The Human Body in Health and Illness 5th edition

Chapter 3
Cells

Lesson 3.1
Cells

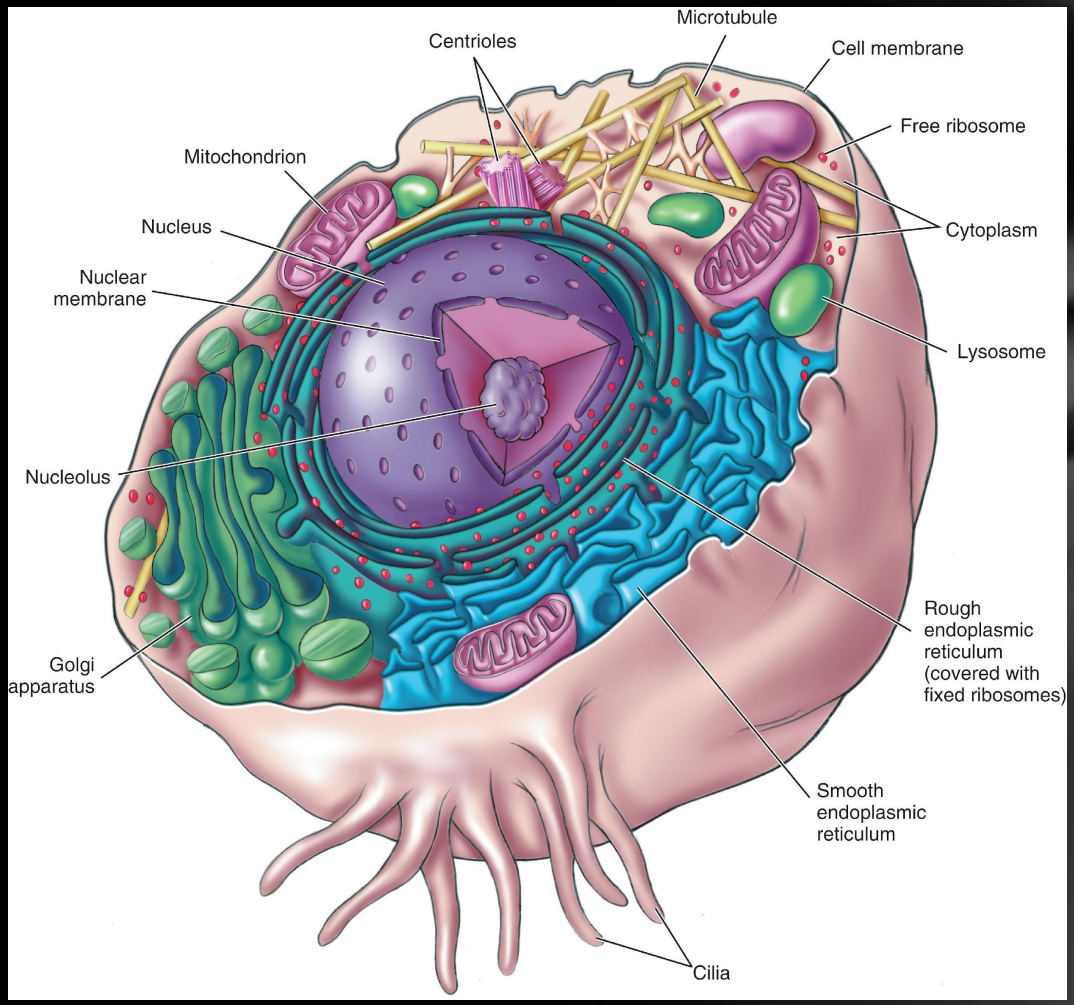
1. Label a diagram of the main parts of a typical cell, and do the following:
   - Explain the role of the nucleus.
   - Describe the functions of the main organelles of the cell.
   - Identify the components of the cell membrane.
2. Do the following regarding transport mechanisms:
   - Describe the active and passive movements of substances across a cell membrane.
   - Define tonicity and compare isotonic, hypotonic, and hypertonic solutions.
3. Describe the phases of the cell cycle, including mitosis.
4. Explain what is meant by cell differentiation.
5. Explain the processes and consequences of uncontrolled and disorganized cell growth and apoptosis.

