BIO 211:
ANATOMY & PHYSIOLOGY I

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CHAPTER 03 and Lab

Overview of the CELL CYCLE

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Some illustrations are courtesy of McGraw-Hill.

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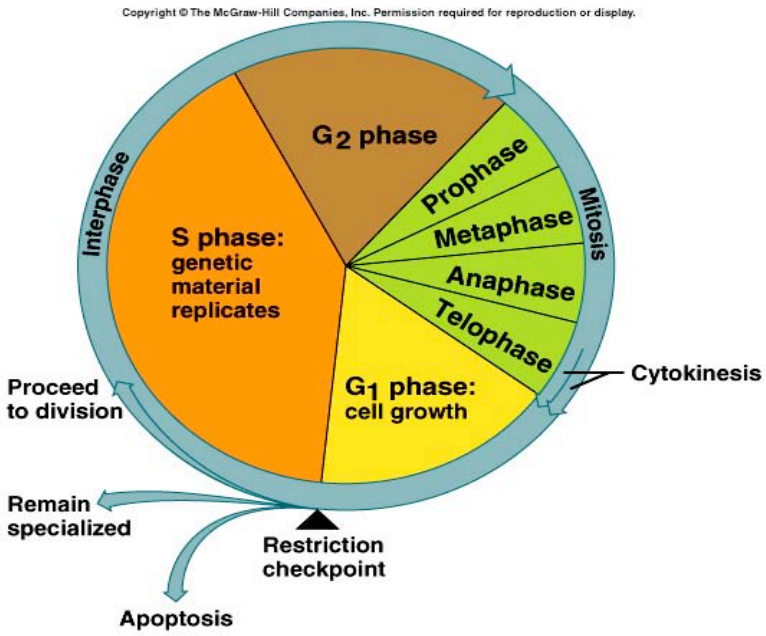
The Cell Cycle

Series of changes a cell undergoes from the time it forms until the time it divides-



Stages:
- interphase
- mitosis
- cytoplasmic division
- differentiation

The Cell Cycle

A. The Cell Cycle

1. During the **first growth phase, G_1**, (your text refers to G as "gap") the cell synthesizes new proteins and grows in size. At the end of this phase, **centrioles replicate.**

2. During the **S, or synthesis phase**, the cell undergoes **semiconservative replication of DNA.**

3. **G_2, the second growth phase**, is a **brief period** in which the **cell makes the enzymes needed for cell division.** G_1, S, and G_2 are collectively known as **interphase.**

4. During the **M, or mitotic, phase**, the nucleus replicates its contents **(karyokinesis).**

Interphase

- **very active period**
- **cell grows**
- **cell maintains routine functions**
- **cell replicates genetic material to prepare for nuclear division**
- **cell synthesizes new organelles to prepare for cytoplasmic division**

- **Phases:**
  - **G phases – cell grows and synthesizes structures other than DNA**
  - **S phase – cell replicates DNA**

Mitosis

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LAB ATLAS REFERENCE:
pp. 6 - 7
Morton & Perry, 1998

- **produces two daughter cells from an original cell**
- **nucleus divides – karyonkinesis**
- **cytoplasm divides – cytokinesis**
- **Stages:**
  - **prophase – chromosomes form; nuclear envelope disappears**
  - **metaphase – chromosomes align midway between centrioles**
  - **anaphase – chromosomes separate and move to centrioles**
  - **telophase – chromatin forms; nuclear envelope forms**

Mitosis

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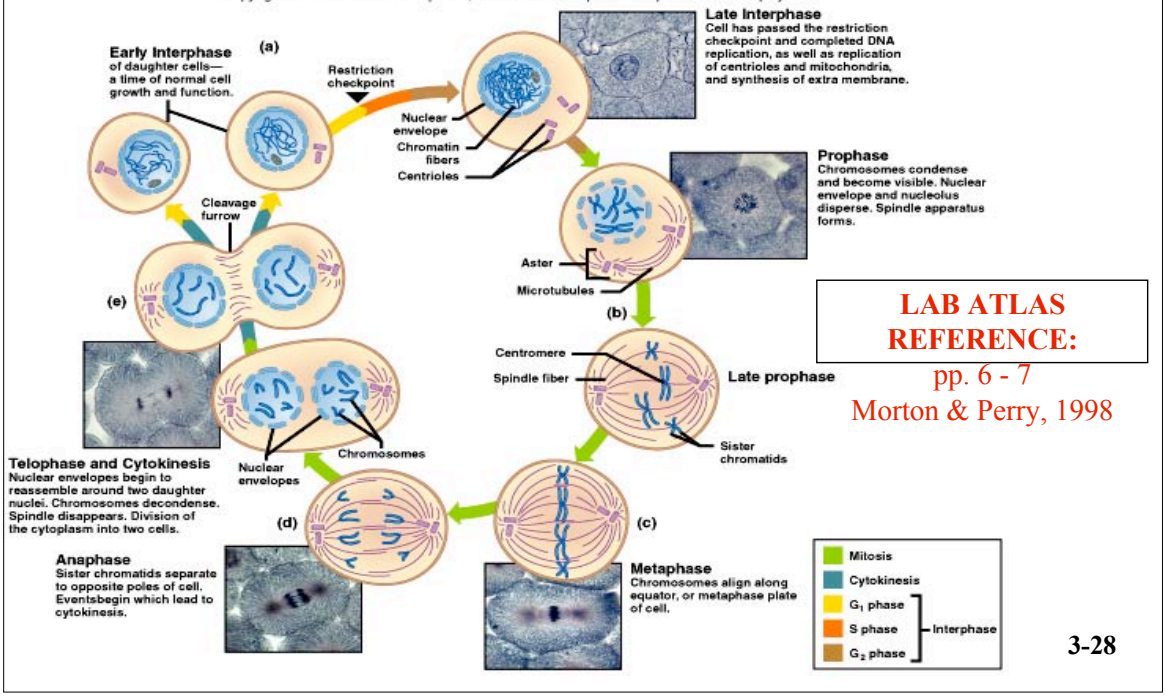

