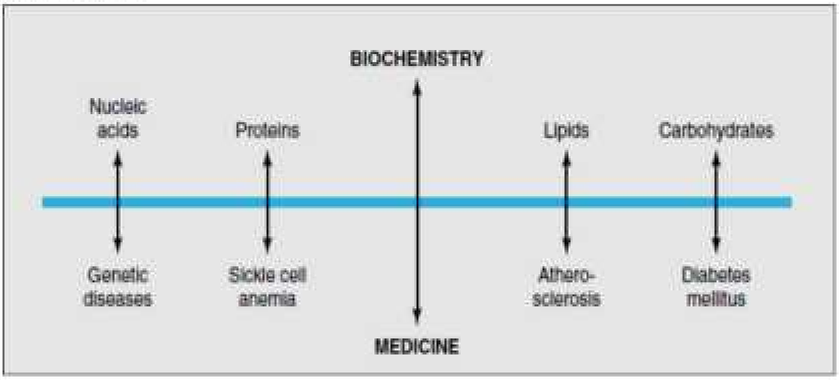
Introduction

Biochemistry

Biochemistry (sometimes called biological chemistry) can be defined as the science concerned with the chemical basis of life. The cell is the structural unit of living systems. Thus, biochemistry can also be described as the science concerned with the chemical constituents of living cells and with the reactions and processes they undergo. Biochemistry play as large areas of cell biology, of molecular biology, and of molecular genetics. Biochemistry has become so successful at explaining living processes that now almost all areas of the life sciences from botany to medicine are engaged in biochemical research.

Biochemistry has impact on Nutrition & Preventive Medicine

One major for the maintenance of health is the dietary intake of a number of chemicals; these are vitamins, certain amino acids, certain fatty acids, various minerals, and water. Because much of the subject matter of both biochemistry and nutrition is concerned with the study of various aspects of these chemicals, there is a close relationship between these two sciences. In addition nutritional approaches to for example the prevention of atherosclerosis and cancer are receiving increased emphasis. Understanding nutrition depends to a great extent on knowledge of biochemistry.



Examples of the two-way street connecting biochemistry and Medicine

Carbohydrates

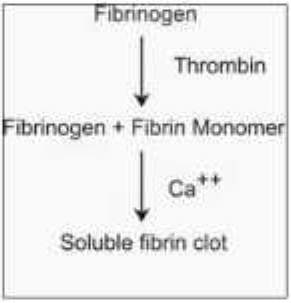
Carbohydrates are widely distributed in plants and animals; they have important structural and metabolic roles. In plants, glucose is synthesized from carbon dioxide and water by photosynthesis and stored as starch or used to synthesize cellulose of the plant framework.

Animals can synthesize carbohydrate from lipid, glycerol and amino acids, but most animal carbohydrate is derived ultimately from plants. Glucose is the most important carbohydrate; most dietary carbohydrate is absorbed into the bloodstream as glucose, and other sugars are converted into glucose in the liver. Glucose is the major metabolic fuel of mammals (except ruminants) and a universal fuel of the fetus. It is the precursor for synthesis of all the other carbohydrates in the body, including glycogen for storage; ribose and deoxyribose in nucleic acids; and galactose in lactose of milk, in glycolipids, and in combination with protein in glycoproteins and proteoglycans. Diseases associated with carbohydrate metabolism include diabetes mellitus, galactosemia, glycogen storage diseases, and lactose intolerance.

Proteins

Proteins are large biological molecules, or macromolecules, consisting of one or more long chains of amino acid residues. The individual amino acid residues are bonded together by peptide bonds and adjacent amino acid residues. The sequence of amino acid residues in a protein is defined by the sequence of a gene, which is encoded in the genetic code. In general, the genetic code specifies 20 standard amino acids. Plasma proteins serve many different functions, including transport of lipids, hormones, vitamins and metals in the circulatory system and the regulation of a cellular activity and functioning and in the immune system. Proteins perform a vast array of functions within living organisms, including catalyzing metabolic reactions, replicating DNA. Serum albumin accounts for 55% of blood proteins. All the proteins of the albumin family are water-soluble, and experience heat denaturation. Albumins are commonly found in blood plasma and differ from other blood proteins in that they are not glycosylated. Substances containing albumins, such as egg white. Its main function is to regulate the colloidal osmotic pressure of blood. Alpha-fetoprotein (alpha-fetoglobulin) is a fetal plasma protein that binds various cations