Cells Are Specialized

Cells are basic units of living matter

Cell structures reflect their specialized functions

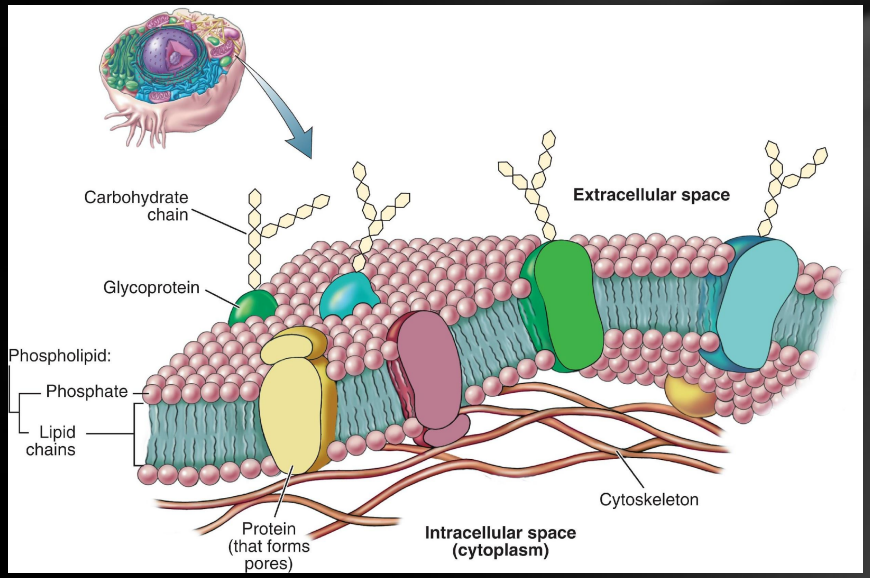
A Typical Cell



Cell Membrane

Cell membrane

- Encases cell
- Regulates what enters and leaves the cell
- Semipermeable



Inside the Cell

Nucleus

- Controls the workings of the entire cell
- Is surrounded by double-layered nuclear membrane
- Found inside the nucleus
  - Nucleoplasm: Gel-like substance
  - Nucleolus: Involved in synthesis of ribosomes
  - Chromatin: Threadlike structure that contains genes

Inside the Cell, cont'd

Cytoplasm: A gel-like substance found inside the cell but outside the nucleus

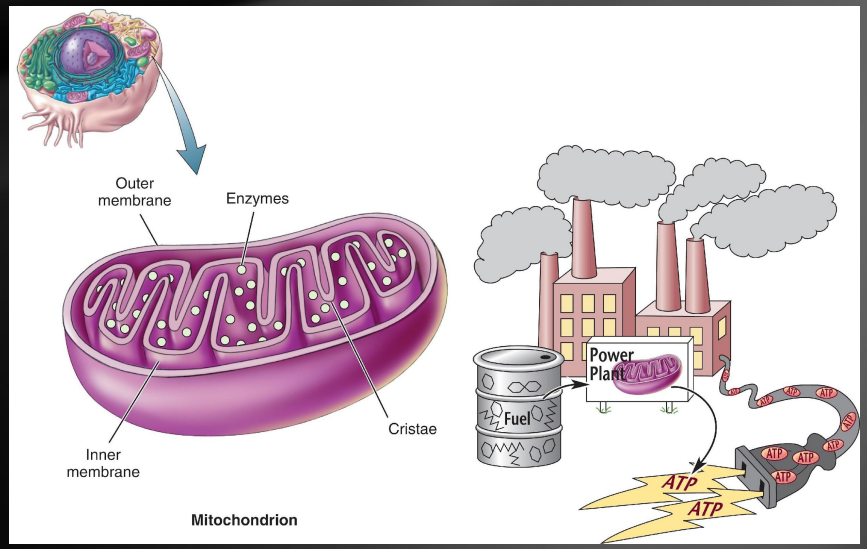
Composed of:

- Cytosol (gel-like)
- Organelles ("little organs")

Cytoplasmic Organelles

Mitochondria

- Slipper-shaped power plants of cell
- Two layers
  - Smooth outer layer
  - Folds (cristae) in inner layer



