

Disciplina: SLC0673

Vitaminas

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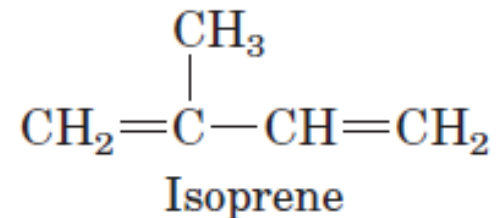
Vitamins

Vitamins, compounds that are essential to the health of humans and other vertebrates but cannot be synthesized by these animals and must therefore be obtained in the diet.

There are two general classes of such compounds:

- Soluble in nonpolar organic solvents (fatsoluble vitamins)
- and those that could be extracted from foods with aqueous solvents (water-soluble vitamins).

Eventually the fat-soluble group was resolved into the four vitamin groups A, D, E, and K, all of which are isoprenoid compounds synthesized by the condensation of multiple isoprene units.



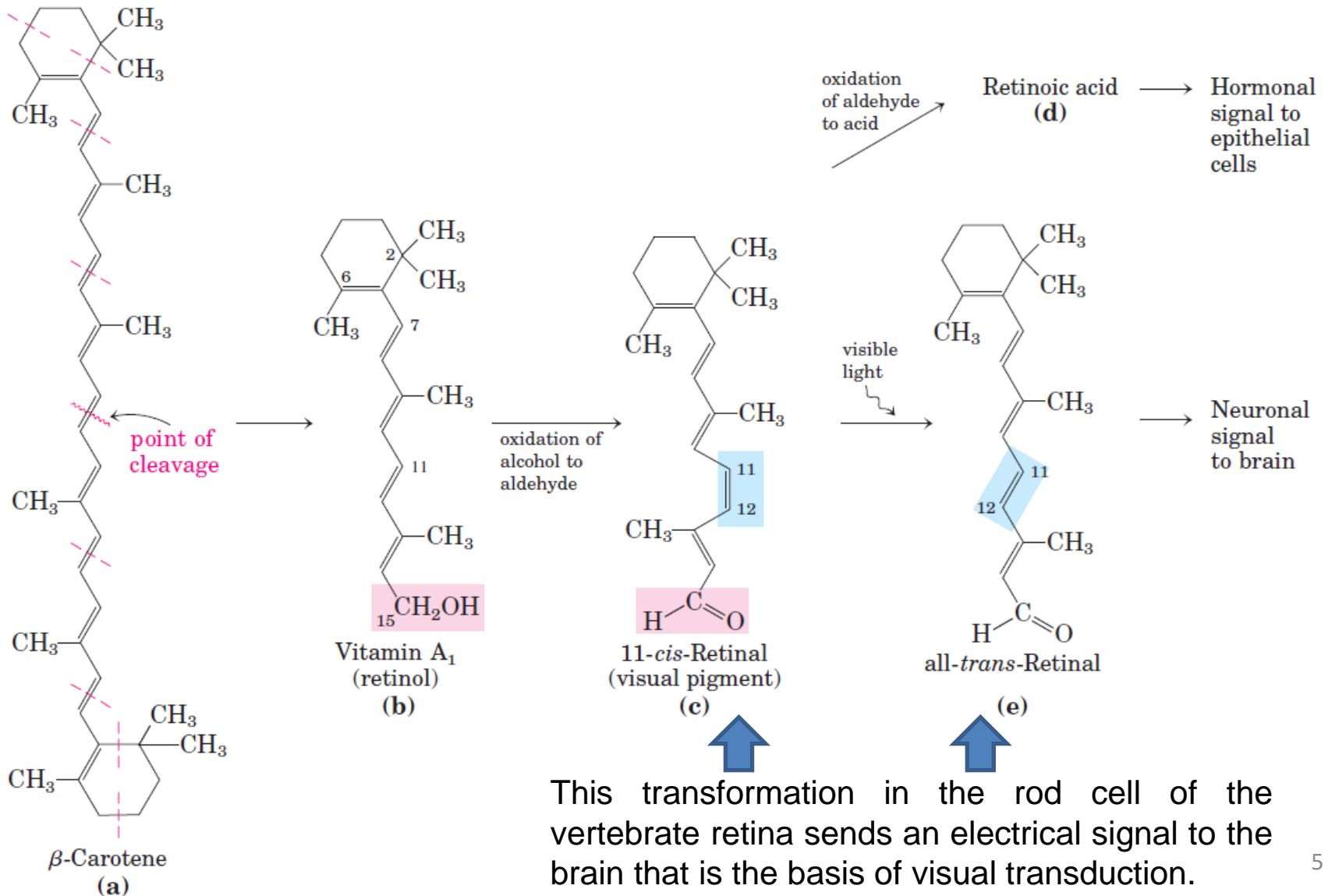
Fat soluble vitamins

Vitamin A

Vitamin A is a group of unsaturated nutritional organic compounds, that includes retinol, retinal, retinoic acid, and several provitamin A carotenoids, and beta-carotene.

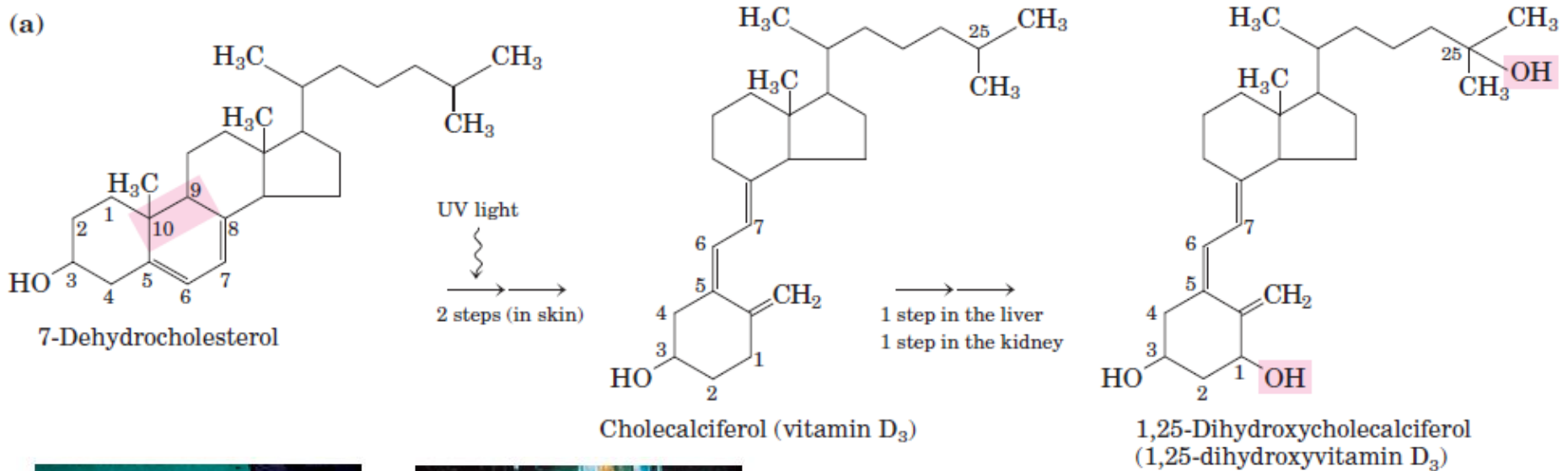
Deficiency of vitamin A leads to a variety of symptoms in humans, including dryness of the skin, eyes, and mucous membranes; retarded development and growth; and night blindness.

Vitamin A



Vitamin D₃

(a)