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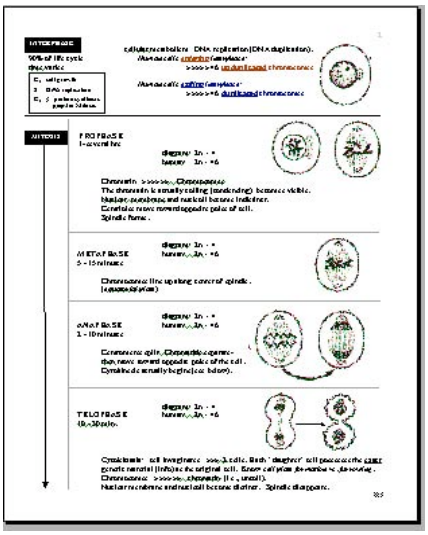
Cytoplasmic Division

(CYTOKINESIS)

- begins during anaphase
- continues through telophase
- contractile ring pinches cytoplasm in half (furrowing)

Be sure to get the separate, one-page download called:
MITOSIS SKETCH



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Control of Cell Division

- cell division capacities vary greatly among cell types
  - skin and blood cells divide often
  - liver cells divide a specific number of times then cease
- chromosome tips (telomeres) that shorten with each mitosis provide a mitotic clock
- cells divide to provide a more favorable surface area to volume relationship
- growth factors and hormones stimulate cell division
  - hormones stimulate mitosis of smooth muscle cells in uterus
  - epidermal growth factor stimulates growth of new skin
- contact inhibition
- tumors are the consequence of a loss of cell cycle control

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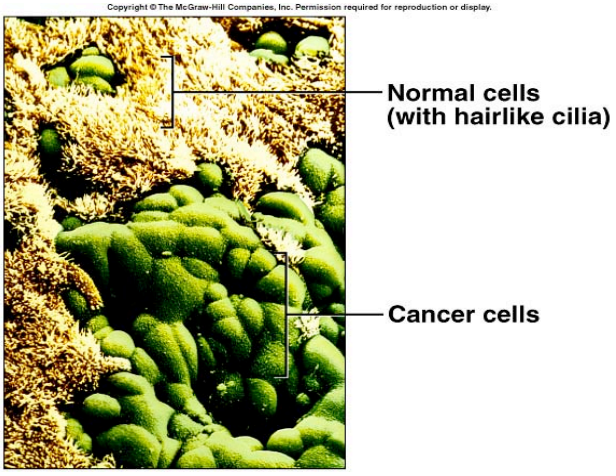
Tumors

Two types of tumors

- benign –
  usually remains localized
- malignant –
  invasive and can metastasize; cancerous

Genes that cause cancer

- oncogenes –
  activate other genes that increase cell division
- tumor suppressor gene –
  normally regulate mitosis; if inactivated they will not regulate mitosis



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Stem and Progenitor Cells

Stem cell

- can divide to form two new stem cells
- can divide to form a stem cell and a progenitor cell
- totipotent – can give rise to any cell type
- pluripotent – can give rise to a restricted number of cell types

Progenitor cell

- committed cell
- can divide to become any of a restricted number of cells
- pluripotent

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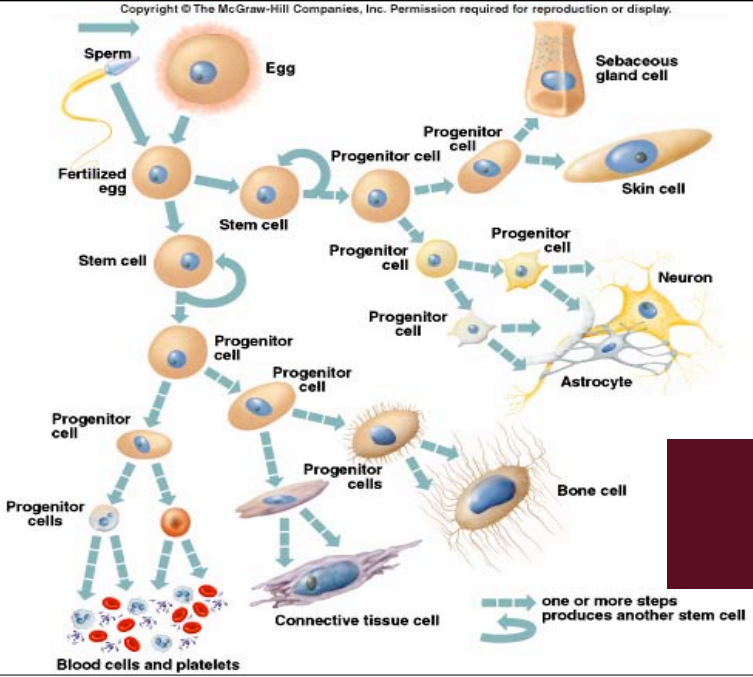
Stem and Progenitor Cells



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