

Tikrit University

College of Nursing

Basic Nursing Sciences



1st stage - 2023-2024

Biochemistry

(Lecture (4) Proteins)

by:

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The Proteins

The name protein is derived from Greek word Proteios which means first because proteins essential for growth and maintenance of life.

Proteins: are complex nitrogenous polymers present in all living matter, contain C,H,O and nitrogen, also contain sulfur, phosphorous, zinc, copper and iron.

-- are made up of hundreds or thousands of smaller units called amino acids which are attached to one another in long chains.

-- there are 20 different types of amino acids that can be combined to make a protein.

-- the sequence of amino acids determines each protein's unique 3-dimensional structure and its specific function.

We need protein in diet

1. repair cells and make new ones.

2. important for growth and development in children, teens, and pregnant women.

Amino acids

Amino acids : are organic acids containing an amino group (NH₂) and a carboxylic acid (COOH) group. The side chain can be, aliphatic, aromatic, heterocyclic, containing sulphur group .

All amino acids are L-amino acids configuration.

Proteins are made up of 20 amino acids in different sequences and numbers.

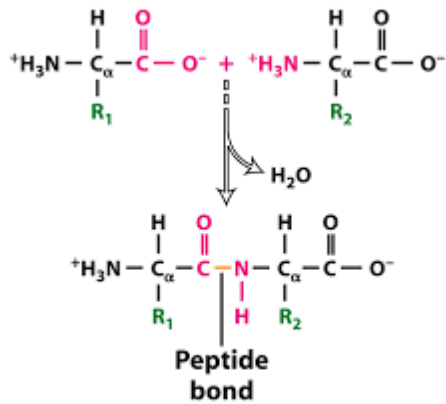
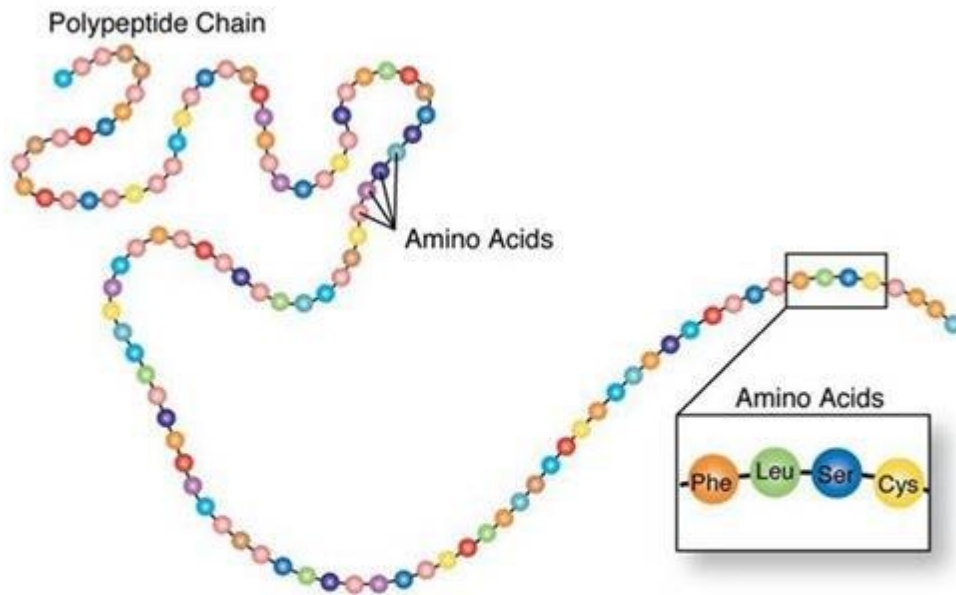
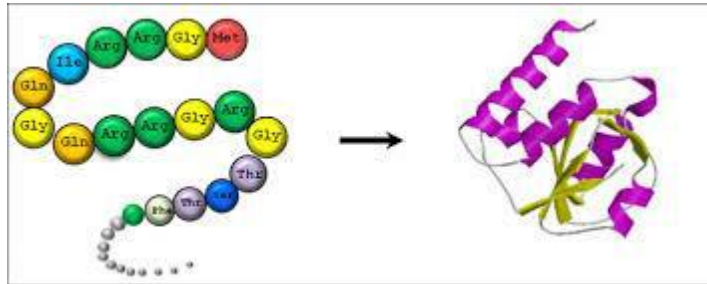