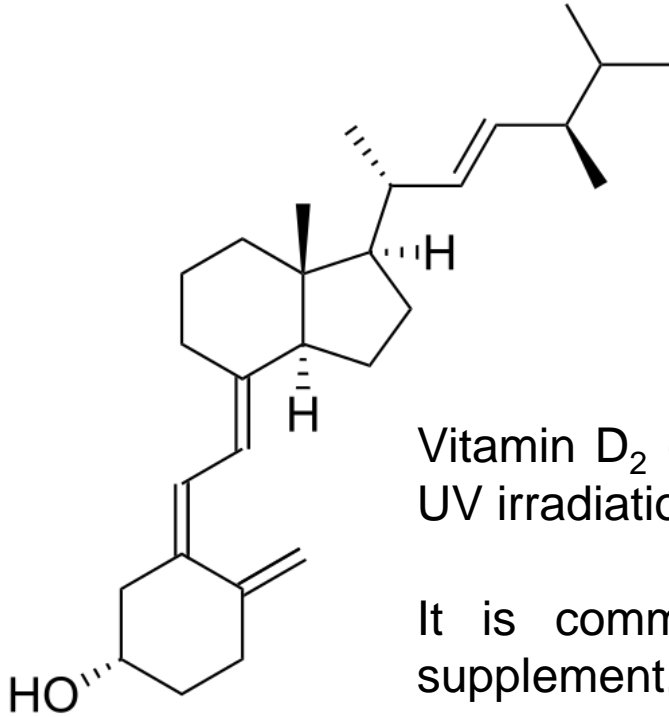
Before vitamin D treatment



After 14 months of vitamin D treatment

(bioactive)

Vitamin D₂



Vitamin D₂ (ergocalciferol) is a commercial product formed by UV irradiation of the ergosterol of yeast.

It is commonly added to milk and butter as a dietary supplement.

The product of vitamin D metabolism, 1,25-dihydroxycholecalciferol, regulates gene expression, for example, turning on the synthesis of an intestinal Calcium-binding protein.

Vitamin E

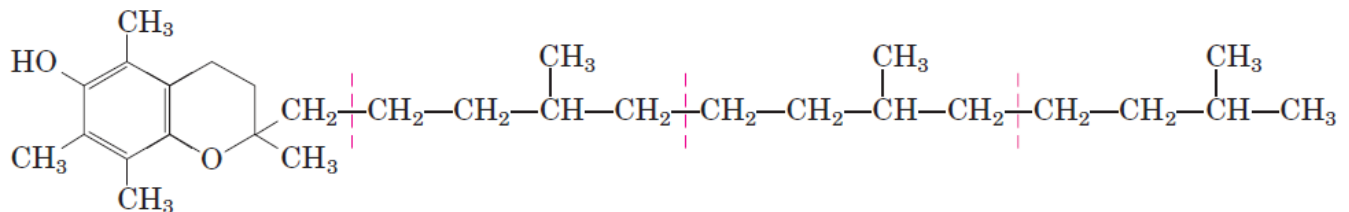
Vitamin E is the collective name for a group of closely related lipids called **tocopherols**, all of which contain a substituted aromatic ring and a long isoprenoid side chain.

Tocopherols associate with cell membranes, lipid deposits, and lipoproteins in the blood. They are biological antioxidants.

Tocopherols are found in eggs and vegetable oils and are especially abundant in wheat germ.

Laboratory animals fed diets depleted of vitamin E develop scaly skin, muscular weakness and wasting, and sterility.

(a)
Vitamin E: an antioxidant

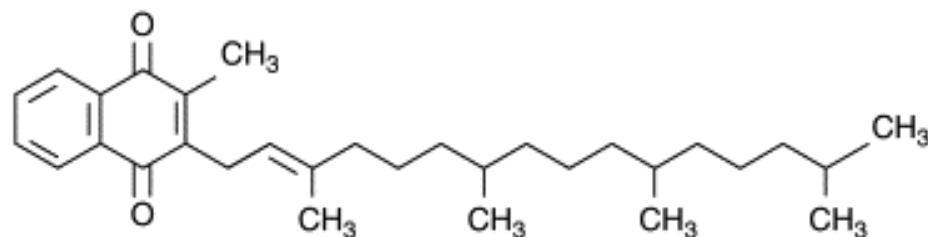


Vitamin K

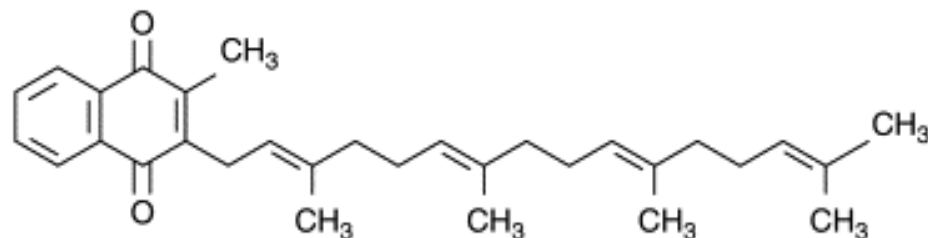
Vitamin K deficiency slows blood clotting, which can be fatal.

