Overview of Vitamins

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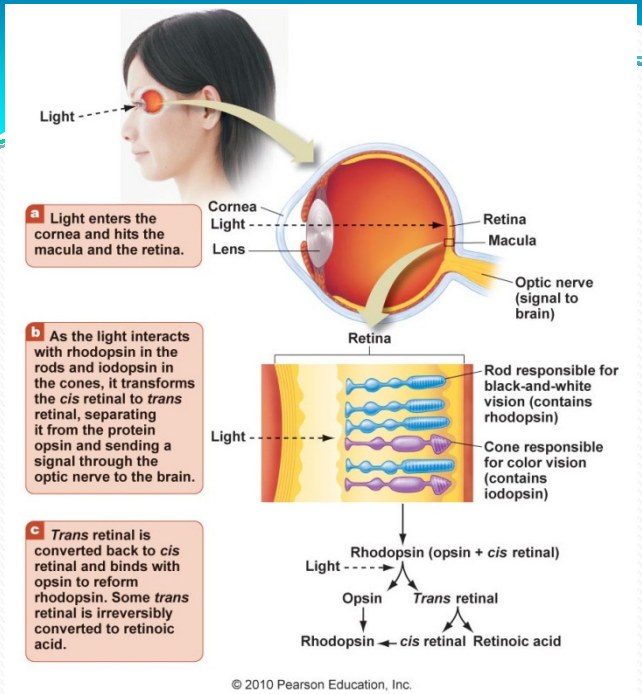