Figure 3-14
Molecular Cell Biology, Sixth Edition
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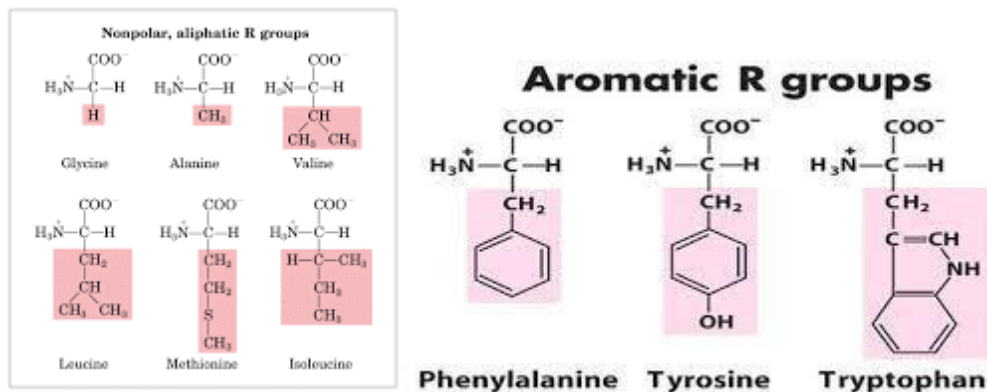
Amino Acids

Ala: Alanine	Gln: Glutamine	Leu: Leucine	Ser: Serine
Arg: Arginine	Glu: Glutamic acid	Lys: Lysine	Thr: Threonine
Asn: Asparagine	Gly: Glycine	Met: Methionine	Trp: Tryptophane
Asp: Aspartic acid	His: Histidine	Phe: Phenylalanine	Tyr: Tyrosine
Cys: Cysteine	Ile: Isoleucine	Pro: Proline	Val: Valine

Classification:

Amino acids are classified into three groups:

1. neutral amino acids: are the largest group which are divided into:
 - a. aliphatic amino acids (glycine, valine, alanine, leucine, isoleucine).
 - b. aromatic amino acids (tyrosine, phenylalanine).
 - c. heterocyclic amino acids (tryptophan, histidine).
 - d. sulphur containing amino acid (cystine , cysteine , methionine)
2. Acidic amino acids (aspartic acid , glutamic acid)
3. Basic amino acids (Lysine , arginine).



Essential amino acids : Amino acids are not synthesized in the body and are essential as constituents of tissue proteins , therefore it must be supplied in food. (valine, phenylalanine, lysine, tryptophan, leucine, isoleucine, methionine , methionine).



Functions or importance of amino acids

Amino acids are monomeric constituents of proteins peptides and many

1. Some amino acids converted to CHO , called as glucogenic a.a.
2. Some amino acid are converted to acetyl COA called ketogenic amino acids.
3. Glycine and cysteine help in synthesis of bile salts.
4. Thyroid hormone, epinephrine, nor epinephrine , and pigment melanine are synthesis from tyrosine.

Digestion and Absorption of Proteins:

Digestion:

A. In stomach : enzyme are: 1. Rennin 2. Pepsin

--Rennin is active in infants and is involved in curdling of milk (milk-clotting enzyme).

acts on casein converting it to soluble para casein, optimum PH=4.

--Pepsin is secreted from chief cells of stomach as inactive pepsinogen, optimum PH = 1.5-2.2, activated by HCL.

Role of gastric HCL.