The aromatic ring of vitamin K undergoes a cycle of oxidation and reduction during the formation of active prothrombin.

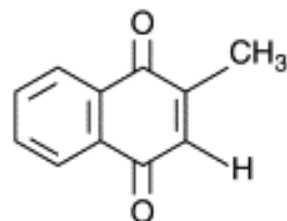
Vitamin K₁ (phylloquinone) is found in green plant leaves; a related form, vitamin K₂ (menaquinone), is formed by bacteria residing in the vertebrate intestine.



Phylloquinone (vitamin K₁)



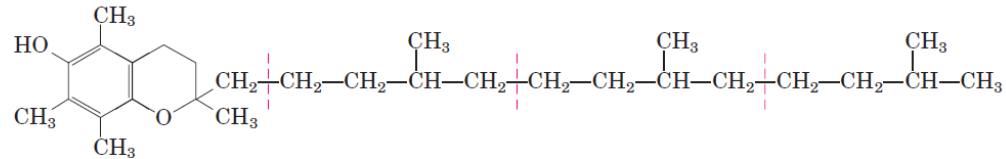
Menaquinone-4 (vitamin K₂)



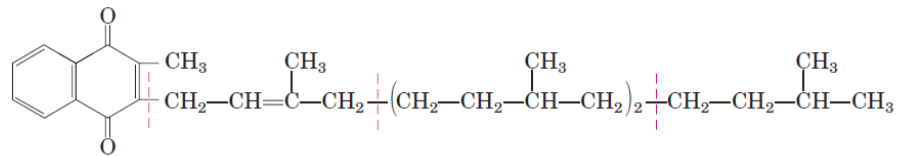
Menadione (vitamin K₃)

Chemical patterns

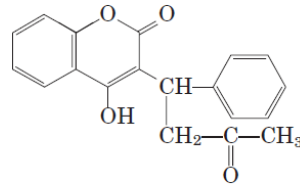
(a)
Vitamin E: an antioxidant



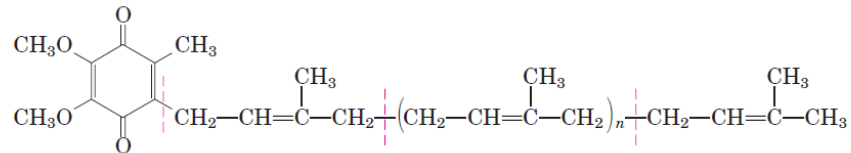
(b)
Vitamin K₁: a blood-clotting cofactor (phylloquinone)



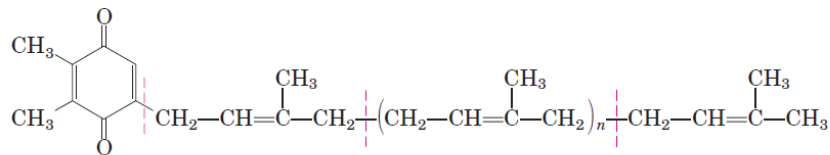
(c)
Warfarin: a blood anticoagulant



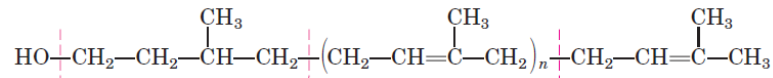
(d)
Ubiquinone: a mitochondrial electron carrier (coenzyme Q)
($n = 4$ to 8)



(e)
Plastoquinone: a chloroplast electron carrier ($n = 4$ to 8)



(f)
Dolichol: a sugar carrier
($n = 9$ to 22)



