

7. RIBOFLAVIN (VITAMIN B2)

The two biologically active forms are flavin mononucleotide (FMN) and flavin adenine dinucleotide (FAD), formed by the transfer of an adenosine monophosphate moiety from ATP to FMN (Figure 28.15). FMN and FAD are each capable of reversibly accepting two hydrogen atoms, forming FMNH₂ or FADH₂. FMN and FAD are bound tightly-sometimes covalently-to flavoenzymes that catalyze the oxidation or reduction of a substrate.

Functions of FMN and FAD

They take part in oxidation reactions.

FMN is required for:

L-amino acid oxidase

Cytochrome C reductase.

FAD is required as coenzyme for:

Succinate dehydrogenase

Pyruvate dehydrogenase complex

α-ketoglutarate dehydrogenase complex

Xanthine oxidase

Riboflavin deficiency

Riboflavin deficiency is not associated with a major human disease, although it frequently accompanies other vitamin deficiencies. Deficiency symptoms include dermatitis, cheilosis (fissuring at the corners of the mouth), and glossitis (the tongue appearing smooth and purplish).

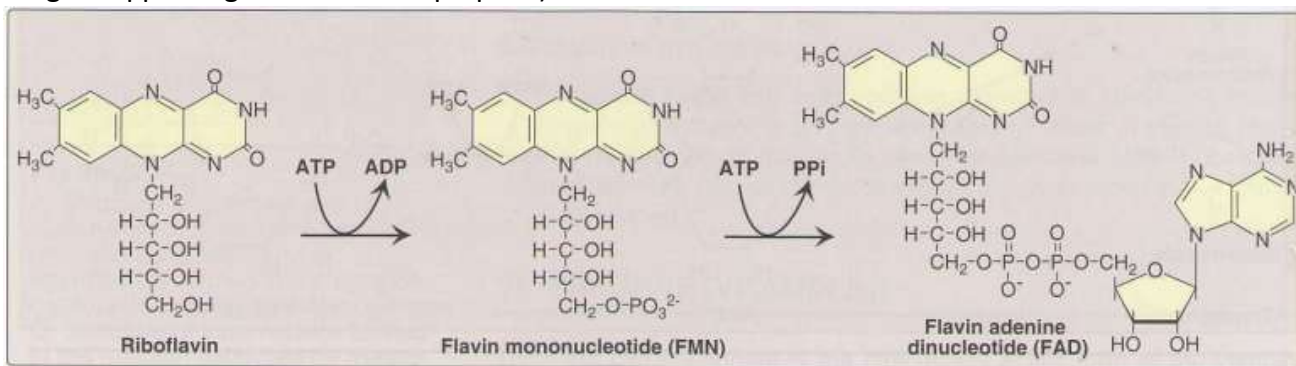


Figure 28.15

Structure and biosynthesis of flavin mononucleotide and flavin adenine dinucleotide.



Glossitis



Cheilosis

Sources of Riboflavin (Vitamin B2)

Animal liver, yeast, green leafy vegetables, milk and eggs.

Recommended Dietary Allowance of Riboflavin (Vitamin B2)

Adults: 2.0 mg/ day

Children: 1.2 mg/ day

Pregnancy and lactation: 2.0 mg/day.

8. BIOTIN (Vitamin B7)

Biotin also known as vitamin H or coenzyme R, is a water-soluble B-vitamin (vitamin B7), is a coenzyme in carboxylation reactions, in which it serves as a carrier of activated carbon dioxide (Figure 10.3, for the mechanism of biotin-dependent carboxylations). Biotin is covalently bound to the ϵ -amino groups of lysine residues in biotin-dependent enzymes (Figure 28.16). Biotin deficiency does not occur naturally because the vitamin is widely distributed in food. Also, a large percentage of the biotin requirement in humans is supplied by intestinal bacteria. However, the addition of raw egg white to the diet as a source of protein induces symptoms of biotin deficiency, namely, hair loss (alopecia), dermatitis, glossitis, loss of appetite, and nausea. Raw egg white contains a glycoprotein, avidin, which tightly binds biotin and prevents its absorption from the intestine. With a normal diet. however, it has been estimated that 20 eggs/day

