Tikrit University

College of Nursing

Basic Nursing Sciences

1st stage - 2023-2024

Biochemistry

(Lecture (5) Metabolism of amino acids)

by:

MSc. Reemy Marwan Mohammed saleh

Metabolism of amino acids

1. Transamination: transfer of NH2 group from one amino acid to

keto acid resulting in the formation of new amino acid and new keto acid.

Importance: 1. synthesis of any non essential amino acids body needs.

2. convert excess amino acids to α-keto acids to make control blood level amino acids.

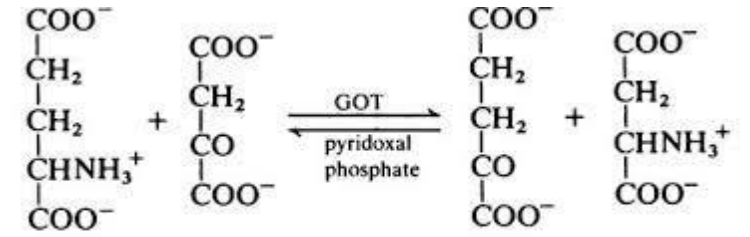
Examples:

L-gl utamic acid + oxaloacetic acid sGOT or AST α -keto-glutaric acid

+ L-aspartic acid

L-glutamic acid + pyruvic acid sGPT or ALT α -keto-glutaric acid

+ L-alanine



Glutamate Oxaloacetate 2-Oxoglutarate Aspartate

Enzymes Transaminase are:

1. Glutamate oxaloacetate transaminase (GOT) or Aspartate transaminase(AST). Increased in cardiac infraction and in liver cirrhosis.

2. Glutamate pyruvate transaminase(GPT) or Alanine transaminase(ALT).

Increased in liver diseases infective hepatitis.

2. Oxidative Deamination:

Removal of amino group from amino acids to form α -keto acid and ammonia(NH2). The enzyme is amino oxidase.

CH3–CH–COOH amino acid oxidase CH3—C—COOH + NH3

NH2 O

Alanine(amino acid) pyruvic acid (keto acid)

