

MEIOSIS

Homologous chromosomes are pairs of chromosomes with genes of the same trait (hair color, eye color, height, etc.)

Genes

Homologous Chromosomes

Haploid and Diploid Cells

- **Gametes** are sex cells (reproductive cells)
- A cell with n chromosomes is called a **haploid** cell. ☹️
- A cell that contains $2n$ chromosomes is called a **diploid** cell. ☹️

- Human body cells have 46 chromosomes
- Each parent contributes 23 chromosomes
- **Homologous chromosomes**—one of two paired chromosomes, one from each parent ☹️

Human Genome

23 pairs of chromosomes

1 2 3 4 5
6 7 8 9 10 11 12
13 14 15 16 17 18
19 20 21 22 X²³ Y

Meiosis

- Meiosis produces gametes (egg/sperm) used in sexual reproduction
- Gametes combine in fertilization.

Female (diploid) $2n$ Male (diploid) $2n$

Grows into adult male or adult female

Zygote (diploid) $2n$

Meiosis Meiosis

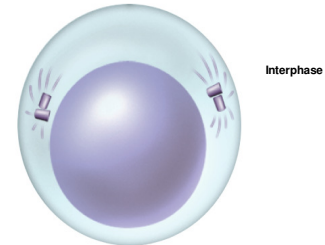
Female gamete (haploid) n Male gamete (haploid) n

Fertilization

Meiosis

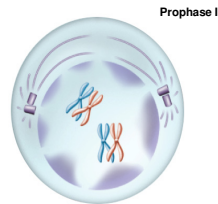
- Reduces the chromosome number by half (1 set/haploid)
- Involves two cell divisions called meiosis I and meiosis II
- Only for making gametes (sex cells)

- Interphase
 - Occurs prior to Mitosis & Meiosis
 - Chromosomes/DNA replicate.
 - Growth



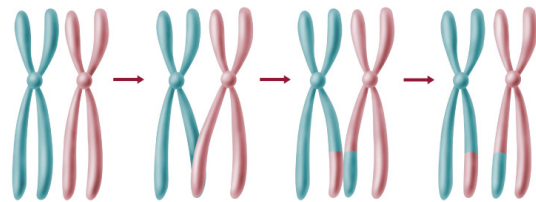
Meiosis I

- Prophase I
 - Pairing (synapse) of **homologous chromosomes** occurs. Crossing over may occur
 - Nuclear envelop breaks down and spindles form



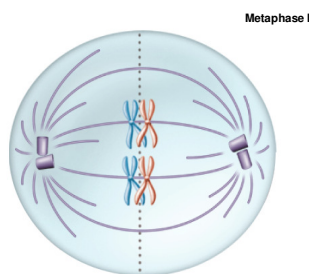
Meiosis I

- Prophase I
 - Crossing over produces exchange of genetic information (more variety).



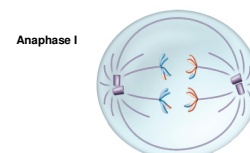
Meiosis I

- Metaphase I
 - Spindles attached at centromeres.
 - Homologous chromosomes up at equator.



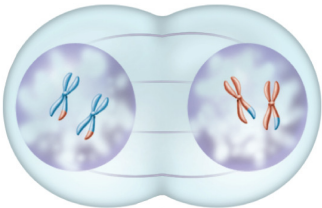
Meiosis I

- Anaphase I
 - Homologous chromosomes separate and move to opposite poles. Ensures one of each kind or chromosome in new cells.
 - Goes from $2n$ to n chromosomes.



Meiosis I

- **Telophase I**
 - Spindles break down
 - Chromosomes become chromatin
 - Nuclei form
 - Cell divides



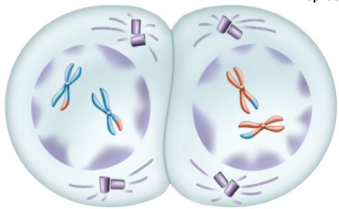
Telophase I

Cytokinesis

- Cytoplasm divides
- Two cells will enter meiosis II with copied DNA

Meiosis II

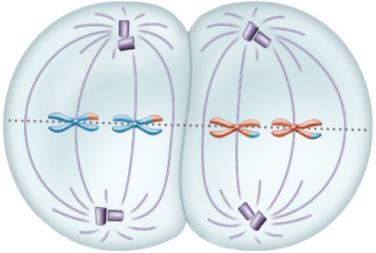
- **Prophase II**
 - Chromosomes appear and spindles form
 - Nuclei break down



Prophase II

Meiosis II

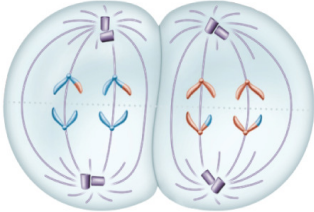
- **Metaphase II**
 - Chromosomes line up at equator with spindles attached at centromeres.



Metaphase II

Meiosis II

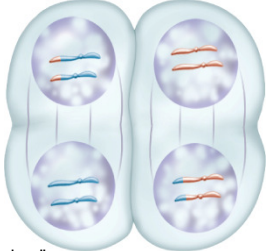
- **Anaphase II**
 - Spindles shorten
 - Sister chromatids move to opposite poles



Anaphase II

Meiosis II

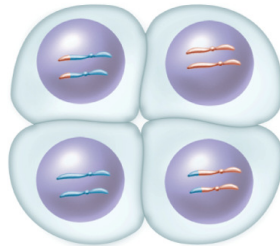
- **Telophase II**
 - Chromosomes reach opposite ends and nuclei reform.



Telophase II

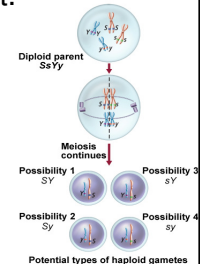
Meiosis II

- Cytokinesis creates 4 nonidentical haploid cells with half the number of chromosomes



The Importance of Meiosis

- **USED ONLY** for **SEXUAL** Reproduction
- Produces **four** haploid gametes that are **NOT** identical with half the number of chromosomes as the parent.
- **Genetic Diversity**



Sexual Reproduction vs. Asexual Reproduction

- **Asexual reproduction**
 - The organism inherits all of its chromosomes from a single parent.
 - The new individual is genetically identical to its parent. (Mitosis)
- **Sexual reproduction**
 - Need two parents
 - New individuals are **NOT** identical to parents (uses Meiosis)