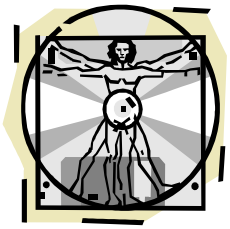
Bio& 241
Unit 1 / Lecture 2



Development of the Cell Theory

- Hooke (1665) named the cell
- Schwann (1800's) states:
  all animals are made of cells
- Pasteur (1859) disproved idea of
  spontaneous generation
  - living things arise from nonliving matter
- Modern cell theory emerged

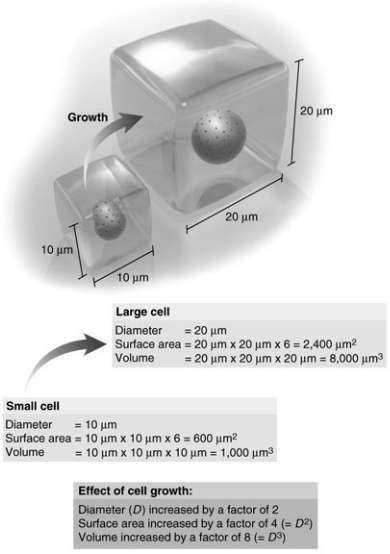
Modern Cell Theory

- All organisms composed of cells and cell products.
- Cell is the simplest structural and functional unit of life.
- Organism's structure and functions are due to the activities of its cells.
- Cells come only from preexisting cells.
- Cells of all species have many fundamental similarities.

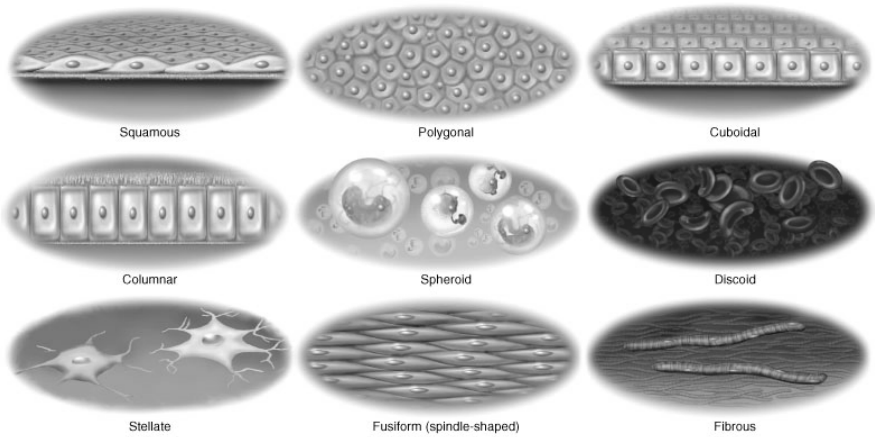
Cell Size

- Human cell size
  - most from 10 - 15 µm in diameter
    - egg cells (very large)100 µm diameter
    - nerve cell (very long) at 1 meter long
- Limitations on cell size
  - cell growth increases volume faster than surface area
    - nutrient absorption and waste removal utilize surface