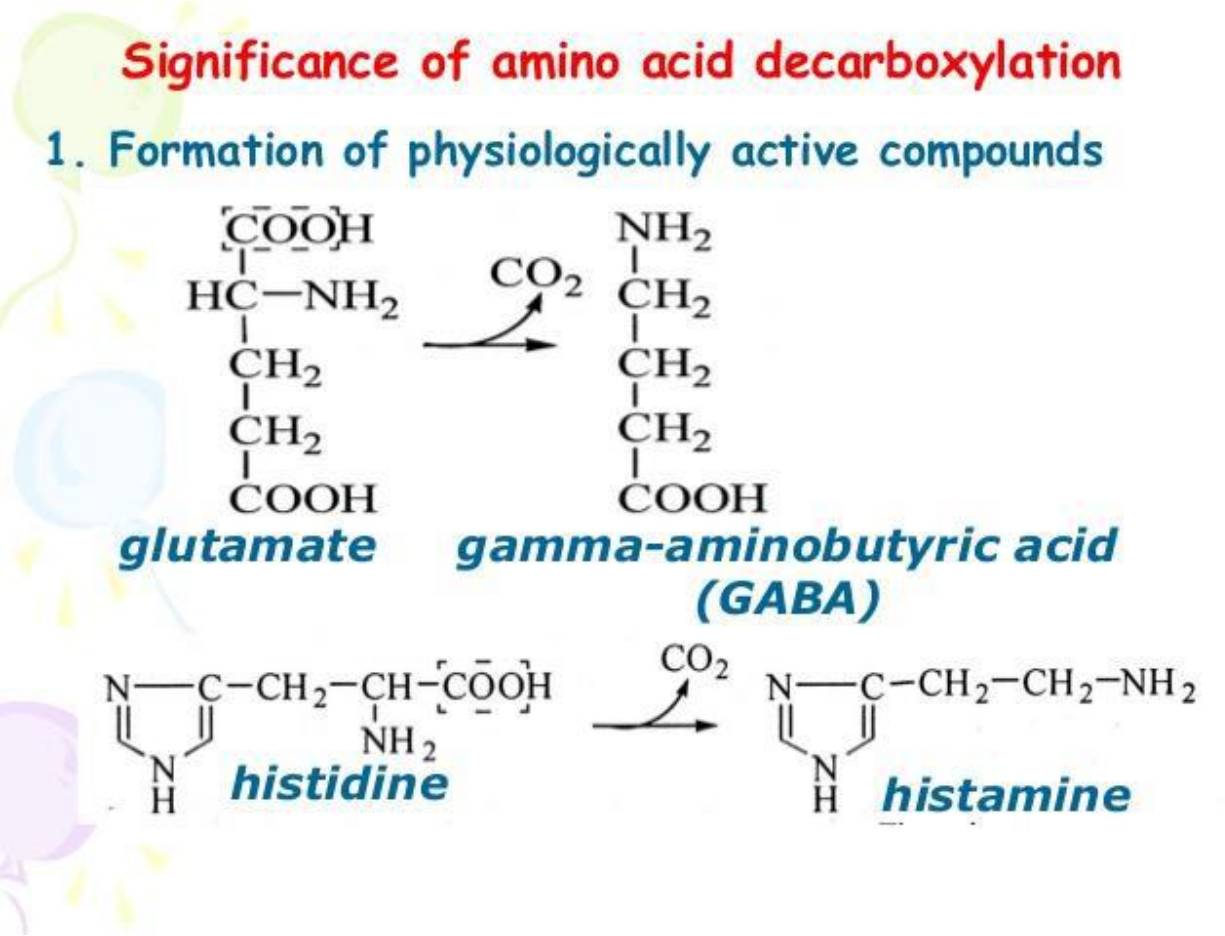
3. Decarboxylation: Removal of carboxyl group from amino acids gives rise to some of the biologically active amines. The enzyme is decarboxylase and phosphate as coenzyme.

histidine histamine (powerful vasodilator)

tyrosine tyramine (increase blood pressure)

glutamic acid amino butyric acid (stimulates neuronal activity).

tryptophan tryptamine



Blood Proteins: includes

1. Albumin(A) 2. Globulin(G) 3. Fibrinogen

Normal value:

A = 3.5 -5.0 mg/dl (53%)

G = 2.3 -3.5 mg/dl (47%)

Normal ratio A/ G = 1.2 / 1

Hyperproteinemia : increase level of plasma protein from their normal value (increase both A and G). is shown in :

1. dehydration

2. multiple myeloma.

3. after a stressful exercise. It is a physiological process without any disease.

4. Amyloidosis: in this condition there is an abnormal production of protein in the bone marrow. The condition is called amyloidosis. Liver, spleen and kidney are generally affected.

5. Inflammation in the tissues as it occurs in bacterial infection, or in burns, or due to certain diseases such as HIV and AIDs can give rise to increased protein level in the blood.

6. Kidney failure and eclampsia during pregnancy are known causes of hyperproteinemia.

Side Effects

1. high protein concentration in the blood causes extra burden for the kidney to filter it.

2. Kidney stones can form when there is too high protein level in blood for a long duration.

3. Dehydration: It occurs as a result of accumulation of ketones in the blood. The condition is referred as ketosis.

4. Osteoporosis is another side effect of too much of protein in blood.

Treatment: 1. eating vitamin C rich foods such as citrus fruits, and other vegetables will help the kidney to flush excess amount of protein in the blood

hypoproteienemia: decrease level of plasma protein from their normal value (decrease both A and G). A/G also decrease. Is shown in: 1. malnutrition 2. malabsorption

3. hemorrhage 4. kidney disorder 5. liver disease.

Side effect:

- muscle loss
- slowed growth
- weakened immune system
- weakened heart and lungs

A severe protein deficiency can be life-threatening.

