

Introduction of Biochemistry | Biochemistry & Clinical Pathology | Diploma in Pharmacy-I

- Biochemistry is the study of chemistry of living organism and deals with the structure and function of tissue cell Organelles and individual bio molecular.
- Biochemistry means chemistry of life.
- In biochemistry we also study about the chemical process in living organism.
- Biochemistry is helpful in the detailed study of structure and function of biomolecules (Carbohydrates, Proteins, Lipids, Minerals).
- Study about the various interaction of different biomolecular (Carbohydrates, Proteins, Lipids, Minerals).
- Study about the energy transformation in living cells organism.
- The study of natural of enzyme and working of enzymes and study of different types of enzymes.

Proteins

- **Proteins** are naturally occurring polymers made up of amino acids.
- Almost everything that occurs in the cells involves one or more Proteins.
- **Proteins** provide structure, cellular reaction and carried out the tasks.

Role of protein

- **Protein** perform difference role in the living system.
- **Proteins** which catalyze by your chemical reactions are called enzymes.
- Proteins are responsible for transportation of metabolites fructose, Glucose or Gases (like Oxygen, Carbon dioxide) are called transport proteins.
- **Protein** which are responsible for to protect from infection and other toxic substances are called antibiotics or defense proteins.
- **Proteins** which are required to give strength to cells or tissue are called structural proteins.
- **Proteins** which are required to carry out mechanical work are called **muscle proteins**.

Amino acids

20 amino acid are found in protein and they are called standard amino acid. These amino acids contain the carboxyl group and the amino group attached to α carbon.

Classification of protein

1. **Simple Proteins**
2. **Conjugated Proteins**
3. **Derived Proteins**

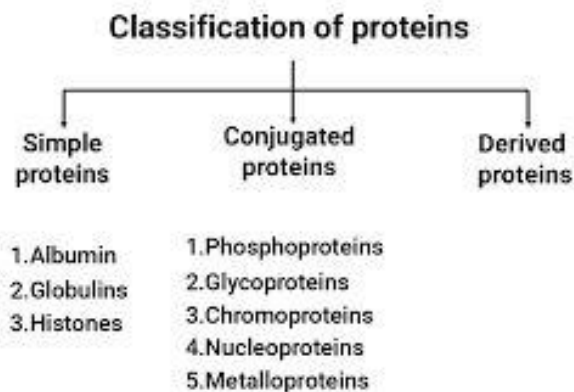


Fig: Classification of protein

1. **Simple Proteins:-** *Simple protein* contain only amino acid residue and other intimately bound material.
2. **Conjugated Proteins:-** *Conjugated proteins* contain in addition to polypeptide chain others substance or groups which impart characteristics properties.
3. **Derived Proteins:-** *Derived protein* are derived from partial to complete hydrolysis from the simple or conjugated *proteins* by the action of acids, alkalis or enzymes.

Qualitative tests of Proteins:-

1. Heat test:-

- When protein solution is heated in boiling water both the protein get co-angulated and lose their biological activity.
- This is called thermal denaturation of proteins
- e.g. – Boiling water.

2. Test with trichloroacetic acid (TCA)-

- *TCA* is normally used to precipitate proteins from their solution. *TCA* denatures the proteins.

3. Biuret Test:-

- *Biuret reagents* consists of copper sulphate in an *alkaline medium* when proteins are treated with **Biuret reagent** it's shows a *violet colour*.

4. Hydrolysis Test:-

- *Proteins* on hydrolysis gives free amino acids Hydrolysis can be carried out by acids like HCL, H₂SO₄, etc. Or Alkalis like – NaOH, KOH etc.

5. Xanthoprotic test:-

- Nitration of aromatic amino acids of protein give yellow colour concentrated nitric acid is used for Nitration.

6. Millon's Test:-

- Phenolic group of tyrosine of proteins react with mercuric sulphate in the presence of sodium nitrate and sulphuric acid to give red colour.

7. Precipitation test:-

- Protein are Precipitated by using different agents the common precipitation agents are salt, Organic solvent heavy metal ion, acids etc.
- **Salt – Ammonium sulphate, Sodium chloride.**
- **Acids – Trichloroacetic acid (TCA), Acetic acid, Hydrochloric acid.**
- **Organic solvents – Acetone alcohol**
- **Heavy metal ions – Ammonium molybdate, Copper or Mercury salts.**

Biological value:-

- *Proteins* give amino acids on hydrolysis during digestion and blood Amino acids are the building blocks required for a cell to synthesis of *proteins*.