Water soluble vitamins

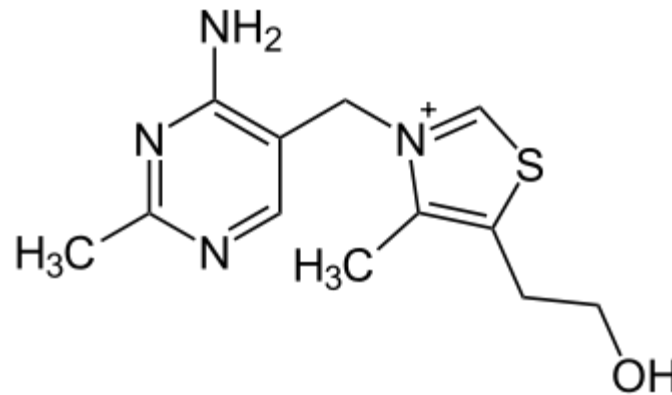
B complex

B vitamins are a class of water-soluble vitamins involved in many cell metabolism reactions. They are chemically heterogeneous.

Thiamine (vitamin B1)	Found in moderate amounts in all of the nutritious foods: nuts and seeds, legumes, whole-grain/enriched cereals and breads, pork
Riboflavin (vitamin B2)	Enriched, whole-grain cereals and breads, leafy green vegetables, milk products
Niacin (vitamin B3)	Peanut butter, vegetables (particularly leafy green vegetables, asparagus and mushrooms), enriched or whole-grain cereals and breads, fish, poultry and meat
Pantothenic Acid (vitamin B5)	It is widespread in foods.
Pyridoxine (vitamin B6)	Fruits, vegetables, poultry, fish, meat
Folic Acid (vitamin B9)	Liver, orange juice, seeds, legumes, leafy green vegetables. It is now added to many refined grains.
Cobalamin (vitamin B12)	Milk, milk products, eggs, seafood, fish, poultry, meat. It is not present in plant foods.

B complex

Vitamin B ₁	Thiamine
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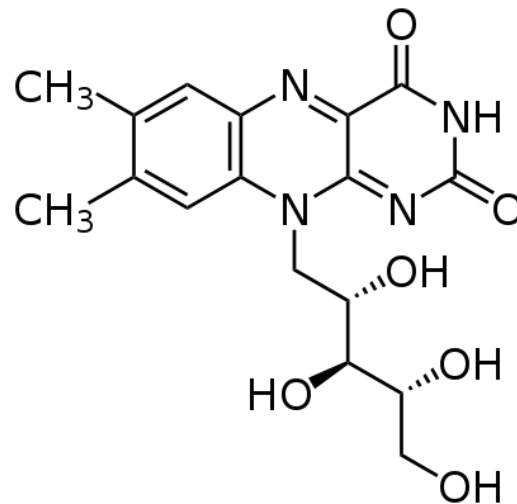
Lack of vitamin B1 in the human diet leads to the condition known as beriberi, characterized by an accumulation of body fluids (swelling), pain, paralysis, and ultimately death.

Thiamine plays a central role in the generation of energy from carbohydrates. Its active form is a coenzyme called thiamine pyrophosphate (TPP).

B complex

Vitamin B₂

Riboflavin

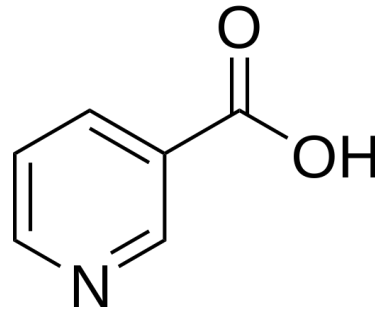


Riboflavin is involved in the energy production for the electron transport chain, the citric acid cycle, as well as the catabolism of fatty acids (beta oxidation).

Riboflavin is a component of the Flavin Adenine Dinucleotide (FAD).

B complex

Vitamin B ₃	Niacin
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Humans generally cannot synthesize niacin in sufficient quantities, and this is especially so for those with diets low in tryptophan (precursor).

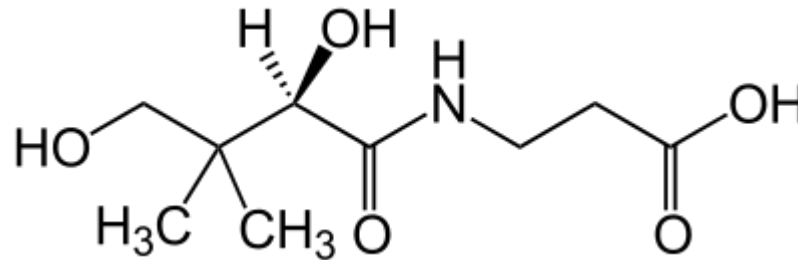
Insufficient niacin in the diet can cause pellagra, dermatitis, diarrhea, and dementia, followed in many cases by death.

