



Proteins

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Introduction

- ▶ Proteins are the high molecular weight polymers of a group of low molecular weight monomers called amino acids.
 - ▶ The amino acids joined by peptide bond.
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Biological importance

- ▶ Essential part for structures in body(structural proteins) e.g collagen of bones/cartilages, keratins of hair /nails.
 - ▶ Give energy to body when carbohydrates are not present. Calorific value -4cal/gm .
 - ▶ Act as catalysts, enhancing the rate of reactions.
 - ▶ Most of enzymes and hormones are proteins.
 - ▶ Serve as carrier for transport of substances.
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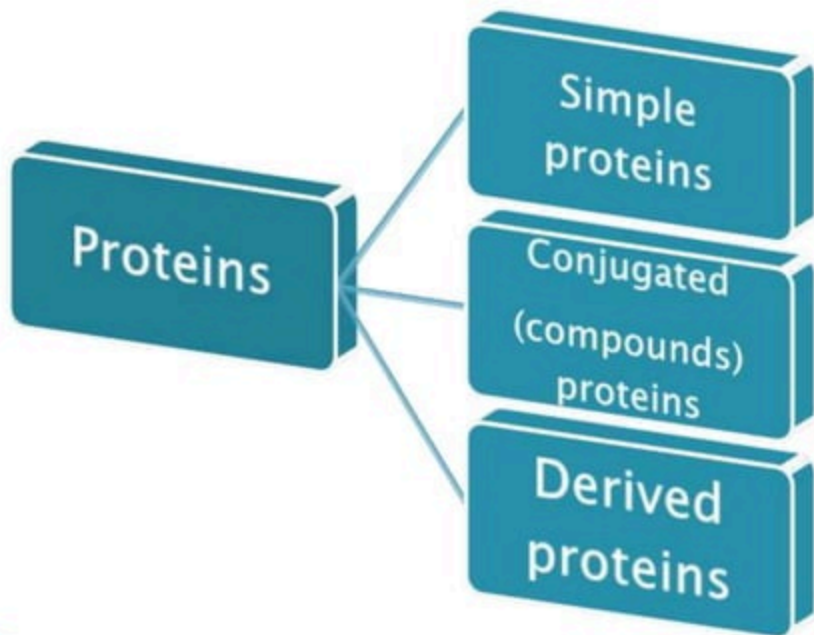
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- ▶ They bind with certain substances in body and store them in various tissues of body. (storage proteins) e.g ferritin
 - ▶ They act as antibodies (globulins) , provide immunity to the body.
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Classification of proteins

- ▶ Proteins can be classified into various types.
- ▶ There are three main classifications of proteins .
- ▶ 1) classification based on the *solubility and physical properties*
- ▶ 2) classification based on *functional properties*
- ▶ 3) classification based on *shape of protein molecules*.

1) Classification acc.to solubility/physical properties



Simple proteins


- ▶ Simplest form of proteins
- ▶ Easily soluble in solution
- ▶ E.g - albumins , globulins..

They form solutions with various acids and salts in body.

Conjugated proteins(compound)

- ▶ Simple proteins which are complexed with non protein substances.
- ▶ E.g- *nucleoproteins* → proteins + nucleic acid
Glycoproteins → oligosaccharides + proteins,
Phosphoproteins → phosphoric acid +.. ,
Lipoproteins → lipids + protein

Derived proteins

- ▶ Derived from the hydrolysis of simple and compound proteins.
 - ▶ E.g- fibrin from fibrinogen,
Proteoses derived from proteins by breakdown of peptide bonds.
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2) Classification based on functional properties

- ▶ *Structural proteins*– keratin of hair/nails, collagen of bones.
- ▶ *Contractile proteins*– actin ,myosin
- ▶ *Defence proteins*– immunoglobulins
- ▶ *Transport proteins*–haemoglobin
- ▶ *Catalytic proteins*– hexokinase
- ▶ *Storage proteins*–albumin
- ▶ *Hormonal proteins*– insulin,growth hormone(GH)

3) Classification based on shape of protein molecules

- ▶ Mainly two types of proteins based on the shape of molecules of proteins
 - 1) Globular proteins
 - 2) Fibrous/ fibrillar proteins.

