CELL CYCLES: MITOSIS, CYTOKINESIS AND MEIOSIS
MITOSIS: The division of chromosomes in the nucleus

S phase: duplication of DNA (to form two complete copies of each chromosome)
DNA (chromatin) is wound into a manageable length ("condensed") by multiple stages of coiling

- Two daughter DNAs: two chromatids
- Joined at centromere (kinetochore)
The "division of chromosomes" is really a separation of chromatids
Prophase

- Chromatin condenses
- Centrosomes divide
- Asters (microtubules) form (in animal cells)
**Prometaphase**
- Spindle forms
- Nuclear envelope disappears
- Nucleolus disappears

**Metaphase**
- Spindle fibers attach to kinetochores
- Chromosomes move to equitorial plane
**Anaphase**
- Centromeres divide
- Chromosomes move to poles
- Cytokinesis begins

**Telophase**
- Chromosomes uncoil
- Nuclear membrane, nucleolus reform
- Spindle disappears
Same process in pictures from the 8th edition:
Proteins are involved in the separation of chromatids
- Cohesin; Securin; Separase
Cytokinesis: The division of the cytoplasm

**Animal cells:**
- Cleavage furrow
- Actin-myosin

**Plant cells:**
- Cell plate
- Kinesin-microtubules
These cells, from a bean root tip, are dividing by mitosis. Can you identify the phases of mitosis?
MEIOSIS

A sexual life cycle involves an alternation of diploid (2n) and haploid (1n) generations. *Meiosis is the process of deriving haploid cells from diploid cells.*
Meiosis is a process for reducing chromosome number from 2n to 1n

- Diploid nucleus
  - Two chromosomes of each type
  - One from each gamete in fertilization
  - “Homologous chromosomes”
- Meiosis separates homologous chromosomes
  - Result: one of each type of chromosome

Diploid karyotype                       Haploid karyotype
**Meiosis strategy:**

Start at G2 (2 chromatids/chromosome), like mitosis; divide twice without intervening chromosome doubling

- One diploid cell (G2)
  - 2 chromosomes (of each type)
  - 4 chromatids (2 per chromosome)

  **First division**
  - Two cells
    - 1 chromosome
    - 2 chromatids per chromosome

  **Second division**
  - Four cells
    - 1 chromosome
    - 1 chromatid
MEIOSIS I

Early Prophase I

Mid-Prophase I

Centrosomes

Pairs of homologs

LIFE: THE SCIENCE OF BIOLOGY, Seventh Edition, Figure 9.14 Meiosis (Part 1)
Products

LIFE: THE SCIENCE OF BIOLOGY, Seventh Edition, Figure 9.14 Meiosis (Part 6)
These cells, from a lily anther, are forming pollen mother cells by meiosis. Can you identify the phases?