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AMINO ACID PHATHWAY AND ITS SIGNIFICANCE

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ABSTRACT

Amino acids are organic compounds that contain both amino and carboxylic acid functional groups. Although over 500 amino acids exist in nature, by far the most important are the 22 α-amino acids incorporated into proteins. Only these 22 appear in the genetic code of all life. Amino acid are organic compound containing amine (-NH2) and carboxyl(-COOH) functional groups along with side chaine(R). Many amino acids contains only carbon, hydrogen, oxygen and nitrogen but other atoms may be present sulphur such as cystine but some amino acids are aromatics such as phenylalanine or hetrocyclic such as proline (pyrrolidine nucleus), tryptophan (Indole nucleus), histidine (Imidazole nucleus). Therefore amino acid synthesis is the set of biochemical processes or metabolic pathway by which the amino acids are produced. All amino acids are drived from the intermediate glycolysis, citric acid cycle (Krebs cycle), or Pentose phosphate pathway. Nitrogen inter the pathway by Glutamate and glutamine. The remaining the essential amino acids obtained from the foods. Therefore the aim of review of amino acid pathway is to focus on the biosynthesis of several amino acids which are essential for the human life.

Keywords: Amino Acid, Biosynthesis, Metabolites, Glycolysis, Krebs Cycle.

I. INTRODUCTION

Amino acid synthesis is the set of biochemical processes (metabolic pathways) by which the amino acids are produced. The substrates for these processes are various compounds in the organism's diet or growth media. Not all organisms are able to synthesize all amino acids. humans can synthesize 11 of the 20 standard amino acids. These 11 are called the non-essential amino acids).[1]

An essential amino acid, or indispensable amino acid, is an amino acid that cannot be synthesized from scratch by the organism fast enough to supply its demand, and must therefore come from the diet of the 21 amino acids common to all life forms, the nine amino acids humans cannot synthesize are valine, isoleucine, ieucine, methionine, phenylalanine, tryptophan, threonine, Histidine and lysine.

These six amino acids are non-essential (dispensable) in human, means they can be synthesized in sufficient quantities in the body. These are cysteine, glycine, glutamine, Proline and tyrosine. Alanine, aspartic acid, asparagine, glutamic acid, serine, Selenocysteine (21st amino acid), Pyrrolysine (22nd amino acid).

Amino acids are molecules used by all living things to make proteins. Your body needs 20 different amino acids to function correctly. Nine of these amino acids are called essential amino acids. Essential amino acids must be consumed through the food you eat. Essential amino acids can be found in a variety of foods, including beef, eggs and dairy.

Table 1: Essential, conditionally essential and non-essential amino acids

Essential	Conditionally essential	Non-essential
Histidine (H)	Arginine (R)	Alanine (A)
Isoleucine (I)	Cysteine (C)	Aspartic acid (D)
Leucine (L)	Glutamine (Q)	Asparagine (N)
Lysine (K)	Glycine (G)	Glutamic acid (E)
Methionine (M)	Proline (P)	Serine (S)
Phenylalanine (F)	Tyrosine (Y)	Selenocysteine (U)

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Threonine (T)		Pyrrolysine* (O)
Tryptophan (W)		
Valine (V)		

What do amino acids do

Your body uses amino acids to make proteins. The different types of amino acids are involved in many important rolrs in your body. Amino acids help-

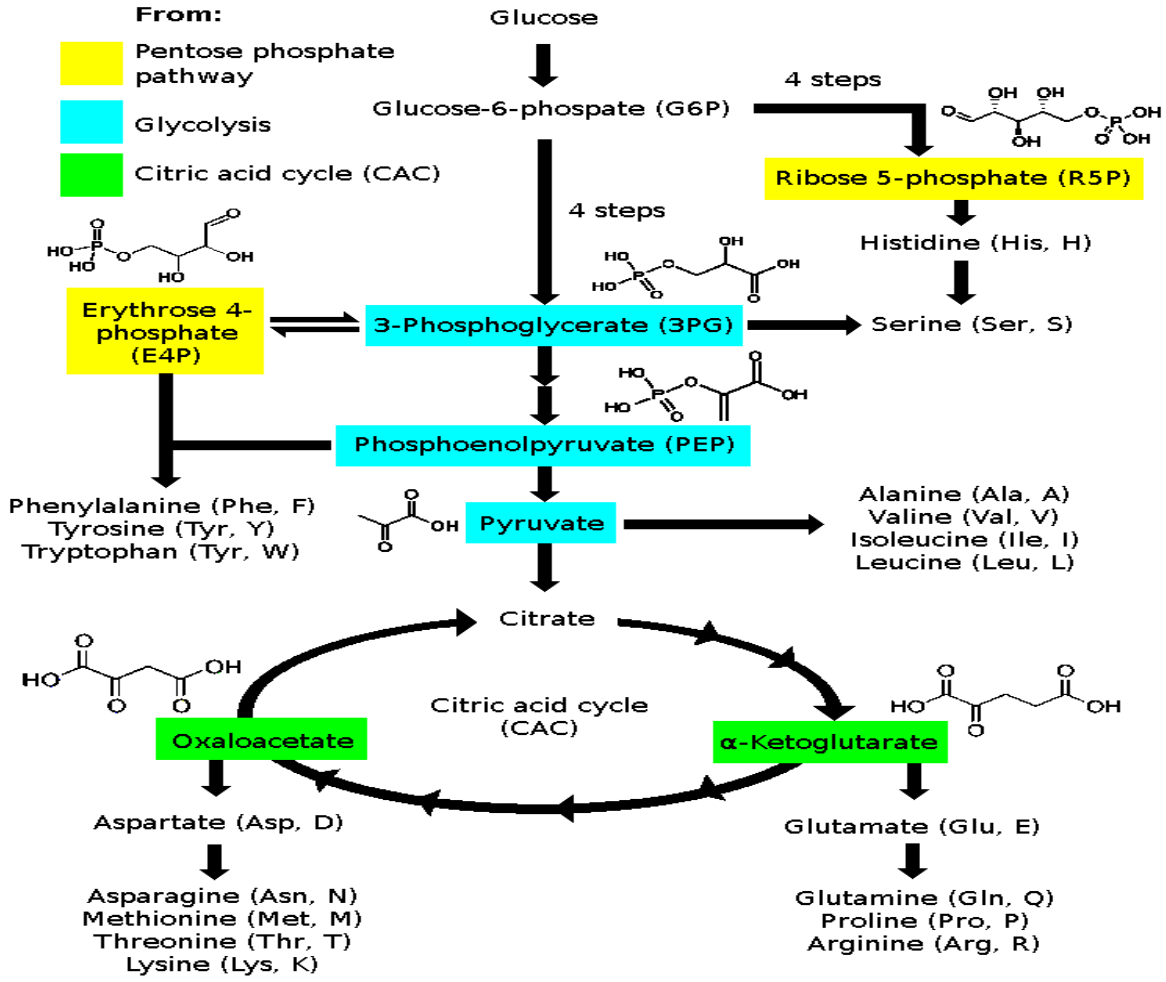
1. Break down food
2. Grow and repair body tissues.
3. Make hormones and brain chemicals (neurotrasmitters)
4. Provide an energy source.
5. Maintain healthy skin, hair and nails.
6. Boost your immune system.
7. Build muscle
8. Sustain a normal digestive system