Niacin is present in Nicotinamide Adenine Dinucleotide (NAD).

B complex

Vitamin B₅

Pantothenic acid



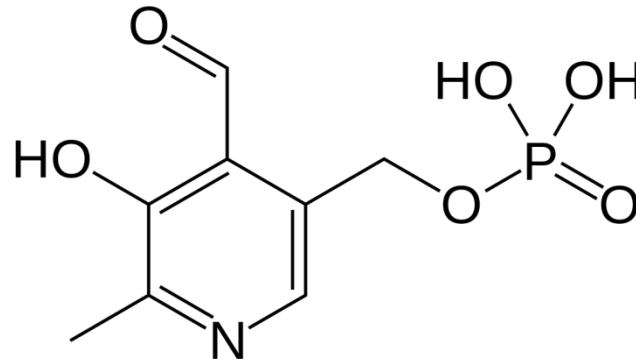
Pantothenic acid is involved in the oxidation of fatty acids and carbohydrates.

This vitamin is a component of coenzyme A (CoA).

B complex

Vitamin B₆

pyridoxine, pyridoxal, pyridoxamine

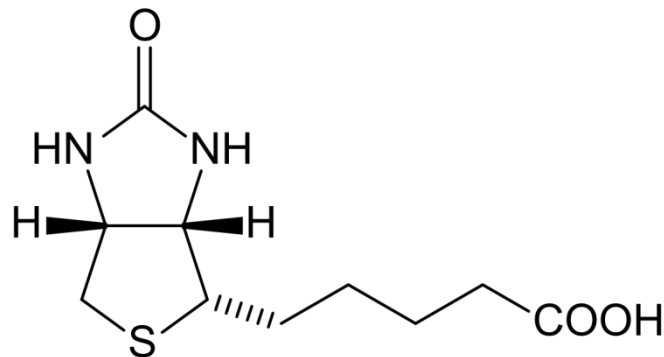


The active form pyridoxal 5'-phosphate (PLP) (depicted) serves as a cofactor in many enzyme reactions mainly in amino acid metabolism.

All aminotransferases have the same prosthetic group and the same reaction mechanism. The prosthetic group is pyridoxal phosphate (PLP), the coenzyme form of pyridoxine, or vitamin B6.

B complex

Vitamin B ₇	Biotin
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Biotin plays a key role in the metabolism of lipids, proteins and carbohydrates.

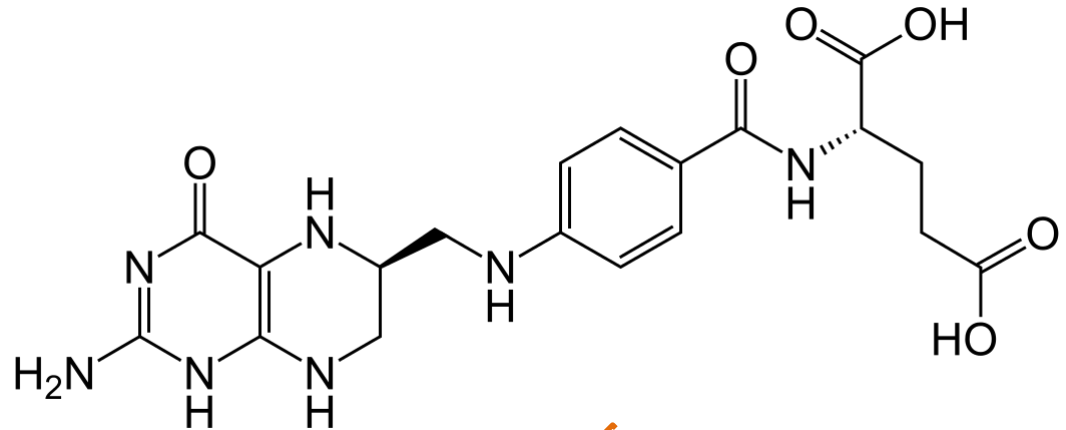
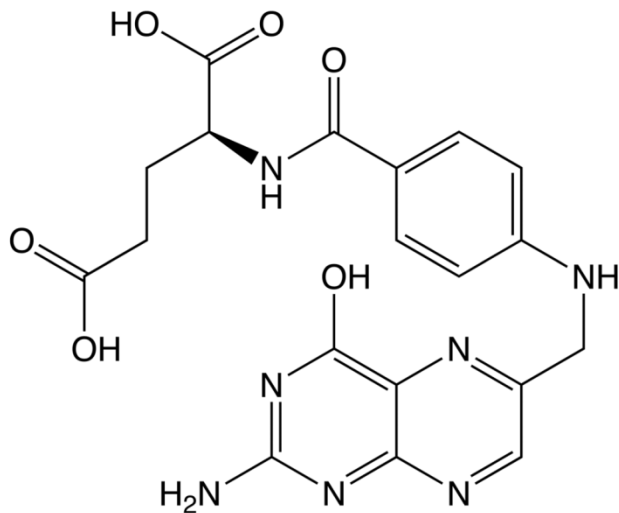
The pyruvate carboxylase reaction requires this vitamin, which is the prosthetic group of the enzyme. Hence, it plays a key role in many carboxylation reactions.