Cytoplasmic Organelles, cont'd

Ribosomes

- Sites of protein synthesis
- Fixed and free

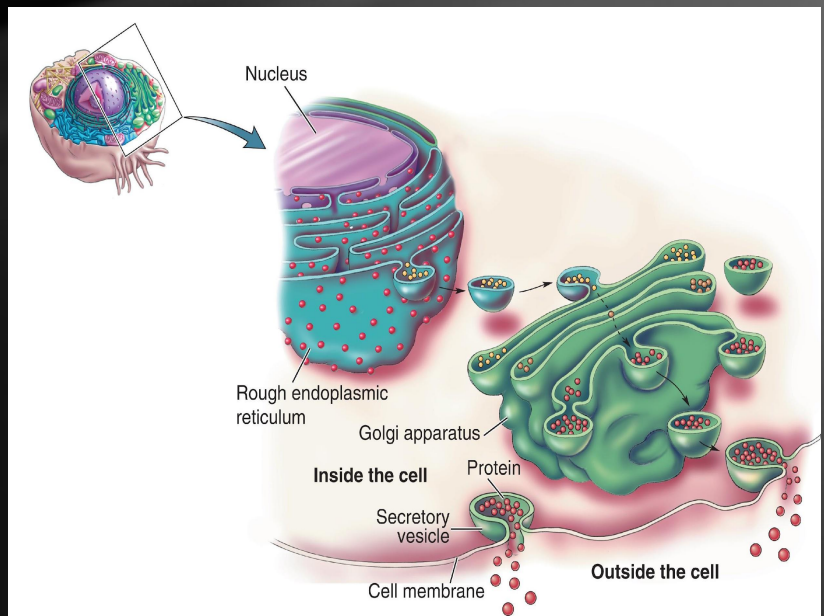
Endoplasmic reticulum (ER)

- Network of membranes in cytosol
- Rough endoplasmic reticulum (RER): Fixed ribosomes on surface
- Smooth endoplasmic reticulum (SER): No ribosomes; site of lipid and steroid synthesis

Cytoplasmic Organelles, cont'd

Golgi apparatus

- Puts finishing touches on protein after synthesis on RER
- Packages protein in Golgi membrane
- https://youtu.be/8IlzKri08kk