Globular proteins–

they are relatively spherical or oval shape.
e.g– blood proteins, anti bodies..

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- ▶ Fibrous/fibrillar proteins–
they are long ribbon shaped or fibres in shape.
e.g– collagen, elastin, keratin..

Metabolism of proteins

- ▶ Proteins are made of amino acids.
- ▶ These amino acids are made up of C,H,O and N.
- ▶ The total amino acids in the body derived from the food or from breakdown of proteins, ultimately are excreted in the urine as UREA.
- ▶ The formation of urea is divided into 4 processes–
 - 1) Transamination
 - 2) Oxidative deamination

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3) Ammonia transport

4) Urea cycle

1) **TRANSAMINATION-**

Transamination involves the transfer of an amino group from an amino acid to another, to form a new amino acid.

- Transaminase enzyme helps in this reaction.
- Mainly takes place in liver, kidney, heart and brain.

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- ▶ **2) Oxidative Deamination–**

- it results in the liberation of the amino group as free ammonia (NH_3).

- these reactions occur mainly in liver and kidneys.

- they contain enzymes for deamination of amino acids.

▶ **3) Ammonia transport-**

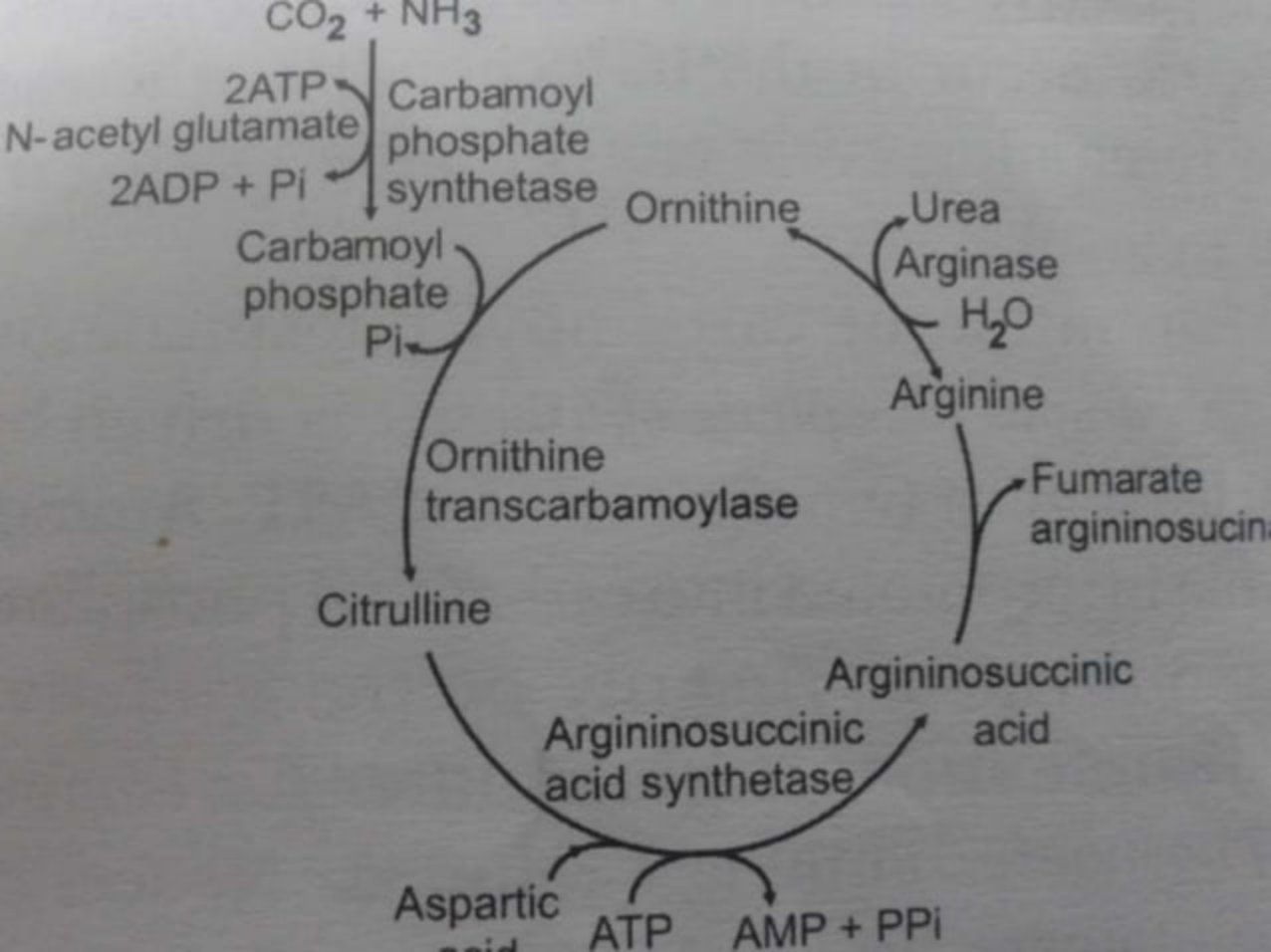
- the ammonia formed in the body must be kept at low levels in the blood, because even a slightly elevated concentrations are toxic to the CNS.
- this is due to the rapid removal of ammonia from blood.
- most of the ammonia formed in the kidneys ,is excreted into the urine as NH_4^+ .

