Lipid-Soluble Vitamins

Vitamins

Are **organic** molecules required in **only trace amounts** that must be obtained through the diet because **our bodies do not have the ability to synthesize them.**

Vitamin classification

- Water-soluble and fat-soluble

Vitamin classification

Water-soluble vitamins

- Found in the aqueous environment inside cells, where most of them are needed as components of coenzymes.
- B and C vitamins
- ¬OH, ¬COOH groups or other polar groups result in their water solubility
- Excreteted in Urine

Fat-soluble vitamins

- Stored in the body s fat deposits
- A, D, E, and K vitamins
- None has been identified as a coenzyme
- Accumulate in body fats so they have greater hazards of overdosing

Fat-soluble vitamins

TABLE 19.4 The Fat-Soluble Vitamins*

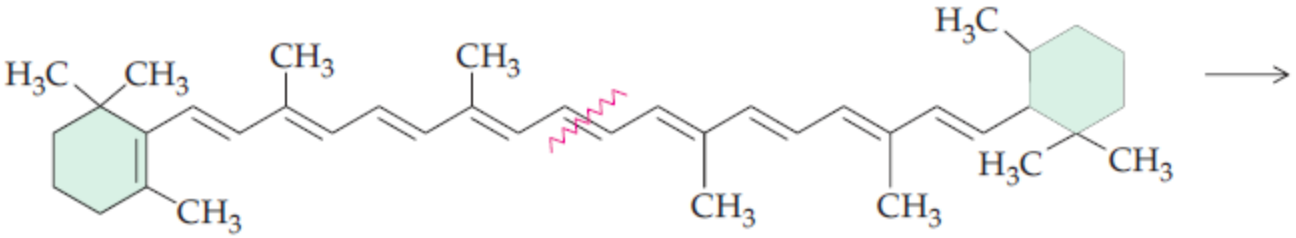
VITAMIN	SIGNIFICANCE	SOURCES	REFERENCE DAILY INTAKE**	EFFECTS OF DEFICIENCY	EFFECTS OF EXCESS
A	Maintains epithelia; required for synthesis of visual pigments; antioxidant	Leafy green and yellow vegetables	1000 μg	Retarded growth, night blindness, deterioration of epithelial membranes	Liver damage, skin peeling, central nervous system effects (nausea, anorexia)
D	Required for normal bone growth, calcium and phosphorus absorption at gut, and retention at kidneys	Synthesized in skin exposed to sunlight	10 μg	Rickets, skeletal deterioration	Calcium deposits in many tissues, disrupting functions
E	Prevents breakdown of vitamin A and fatty acids; antioxidant	Meat, milk, vegetables	10 mg	Anemia; other problems suspected	None reported
K	Essential for liver synthesis of prothrombin and other clotting factors	Vegetables; production by intestinal bacteria	80 μg	Bleeding disorders	Liver dysfunction, jaundice

**Adapted in part from Frederic H. Martini,* Fundamentals of Anatomy and Physiology, *4th edition (Prentice Hall, 1998).*

***RDI values are the basis for information on the Nutrition Facts Label included on most packaged foods. The values are based on the Recommended Dietary Allowances of 1968. RDIs for fat-soluble vitamins are often reported in International Units (IU), which are defined differently for each vitamin. The values given here are approximate equivalents in mass units.*

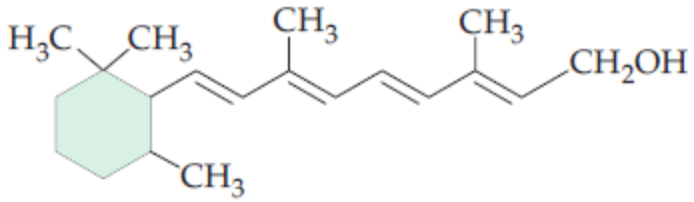
Fat-soluble vitamins
Vitamin A

- Essential for night vision, healthy eyes, and normal development of epithelial tissue.
- Has three active forms: retinol, retinal, and retinoic acid.
- Produced in the body by cleavage of **β-caroten**e that gives an orange color to carrots and other vegetables