On the Cell Membrane

Microvilli

- Help move water across cell membrane

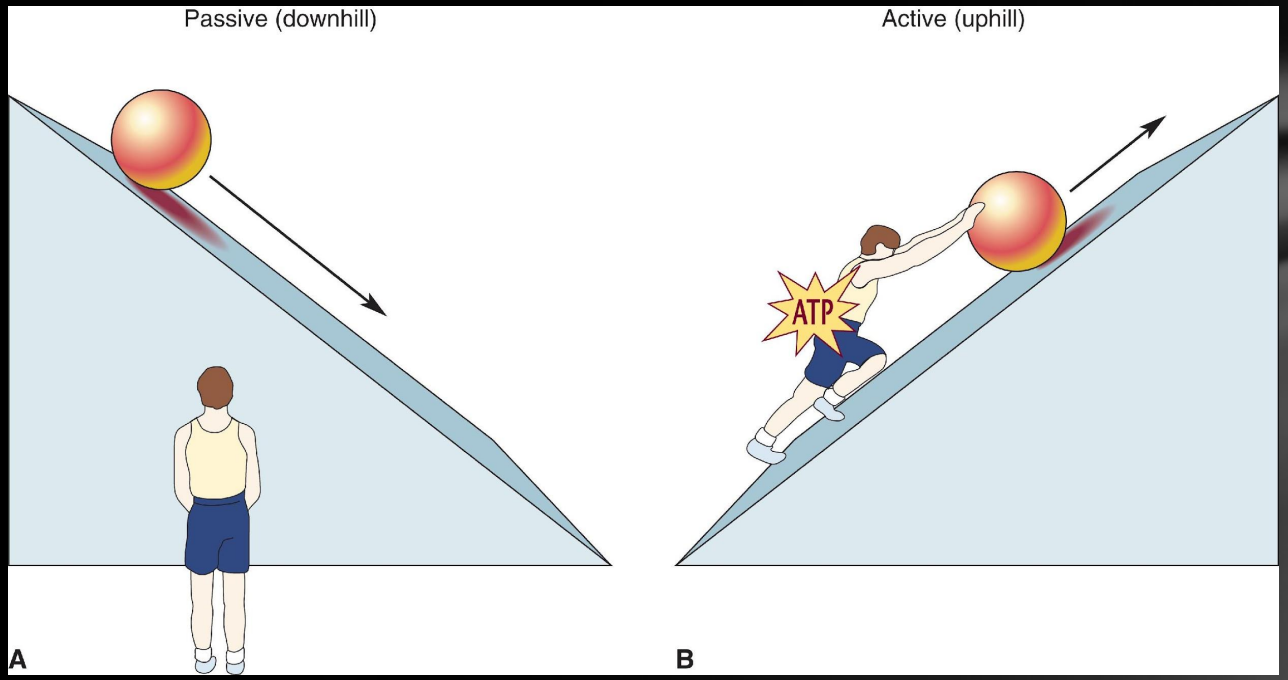
Cilia

- Short, hairlike projections
- Wavelike motions move substances across cell's surface

Flagella

- Whiplike: thicker, longer, and fewer in number than cilia
- Enable sperm to swim