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4) Urea formation (urea cycle) –

- ▶ The formation of urea mainly occurs in the liver.
- ▶ Urea is formed from the ammonia and carbon dioxide.
- ▶ This cycle occurs initially in mitochondria and later in the cytosol of the cell.



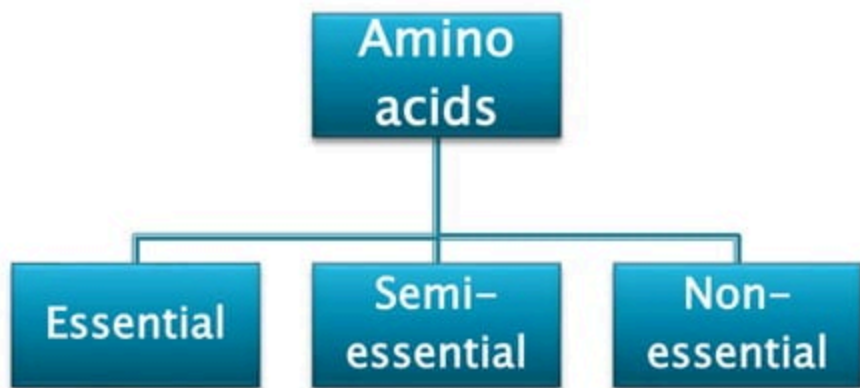


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- ▶ Urea produced in the liver cells and is transported in the blood to the kidneys, where it is filtered and excreted in the urine.

Classification of Amino acids


- ▶ It is important for us to understand the nutritional classification of amino acids.\
- ▶ The amino acids can be classified into three categories based on their nutritional aspects.



Essential amino acids

- ▶ These are the amino acids which are not synthesized by the body and therefore must be provided to the body through the diet.
 - ▶ E.g- phenylalanine, methionine, tryptophan etc..
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Semi-essential amino acids

- ▶ These are those amino acids which are not synthesized by the body in sufficient quantity during growth. So they are to be obtained from diet for growth of body.
 - ▶ These are known as growth promoting factors.
 - ▶ These are essential in growth of children and pregnant women.
 - ▶ E.g- arginine and histidine
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Non-essential amino acids

- ▶ These are those amino acids which can be synthesized by the body.
 - ▶ They are synthesized from the essential amino acids.
 - ▶ E.g- Glycine, Alanine, tyrosine etc.
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