β-Carotene

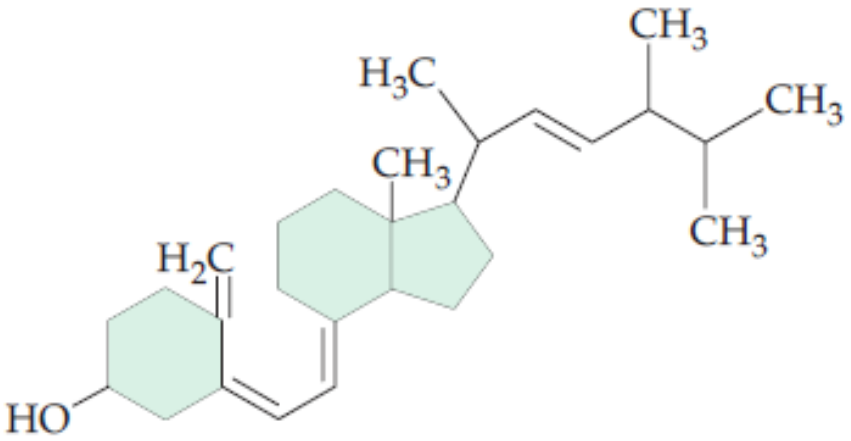
2



Vitamin A
(Retinol)

Fat-soluble vitamins
Vitamin D

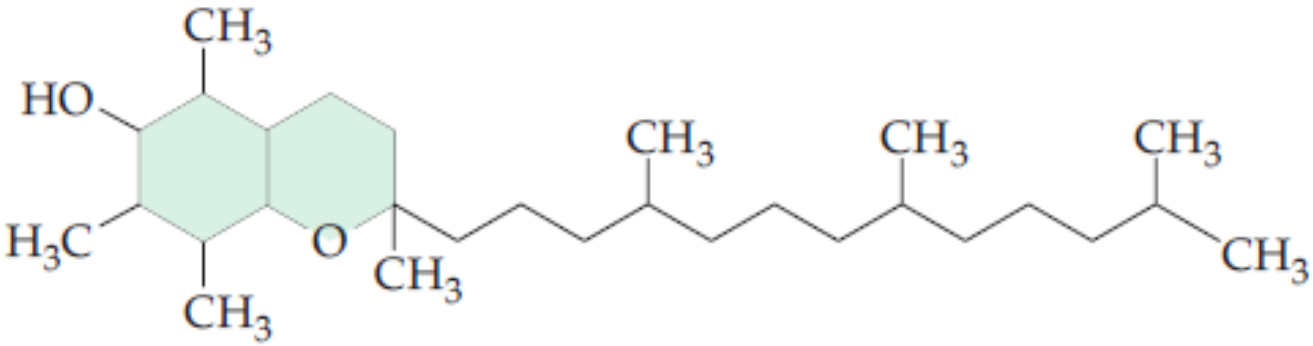
- Related in structure to cholesterol
- Synthesized when UV light from the sun strikes a cholesterol derivative in the skin.
- In the kidney, vit. D is converted to a hormone that regulates Ca+2 absorption and bone formation.



Vitamin D

Fat-soluble vitamins
Vitamin E

- Comprises a group of structurally similar compounds called tocopherols, the most active of which is α-tocopherol
- Is an antioxidant
- It prevents the breakdown by oxidation of vitamin A and polyunsaturated fats.



Vitamin E

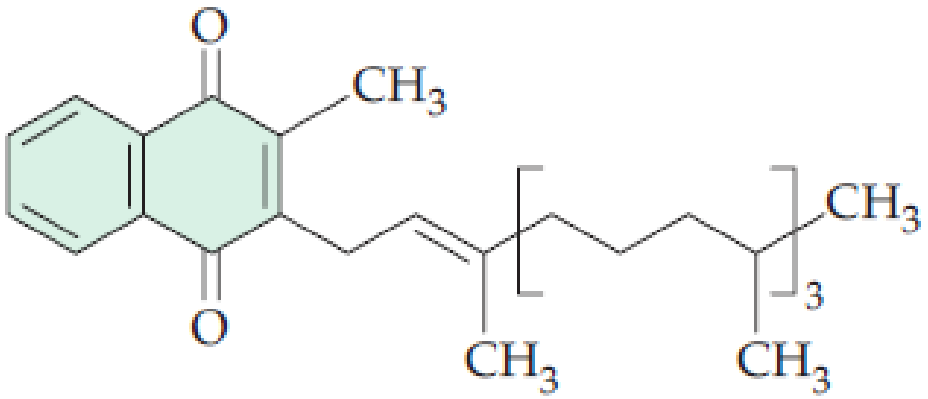
Fat-soluble vitamins
Vitamin K

- Includes a number of structurally related compounds

- Hydrocarbon side chains of varying length.

- Synthesis of several blood-clotting factors.

- Produced by intestinal bacteria, so deficiencies are rare.



Vitamin K