Passive and Active Transport



Transport Mechanisms

Passive mechanisms

- Diffusion
- Facilitated diffusion
- Osmosis
- Filtration

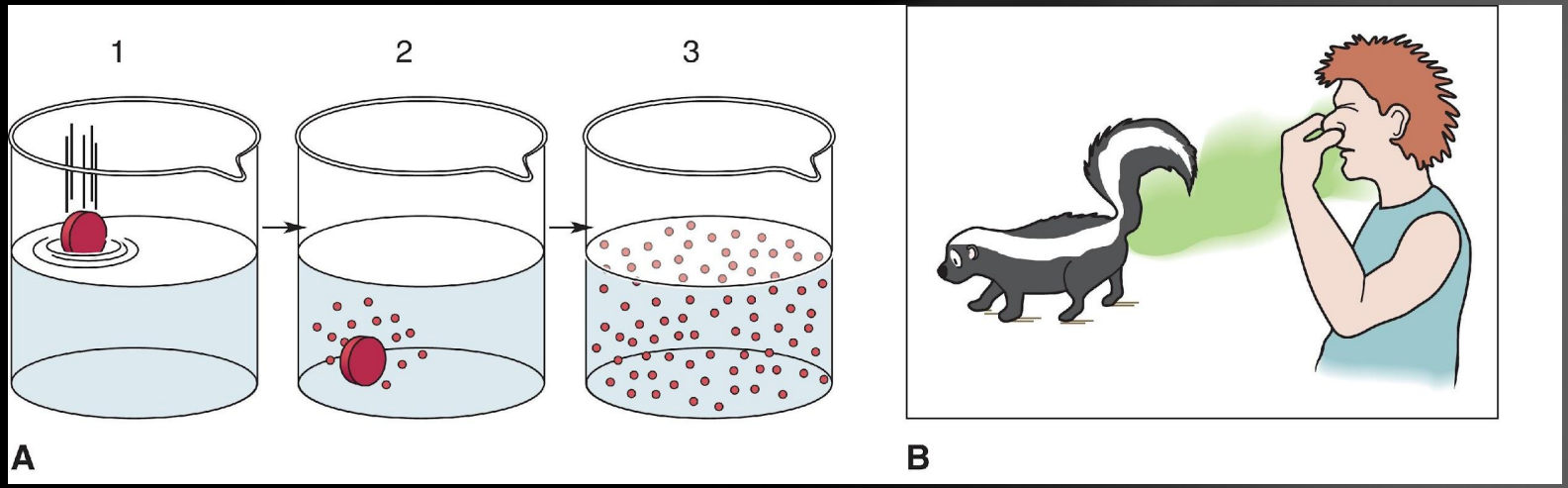
Active mechanisms

- Active transport pumps
- Endocytosis
- Exocytosis

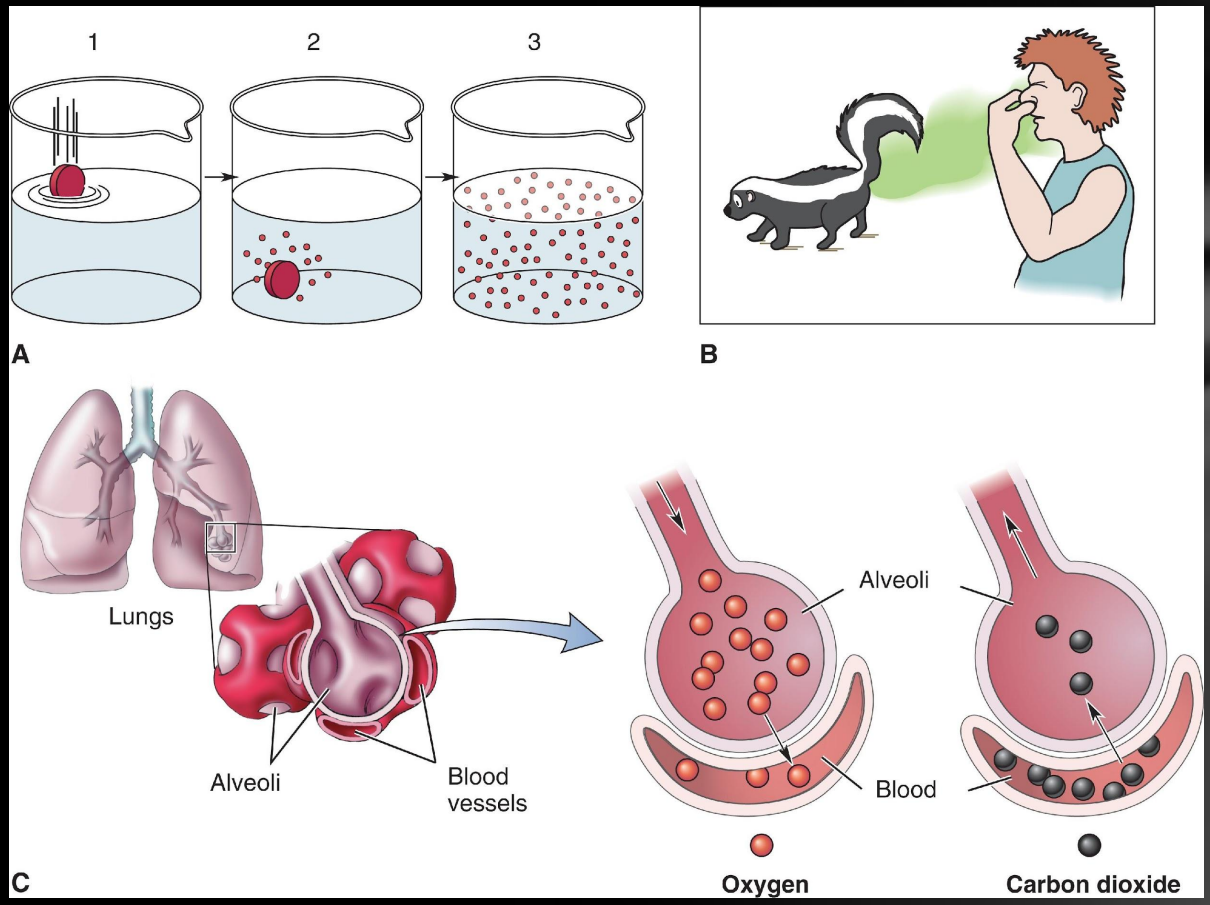
Passive Transport: Diffusion

Movement of a substance from an area of higher concentration to one of lower concentration

Equilibrium: Point at which concentration is equal and no further net diffusion occurs



Passive Transport: Diffusion, cont'd



Passive Transport: Osmosis

Movement of water (solvent) from area with more water to area with less water across selective permeable membrane

