Cell Division and Mitosis

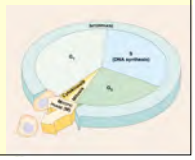
Chapter 12 in Campbell et al.

The cell cycle

- Eukaryotic cells can divide once per 8 to 20 hours, bacteria, once per 45 minutes - the "generation time"
- Dividing cells must accomplish several tasks (what are they?)

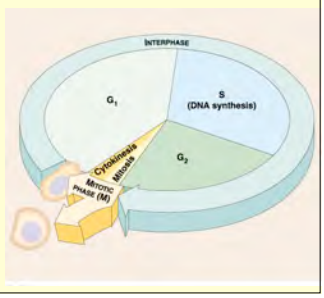
Chromosomes

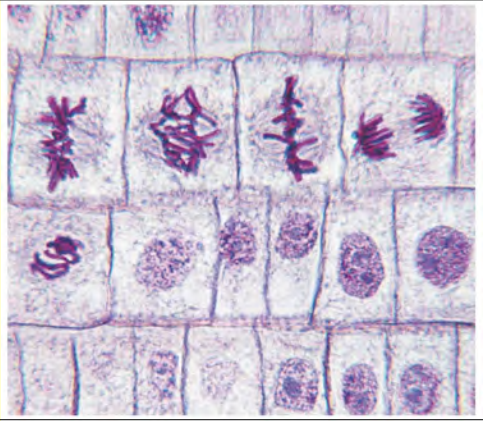
- Genes are carried on chromosomes
- Chromosomes are long strands of DNA held together by proteins (this combination of material is called chromatin).
- Prokaryotic vs. eukaryotic chromosomes
- Chromosomes come in pairs in diploid organisms: *homologous* chromosomes are members of the same pair
- Unduplicated and duplicated
  - where in the cell cycle would you find duplicated chromosomes?
- What the heck are chromatids?



The cell cycle

- Interphase vs. cell division
- Gap 1 - growth
- S phase - duplication of genetic material (DNA)
- Gap 2 - protein synthesis, pepare for division
- Mitosis - divide the contents of the nucleus
- Cytokinesis - physical separation into two cells





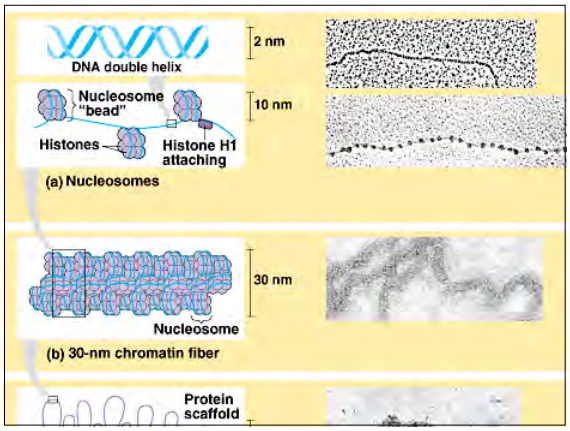
Cell Division

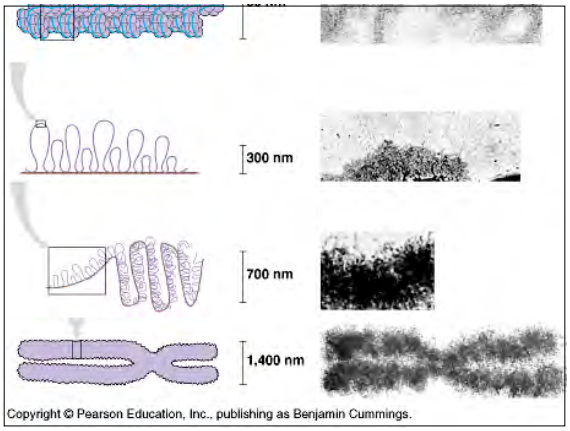
- Cells need to make sure each daughter cell gets what it needs
- The most important (and complicated) thing to pass on is the cell's DNA
- The DNA gets replicated in the S phase of the cell cycle, and divided during mitosis

