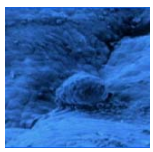
Cellular Reproduction
Chapter 10

1. Importance
2. Bacterial Reproduction
3. Eukaryotic Cell Cycle
4. Eukaryotic Chromosomes
5. Mitosis
6. Cytokinesis in animal and plant cells
7. Sexual life cycle
8. Meiosis
9. Cloning
10. Cancer

Importance of Cell Division

- Growth and Development

Zygote
1 Cell

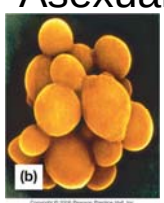


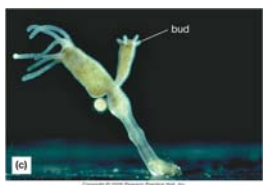
Embryo
100 cells

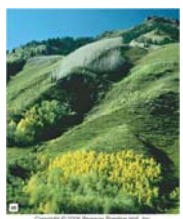
Fetus
millions cells

Adult
100 trillion cells

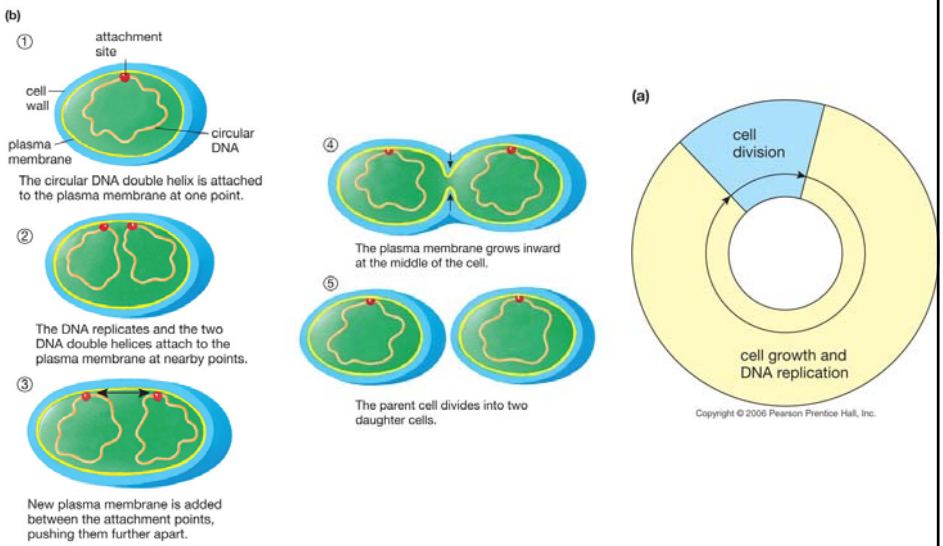
- Asexual Reproduction



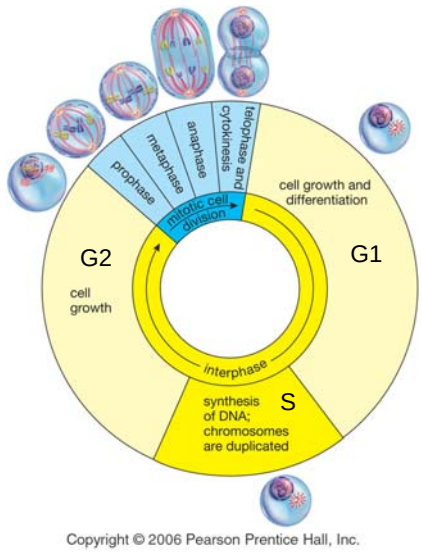


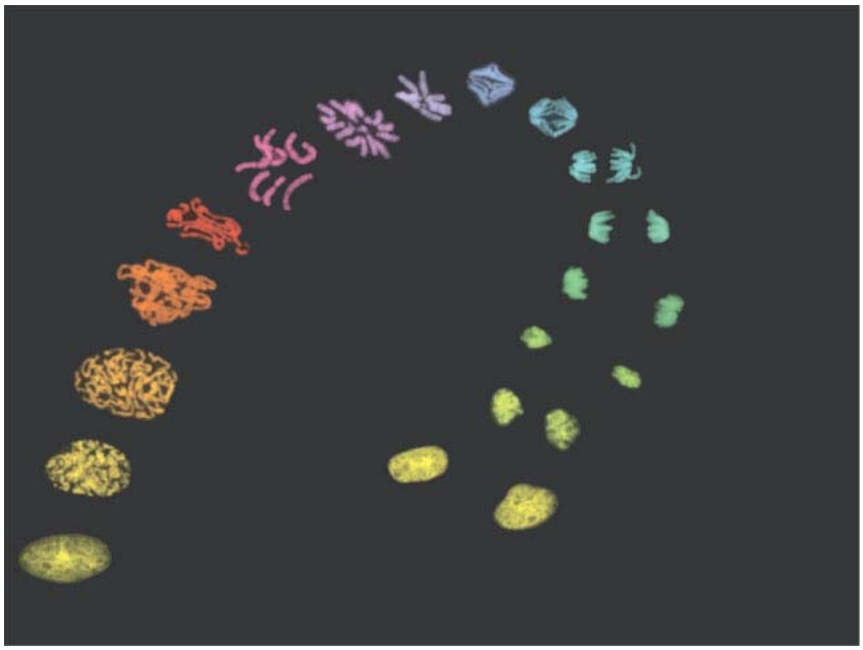


Bacterial Binary Fission

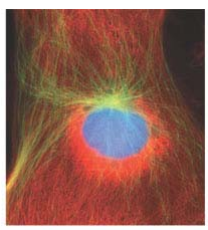


Eukaryotic Cell Cycle

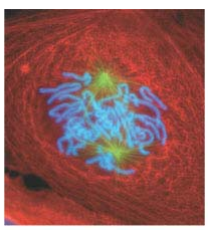




