Mitosis and Meiosis

- **Mitosis** produces two identical cells
  - Stages of mitosis
  - Alignment and separation of chromosomes
  - Cytokinesis

- **Meiosis** produces genetically variable, haploid, cells
  - Sexual life cycle
  - Mechanics of meiosis

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Overview of Mitosis

DNA replication during **Interphase**

- **Prometaphase**
  - Nuclear envelope breaks down.
  - Chromosomes attach to spindle

- **Metaphase**
  - Chromosomes align in the center of the cell

- **Anaphase**
  - Sister chromatids separate

- **Telophase and Cytokinesis**
  - Cleavage furrow

Spindle fibers shorten at the kinetochore

Kinetochore

- Chromosome movement
- Tubulin subunits
- Motor protein
- Kinetochore
Cytokinesis

Animal cells divide by Constriction

Plant cells build a partition

Contractile ring of microfilaments

Vesicles forming cell plate

How do the cytoplasmic organelles divide?

- Mitochondria (and chloroplasts) are present in multiple copies, and randomly segregate into the two daughter cells.
- Membrane bound organelles (e.g. ER) fragment along with the nuclear membrane and are reconstituted in the daughter cells.

The human life cycle

Gametes are the only haploid cells

Mitosis only occurs during gamete formation

Mitosis

Meiosis

Meiosis only occurs during gamete formation

Meiosis 1

MEIOSIS I: Separates homologous chromosomes

PROPHASE I

Sister chromatids remain paired

Haploid homologous chromosomes split up

Metaphase I

Anaphase I

Telophase I and Cytokinesis

Meiosis 2

MEIOSIS II: Separates sister chromatids

PROPHASE II

Sister chromatids separate

Homologous chromosomes line up

Metaphase II

Anaphase II

Telophase II and Cytokinesis

Mitosis produces an exact copy of the parent cell.
- Used for growth and asexual reproduction.

Mitosis produces reduced (haploid) gametes, which are genetically unique.
- Necessary only for sexual reproduction.
Mitosis vs Meiosis

- **Mitosis**
  - Reduces the number of chromosome sets from two to one
  - Daughter cells genetically identical to their parent cell and to each other

- **Meiosis**
  - Reduces the number of chromosome sets from two to one
  - Daughter cells genetically distinct from parent cell and from each other

**Diagram:**
- **Homologs pair in meiosis 1**
- **Sister chromatids separate in meiosis 2**
- **Mitosis**
  - Not paired diploid
  - Daughter cells genetically identical to their parent cell and to each other
- **Meiosis**
  - Paired haploid
  - Daughter cells genetically distinct from parent cell and from each other