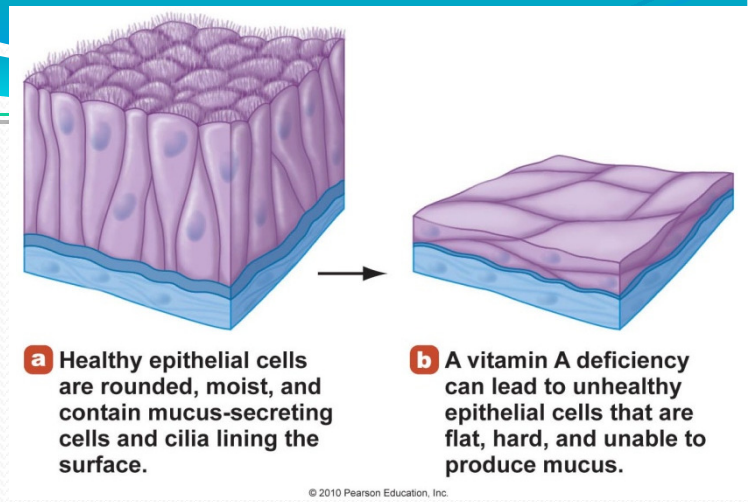

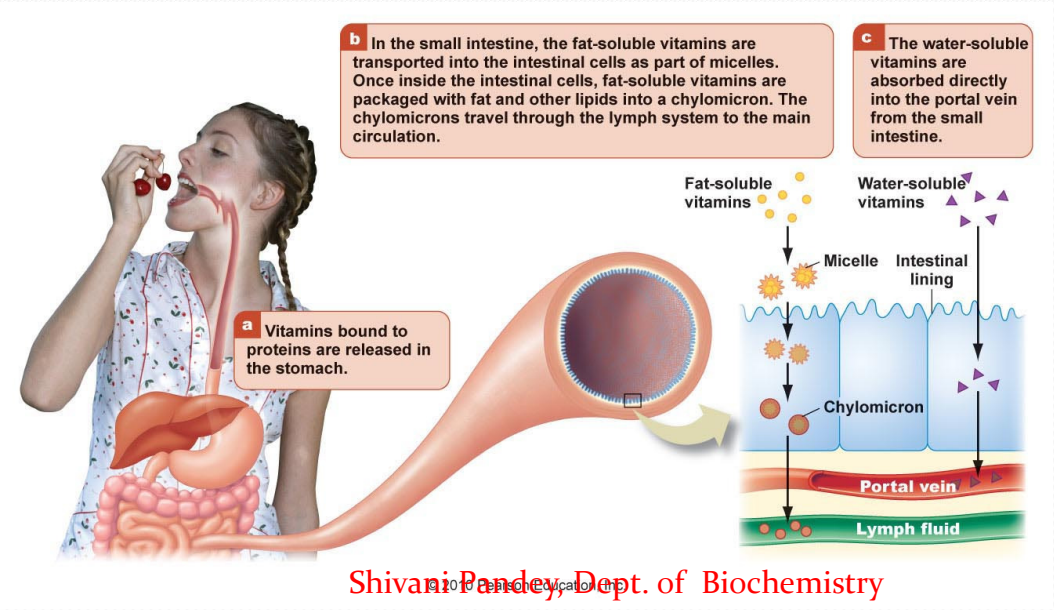

Vitamins

- Tasteless, organic compounds
- Required in small amounts
- Functions
  - Regulate metabolism
  - Help convert energy in fat, carbohydrate, and protein into ATP
  - Promote growth and reproduction
- Deficiencies can result in potentially serious consequences

History of Vitamins

- Disease related to deficiency and foods that help were recognized long before the vitamin was discovered
- Vitamins became valued for promoting public health
- 1940s U.S. government mandated specific vitamins be added to grains and milk to improve health
- Scientists are now focusing on prevention of disease with vitamin research

Naming Vitamins

- Each new vitamin is temporarily named when discovered
- The naming of vitamins follows the letters of the alphabet, starting with A; we are up to the letter K
  - A, B, C, D, E, and K
    - B has many subscripts
  - F, G, and H were dropped

Criteria for Vitamins

- Cannot be synthesized in ample amounts in the body
- Chronic deficiency is likely to cause physical symptoms
- Symptoms will disappear once the vitamin level in the body is restored
  - Deficiency can cause permanent damage
- 13 compounds meet the above criteria

Classification of Vitamins

Classification is based on solubility

- Eight water-soluble: B vitamin complex and vitamin C
- Four fat-soluble: vitamins A, D, E, and K

- Solubility influences a vitamin's
  - Digestion
  - Absorption
  - Transportation
  - Storage
  - Excretion

Vitamin Structure and Function

- All vitamins contain carbon, hydrogen, and oxygen
  - Some vitamins contain nitrogen and sulfur
- Chemical structure of each vitamin is unique
- Each vitamin is a singular unit
- Vitamins are absorbed intact
- Vitamins perform numerous essential functions

Role of Vitamins in Promoting Health

Metabolic functions	Vitamins That play role
• Antioxidants	Vitamin C & E
• Blood clotting & red blood cell synthesis	Folate, Vit B_6,B12 & Vit K
• Bone health	Vit. A, D, K & C
• Energy	Biotin, Niacin, B1,B2,B_6 &B12
• Growth & Reproduction	Vit A& D
• Immune function	Vit A, D & C
• Protein metabolism	Folate, B_6 & B12

Vitamin Absorption and Storage

- All absorption takes place in the small intestine

- Fat-soluble vitamins
  - Are absorbed in the duodenum
  - Storage
    - Vitamin A is mainly stored in the liver
    - Vitamins K and E are partially stored in the liver
    - Vitamin D is mainly stored in the fat and muscle tissue
    - Can build up in body to point of toxicity

Vitamin Absorption and Storage

- Water-soluble vitamins
  - Absorbed with water and enter directly into the blood stream
  - Most absorbed in the duodenum and jejunum
  - Most are not stored in the body
  - Excess intake excreted through the urine
  - Important to consume adequate amounts daily
  - Dietary excesses can be harmful

