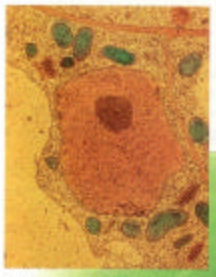
Cells

Chapter 8
and
Detailed Information



Cells:

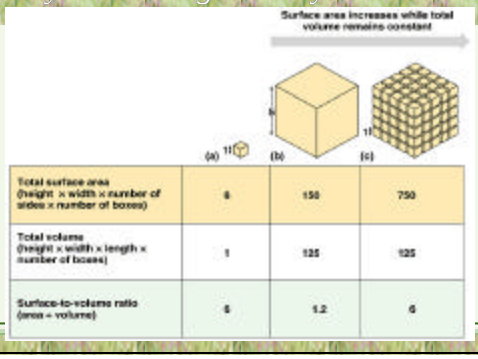
- Cytology: the study of cells
- Cytologists: scientists who study cells
- Cells are the basic unit of structure and function in a living organism.

- Smaller cells function more efficiently…why?

Cell Sizes:

- Cells vary in size, but most remain smaller rather than larger because they have more surface area/volume if they are smaller than larger.
- Most cells are so small that we need to use microscopes to see them and much smaller measurements than we normally use:
  - Micrometer (µm) = 1/1,000,000 of a meter = (10^{-6})
  - Nanometer (nm) = 1/1,000,000,000 of a meter = (10^{-9})
    - Red blood cells: ~ 9 µm
    - Human egg cell: ~ 130 µm
    - Amino Acid: ~ 0.9 nm
    - Epithelial cell: ~ 50 µm
    - Protein: ~ 6 nm
    - *Some are larger* -- Nerve Cells: ~ 90 cm

Why cells are generally small:



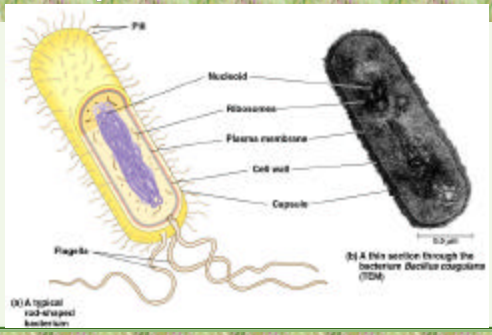
Types of Cells:

- There are two types of cells:
  - Prokaryotic
  - Eukaryotic

Types of Cells

- Prokaryotic - cells that lack membrane-bound internal structures; has no defined nucleus.
  - Most prokaryotes are unicellular.
  - Have DNA, but the DNA is not enclosed in a membrane-bound nucleus.
  - Usually ~ 1-10 µm in diameter.
  - Possess a peptidoglycan membrane which is a combination of protein and carbohydrate.
  - ie: bacteria, blue-green algae

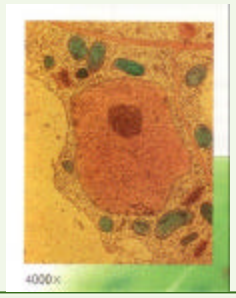
Prokaryote Cell:



Types of Cells

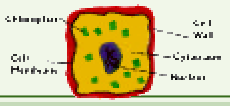
- Eukaryotic - cells that contain internal membrane-bound structures called organelles, have a true defined nucleus where different parts of the cell to specialize in different functions.
  - Can be unicellular or multicellular.
  - DNA is enclosed in a membrane-bound nucleus.
  - Usually about 10-100 μm in diameter (most between 10-30 μm.)
  - Derived from the Greek words:
    - eu- true/good
    - karyon- kernal/nucleus
  - ie: you, onion, protozoan

Eukaryotic Cells:



Main Parts of a Eukaryotic Cell

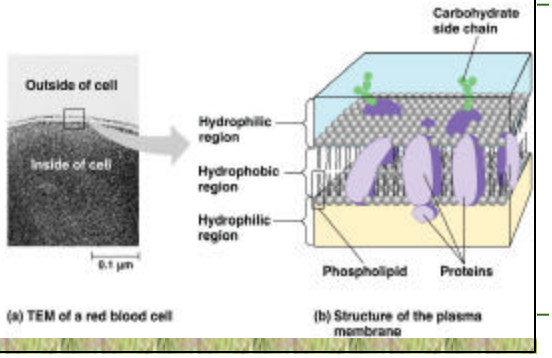
- Three Main Parts:
  - Cell Membrane
    - (AKA: Plasma Membrane)
  - Nucleus
  - Cytoplasm
- In plant and bacteria cells there is an "extra" part
  - Cell Wall



Cell (Plasma) Membrane

- Boundary between the cell and its external environment (complex double barrier of lipid and protein molecules.)
- Flexible, allows the cell to vary its shape when necessary.
- Maintains the chemical balance within the cell.
- Controls the movement of materials that enter and exit the cell by being selectively permeable. (O_2, nutrients enter and excess H_2O, wastes exit.)

Plasma membrane:



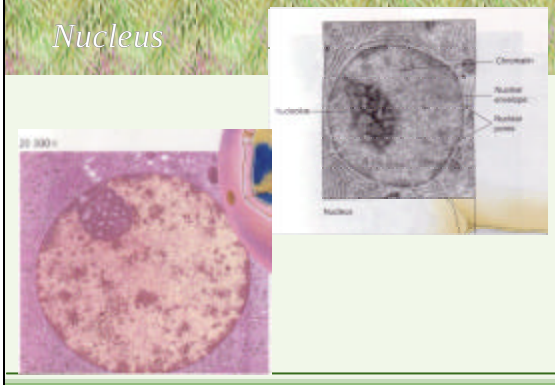
Nucleus

- Nickname: Control center
- Membrane-bound structure within the cell that directs cell activities.
- Contains and is responsible for transmission of the genetic material for the cell.
  - During most of the life cycle of the cell, the genetic material is in long tangled strands called chromatin, but when a cell prepares for replication, the chromatin condenses into short thick rods called chromosomes.

Nucleus Continued….

- It is the largest organelle.
- Surrounded by a porous double membrane and (each membrane is a double layer--making it 4 layers thick) called a nuclear envelope.
- The nucleus is ~ 5 μm in diameter.
- Contains a Nucleolus: region that produces ribosomes.
- Contains nucleoplasm: the cytoplasmic material inside the nucleus.

Nucleus



Cytoplasm:

- All of the material that lies inside the cell membrane except the nucleus.
- A thick, clear, aqueous salt solution that allows suspended materials to float freely within the cell.
- Jelly-like substance inside the cell and all the organelles.
- Cytoplasmic streaming: constant motion of the cytoplasm.

Cell Wall

- Rigid structure that surrounds a plant or bacteria cell.
- Inflexible structure that surrounds the plasma membrane.
- Thicker than the plasma membrane.
- Made of different substances in different organisms.
  - Cellulose in plants- form fibers to give the plant support.(fiber of our diets)
  - Chitin in fungi-nitrogen containing polysaccharide.

Cell Wall

- Primary cell wall: first wall laid down when the cell is formed; made primarily of cellulose.
- Secondary cell wall: inside the primary cell wall; formed after the cell has stopped growing; made of lignin; provides rigidity.
- Middle Lamella: outside the primary cell wall; made of pectin; essentially a cellular glue for adjacent cells.