***Basics of Biology***

***Cellular Structure***

Biological systems are essentially an assembly of molecules where water, amino acids, carbohydrates (sugar), fatty acids, and ions account for 75–80% of the matter in cells. The remainder of the cell mass is accounted for by macromolecules, also called polymers (or biopolymers in the present case), which include peptides/proteins (formed from amino acids), polysaccharides (formed from sugars), DNA (dioxyribonucleic acid, formed from nucleotide bases and dioxyribose sugar), RNA (ribonucleic acid, formed from nucleotide bases and ribose sugar), and phospholipids (formed from fatty acids). These macromolecular polymers organize to form cells. To contain these molecules, a semipermeable membrane (phospholipid bilayer) surrounds them to form a cell.

Eukaryotic cells, for the most part, organize to form complex living organisms. From a single pluripotent cell (a cell with the capacity to differentiate into several cell types) arises tissues and organs, and finally a complex living organism.

The structure of a cell—specifically, eukaryotic cells—can be described in terms of the various subcellular compartments and the constituent chemical species they contain. The main structural components of a cell are:

• Plasma membrane, which defines the outer boundary of a cell. This is present in all cells.

• Cell wall, which exists in the prokaryotic cells as well as in the eukaryotic cells of plants but not animals.

• Cytoplasm, which represents everything within a cell, except the nucleus.

• Cytosol, which is the fluid of the cytoplasm.

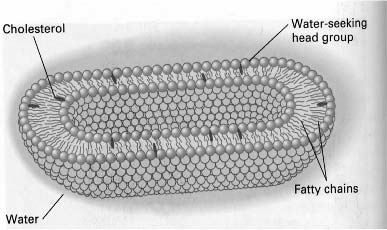
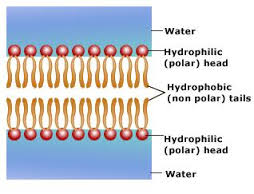
• Organelle, which is the name used for a subcellular compartment in a cell where a specific cellular function takes place.

• Nucleus, which contains the chromosomes (genetic information).

Organelles are like little organs of a cell that perform various cellular functions, just like organs perform various tasks in a living system. Organelles are intracellular (or subcellular) structures: specifically, nucleus, mitochondria, Golgi apparatus, endoplasmic reticulum, cytoskeleton, lysosomes, and peroxisomes. The following describes some structural aspects of various cellular components and functions they perform.

***Plasma Membrane:***

One feature common to all cells and many of the organelles they contain is a thin layer of material called membrane Membrane can be folded and twisted into many different structures, shapes, and forms. This forms a semipermeable outer boundary of both prokaryotic and eukaryotic cells. This outer membrane, about 4–5 nm thick, is a continuous sheet of a double layer (bilayer) of long-chain molecules called ***phospholipids*.** A phospholipid molecule has a long tail of alkyl chain, which is hydrophobic (refuse water), and a hydrophilic head (likes water) which carries a charge (and is thus ionic). Phospholipid molecules spontaneously orient (or self-organize) to form a bilayer in which the hydrophobic tails are pointed inwards (shying away from the outer aqueous environment). The hydrophilic, ionic head groups are in the exterior and are thus in contact with the surrounding aqueous environment. This structure is shown in detail in Figure 1. The membrane derives its rigidity by inclusion of cholesterol molecules, which are interdispersed in the phospholipid bilayer. The plasma membrane controls the transport of food, water, nutrients, and ions such as Na+, K+, and Ca2+ (through so-called ion channels) to and from the cell as well as signals (cell signaling) necessary for proper cell function.

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***Figure 1.****Schematics of the phospholipid membrane bilayer structure.*