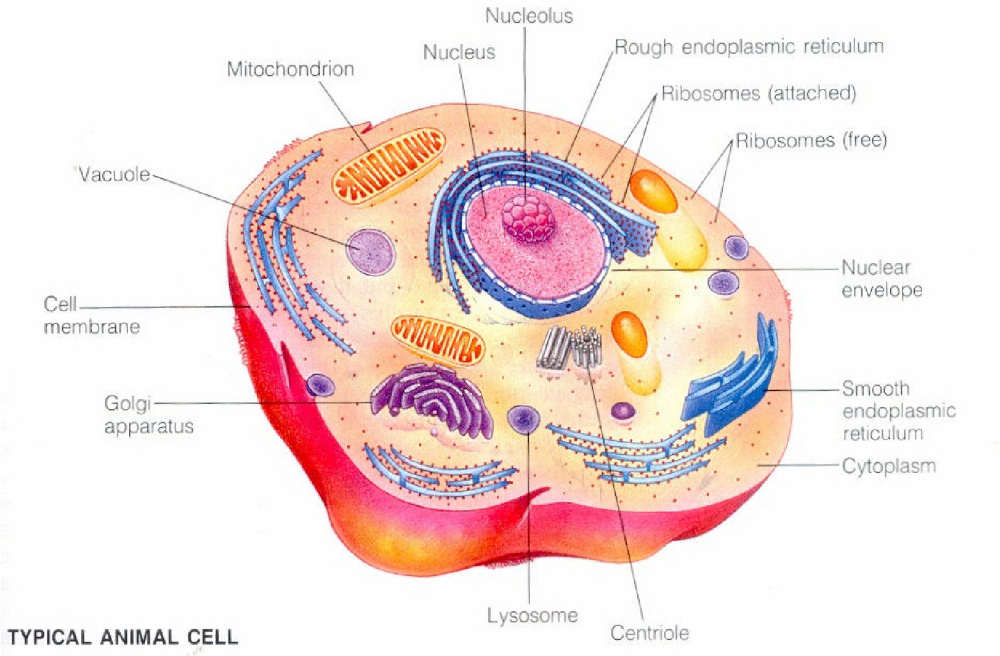
Life Science Handout
Chapters 1 & 2

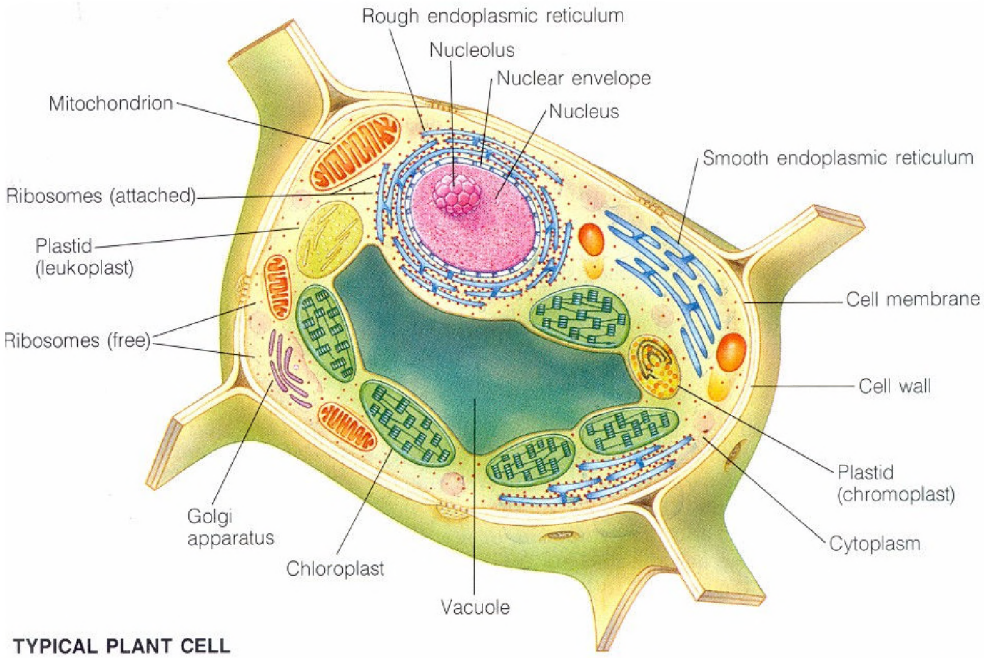
Chapter 1: Cell Structure & Function

I. Animal Cell:



TYPICAL ANIMAL CELL

II. Plant Cells



TYPICAL PLANT CELL

I) Atoms, Elements, Compounds and Mixtures

A) Definitions

1) **Atom**: The basic building block of matter, unable to be subdivided by ordinary chemical means.
2) **Element**: Substance composed entirely of one type of atom. About 100 different atoms are known to exist.

3) **Compound**: Two or more elements combined chemically (Ionic or covalent) in a definite proportion forming a **Molecule**.
4) **Mixture**: Substances that are mixed physically- not chemically- where proportions are not fixed.

B) Atomic Structure

1) **Nucleus**: The central part of the atom surrounded by an electron cloud. Composed of protons and neutrons.
2) **Proton**: About the same mass as a neutron. Each proton has an electrical charge of +1.
3) **Neutron**: About the same mass as a proton. Each neutron has a neutral electrical charge.
4) **Electron**: Found in shell clouds surrounding the nucleus. Has about $1/2000^{th}$ the mass of a proton and has a –1 electrical charge.