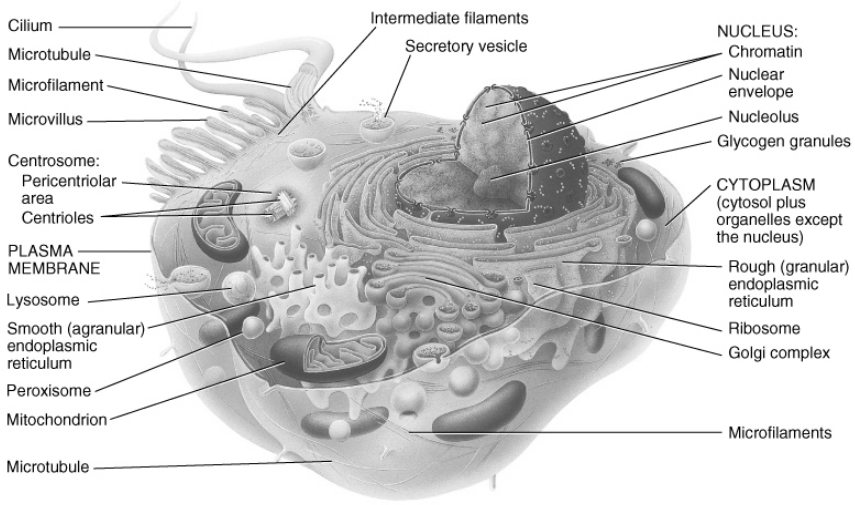
Cell Surface Area and Volume



Cell Shape and Function



Cellular Organelles



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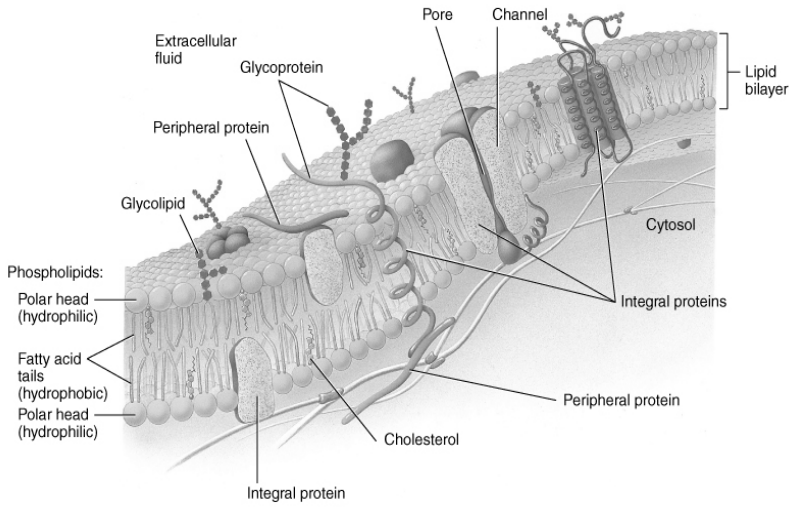
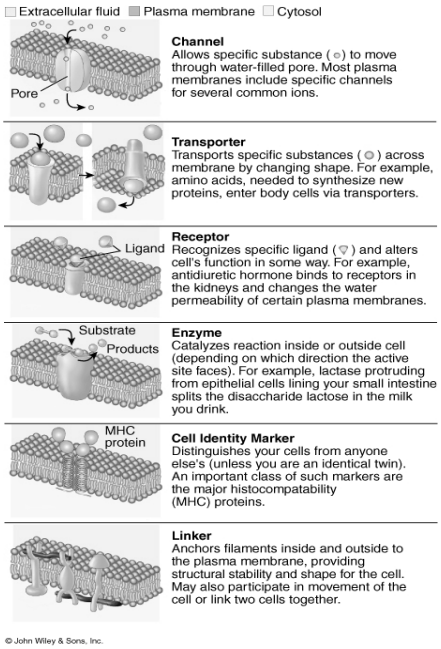
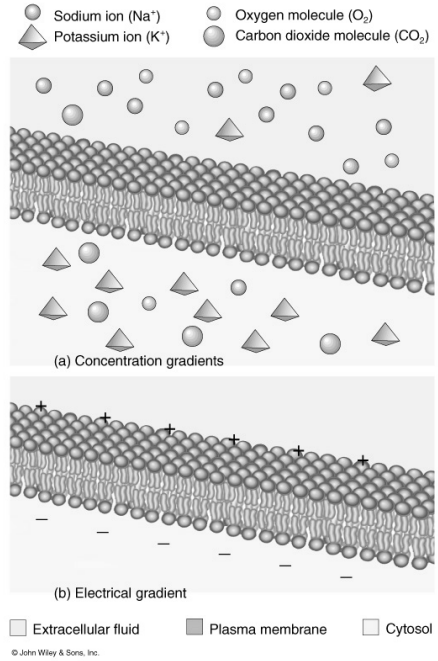
Fluid Mosaic Model for the Plasma Membrane