Biotin is abundant in many foods and is synthesized by intestinal bacteria. Its deficiency is rare, but can sometimes be caused by a diet rich in raw eggs.

B complex

Vitamin B₉

Folic acid

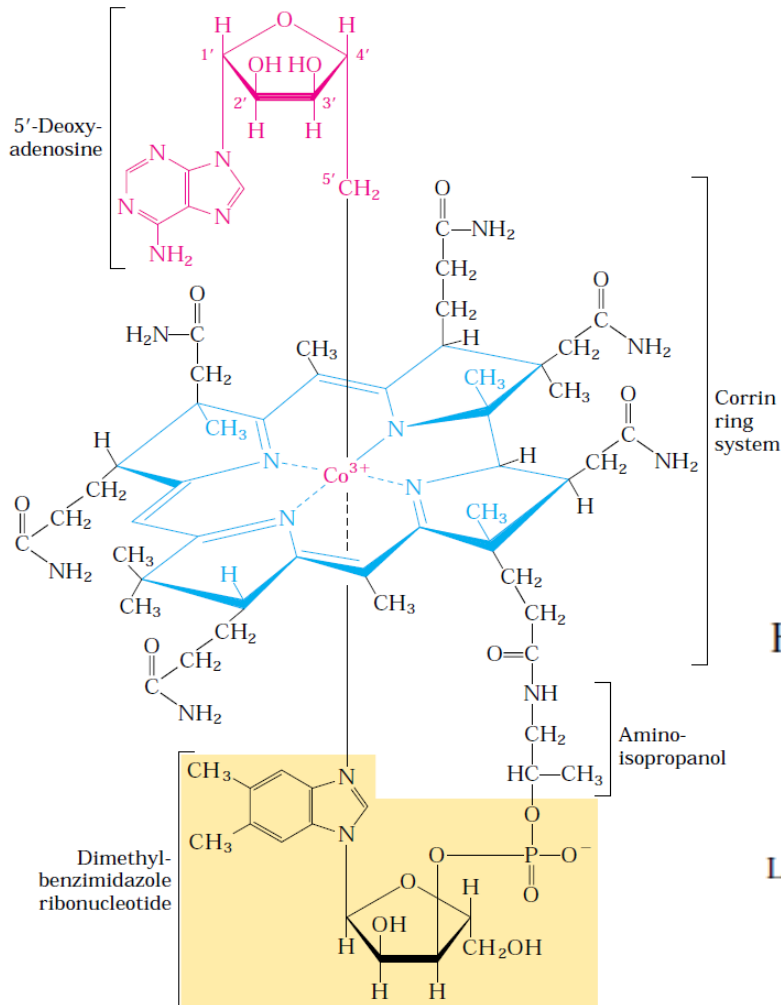


Folic acid acts as a co-enzyme in the form of tetrahydrofolate (THF), which is involved in the transfer of single-carbon units in the metabolism of nucleic acids and amino acids. Folate also aids in erythropoiesis, the production of red blood cells.