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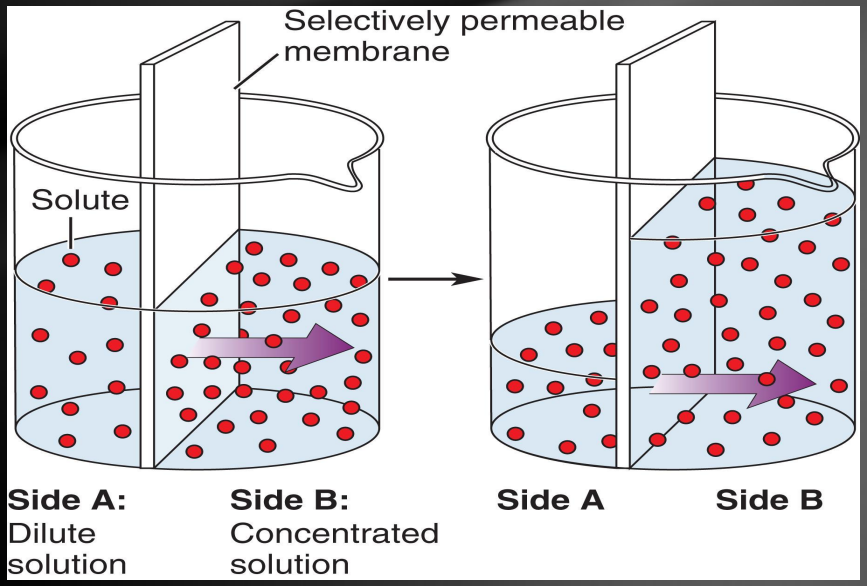
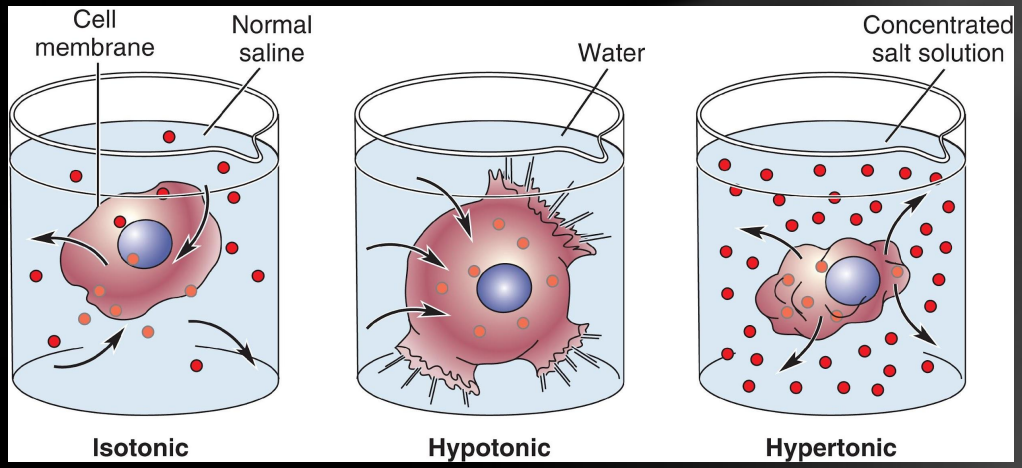


Tonicity

Ability of a solution to affect the volume and pressure within a cell

- Isotonic solution
- Hypotonic solution
- Hypertonic solutions
- Pg 39



Active Transport: Pumps

Active transport pumps

- Move substance from area of lower concentration to area of higher concentration
- Require input of energy (ATP)

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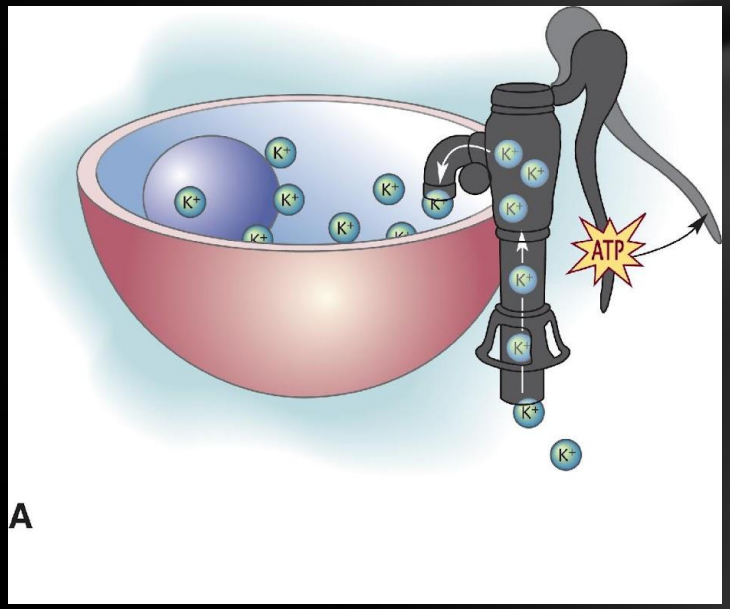
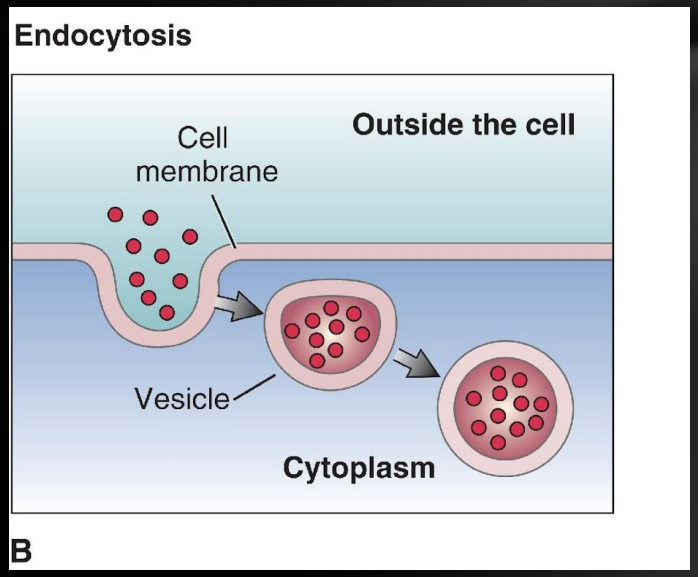