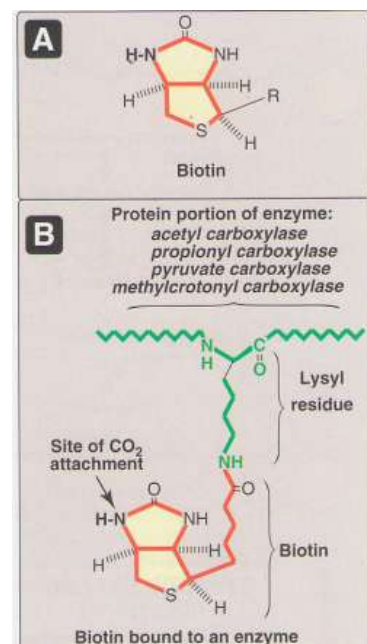


Figure 28.16

A. Structure of biotin. B. Biotin covalently bound to a lysyl residue of a biotin-dependent enzyme.

would be required to induce a deficiency syndrome.

Thus, inclusion of an occasional raw egg in the diet does not lead to biotin deficiency, although eating raw eggs is generally not recommended due to the possibility of salmonella infection.

Multiple carboxylase deficiency results from a defect in the ability to link biotin to carboxylases or to remove it from carboxylases during their degradation. Treatment is biotin supplementation.

Sources of Biotin

Egg yolk, organ meats (liver, kidney), milk, legumes and nuts.