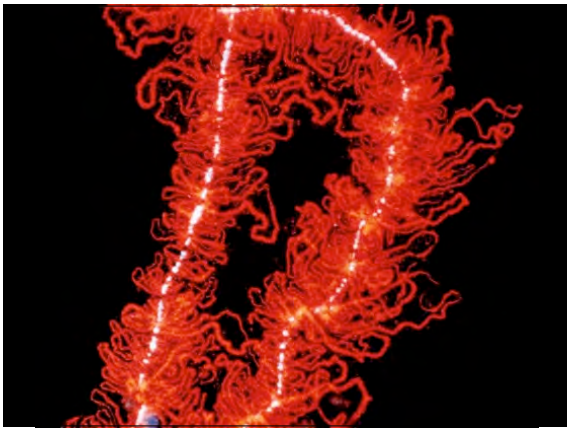
Condensation of Chromosomes

(see pp. 359-361 in Campbell)

- The problem - (with analogies)
- The solution - (with more analogies)
  - Histones, nucleosomes, beads on a string
  - Supercoiling
  - Looping. Scaffolding proteins
  - The final result
    - when do you see fully condensed chromosomes?

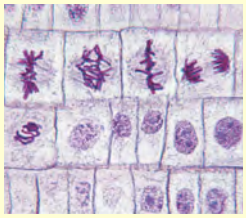






Mitosis - nuclear division

- The challenge of mitosis
- The tasks - break down nuclear envelope, sort chromosomes, divide evenly, move to new location, form 2 new nuclear envelopes.
- The role of microtubules



Anatomy of a chromosome
(and other players in mitosis)

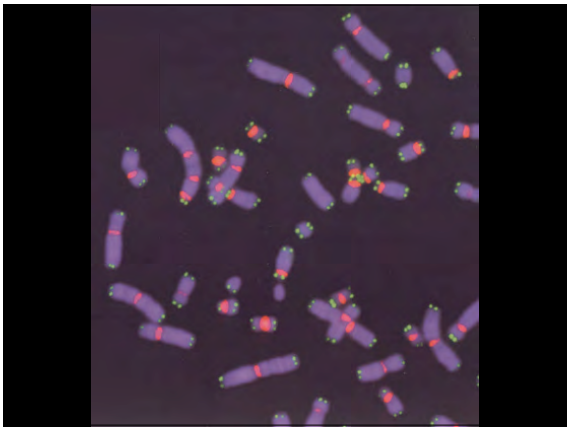
- Chromosomes
  - Condensed or uncondensed?
  - Duplicated or unduplicated?
  - Centromere, telomeres
  - Kinetochore

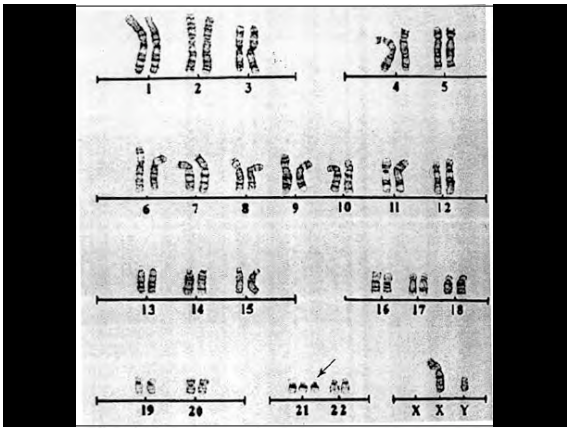
  Centrosomes/MTOC
  - microtubules
  - mitotic spindle and asters

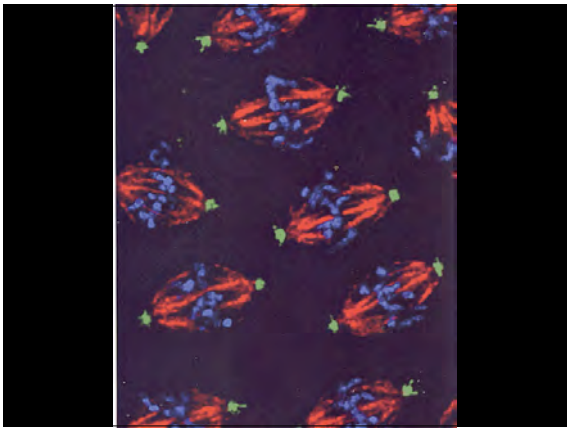
The phases of mitosis

(study pp. 244-245 in your text!)

- Prophase
- Metaphase
- Anaphase
- Telophase
- (then cytokinesis)







Bottom Line

- Mitosis and cytokinesis produce two daughter cells, each genetically identical to the parental cell.

Control of Cell Division

- There are "checkpoints" in the cell cycle that determine whether cells proceed to the next phase.
- Uncontrolled cell division = ???
- I recommend reading pp. 228-233, but I will not hold you responsible for that material