Background Information

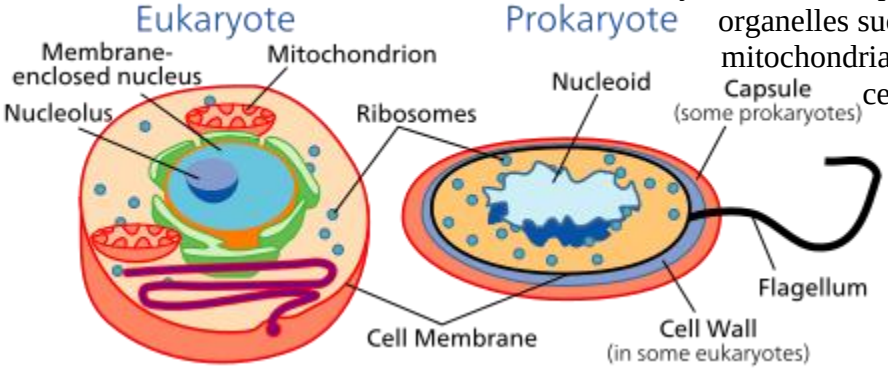
Modern cell theory states that:

• All organisms are made up of cells.
• New cells are derived from pre-existing cells.
• The cell is the structural and functional unit of all living things.
• Cells contain hereditary information that is passed from cell to cell during cell division.
• All cells are basically the same in chemical composition and metabolic activities.

Cells are the basic units of life. Cells can combine to form complex structures or exist as singular life forms. There are two major types of cells: prokaryotic and eukaryotic. Prokaryotic cells (or bacteria) lack a nucleus, are small in size (2-8 micrometers) and are simple in structure. They do not contain internal membranes. Eukaryotic cells are nucleated cells, that is they contain a nucleus, are larger in size (10-100 micrometers) and are more complex. On average, eukaryotic cells are ten times larger than prokaryotic cells.

Source of picture: http://en.wikipedia.org/wiki/Cell_(biology)

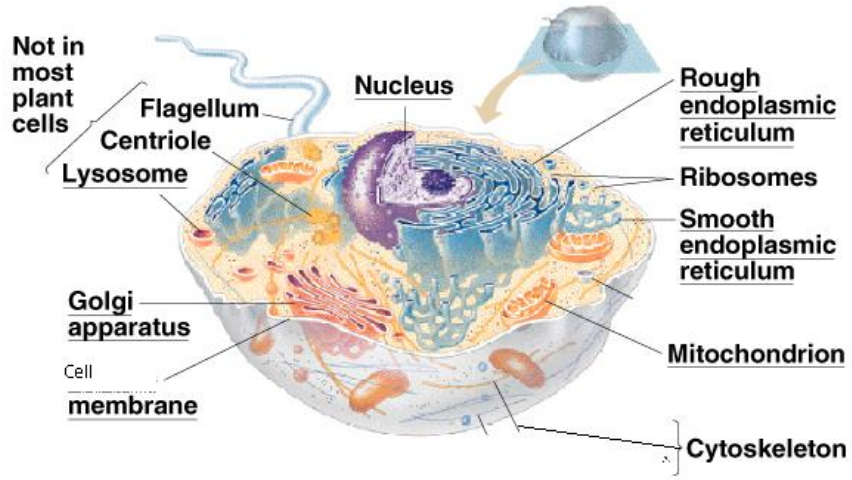
The cells of protozoa, algae, fungi, plants, and animals are eukaryotic cells. Eukaryotic cells are more commonly divided into two categories for further study: animal and plant. Plant and animal cells are similar, but do not have exactly the same cell parts and shape. Both have many common organelles such as the nucleus, ribosomes, mitochondria, etc. Plant cells have chloroplasts, central vacuoles and cell walls; these are absent in animal cells. Animal cells have lysosomes, centrioles and may contain flagella; these are absent in plant cells. Due to the presence of the cell wall, the plant cell is more boxy in shape.

