Introduction to Genetics

*What is genetics?

Brief History of Genetics

*Prehistoric Times: Domesticated Animals/Cultivated Plants (~1000 B.C.)

A review of the eukaryotic cell:

Elaborately compartmentalized systems

*Generalized animal cell

*Generalized plant cell

Brief History of Genetics

*The Greek Influence (~400-300 B.C.)
  - Hippocrates: pangenesis
  - Aristotle: “vital heat”

*Pre-Mendelian Ideas (1600-1850)
  - Blending Inheritance
  - Epigenesis
  - Preformation

*Charles Darwin (1859)
  - Natural Selection

*Gregor Mendel (1866)
  - Particulate Inheritance
Chromosome duplication and distribution during cell division

Review of terms:
* Diploid and haploid
* Homologous chromosomes

The Mitotic Cell Cycle

* Mitotic phase vs. interphase

Subphases of interphase:
* $G_1$ - first gap
* $S$ - synthesis
* $G_2$ - second gap

Mitosis

Late Interphase

Prometaphase

Prophase

Metaphase

Anaphase

Telophase

Chromosomes (2n = 46 strands)

Nucleus

Chromatid (2n = 23 strands)

Spindle fibers

Kinetochore

Centrosome

Spindle poles

Mitotic spindle

Nuclear envelope

Chromatin fibers

Nuclear envelope
Mitosis: Plant Cell

Sexual vs. Asexual reproduction

"budding"

Overview of meiosis:
- Two consecutive cell divisions
  - meiosis I
  - meiosis II
- AKA: Reduction-Division
Meiosis I

Interphase
Preparatory phase, cell grows, organelles replicate
Chromosomes arrange

Prophase I
Nucleus forms; chromosomes condense
Chromatids form; homologs pair
Crossing over occurs

Metaphase I
Chromosomes align at equator of cell
Homologs separate; sister chromatids stay together

Anaphase I
Homologs separate
Sister chromatids split

Meiosis II

Interphase
Preparatory phase, cell grows, organelles replicate
Chromosomes arrange

Prophase II
Chromosomes condense
Chromatids form
Crossing over occurs

Metaphase II
Chromosomes align at equator of cell
Sister chromatids separate

Anaphase II
Sister chromatids split

Meiosis and Meiosis Compared:

Mitosis

Prophase
Elongated chromosomes (two sister chromatids)
Nucleolus breaks down
Centrioles duplicate

Metaphase
Chromosomes align at equator of cell
Sister chromatids remain together

Anaphase
Sister chromatids split
Daughter cells of mitosis

Meiosis

Prophase I
Homologs pair
Crossing over occurs

Metaphase I
Chromosomes align at equator of cell
Homologs separate; sister chromatids stay together

Anaphase I
Homologs separate
Sister chromatids split

Meiosis II

Prophase II
Chromosomes condense
Chromatids form
Crossing over occurs

Metaphase II
Chromosomes align at equator of cell
Sister chromatids separate

Anaphase II
Sister chromatids split
Daughter cells of meiosis