II. METHODOLOGY

METABOLIC PATHWAY OF AMINO ACID (AMINO ACID PATHWAY)

Amino acid pathway is the metabolic pathway by which the amino acids are produced. The substrates for these processes are various compounds in the organisms diets are growth media.not all organisms are able to synthesize all amino acids. For example, human can synthesize 11 of the 20 amino acids. Theses are called the non- essential amino acids.

All the pathways start from glycolysis and krebs cycle (Citric acid cycle).



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Biosynthesis of glutamate, glutamine, Proline, arginine and histamine.

α-ketoglutarate is an intermidiate of krebs cycle which is involved in the process of biosynthesis of many amino acids.Most amino acids are synthesized from α-ketoacids, and later transaminated from another amino acid, usually glutamate. The enzyme involved in this reaction is an aminotransferase. α-ketoacid + glutamate ⇄ amino acid + α-ketoglutarate, Glutamate itself is formed by amination of α-ketoglutarate: the glutamate is also involved in synthesis of proline.

Biosynthesis of phenylalanine, tyrosine, and tryptophan from erythrose 4 phosphate and phosphoenolpyruvate.

Phenylalanine, tyrosine, and tryptophan, the aromatic amino acids, arise from chorismate. The first step, condensation of 3-deoxy-D-arabino-heptulosonic acid 7-phosphate (DAHP) from phosphoenolpyruvate (PEP) and erythrose-4-phosphate (E4P). Tyrosine and phenylalanine are biosynthesized from prephenate, which is converted to an amino acid-specific intermediate. This process is mediated by a phenylalanine (PheA) or tyrosine (TyrA) specific chorismate mutase-prephenate dehydrogenase.

PheA uses a simple dehydrogenase to convert prephenate to phenyl-pyruvate, while tyrosine (TyrA) uses a NAD-dependent dehydrogenase to make 4-hydroxylphenylpyruvate. While tryptophan biosynthesis involves conversion of chorismate to anthranilate using anthranilate synthase. This enzyme requires either glutamine as the amino group donor or ammonia itself. Anthranilate synthase enzyme.

Biosynthesis of lysine, asparagine, methionine, threonine, and isolucine

It starts from the intermediates of krebs cycle oxaloacetate and synthsize amino acids via lysine, asparagine, methionine, threonine and isoleucine, through aspartate. The biosynthesis of aspartate involved the transamination of oxaloacetate, later, the enzyme aspartokinase, which catalyzed the phosphorylation of aspartate and initiates its conversion into other amino acids. Lysine is synthesized from aspartate via the diaminopimelate (DAP) pathway, the biosynthesis of asparagine originates with aspartate using asparagine synthase. The aspartate produces key intermediate aspartate 4 semialdehyde, which later branched to produce methionine. By utilizing similar intermediates the threonine and isoleucine produced sebsequently.

Biosynthesis of serine, glycine, cysteine

In the biosynthetic pathway originated from 3-phosphoglycerate of glycolysis, serine is the first amino acid produced in the chain. The enzyme phosphoglycerate dehydrogenase is key intermediate. The availability of enzyme is regulated by the conc. Of serine in the cell. Serine is then modified to produce other amino acids glycine and cysteine.

Biosynthesis of alanine, valine, and leucine

Pyruvate: alanine, valine, and leucine. Pyruvate, the result of glycolysis, can feed into both the TCA cycle and fermentation processes. Reactions beginning with either one or two molecules of pyruvate lead to the synthesis of alanine, valine, and leucine.

III. CONCLUSION

The amino acid biosynthetic pathway of leads to understanding the reaction mechanisms of enzymes and organisms. There is scientific interest in continuing to investigate the biosynthesis of amino acids from several points of view such as application in food industry pharmaceuticals, and chemical industries, genetics, and health.

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