Functional Roles of Membrane Protein Molecules



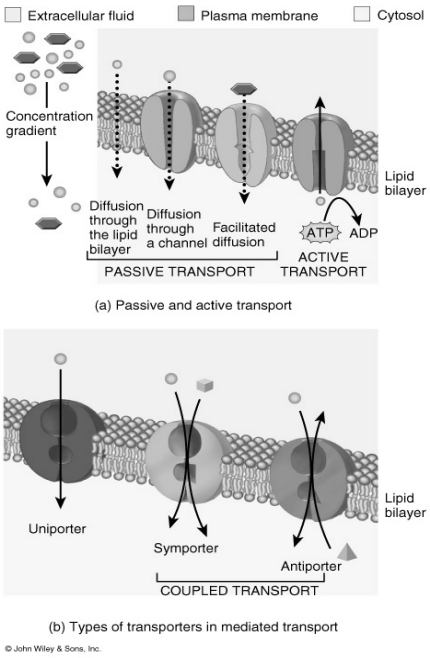
Concentration Gradient of Ions across a Membrane and the Resulting Electrochemical Potential



Diffusion Rates

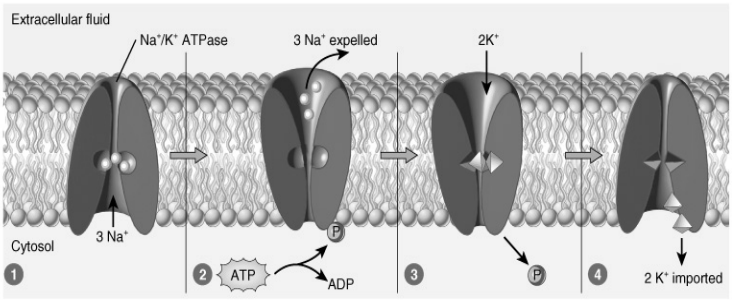
- Factors affecting diffusion rate through a membrane
  - temperature - ↑ temp., ↑ motion of particles
  - molecular weight - larger molecules move slower
  - steepness of concentrated gradient - ↑difference, ↑ rate
  - membrane surface area - ↑ area, ↑ rate
  - membrane permeability - ↑ permeability, ↑ rate

Mechanisms of Membrane Transport of Materials into and outside of Cells



Primary Active Transport
The Sodium/Potassium Pump

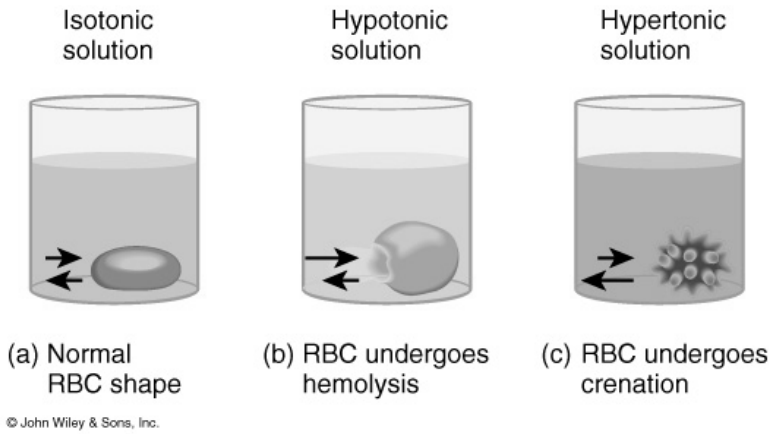
Found on many cell of the body including muscle cells and nerve cells.