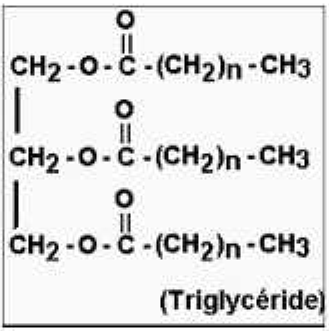
Globulins make up 38% of blood proteins and transport ions, hormones, and lipids assisting in immune function. Fibrinogen comprises 7% of blood proteins; conversion of fibrinogen to insoluble fibrin is essential for blood clotting. Plasma is the blood fluid that carries blood fibrinogen, while serum is the water fluid from blood without the fibrinogen.



The remainder of the plasma proteins (1%) are regulatory proteins, such as enzymes, proenzymes, and hormones. All blood proteins are synthesized in liver except for the gamma globulins. Conditions with proteinuria consisting mainly of Bence-Jones proteins as a sign: Chronic lymphocytic ,leukemia, Amyloidosis, Malignancies (e.g., lymphoma, other cancers), Multiple myeloma.

Lipids

Lipids are a heterogeneous group of compounds, including fats, oils, steroids, waxes, and related compounds. They have the common property: relatively insoluble in water and soluble in no polar solvents such as ether and chloroform. They are important dietary constituents not only because of their high energy value but also because of the fat-soluble vitamins and the essential fatty acids contained in the fat of natural foods. Fat is stored in adipose tissue, where it also serves as a thermal insulatorin the subcutaneous tissues and around certain organs. Combinations of lipid and protein (lipoproteins) are important cellular constituents, occurring both in the cell membrane and in the mitochondria, and serving also as the means of transporting lipids in the blood.



Enzyme

The best-known role of proteins in the cell is as enzymes, which catalyze chemical reactions. Enzymes are usually highly specific and accelerate only one or a few chemical reactions. Enzymes carry out most of the reactions involved in metabolism, as well as DNA replication, DNA repair, and transcription. They are responsible for thousands of metabolic processes in life. Most enzymes are proteins. The molecules bound and acted upon by enzymes are called substrates. Although enzymes can consist of hundreds of amino acids.

The region of the enzyme that binds the substrate and contains the catalytic residues is known as the active site. Some enzymes do not need any additional components to show full activity. However, others require non-protein molecules called cofactors to be bound for activity. Cofactors can be either inorganic (e.g., metal ions and iron-sulfur clusters) or organic compounds (e.g., flavin and heme).Organic cofactors can be either prosthetic groups.

Hormones

Hormone is a substance that is synthesized in one organ and transported by the circulatory system to act on another tissue. However, this original description is too restrictive because hormones can act on adjacent cells (paracrine action) and on the cell in which they were synthesized (autocrine action) without entering the systemic circulation.

A diverse array of hormones each with distinctive mechanisms of action and properties of biosynthesis, storage, secretion, transport, and metabolism has evolved to provide homeostatic responses.

Nucleic acids

Nucleic acids are the molecules that make up DNA, an extremely important substance that all cellular organisms use to store their genetic information that the most common nucleic acids are deoxyribonucleic acid (DNA) and ribonucleic acid (RNA). Their monomers are called nucleotides. A nucleotide consists of a phosphate group, a ribose sugar, and a nitrogenous base.

The phosphate group and the sugar of each nucleotide bond with each other to form the backbone of the nucleic acid, while the sequence of nitrogenous bases stores the information. The most common nitrogenous bases are adenine, cytosine, guanine, thymine, and uracil. The nitrogenous bases of each strand of a nucleic acid will form hydrogen bonds with certain other nitrogenous bases in a complementary strand of nucleic acid. In DNA thymine binds with adenine (A-T); guanine and cytosine (G-C) can bind with one another. In addition in RNA there is uracil bind with adenine (U-A), guanine and cytosine (G-C) also can bind only with one another.