

Protein importance and its measurement

Proteins : are Large molecules composed of one or more chains of amino acids in a specific order determined by the base sequence of nucleotides in the DNA coding for the protein.. Proteins are required for the structure, function, and regulation of the body's cells, tissues, and organs.

Proteins perform a vast array of functions within organisms, including catalysing metabolic reactions, DNA replication, responding to stimuli, providing structure to cells, and organisms, and transporting molecules from one location to another.

Protein synthesis

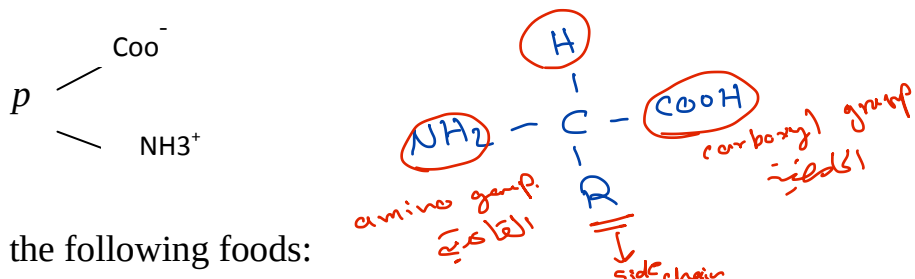
A gene is a segment of a DNA molecule that contains the instructions needed to make a new protein. All of our cells contain the same DNA molecules, but each cell uses a different combination of genes to build the particular proteins it needs to perform its specialized functions.

The origin and occurrence:

Protein always are produced in nature by living matter and chiefly by plants . Animals may eat proteins ,but transform them into other types of protein ,but animals have limited powers to synthesis protein.

Protein occur in living matter cell or are associated with living things , they constitute a large part of the solid matter of muscles , tendons الأوتار , ligament رابطة عضلات , cartilage غضاريف and 20% blood, About half of the solid matter involved in synthesis of the brain, nerve tissue and bone.

structure of protein: The two-peptide molecule (-C O N H -) represents a simple unit of protein synthesis, and the protein molecule has two acidic and basic sides. On this basis, a simple design of the protein molecule can be developed as shown.



Protein is found in the following foods:

- meats, poultry, and fish ,eggs ,nuts and seeds ,milk and milk products ,some vegetables, and some fruits .

Recommended Dietary Allowance for Protein

The human	ages	<u>Grams</u> of protein needed <u>each day</u>
Children ages	1 – 3	13
Children ages	4 – 8	19
Children ages	9 – 13	34
Girls ages	14 – 18	46
Boys ages	14 – 18	52
Women ages	19 – 70+	46
Men ages	19 – 70+	56

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Different types of proteins

There are many different types of proteins in our bodies.

1. Enzymes : are proteins accelerate metabolic processes in your cells liver functions, stomach digestion, blood clotting and converting glycogen to glucose .for example pepsin is a digestive enzyme in your stomach that helps to break down proteins in food ,that your body can easily absorb.

2.Hormones are protein-based chemicals secreted by the cells of the endocrine glands.it transported through the blood, hormones act as chemical messengers that transmit signals from one cell to another. An example of a hormonal protein is insulin, which is secreted by the pancreas to regulate the levels of blood sugar in your body

3. structural proteins : are necessary components of your body . They include collagen, keratin. Collagen It has important roles, including providing structure to your skin and helping your blood clot and form connective tissue of your muscles, bones, tendons, skin and cartilage. Keratin is the main structural component in hair, nails, teeth and skin .

4. Defensive :Antibodies, or immunoglobulin, are a core part of your immune system, keeping diseases at bay. Antibodies are formed in the white blood cells called(B lymphocyte or a B cell) , and attack bacteria, viruses and other harmful microorganisms, rendering them inactive

5.Contractile proteins : are involved in muscle contraction and movement, for example, Actin, Myosin, Myoglobin, Ferritin. **Actin, Myosin**, exist as filaments in muscles. When calcium ions are present the filaments slide over each other, causing the muscle to contract.