Tonicity

- Tonicity - ability of a solution to affect fluid volume and pressure within a cell
  - depends on concentration and permeability of solute
- Hypotonic solution
  - low concentration of nonpermeating solutes (high water concentration)
  - cells absorb water, swell and may burst (lyse)
- Hypertonic solution
  - has high concentration of nonpermeating solutes (low water concentration)
  - cells lose water + shrivel (crenate)
- Isotonic solution = normal saline

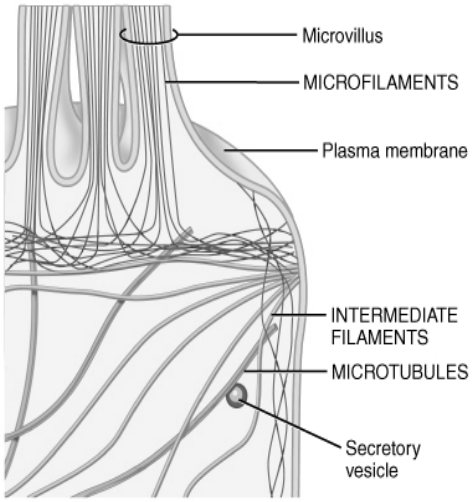
Movement of Water Across Plasma Membranes



Osmolarity

- One osmole = 1 mole of dissolved particles
  - 1M NaCl (1 mole Na^+ ions + 1 mole Cl^- ions) thus 1M NaCl = 2 osm/L
- Osmolarity = # osmoles/liter of solution
- Physiological solutions are expressed in milliosmoles per liter (mOsm/L)
  - blood plasma = 300 mOsm/L
  - osmolality similar to osmolarity at concentration of body fluids

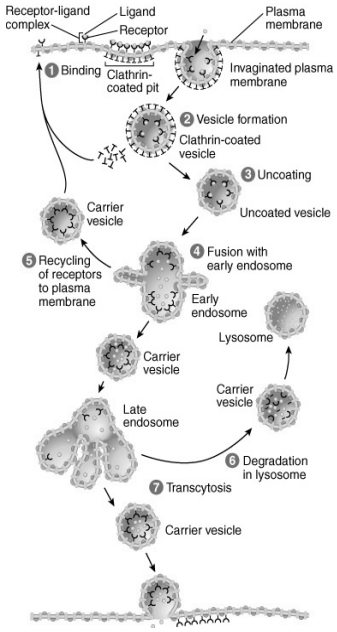
Components of the Cytoskeleton



(a) Overview of cytoskeleton

Vesicular Transport

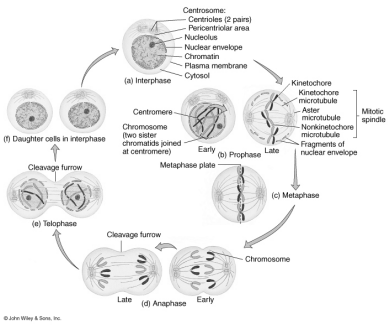
- **Endocytosis**
  1. **Phagocytosis**
  2. **Pinocytosis**
- **Exocytosis**



Stages of a Typical Cell Cycle

- **Interphase**

1. **G1: Cell duplicates organelle and cytosolic components**
2. **S: Replication of DNA**
3. **G2: Cell growth continues and synthesis of enzymes & proteins require for cell divisions**



Clinical Terms Associated with Cells

1. Neoplasm: An abnormal formation of tissue; for example, a tumor.
2. Anaplasia: loss of differentiation of cells, an irreversible alteration in adult cells toward more primitive (embryonic) cell types
3. Dysplasia: Cells that look abnormal under a microscope but are not cancer
4. Hyperplasia: An abnormal increase in cells in a tissue or organ, excluding tumor formation, whereby the bulk of the tissue or organ is increased.
5. Metaplasia: Transformation of cells or tissues from a normal to abnormal states.
6. Apoptosis: Cell death in which a programmed sequence of events leads to the elimination of cells