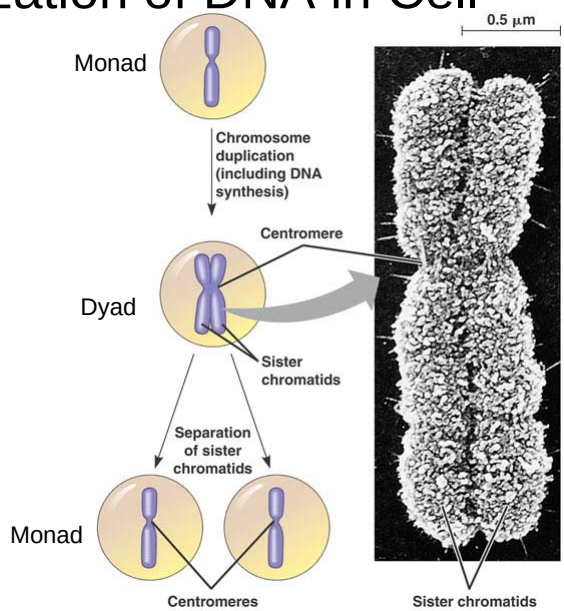
Organization of DNA in Cell



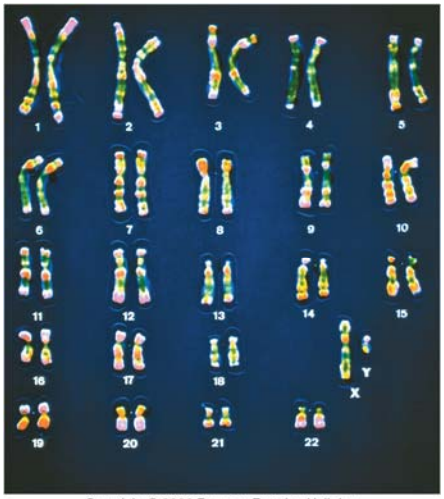
Interphase Chromatin



Mitotic Chromatin



Chromosomes



Karyotype – number and type of chromosomes

Diploid Cells – two matched sets of chromosomes

Homologous Chromosomes – matched pair of chromosomes

Sex chromosomes – set of chromosomes that differ in two sexes

Autosomes – any chromosome that is not a sex chromosomes

Haploid Cells – cells with only one set of chromosomes - gametes

Chromosome Number

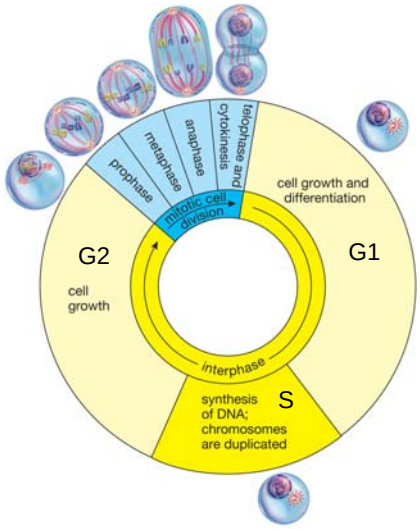
- Humans 23 pair of chromosomes
  - Diploid cells total of 46 chromosomes
    - 44 Autosomes
    - 2 Sex Chromosomes
  - Haploid cells total of 23 chromosomes
    - 22 Autosomes
    - 1 Sex Chromosomes
- Other species have different # of chromosome.