1. It causes denaturation of proteins.
2. Converts proteins to meta proteins, which are easily digested.
3. Activate pepsinogen to pepsin.

pepsinogen HCL pepsin

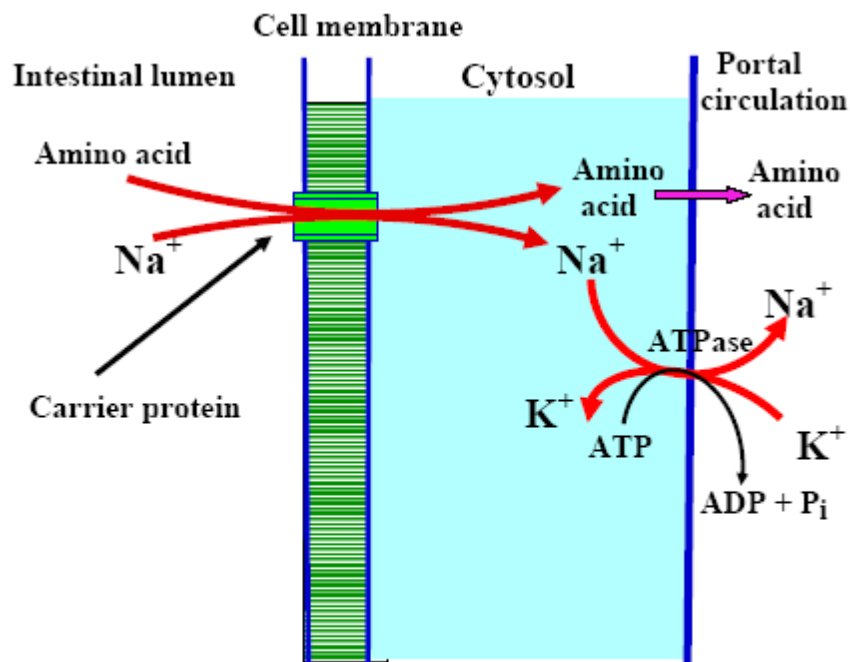
A.pepsinogen autoactivation pepsin

(the end products of proteins digestion in the stomach are proteases, peptones, and Large polypeptides).

B. Pancreatic juice : contain trypsin , chymotrypsin , elastas etc .

C. Intestinal juice: complete digestion of the small peptides to amino acids.

Absorption of amino acids: is mainly in small intestine, the process require of an energy.



Carrier Protein Transport System

Dynamic Equilibrium:

It means there are balance in synthesis and Break down of tissues (protein).

All tissues and blood have constant 1. composition and 2. size of proteins

In man 70 k gm, about 400 gm of protein is synthesized daily and much is also degraded.

Nitrogen balance: means amount of nitrogen intake in food (mainly as protein) is equal to the amount of nitrogen excretion in urine as urea, uric acid, creatinine.

ex: healthy adult.

Positive nitrogen: means amount of nitrogen intake in food is more than nitrogen excretion in urine.

ex: growing periods, pregnancy, adolescence

Negative nitrogen: means nitrogen intake in food is less than nitrogen excretion in urine. ex: starvation, malnutrition, low protein intake, old age.

Pathway of protein metabolism

1. Anabolism: synthesis of
 - a. tissue proteins, blood proteins, enzymes, hormones.
 - b. synthesis of non protein nitrogen compound.
like creatinine , urea, purine, pyrimidine.
2. Catabolism: break down
 - a. transamination b. oxidative deamination
 - c. decarboxylation d. formation of urea
 - e. utilization of nitrogen to glutamine

Amino acids in the blood:

All amino acids occur in blood in varying concentration.

In post absorptive state: 30-50 mg/ dl of total amino acids is present in the blood(amino acid contain 4-5 mg/dl of nitrogen).

Following protein containing meal: the total level of amino acids rise to 45-100 mg/dl and(amino acid nitrogen 6-10 mg/dl).

Amino acids in the tissues:

The amount of amino acids in tissues at any moment = amino acids absorbed from intestine(diet) + amino acids result from break down of tissue.

In starvation: The amount of amino acids increased in tissue due to tissue break down only because no absorption from intestine (no diet).

Catabolism of amino acids

Proteins from diet and tissue, break down in to the amino acids.

Amino acids keto acids + NH₃

NH₃ urea , creatinine, uric acid, etc---

new a.as (non essential a.as).

Keto acid TCA cycle CO₂ + H₂O

glucogenic a.as (Glucose)

ketogenic a.as (Acetyl CoA)

glucogenic a.as ketogenic a.as glucogenic and ketogenic a.as

valine, serine, glycine, leucine isoleucine, lysine, phenylalanine,

alanine , cystine , cysteine, tyrosine, tryptophan

therionine,metionine, histidine , arginine.