Biochemical importance of proteins:-

- **Proteins** are the structural component of protoplasm cell and tissues.
- Enzymes and few hormone are Proteins in nature antibiotics, hemoglobin are also Proteins.
- **Protein** is one of the important components of diet it is required to maintain growth and healthy functioning of the body.

Protein are also classified and nutritional basic.

1. **Complete Proteins:** – **Proteins** which contain all the essential amino acids in required quantity are called complete **Proteins**.
2. **Incomplete Proteins:-** **Proteins** not containing all the essential amino acid are called incomplete protein.

Protein deficiency:-

- We know that proteins are required for several Vital process in the body.
- Naturally a low intake of proteins in result in deficiency symptoms such condition that are developed may be due to low dietary intake.

Protein deficiency disease:-

A) Kwashiorkor:

- The symptoms of the diseases slow down the growth, edema and change in skin, hair pigmentation and texture.
- Frequently there is liver enlargement there is vomiting and diarrhea and stools contain much undigested food.
- The course of this disease due to large family size, poor mental health, poor environmental conditions and delayed supplementary feeding.

Note:- This disease appears most commonly in children between the ages of 1 to 4 year.

B) Nutritional edema:

- It result from long contained loss of protein and usually occurs in famine areas. The Proteins deficiency in adults is very rare.
- The deficiency symptoms include loss of weight reduced fat ammonia, infections, frequent loose stools delay in healing of wounds and Edema.
- Use of soybean, milk and eggs and other nutritious diet can cure the Protein deficiency syndrome in adults.
- Deficiency of protein shows different changes in body.

C) Marasmus:

- It is a disease of infants below one year of age.
- It's cause is Proteins and carbohydrate or other nutritional factor deficiencies.
- Proteins and energy deficiency disease is also known as **Marasmus kwashiorkor**.
- **Marasmus** is more likely to occur in poor people.

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- The cause of this disease is due to the delayed breast feeding.
- Providing diet rich in colors, proteins and other nutritional factors is the best course in preparation and cure of the *Marasmus*.

Amino acids

- *Amino acids* are building blocks of protein.
- *Amino acids* are compound that contain an amino group and carboxyl group and the amino group attached to alpha carbon.
- The key elements of an *amino acid* are Carbon (C) Hydrogen (H) Oxygen (O) and nitrogen (N).
- There are 20 *amino acids* at present in our body in which 9 **Essential** and 11 **Non-essential amino acids**.

Essential Amino Acids:-

- The amino acids which cannot be synthesized in the body but are required for normal function of body are called as *essential amino acids*.
- These amino acids should be supplied through diet.

Non-essential amino acids:-

- The amino acids which are synthesized in the body are called as *non-essential amino acids*.

Essential Amino Acids		Non-essential amino acids
1	Valine	Alanine
2	Histidine	Asparagine
3	Leucine	Aspartic acid
4	Phenylalanine	Cysteine
5	Tryptophan	Glutamic acid
6	Lysine	Glutamine
7	Arginine	Glycine
8	Methionine	Cysteine
9	Threonine	Proline
10	Isoleucine	Serine

A) Physical properties of Amino acids:

1) Solubility :

- All amino acids are Soluble in water but their Solubility varies to a great extent.
- Solubility depends on the nature of R- group. i.e. polarity of the amino acid.
- Polar amino acids are highly Soluble in water.
- Non-polar amino acids are highly Soluble in organic solvents like chloroform, ether etc.

2) Optical activity:

- All standard amino acid except glycine have an asymmetric carbon atom due to this amino acids are optically active.

3) Acid and Base behaviour:

- Amino acids contain the acidic carboxyl group (-COOH) and the basic group amino (-NH₂) Hence amino acids are called as amphoteric molecules or ampholytes (i.e. *Amphoteric electrolytes*)

B) Chemical properties of Amino acids

1. Ninhydrin reaction:

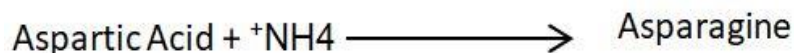


2. Reaction with Dansyl chloride :



3. Reaction with Carboxyl group:

a. Amide Formation:



Chemical properties of Amino acids

Polypeptides:

- polypeptides are a chain of amino acids.

- All Proteins are polypeptides.
- 500 or more than 500 amino acids held together by peptide bond.

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