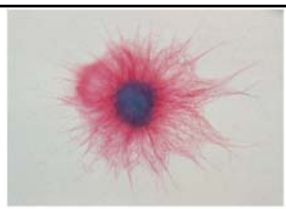
  Haploid corn cells – 10

  Haploid gold fish cells – 96

  Haploid fruit flies - 4

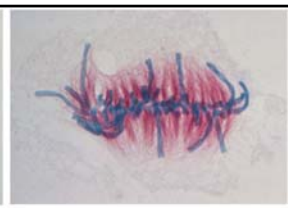
Eukaryotic Cell Cycle





(a) Interphase in a seed cell: The chromosomes (blue) are in the thin, extended state and appear as a mass in the center of the cell. The spindle microtubules (red) extend outward from the nucleus to all parts of the cell.

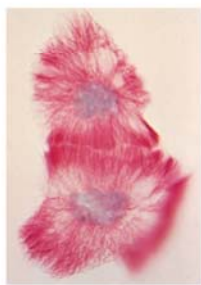
(b) Late prophase: The chromosomes (blue) have condensed and attached to the spindle microtubules (red).



(c) Metaphase: The chromosomes have moved to the equator of the cell.

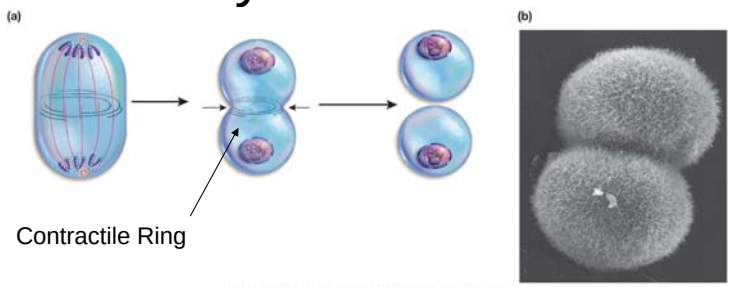
(d) Anaphase: Sister chromatids have separated, and one set has moved toward each pole.

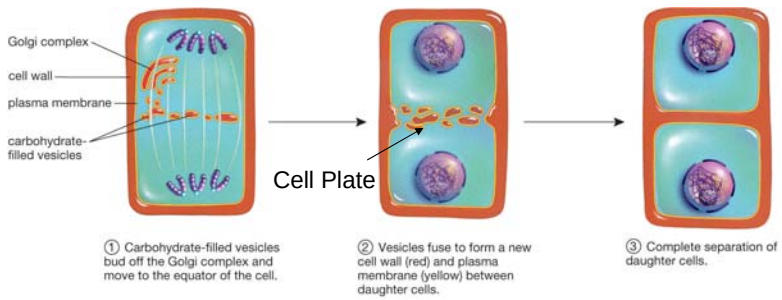
(e) Telophase: The chromosomes have gathered into two clusters, one at the site of each future nucleus.



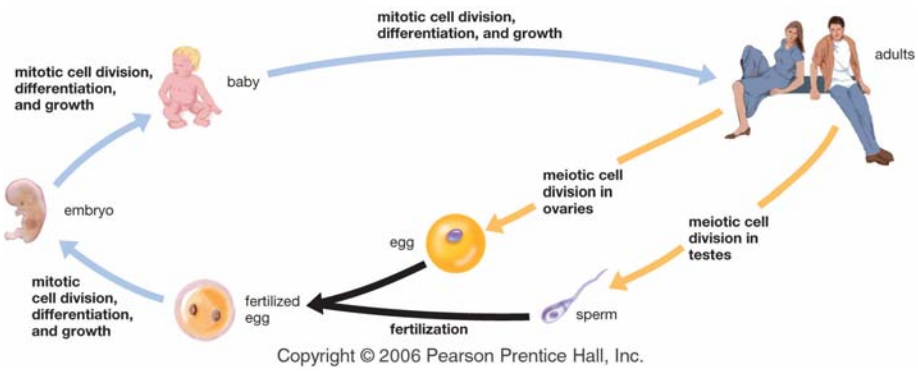
(f) Resumption of interphase: The chromosomes are relaxing again into their extended state. The spindle microtubules are disappearing, and the microtubules of the two daughter cells are rearranging into the interphase pattern.