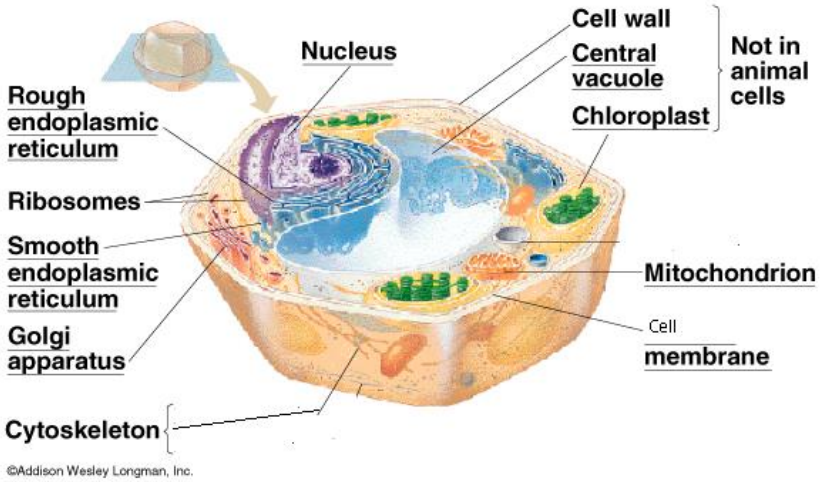


Organelles are cellular compartments with specific functions.

Organelle name	Function	Cell type found in
Nucleus	Control center, DNA storage	Animal and plant
Nucleoid region	Genetic material	Prokaryote only
Cell membrane	Passageway for materials entering and exiting the cell	Animal, plant, prokaryote
Cell wall	Structure and support	Plant and prokaryote
Mitochondria	Site of cellular respiration/power house	Animal and plant

Chloroplast	Site of photosynthesis – converts solar energy into chemical energy of sugars	Plant only
Rough ER	Protein synthesis	Animal and plant
Smooth ER	Lipid synthesis	Animal and plant
Golgi apparatus	Edits materials manufactured in ER's and then packages and ships them to desired location	Animal and plant
Ribosomes	Protein factories	Animal, plant, prokaryote
Central vacuole	Storage of water, pigments, poisons	Plant only
Lysosomes	Digestive sacs that break down such things as damaged organelles	Animal only
Centrioles	Aid in cell division	Animal only
Flagella	Locomotion	Animal and prokaryote





A virus is not a cell; rather a small **infectious agent** that can replicate only inside the living cells of organisms. They are not considered to be living since they rely on a host cell in order to reproduce.

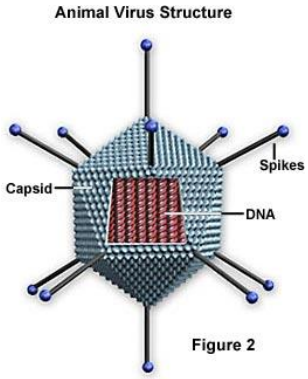


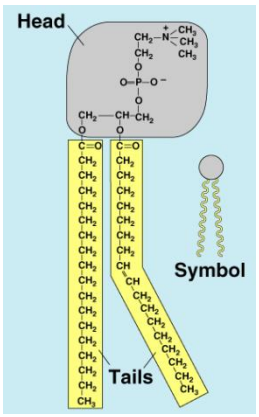
Figure 2

Viruses are very small and have very simple structures:

- Genetic material (either DNA or RNA)
- The smallest known viral genome consists of only four genes. The largest consists of several hundred genes.
- Membranous envelope, called a capsid, surrounds genetic material
- Glycoprotein spikes on the outside to help the virus recognize a host cell

The cell membrane controls what comes in and out of the cell helping to maintain a stable internal environment.

