

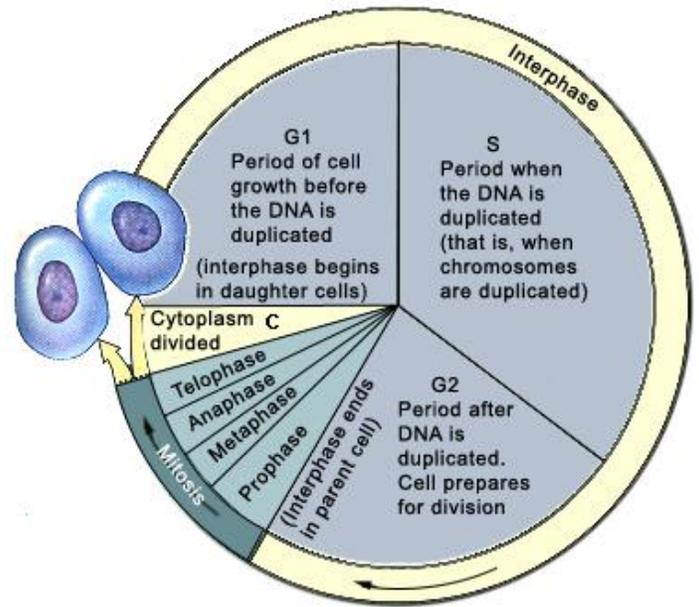
MITOSIS AND MEIOSIS

13 July 2016

Campbell's, 7th: 218-249, Sadava, pp 180-204, Campbell, 228-261, 10th: 232-249

genome	an organism's genetic endowment
gene pool	sum of all genomes of a species
chromosomes	carry sets of genes (46 in humans)
ploidy	number of <i>sets of chromosomes</i>
chromosome count	number of chromosomes
chromatids	identical chromosome copies
centromere	feature linking sister chromatids (kinetochore)
gene	a segment of DNA coding for protein or function

All **somatic** cells in the body carry the identical genetic information.



MITOSIS ("process of threads") **creates 2 identical daughter cells**: Each cell receives *identical* genetic information because each chromosome is duplicated prior to mitosis in the S (synthesis) phase. Once the **centromere is split**, the **sister chromatids separate** **identical copies** are pulled to opposite ends of the cell.

CELL CYCLE, Four stages (p 235)

- gap 1** (G_0) ("Gap" in replication), ends at restriction point. **DNA replication** starts (most cells are in G_0)
- S** (synthesis) DNA is replicated
- gap 2** ended with a second checkpoint, when sufficient **cyclin**, etc, triggers entry into mitosis.
- mitosis** third checkpoint at end of metaphase signals OK to enter anaphase.
- cytokinesis** cell division: **cleavage** in animals (235), **cell plate** in plants

Interphase The part of the cell cycle between processes of mitosis.

MITOSIS Stages: note roles of centrioles, spindle, microtubules, aster, kinetochore (p 236-237)

- Prophase** nuclear envelope dissolves, chromosomes condense, may look like ball of yarn
- Metaphase** chromosomes are maneuvered to the central plane of cell by spindle
- Anaphase** *after* centromeres split, anaphase has started
- Telophase** chromosomes have reached the poles of the cell

In a plant: http://www.youtube.com/watch?v=us3WQFBz_nU

Two **identical daughter cells** are produced.

Mitotic rate varies from tissue to tissue, leads to different frequency and types of cancers:

- epithelial** high intrinsic mitotic rate most frequent **carcinoma**
- connective** moderate mitotic ability less frequent **sarcoma**

Animal mitosis: asters, cleavage furrow during cytokinesis (microfilament draw string)

VIDEO: <http://www.youtube.com/watch?v=DD3IQknCEdc> (Lung tissue culture)

Plant mitosis: no asters, cell plate forms of vesicles.

VIDEO: <http://www.youtube.com/watch?v=aDAw2Zg4IgE&NR=1> (Lily cells)

MEIOSIS ("reduction process"): halve **ploidy**, **number of sets of chromosomes**, reduced from 2N to 1N: (p 255-257) **Alternation of generations (sex)** requires reduction in genetic content for constant content Meiosis only occurs in **gonads**. Generates heterogeneous **gametes**. Provides heterogeneity of **progeny**. Superficially similar to the stages of mitosis. But double cycles, with important differences.

P 258-259: **STAGES OF MEIOSIS**:

- <http://www.youtube.com/watch?v=op7Z1Px8oO4&feature=related> (crossing over)
- <http://www.youtube.com/watch?v=pdJUvagZjYA&NR=1> (Crossing over, meo I and II)

MEIOSIS I:

- prophase I **synapsis of homologous chromosomes**, crossing over, **chiasmata**, recombination, form **tetrads**. **This is a critical stage of meiosis when recombination occurs, increasing variation.**
- metaphase I tetrads lined up at cell central plane by spindle action.
- anaphase I no duplication of centromeres, sister chromatids still attached, move to ends of cell
- telophase I Chromosomal sets, now **haploid**. (**Ploidy is evaluated by number of centromeres**).

MEIOSIS II:

- prophase II half the number of chromosomes compared to prophase I. No synapsis.
- metaphase II Unsynapsed "X"-shaped chromosomes line up in middle of cell.
- anaphase II centromeres duplicated, single chromosomes pulled to poles of cell
- telophase II four **haploid** cells produced = gametes. Differentiation turns them into sperm or eggs



Meiosis