Cytokinesis





Human Life Cycle



Mitotic Cell Cycle – generates daughter cells identical to mother cell
Meiosis – generates daughter cells with ½ the genetic material of mother cell
Fertilization (fusion of gametes) doubles the genetic material in the zygote

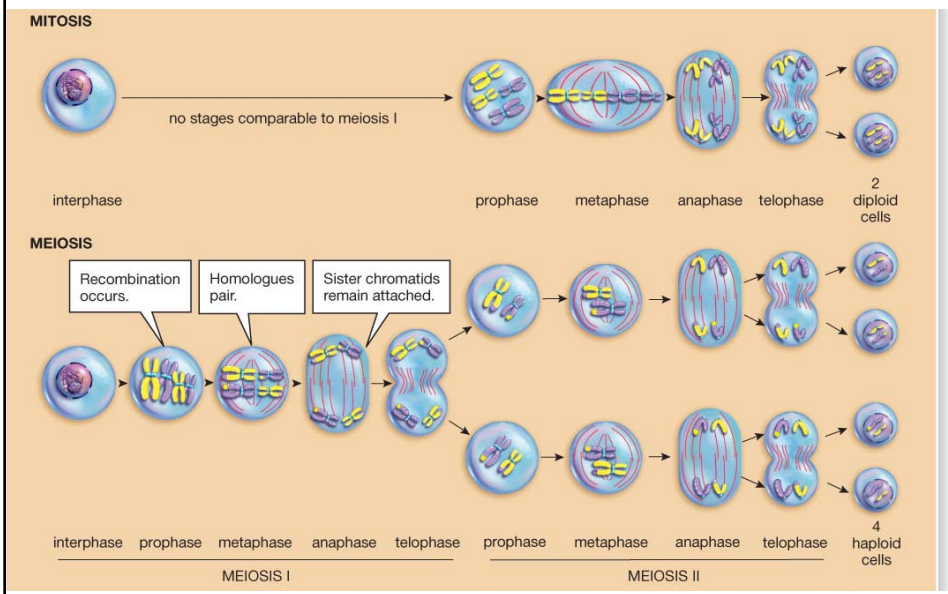
Meiosis

Diploid Cells → Haploid Cells

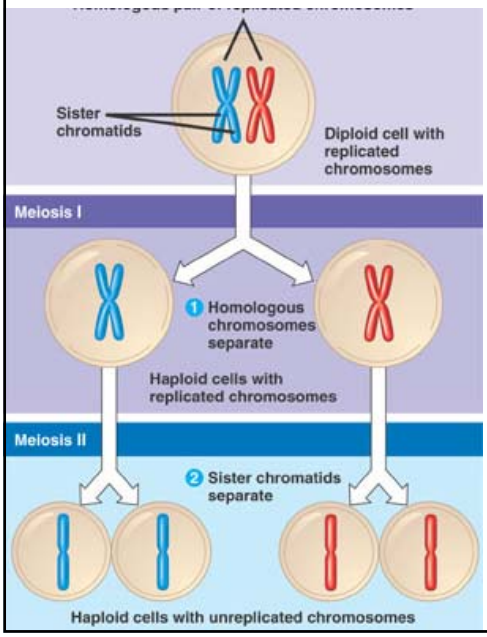
Humans
46 Chromosomes → 23 Chromosomes

Fruit Flies
8 Chromosomes → 4 Chromosomes

Corn
20 Chromosomes → 10 Chromosomes



Overview of Meiosis

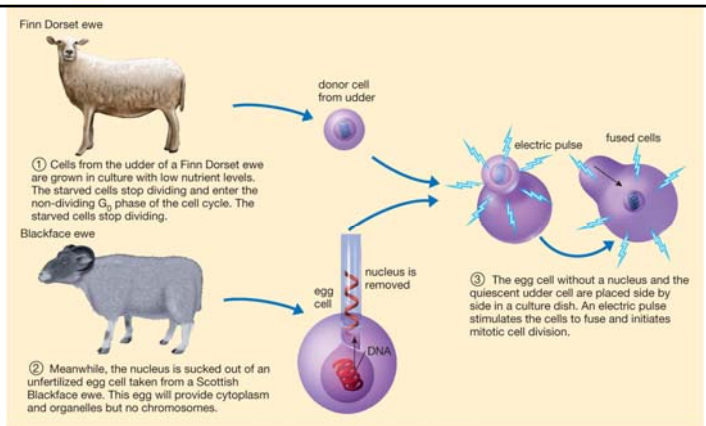


Meiosis I – Diploid cell with dyads gives rise to haploid cell with dyads.