Disturbance in protein metabolism:

Occur due to :

1. lower or inadequate protein intake(especially E.A.A).
2. Incomplete digestion and absorption of proteins.
3. Disorder in CHO and lipids metabolism.
4. Genetic impairment . Ex: abnormal hemoglobin, clotting factor deficiency).

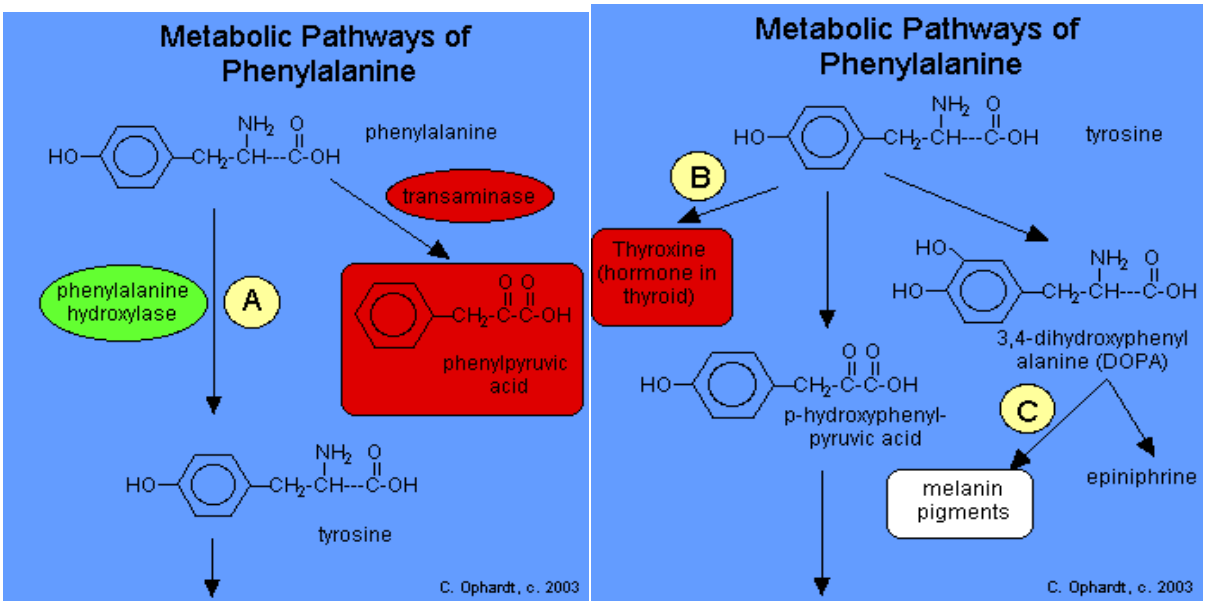
Inborn error metabolism of amino acids

1. phenyl ketonuria: accumulation of phenylketonic compound due to absence of enzyme phenylalanine hydroxylase in liver ,which responsible for conversion of phenylalanine into tyrosine lead to formation of phenyl pyruvic acid and phenyl acetic acid appear in urine.

Phenylalanine **hydroxylase** **Tyrosine** **(this condition is occur in children** associated with mental symptoms).

Phenyl pyruvic acid **appear in urine in high conc.**

Phenyl pyruvic acid



2. Tyrosinosis:

a rare condition resulting from a defect in amino acid metabolism and transmitted . It is characterized by the excretion of an excessive amount of parahydroxyphenylpyruvic acid tyrosyl metabolites in the urine. caused by defective formation of hydroxyphenylpyruvic acid oxidase or of tyrosine transaminase.

3. Albinism: Greek word, albino means, white. it is disease with an incidence of one in 20.000 population Albinism : is defect in melanin synthesis due to completely absent of tyrosinase enzyme. (the skin has low pigmentation and sensitive to UV rays, iris may be grey, hair white).

Tyrosine → tyrosinase → DOPA (3,4 di hydroxy phenylalanine) → Melanine