Active Transport: Endocytosis

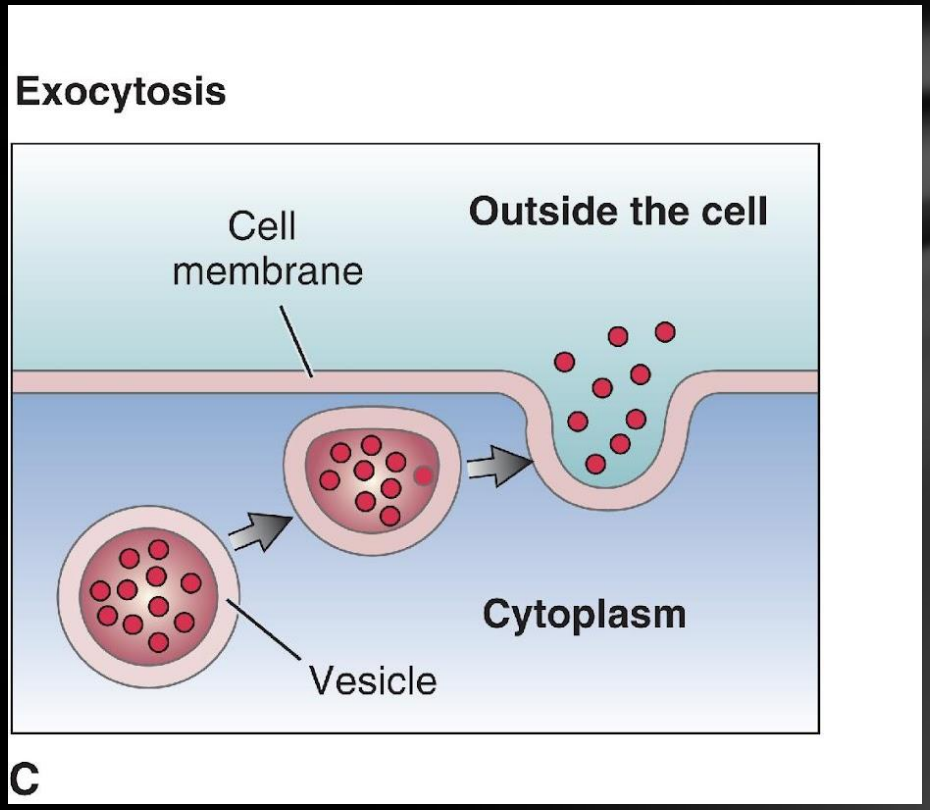
Ingestion of substances by the cell membrane

- Phagocytosis
- Pinocytosis



Active Transport: Exocytosis

Secretion of cellular products out of the cell



Cell Division

Types of cell reproduction (division)

