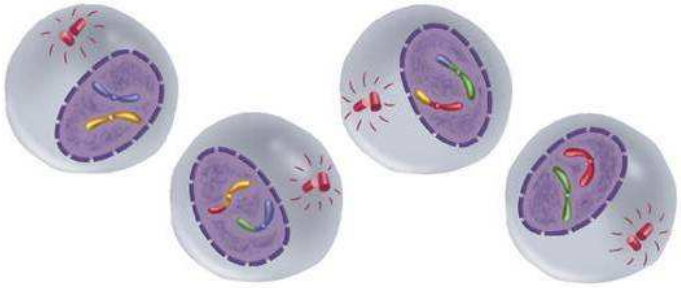
The chromosomes line up in the center of cell.

Anaphase II

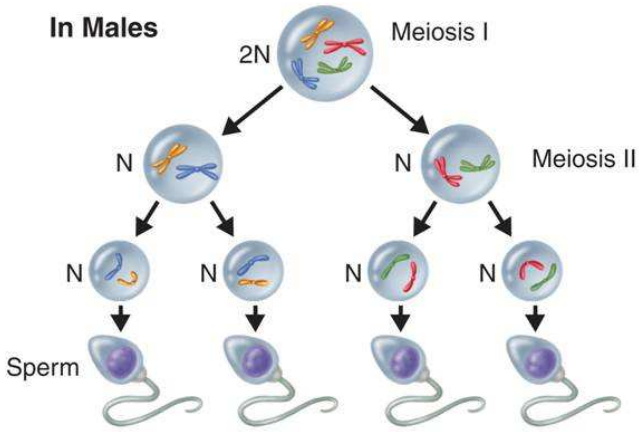
The sister chromatids separate and move toward opposite ends of the cell.



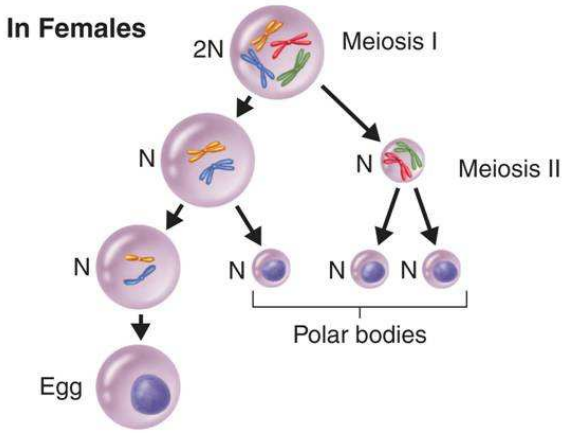
Telophase II and Cytokinesis
Meiosis II results in four haploid (N) daughter cells.



Gamete Formation
In male animals, meiosis results in four equal-sized gametes called sperm.



In many female animals, only one egg results from meiosis. The other three cells, called polar bodies, are usually not involved in reproduction.



How is meiosis different from mitosis?
Comparing Mitosis and Meiosis

Mitosis results in the production of two genetically identical diploid cells.
Meiosis produces four genetically different haploid cells.

Mitosis

- Cells produced by mitosis have the same number of chromosomes and alleles as the original cell.
- Mitosis allows an organism to grow and replace cells.
- Some organisms reproduce asexually by mitosis.

Meiosis

- Cells produced by meiosis have half the number of chromosomes as the parent cell.
- These cells are genetically different from the diploid cell and from each other.
- Meiosis is how sexually-reproducing organisms produce gametes.