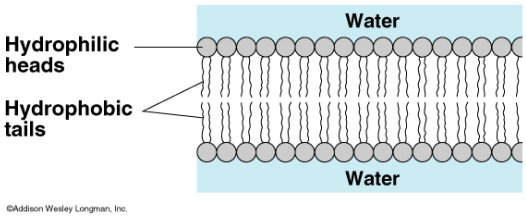
- Also called the plasma membrane.
- Separates the cell from the outside environment.



The major components of the cell membrane are phospholipids that form a bilayer.

- Phospholipids make up the cell membrane.
- Phospholipid structure:
  - 2 nonpolar fatty acid "tails" (hydrophobic)
  - 1 polar phosphate "head" (hydrophilic)

In water, the phospholipids make a double layer by putting their nonpolar "tails" inside and their polar "heads" outside.



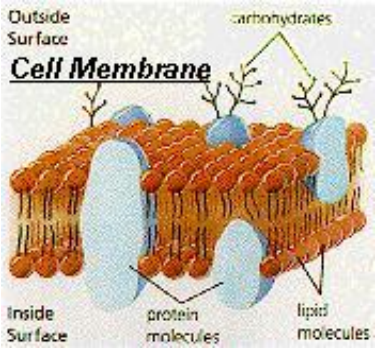
Proteins and carbohydrates are found in the cell membrane too.

Proteins:

- Act as passageways for big molecules to move in and out.
- Act as enzymes
- Act as receptors of messages from other cells.

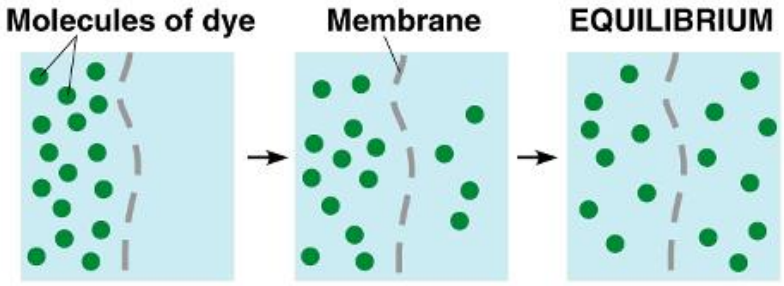
Carbohydrates:

- Act as ID tags so cells can identify each other.



Small molecules move right through the membrane, big molecules move through a protein, and really big molecules are engulfed or spit out by the cell.

- Diffusion is the tendency of any particle to spread out from a high concentration to a low concentration.
- Always High→low
- Diffusion requires no energy, it just happens.
- Also called passive transport.

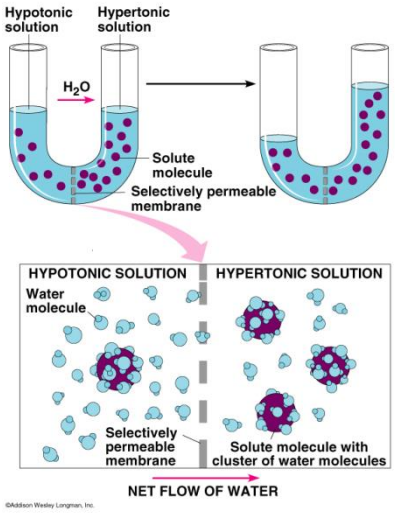


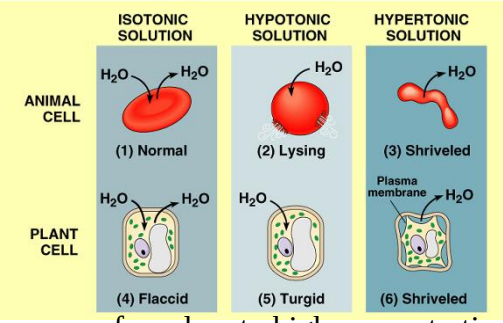
Oxygen, carbon dioxide and water undergo passive transport to diffuse across the cell membrane.