Recommended Dietary Allowance of Biotin

Adults: 0.3 mg/day

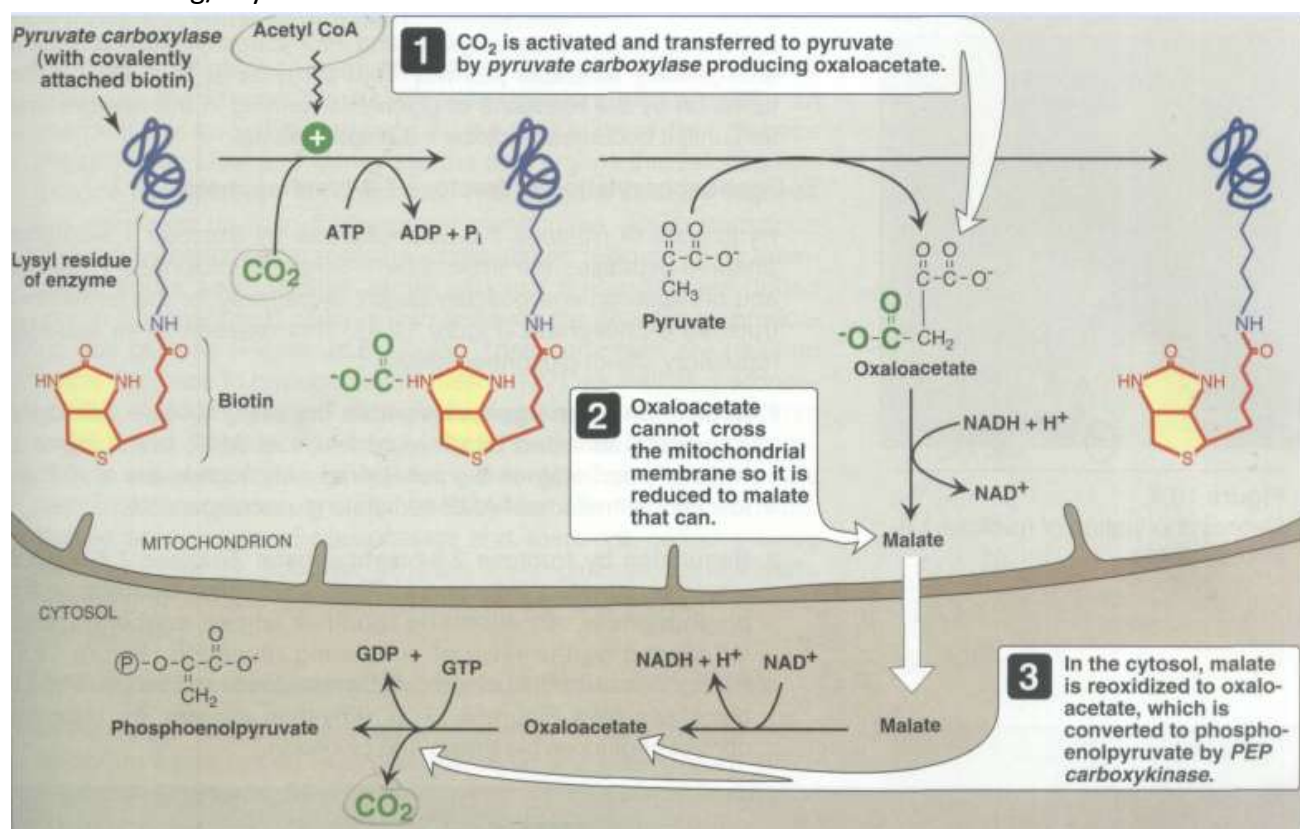


Figure 10.3

Activation and transfer of CO_2 to pyruvate, followed by transport of oxaloacetate to the cytosol and subsequent decarboxylation.

9. PANTOTHENIC ACID (VITAMIN B5)

Pantothenic acid or some time called vitamin B5 is a component of coenzyme A (CoA), which functions in the transfer of acyl groups (Figure 28.17). Pantothenic acid consists of a dihydroxy dimethyl butyric acid joined to α -alanine by a peptide bond. The coenzyme form is Coenzyme A (CoASH). Its reactive group is sulfhydryl

group (SH). CoASH or CoA is required to carry acyl compounds as activated thiol esters. Examples of such structures are:

- Pyruvate + CoASH $\xrightarrow{\text{Pyruvate dehydrogenase complex}}$ Acetyl CoA
- α -ketoglutarate + CoASH $\xrightarrow{\alpha\text{-ketoglutarate DH complex}}$ Succinyl CoA
- Fatty acid + CoASH $\xrightarrow{\text{Thiokinase}}$ Acyl CoA
- α -ketoacyl CoA + CoASH $\xrightarrow{\text{Thiolase}}$ Acyl CoA + Acetyl CoA

Pantothenic acid is also a component of the acyl carrier protein (ACP) domain of fatty acid synthase. Pantothenic acid deficiency is not well characterized in humans. However, deficiency of pantothenic acid is rare. When it is produced experimentally have the symptoms, fatigue, sleep disorders, weakness, abdominal cramp and a burning sensation of the feet.

Sources of Pantothenic acid

Eggs, animal liver, yeast, meat, milk, vegetables and grains.

Recommended Dietary Allowance of Pantothenic acid

Adults: 5-10 mg/day

Children: 4-5 mg/day

Infants: 1-2 mg/day.

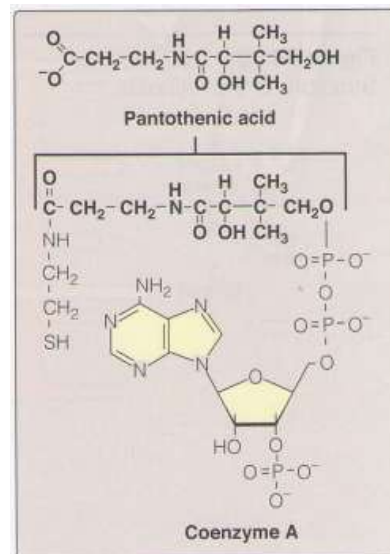


Figure 28.17
Structure of coenzyme A.