COENZYMES

J.H. Freeland-Graves, C. Bavik, in
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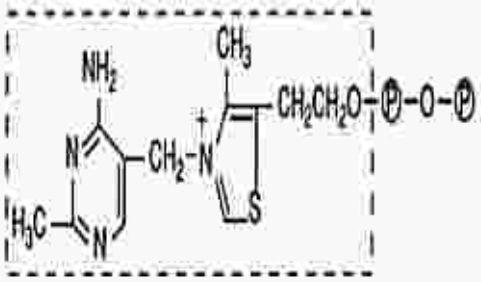
Vitamins

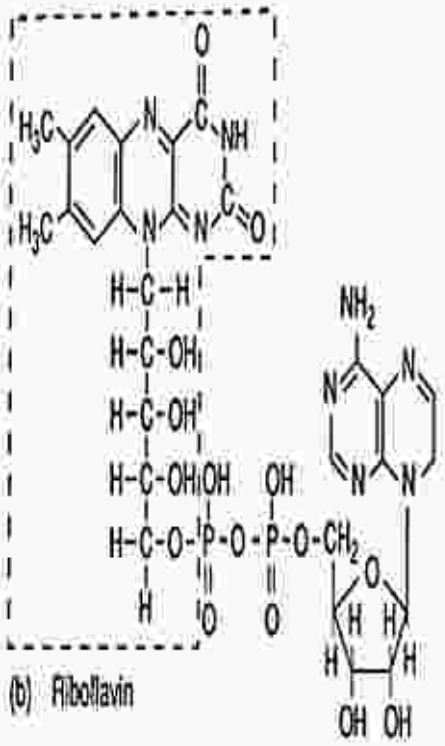
All of the water-soluble vitamins and two of the fat-soluble vitamins, A and K, function as cofactors or coenzymes. Coenzymes participate in numerous biochemical reactions involving energy release or catabolism, as well as the accompanying anabolic reactions (Figure 1). In addition, vitamin cofactors are critical for processes involved in proper vision, blood coagulation, hormone production, and the integrity of collagen, a protein found in bones. (*See* RETINOL | Physiology.)

The active coenzyme form of thiamin, vitamin B_1, is thiamin pyrophosphate (TPP) (Figure 2). TPP is involved in oxidative decarboxylation and transketolase reactions. An example is the decarboxylation (removal of $—COO^-$) of three-carbon pyruvate to two-carbon acetyl coenzyme A (CoA), an

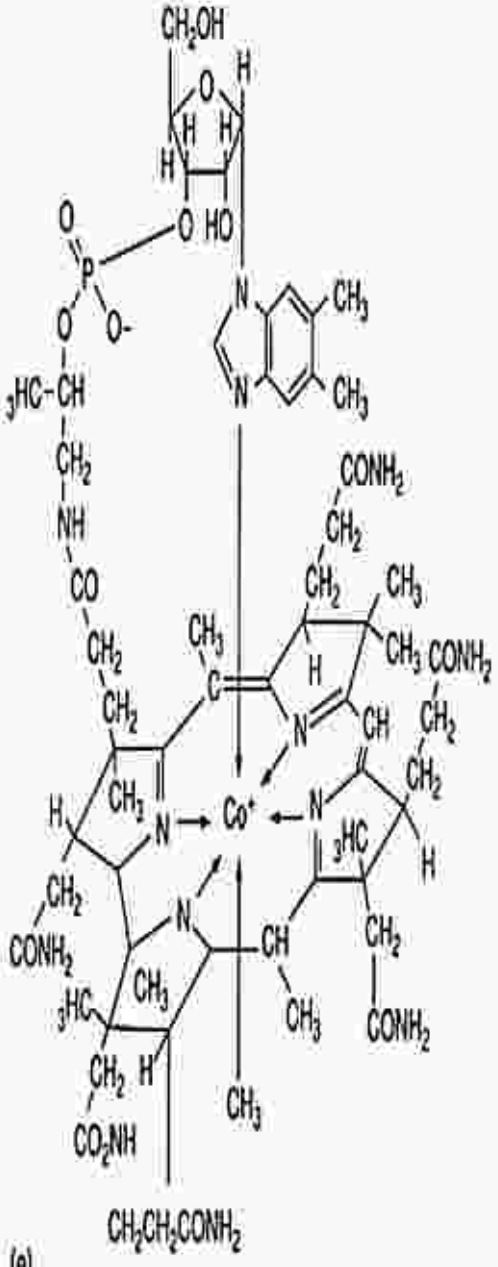
important step in carbohydrate breakdown. (*See* Thiamin | Physiology.)



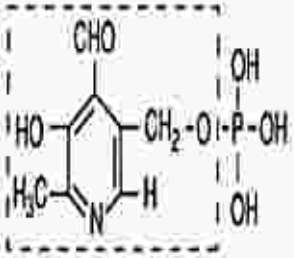
(a) Thiamin



(b) Riboflavin



(e)



(c) Pyridoxal

The active forms of riboflavin, vitamin B_2, are the coenzymes flavin mononucleotide (FMN; Figure 2) and flavin adenine dinucleotide (FAD). These coenzymes serve as hydrogen carriers for oxidation reactions that affect energy nutrients in the citric acid cycle and in the electron transport system. (*See* RIBOFLAVIN | Physiology.)

The coenzyme forms of nicotinic acid are nicotinamide adenine dinucleotide (NAD) and nicotinamide adenine dinucleotide phosphate (NADP). These compounds assist dehydrogenase enzymes in the catabolism of fat, carbohydrates, and amino acids, and in the enzymes involved in synthesis of fats and steroids and other vital metabolites. (*See* NIACIN | Physiology.)

Pyridoxal phosphate (PLP; Figure 2) and pyridoxamine phosphate (PMP) are the coenzyme forms of vitamin B_6. These are cofactors for approximately 120 enzymes, such as the transaminases, racemases, decarboxylases, cleavage enzymes, synthetases, dehydratases, and desulfydrases. Both PLP and PMP participate