C) Periodic Table

1) Elemental Symbols: need to knows:

(a) Hydrogen	H	1	(f) Sodium	Na	11	(k) sulfur	S	16
(b) Helium	He	2	(g) Chlorine	Cl	17	(l) phosphorus	P	15
(c) Carbon	C	6	(h) Potassium	K	19			
(d) Nitrogen	N	7	(i) Calcium	Ca	20			
(e) Oxygen	O	8	(j) Iron	Fe	26			

2) **Atomic Number**: Number of protons found in the nucleus of the atom
3) **Atomic Mass**: The sum of # of protons and # of neutrons found in the atom. Also the weight in grams of one mole of the substance.
4) **Isotope**: Varieties of an element that differ only in the # of neutrons found in the nucleus of the atom.
5) **Mole**: 6.02×10^{23} atoms of the substance: One reactive unit. One mole of a substance weighs its atomic mass in grams. I.e. one mole of carbon weighs 12.0111 grams.

D) Chemical Bonding and Chemical Reactions

1) Electron Energy Levels: Each level will hold 2 electrons
   (a) 1S: 2 electrons
   (b) 2S: 2 electrons
   (c) $2P_1$: 2 electrons
   (d) $2P_2$: 2 electrons
   (e) $2P_3$: 2 electrons
   (f) 3S: 2 electrons
2) Chemical reactions take place with the exchange of electrons found in the **outer electron** energy levels of the reactant chemicals. Chemical reactions **do not involve the nucleus** of the atoms.
3) **Ionic Bonds**: Sodium Chloride: NaCl
   (a) Sodium has only one electron in its outer layer. It gives this electron up to Chlorine because chlorine needs only one more electron to fill its outer energy level. Chlorine takes control of this electron and now has an extra electron and becomes a –1 electrical charge. The Sodium gives the electron up to Chlorine and now has a +1 electrical charge. These are called ions of the element.

4) **Covalent Bonds**: Sharing electrons: water: H_2O
   (a) Oxygen needs two electrons to fill its outer shell. Hydrogen needs 1 electron to fill its shell. By sharing its electron with oxygen, the two hydrogens have their shell full and are now stable. The Oxygen will use the electron from each of the hydrogens to fill its outer shell and become stable. The three outer energy levels of the two hydrogen and one oxygen atom are now full and the molecule becomes very stable.
5) **Chemical Formulas**: The Elements and proportions found in a molecule or compound.
   (a) Each element is represented by its chemical symbol and the # of atoms in subscript:
      (i) Water: H_2O: 2 hydrogen and 1oxygen
      (ii) Table salt: Sodium Chloride: NaCl: 1 Sodium and 1 Chlorine
      (iii) Glucose: $C_6H_{12}O_6$: 6 carbon, 12 hydrogen and 6 oxygen
   (b) **Chemical Reactions** can be written as a formula with reactants on the left and products on the right side of the arrow:
      (i) Reactant + Reactant → Product
      (ii) $6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$
      (iii) Law of the Conservation of Mass requires that the same # of atoms found on the left side must also equal the same # of atoms on the right side. In this case there are a total of 6 carbons, 18 oxygens and 12 hydrogens on each side of the equatio

II) Organic verses Inorganic

1) **Organic Compounds**: Most compounds that contain CARBON are considered to be organic. **Exception** would be **CO_2**, carbon dioxide & **CO** carbon monoxide.
2) **Inorganic Compounds** are those that do not contain carbon.
3) The most important groups of organic compounds found in living organisms are: Carbohydrates, Proteins, Lipids and Nucleic Acids
   (a) **Carbohydrates**: and energy rich made of simple sugars & contain: Carbon, Hydrogen and Oxygen. Examples of foods include glucose, sugars, starch, pastas, rice and breads.
   (b) **Proteins**: Large organic molecules made of carbon, nitrogen, oxygen, hydrogen and sometimes sulfur. Examples include Meat, eggs, fish, Cell membrane, enzymes and hormones
      (i) Protein molecules are made up of smaller molecules called **amino acids**. There are 20 different amino acids and they are used to make thousands of different proteins
      (ii) **Enzymes**: a special type of protein that speeds up chemical reactions inside the cell. W/out enzymes most life sustaining chemical reactions would not be able to take place.
   (c) **Lipids**: Energy rich organic molecule containing carbon, hydrogen and oxygen. Broken into fatty acids & gylcerides Contain more energy potential than carbohydrates. Example: Cholesterol
   (d) **Nucleic Acids**: Very Large organic molecules that contain: carbon, nitrogen, oxygen, hydrogen and phosphorus. Made up of nucleotides. Examples: DNA, mRNA, tRNA, rRNA
      (i) **DNA**: Deoxyribonucleic Acid
      (ii) **RNA**: Ribonucleic Acid

III)

IV) Movement of Substance into and out of the cell

A) **Passive Transport**: movement of substances w/out added energy
   a. **Diffusion**: Movement of a substance from a higher concentration to that of a lower concentration.
   b. **Osmosis**: diffusion of water molecules from a high concentration to a lower concentration

B) **Active transport**: requires energy to be expended by the cell. Often moving substances from low concentration to high concentration. Often uses "Transport Proteins" which grab molecules outside the cell and pull them inside the cell: example insulin requires a transport protein to enter the cell.