KEY CONCEPT
Gametes have half the number of chromosomes that body cells have.

Why might we want a cell with only half of the chromosomes of normal cells?
You have body cells and gametes.

- Germ cells produce gametes and are located in the ovaries and testes.
- Gametes are sex cells: egg and sperm.
- Gametes have DNA that can be passed to offspring.
6.1 Chromosomes and Meiosis

Your cells have autosomes and sex chromosomes.

- Your body cells have 23 pairs of chromosomes.
  - Homologous pairs of chromosomes have the same structure but are not identical.
  - For each pair, one chromosome comes from each parent.
- Chromosome pairs 1-22 are called autosomes.
- Sex chromosomes, X and Y, determine gender in mammals.
6.1 Chromosomes and Meiosis

**Body cells are diploid; gametes are haploid.**

- Fertilization between egg and sperm occurs in sexual reproduction.
- Diploid \((2n)\) cells have two of every chromosome.
  - Body cells are diploid.
  - Half the chromosomes come from each parent.
- Haploid \((n)\) cells have one copy of every chromosome.
  - Gametes (sperm and egg) are haploid.
  - Gametates have 22 autosomes and 1 sex chromosome.
# 6.1 Chromosomes and Meiosis

<table>
<thead>
<tr>
<th>MITOSIS</th>
<th>MEIOSIS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Produces genetically identical cells</td>
<td>Produces genetically unique cells</td>
</tr>
<tr>
<td>Results in diploid cells</td>
<td>Results in haploid cells</td>
</tr>
<tr>
<td>Takes place throughout an organism’s lifetime</td>
<td>Takes place only at certain times in an organism’s life cycle</td>
</tr>
<tr>
<td>Involved in asexual reproduction</td>
<td>Involved in sexual reproduction</td>
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</tbody>
</table>
Cells go through two rounds of division in meiosis.

- Mitosis and meiosis are types of nuclear division that make different types of cells.
- Mitosis makes more diploid cells for the body.
- Meiosis makes haploid cells from diploid cells.
  - Meiosis occurs in sex cells and produces gametes.
  - Meiosis reduces chromosome number and creates genetic diversity.
• Meiosis I and meiosis II each have four phases, similar to those in mitosis.
  – Homologous chromosomes are similar but not identical.
  – Sister chromatids are copies of the same chromosome.
  – Meiosis I divides homologous chromosomes.
  – Meiosis II divides sister chromatids.
6.1 Chromosomes and Meiosis

Interphase

- Not technically a step of meiosis.
  - DNA duplicates
Chromosomes and Meiosis

**Prophase 1**

- Similar as mitosis, except...
- **Two Events:**
  - 1) **Synapsis**: Pairing of homologous chromosomes
  - 2) **Crossing Over**: Exchange of genes
Homologous chromosomes align along cell equator.
Anaphase 1

• Entire chromosomes (not chromatids) are pulled to opposite ends
Chromosomes and Meiosis

**Telophase 1**

- Cytokinesis divides the cells
- Each cell contains 1 of the homologous chromosomes (23 total)
6.1 Chromosomes and Meiosis

- Same as mitosis

**Note**: No new DNA was created (no 2\textsuperscript{nd} interphase)
6.1 Chromosomes and Meiosis

**Metaphase 2**

- Remaining chromosomes are aligned at cell equator
Anaphase 2

- Centromeres split
- Chromatids are pulled to opposite ends
6.1 Chromosomes and Meiosis

- Nucleus reforms on the four new cells
- Each cell has ½ the original number of chromosomes
- **End Result**: Four haploid cells
Haploid cells develop into mature gametes.

• Gametogenesis is the production of gametes.
• Gametogenesis differs between females and males.
  – Sperm become streamlined and motile.
  – Sperm primarily contribute DNA to an embryo.
  – Eggs contribute DNA, cytoplasm, and organelles to an embryo.
  – During meiosis, the egg gets most of the contents; the other cells form polar bodies.