- Osmosis→ diffusion of water across a selectively permeable membrane.
- Passive transport.

The different concentrations of solutes and solvents allow osmosis to happen.

- Hypertonic→more solute than solvent (water)
- Hypotonic→ more solvent (water) than solute
- Water moves from Hypotonic → Hypertonic
- Isotonic→ solute=solvent (water)



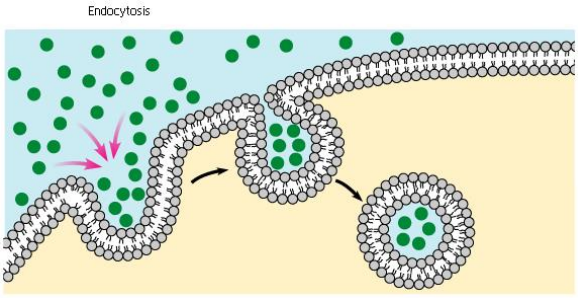


Substances can move from low to high concentration but that requires energy and is called active transport.

- To go from a low concentration→high concentration requires energy.
- i.e. the sodium-potassium pump helps nerve cells send signals.

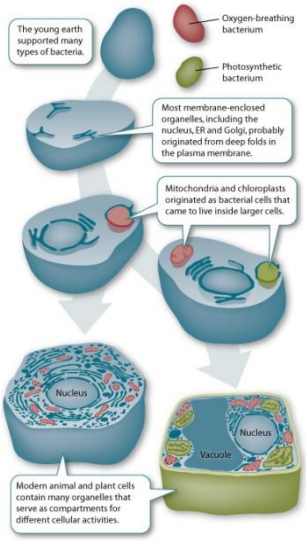
If a molecule is just too large to move directly through the cell membrane, the cell membrane can wrap around the molecules to bring them in or spit them out.

- Endocytosis → A cell takes in macromolecules or other large particles by forming vesicles or vacuoles from its plasma membrane.



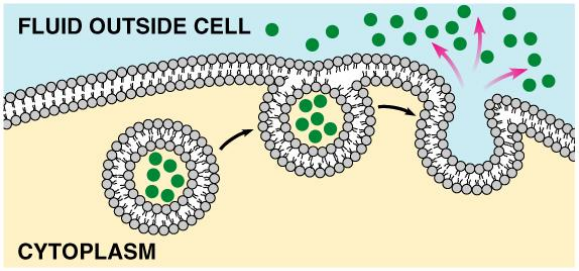
The endosymbiotic theory**,** which is now generally accepted, explains the origins of mitochondria and chloroplasts. According to this theory, mitochondria and chloroplasts originated as bacterial cells that came to live in larger cells.

Evidence for the theory includes:
• chloroplasts and mitochondria both contain circular DNA, similar to prokaryotes
• their cell membrane structures are similar to prokaryotes
• they reproduce by binary fission, as do prokaryotes
• their ribosomes are similar in structure to prokaryotes



Source of picture:
http://learn.genetics.utah.edu/content/begin/cells/organelles/

- Exocytosis → Membrane-bounded vesicles containing large molecules fuse with the plasma membrane and release their contents outside the cell



Exocytosis

Terms and Concepts

Active transport
Bacteria
Biological evolution
Cell function
Cell membrane
Cell nucleus
Cell organelle
Cell theory
Cell wall
Chloroplast
Chromosome
Cytoplasm
Diffusion
DNA (deoxyribonucleic acid)
Endocytosis
Endosymbiosis
Exocytosis
Eukaryote
Golgi apparatus
Hypertonic
Hypotonic
Isotonic
Lysosome
Mitochondrion
Nucleated cells
Nucleus
Nucleolus
Organelle
Osmosis
Photosynthesis
Prokaryote
Protein
Ribosome
Rough and smooth ER
Theory
Vacuole
Virus