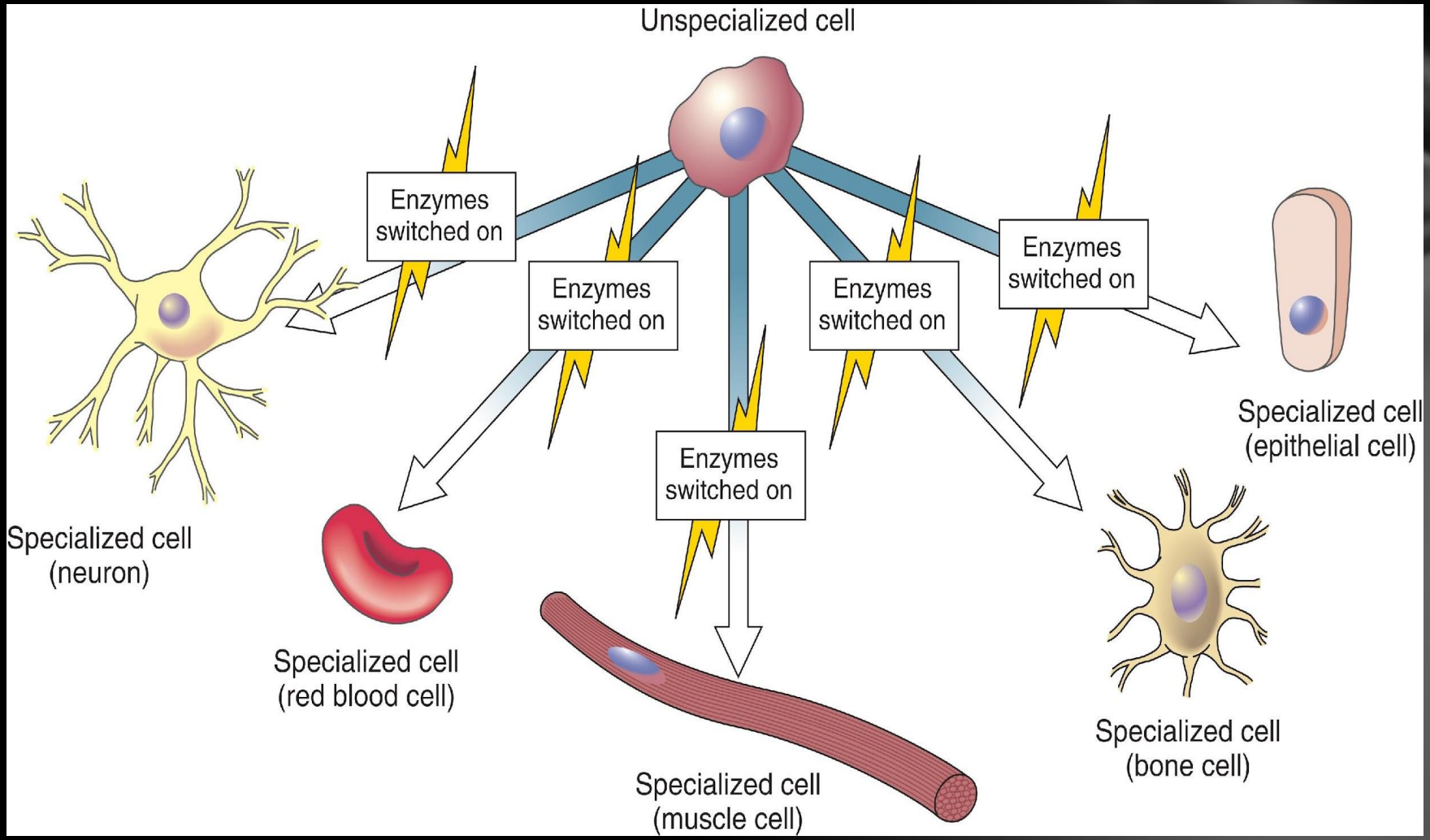
- Mitosis: Bodily growth and repair
- Meiosis: Sex cells only

Cell cycle: The sequence of events that a cell goes through from one mitotic division to the next

https://youtu.be/Lok-enzoeOM

https://youtu.be/qCLmR9-YY7o

Cell Differentiation



Stem Cells

Relatively undifferentiated or unspecialized cells whose only function is the production of additional unspecialized cells

The rate of stem cell division varies with the tissue type

- The stem cells within the bone marrow and skin are capable of dividing more than once a day
- The stem cells in adult cartilage may remain inactive for years

Disorders of Cellular Growth

Abnormal cell growth creates tumors

- Benign (noncancerous)
- Malignant (cancerous)

Cells extend and invade surrounding tissue

Apoptosis leads to cell death

- Helps rid the body of old, unnecessary, and unhealthy cells

Necrosis

- the death of most or all of the cells in an organ or tissue due to disease, injury, or failure of the blood supply.