Cell Structure & Function
The Cell

A cell is the smallest unit that is capable of performing life functions.
Microscopes and Cells

• 1600’s.
  - Anton van Leeuwenhoek first described living cells as seen through a simple microscope.
Robert Hooke first used a compound microscope to view thinly sliced cork cells.

- Compound scopes use a series of lenses to magnify in steps.
- Hooke was the first to use the term “cell”.
• 1830’s.
  – Mathias Schleiden identified the first plant cells and concluded that all plants are made of cells.
  – Thomas Schwann made the same conclusion about animal cells.
Cell Theory

1. All living things are made up of 1 or more cells.
2. Cells are the smallest working units of all living things.
3. All cells come from pre-existing cells through cell division.
Number of Cells

Organisms may be:

- **Unicellular** - composed of 1 cell
  
  OR

- **Multicellular** - made of many cells
Cells can be Eukaryotic or Prokaryotic

• **Prokaryotes**: do not have a nucleus or organelles (bacteria).

• **Eukaryotes**: have a nucleus and organelles (plants, fungi, animals, protists)
Organelles

• **Cell structures** that have a **specific function** and are surrounded by a **membrane** that are found in **eukaryotes** only.
Prokaryotic vs. Eukaryotic

[Diagram of Prokaryotic Cell Structure]

- Nucleoid
- Cytoplasm
- Capsule
- Cell Wall
- Cytoplasmic Membrane
- Ribosomes
- Pili
- Flagella

[Diagram of Anatomy of the Animal Cell]

- Mitochondria
- Microfilaments
- Lysosome
- Peroxisome
- Centrioles
- Nucleus
- Nuclear Pores
- Plasma Membrane
- Nucleolus
- Nuclear Envelope
- Microtubules
- Golgi Apparatus
- Cilia
- Smooth Endoplasmic Reticulum
- Ribosomes

Http://micro.magnet.fsu.edu/cells.html
Prokaryotic Cells

- Believed to be the first cells to evolve.
- Lack a membrane bound nucleus and organelles.
- Genetic material is free in the cytoplasm.
- Ribosomes are only other cell structure.
Eukaryotic

- 2 major types of eukaryotic cells: Plant and Animal cells

http://library.thinkquest.org/C004535/eukaryotic_cells.html
Cell Structures & Functions
Cell Wall

- Found outside of the cell membrane in plant cells & bacteria only
- Contains cellulose that provides support (rigidity) & protection
Cell or Plasma Membrane

- Outer membrane of cells that controls movement of substances in and out of the cell
- Double layer (bi-layer)
- In plants and bacteria, this is within the cell wall.
Cytoplasm

- Gel-like mixture inside cells
- Surrounded by cell membrane
- Contains cell structure that carry out specific jobs ex. Mitochondrion, nucleus
- Provides a medium for chemical reactions to take place
Nucleoid

- In prokaryotes.
- Region of the cytoplasm where chromosomal DNA is located.
- Singular, circular chromosome.
- Smaller circles of DNA called plasmids are also located in cytoplasm.
Ribosomes

- Each cell contains thousands
- Make proteins
- Found on endoplasmic reticulum & floating throughout the cell cytoplasm
Organelles
Nucleus

- “Control center”
- Directs cell activities
- Contains the genetic material (DNA)
- Separated from cytoplasm by nuclear membrane (or nuclear envelope).
Nuclear Membrane

• Surrounds nucleus, separates DNA from cytoplasm
• Made of two layers
• Openings called pores allow some materials to enter and leave nucleus
Chromatin

- In nucleus
- Genetic material (DNA) of cell in its non-dividing state.
- I.e. Uncoiled chromosomes
- Contain instructions for traits & characteristics
Nucleolus

• Dark-staining structure in the nucleus
• Makes ribosomes that make proteins
Rough Endoplasmic Reticulum

- Network of continuous sacs, studded with ribosomes.
- Internal delivery system of the cell.
- Manufactures, processes, and transports proteins for export from cell.
- Continuous with nuclear envelope.
Smooth Endoplasmic Reticulum

- Similar in appearance to rough ER, but without the ribosomes.
- Produces lipids, involved in carbohydrate metabolism, and detoxification of drugs and poisons.
Golgi Apparatus

- Protein 'packaging plant'
- Modifies proteins and lipids made by the ER and prepares them for export from the cell.
- Encloses digestive enzymes into membranes to form lysosomes (transport pods).
Lysosome

- Digestive 'plant' for proteins, fats, and carbohydrates
- Digestive enzymes break down cellular waste and debris
- Transports undigested material to cell membrane for removal
- Cell breaks down if lysosome explodes
Mitochondria

- Cell “powerhouse”
- Membrane bound organelles that are the site of cellular respiration (use glucose to produce cell energy, ATP)
- Active cells like muscles have more mitochondria
Animal Vacuole

- Membrane-bound sacs for storage, digestion, and waste removal
- Contains water solution
Plant Vacuole

• Plants have large central vacuoles that store water and nutrients needed by the cell.

• Help support the shape of the cell.
Chloroplast

- Usually found in plant cells
- Contains green pigment chlorophyll
- Where photosynthesis takes place
- Produces plant food (sugars) and oxygen gas
Cilia and Flagella

- External appendages from the cell membrane that aid in locomotion (movement) of the cell.
- Cilia also help to move substance past the membrane.
Centrioles

- Found only in animal cells.
- Self-replicating
- Made of bundles of microtubules.
- Help in organizing cell division.
Cytoskeleton

- The cell’s skeleton
- Made of microtubules and filaments
- Give the cell shape, strength and ability to move