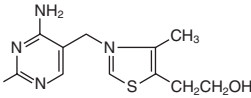
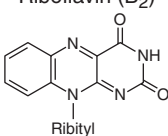
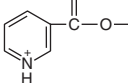
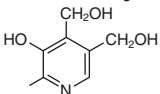
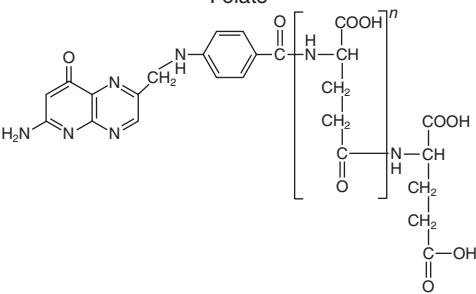
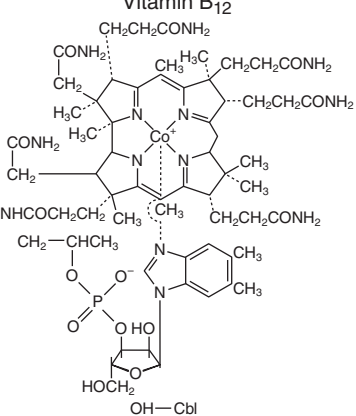


bariatric bypass surgery (*bariatric Wernicke*), and patients receiving chronic diuretic therapy (e.g., in hypertension or heart failure) due to increased urinary thiamine losses. Maternal thiamine deficiency can lead to infantile beriberi in breast-fed children. Thiamine deficiency could be an underlying factor in motor vehicle accidents and could be overlooked in the setting of head injury.

Thiamine deficiency in its early stage induces anorexia and non-specific symptoms (e.g., irritability, decrease in short-term memory).

Prolonged thiamine deficiency causes *beriberi*, which is classically categorized as wet or dry although there is considerable overlap between the two categories. In either form of beriberi, patients may complain of pain and paresthesia. *Wet beriberi* presents primarily with cardiovascular symptoms that are due to impaired myocardial energy metabolism and dysautonomia; it can occur after 3 months of a thiamine-deficient diet. Patients present with an enlarged heart, tachycardia, high-output congestive heart failure, peripheral edema,

Vitamin	Active derivative or cofactor form	Principal function
<p>Thiamine (B<sub>1</sub>)</p> 	Thiamine pyrophosphate	Coenzyme for cleavage of carbon-carbon bonds; amino acid and carbohydrate metabolism
<p>Riboflavin (B<sub>2</sub>)</p> 	Flavin mononucleotide (FMN) and flavin adenine dinucleotide (FAD)	Cofactor for oxidation, reduction reactions, and covalently attached prosthetic groups for some enzymes
<p>Niacin</p> 	Nicotinamide adenine dinucleotide phosphate (NADP) and nicotinamide adenine dinucleotide (NAD)	Coenzymes for oxidation and reduction reactions
<p>Vitamin B<sub>6</sub></p> 	Pyridoxal phosphate	Cofactor for enzymes of amino acid metabolism
<p>Folate</p> 	Polyglutamate forms of (5, 6, 7, 8) tetrahydrofolate with carbon unit attachments	Coenzyme for one carbon transfer in nucleic acid and amino acid metabolism
<p>Vitamin B<sub>12</sub></p> 	Methylcobalamine Adenosylcobalamine	Coenzyme for methionine synthase and L-methylmalonyl-CoA mutase

**FIGURE 96e-1** Structures and principal functions of vitamins associated with human disorders.