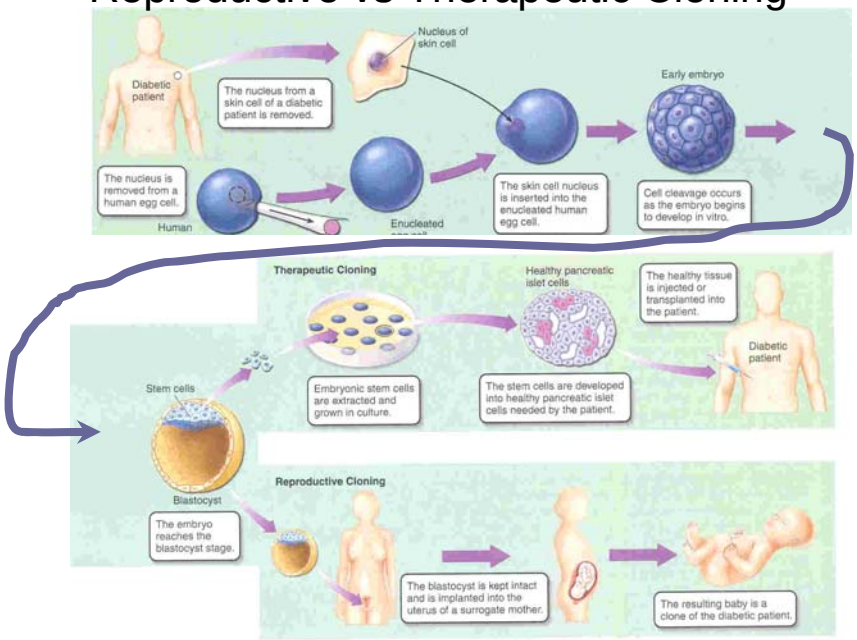
- Prophase I
- Metaphase I
- Anaphase I
- Telophase I

Meiosis II – Haploid cell with dyads gives rise to two cells with monads.

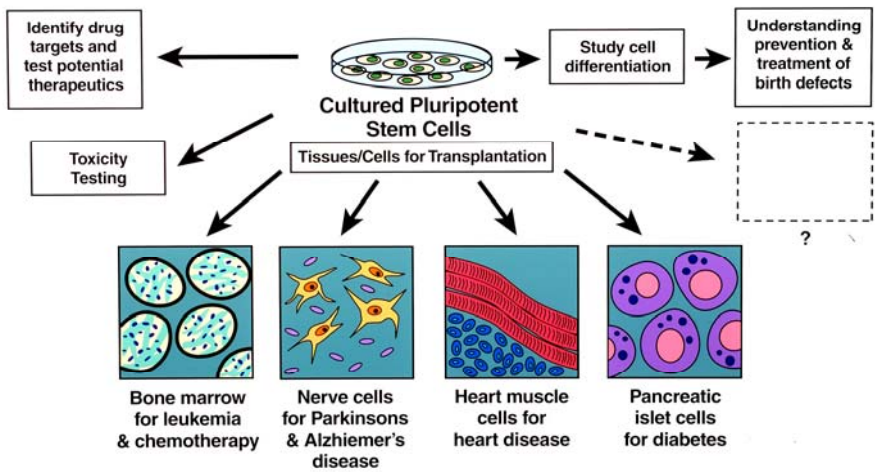
- Prophase II
- Metaphase II
- Anaphase II
- Telophase II



Reproductive vs Therapeutic Cloning



The Promise of Stem Cell Research



Stem Cells are Pluripotent – have the ability to differentiate into diverse cell types

Cancer

- Normally cell division is highly regulated
  - Consider the length of your arm, size of your ear, etc.
- Special genes encode proteins that regulate cell division

  Tumor Suppressor genes – restrain cell division (act like a brake)
  Proto-oncogenes – promote cell division (act like an accelerator)

- Cancer is caused by mutations in these genes
  Tumor Suppressor genes – mutated to lose function
  Proto-oncogenes – mutated to change function
  and become “Oncogenes”
- Causes mutations
  - Spontaneous mutations – errors in DNA Replication
  - Induced mutations – caused by environmental factors called mutagens