B complex

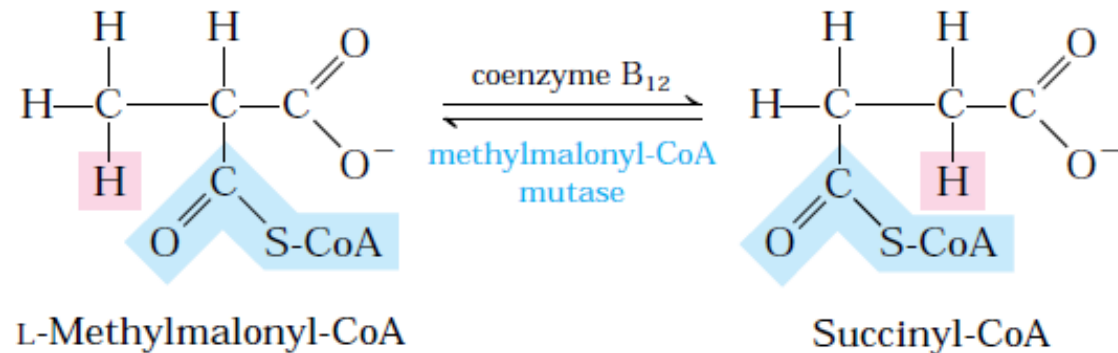
Vitamin B₁₂

Cobalamin



Coenzyme B12 is the cofactor form of vitamin B12.

Coenzyme B12 is the cofactor for the following reaction, as it is for almost all enzymes that catalyze reactions of this general type.



Misclassified vitamins

Vitamin B₄: can refer to the distinct chemicals choline, adenine, or carnitine. Choline is synthesized by the human body, but not sufficiently to maintain good health, and is now considered an essential dietary nutrient. Adenine is a nucleobase synthesized by the human body. Carnitine is an essential dietary nutrient for certain worms, but not for humans.

Vitamin B₈: adenosine monophosphate (AMP), also known as adenylic acid. Vitamin B₈ may also refer to inositol.

Vitamin B₁₀: *para*-aminobenzoic acid (pABA or PABA), a chemical component of the folate molecule produced by plants and bacteria, and found in many foods.

Vitamin B₁₁: pteryl-hepta-glutamic acid - chick growth factor, which is a form of folic acid. Later found to be one of five folates necessary for humans.

Vitamin B₁₃: orotic acid.

Vitamin B₁₄: cell proliferant, anti-anemia, rat growth factor, and antitumor pterin phosphate.

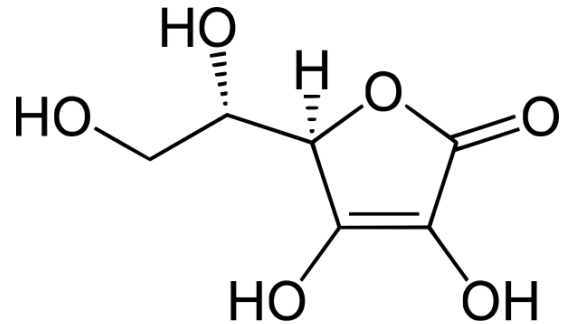
Vitamin B₁₅: pangamic acid, also known as pangamate. Promoted in various forms as a dietary supplement and drug.

Vitamin B₁₆: dimethylglycine (DMG) is synthesized by the human body in the Citric acid (or Krebs) cycle.

Vitamin B₁₇: nitrilosides, amygdalin or Laetrile. These substances are found in a number of seeds, sprouts, beans, tubers, and grains.

Vitamin B₂₀: L-carnitine.

Vitamin C



Scurvy is caused by lack of vitamin C, or ascorbic acid (ascorbate). Vitamin C is required for, among other things, the hydroxylation of proline and lysine in collagen.

Manifestations of advanced scurvy include numerous small hemorrhages caused by fragile blood vessels, tooth loss, poor wound healing and the reopening of old wounds, bone pain and degeneration, and eventually heart failure.