Myoglobin is a red pigment in muscles that binds to oxygen. myoglobin absorbs oxygen from hemoglobin and then releases it to the muscles, when they need to produce energy.

Ferritin is a protein in cells that stores iron and releases it when it's needed. Ferritin is found in the skeletal muscles and also in the liver, spleen, bone marrow, and other areas of the body.

7. Storage proteins : are mainly store mineral ions such as potassium in your body. **Iron**, for example, is an ion required for the formation of hemoglobin, the main structural component of red blood cells.

6.Transport proteins move molecules around our bodies, for example, hemoglobin which founded in red blood cell and transports oxygen through the blood to tissue cell. Fibrinogen founded in the plasma which is involved in the blood clotting process.

The clinical significations:

1.Hyperproteinamia cause: ارتفاع نسبة البروتين بسبب

a. Dehydration

b. Multiple myeloma (due to the formation of myeloma protein). (سرطان النخاع العظمي)

2. Hypoproteinemia cause: انخفاض نسبة البروتين بسبب:

a. Nephritic syndrome التهاب الكلية المزمن b. sever burns and extensive bleeding.

Blood proteins, also termed **plasma proteins**, are proteins present in blood plasma. They serve many different functions, including transport of lipids, hormones, vitamins and minerals in activity and functioning of the immune system. The three major fractions of plasma proteins are known. These fractions are separated as follows–

1. ALBUMIN

2. GLOBULINS : it is larger in size than albumin. They are divided into three main groups: alpha, beta, and gamma.

- a. Alpha-1 globulin. b. Alpha-2 globulin. c. Beta globulin.
- b. Gamma globulin. is classified to: IgA, IgD, IgM, IgE, IgG

The laboratory techniques used for separation proteins:

1. Salts or solvent fractionation: it is depend on change in solubility of protein so albumin soluble in sodium sulphite while globulin will precipitate .
2. Ultracentrifugation: depend on variation in molecular mass and molecular shape for proteins, when rotate with high velocity then will be separate each individually .
3. chromatography : depend on the difference in size ,shape, electric charge and the rate of flow protein through chromatography media.
4. Immunochemical analysis :is technique used for identification and analyze protein(antigen and antibody), it include Eliza
5. Electrophoresis.: it is mostly used, depend on its diffusion velocity in the electrical field to the difference of electrical charge density on the protein surface.

Measurement of protein:

Electrophoresis : Serum protein electrophoresis (SPEP) is a screening test that measures the major blood proteins by separating them into **five distinct fractions: albumin, alpha1, alpha2, beta, and gamma proteins.**

Purpose: Protein electrophoresis is used to diagnose a variety of diseases, such as **cancer, intestinal or kidney protein-wasting syndromes** متلازمه امراض الكليه, **disorders of the immune system,** **liver dysfunction** (ضعف الكبد)

The normal values:

Albumin = 4- 5.5 g/100ml serum

Globulin = 2.2 2.7 g/100 ml serum

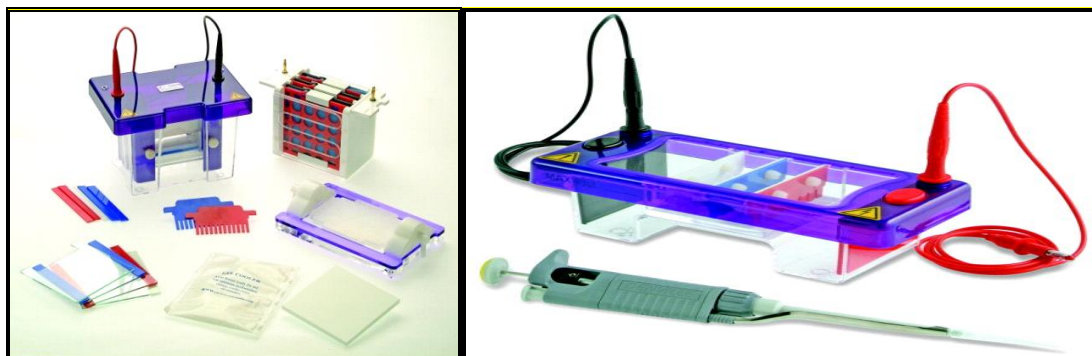
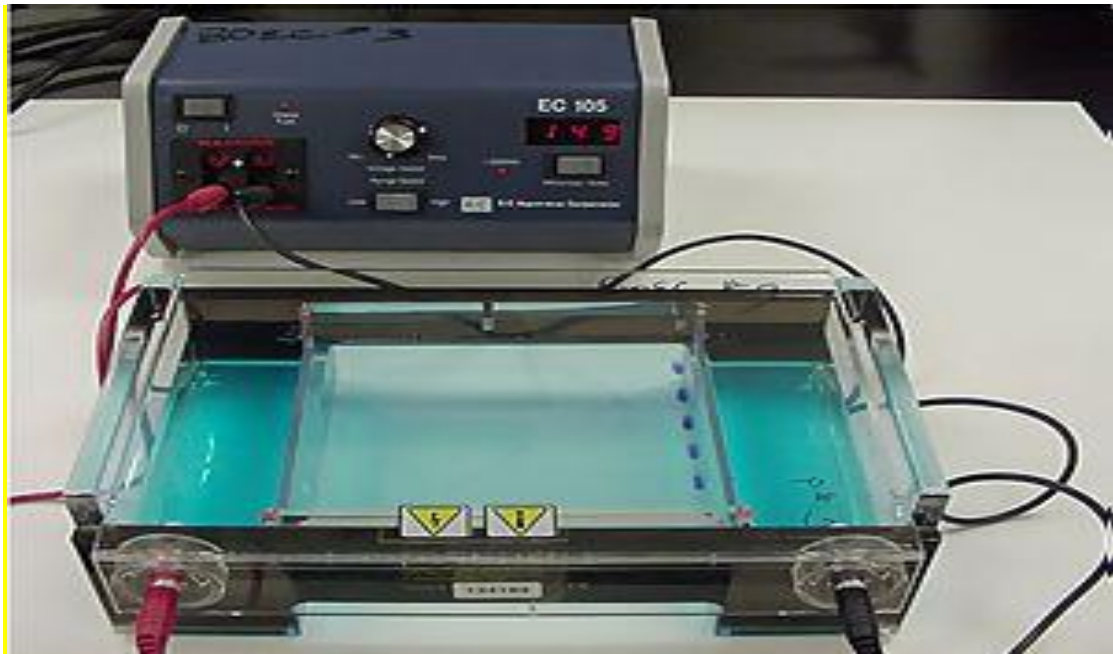
Total protein = 6.2 8.2 g/100 ml serum

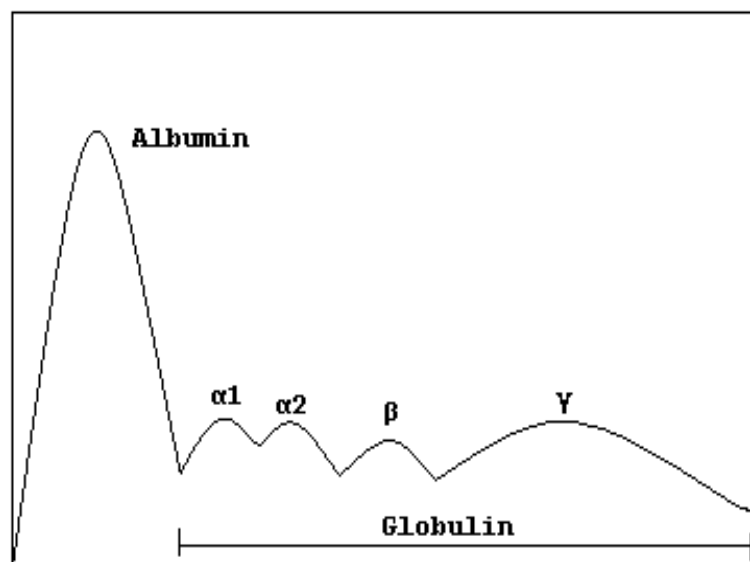
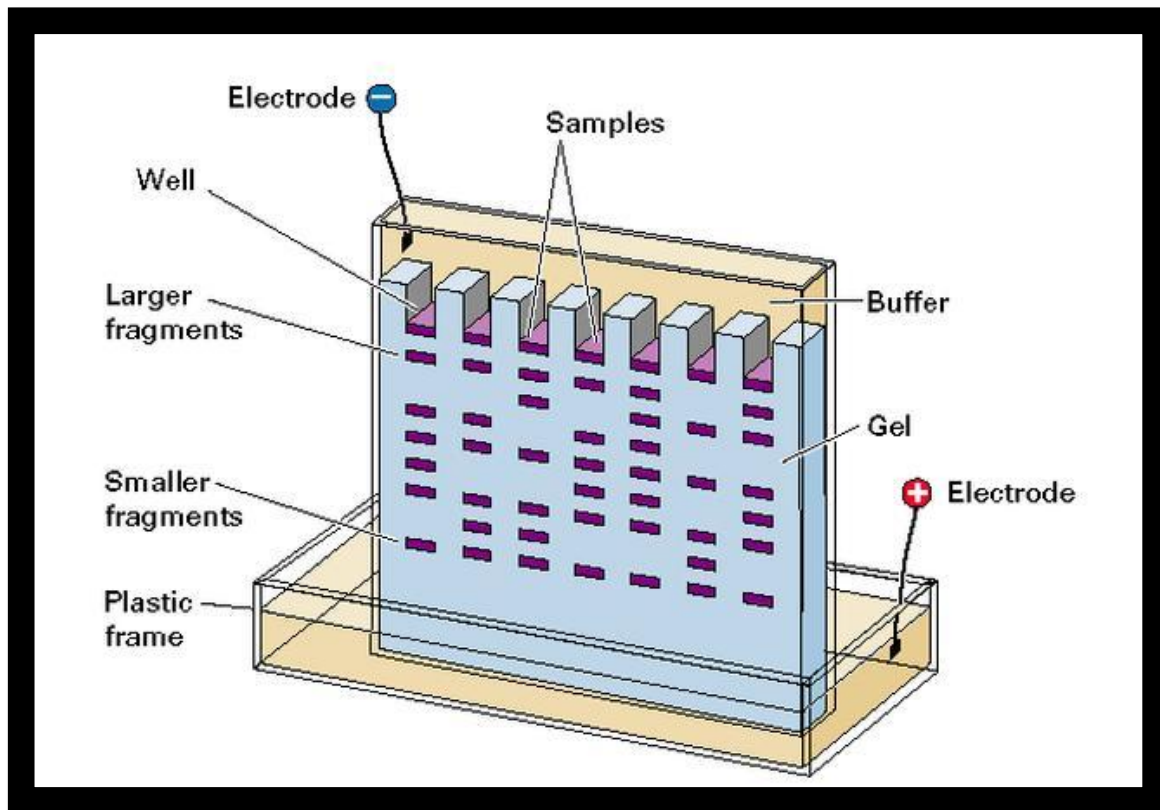
Electrophoresis components:

1. Two plastic tank for 500 ml of buffer solution with pH 8.6
2. Supporting medium (Poly acrylamide-gel)
3. Electrical electrode ,micropipette and combs

4. Power supply unit
5. Staining solution
6. Washing solution
7. Scanner

The principle of this test is : Proteins carry a positive or a negative electrical charge, and they move in fluid when placed in an electrical field and applying power supply with 200 mv and 10-15 mA for 45 min. Serum protein electrophoresis uses an electrical field to separate the proteins in the blood serum into groups of similar size, shape, and charge.





The normal value of protein separation

Separation of protein for different sample