Digesting and Absorbing Vitamins

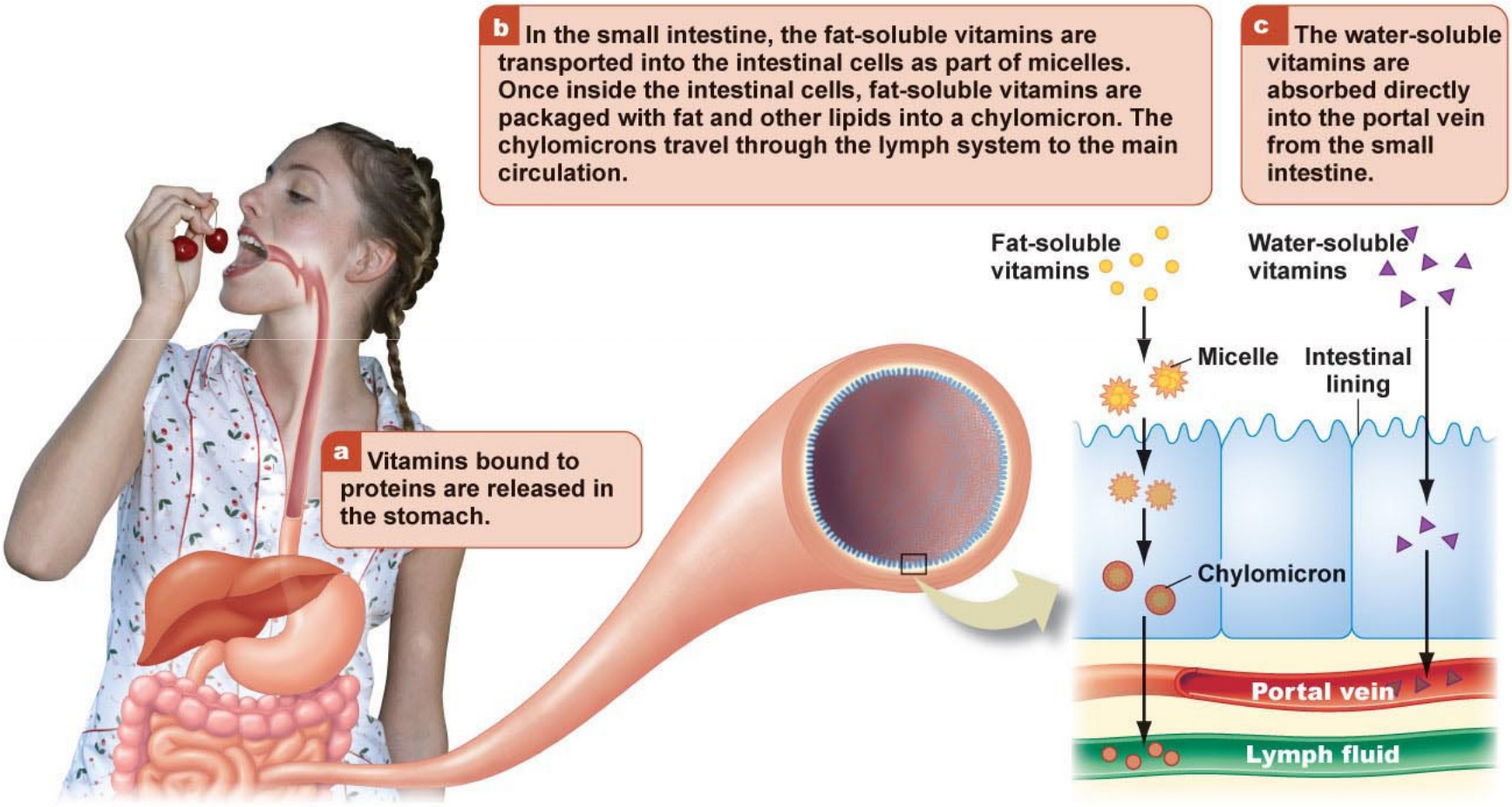

Figure 9.2

Digesting and Absorbing Water-Soluble Vitamins

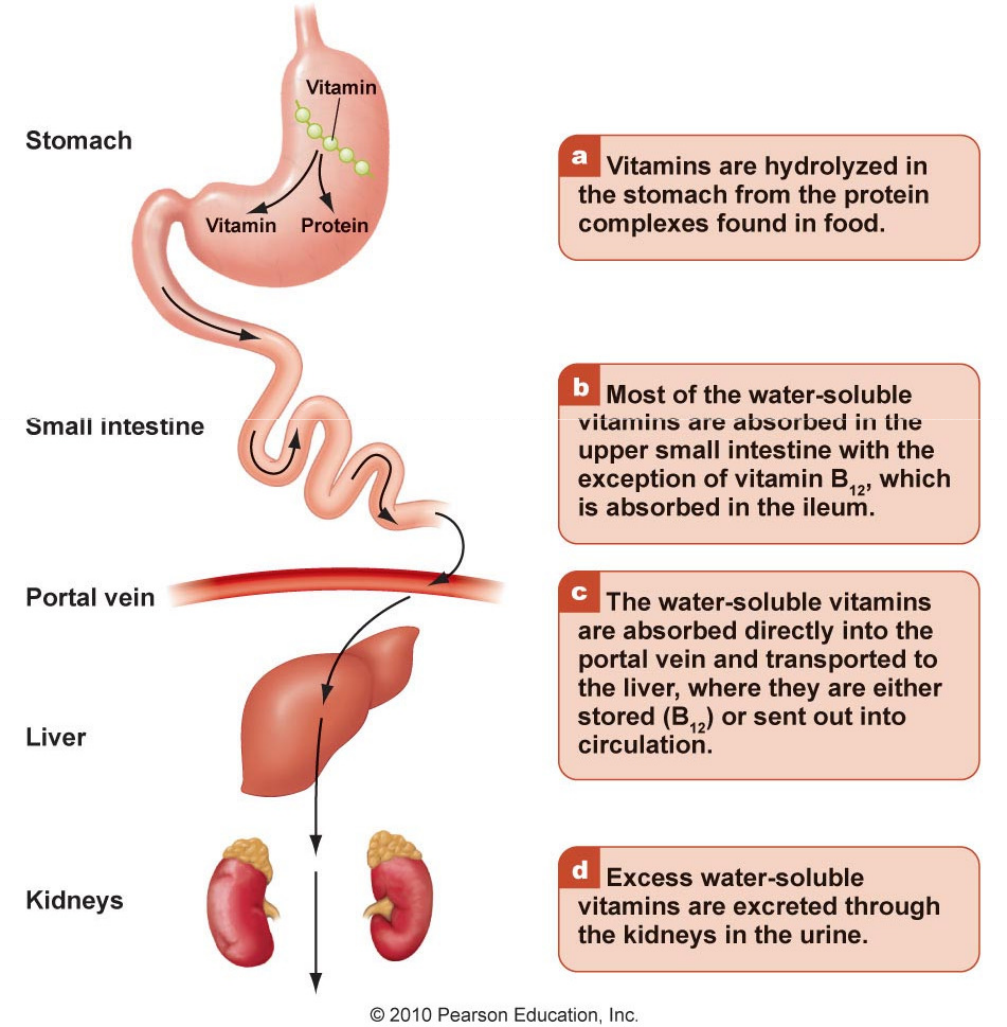

Figure 10.1

	Water-Soluble Vitamins	Fat-Soluble Vitamins
Absorbed in the	Small Intestine	Small Intestine
Hydrophobic or Hydrophilic	Hydrophilic	Hydrophobic
Absorbed into the	Blood	Lymph
Stored in the body	Not Generally	Yes
Can build up and become toxic	Not Generally	Yes
Need to consume daily	Yes	No

Bioavailability

- Varies based on
  - Amount in food
  - Preparation
  - Efficiency of digestion and absorption of food
  - Individual nutritional status
  - Natural or synthetic
- Fat-soluble vitamins are generally less bioavailable than water-soluble vitamins
- Vitamins from animal foods are generally more bioavailable than those in plant foods

Destruction of Vitamins

- Water-soluble vitamins can be destroyed by
  - Exposure to air
  - Exposure to ultraviolet light
  - Water
  - Changes in pH
  - Heat
  - Food preparation techniques
- Fat-soluble vitamins tend to be more stable

Toxicity with Overconsumption

- Vitamin toxicity, AKA hypervitaminosis
  - Rare
  - Results from ingesting excess vitamins and tissue saturation
  - Can damage cells
- Dietary Reference Intakes include tolerable upper intake limits (UL) for most vitamins to prevent excess

Antioxidants

- Group of compounds that neutralizes free radicals, helping to counteract the oxidation that takes place in cells

  - Includes
    - Vitamins E
    - Vitamins C
    - Selenium
    - Flavonoids
    - Carotenoids

- By-products of the body's metabolic reactions

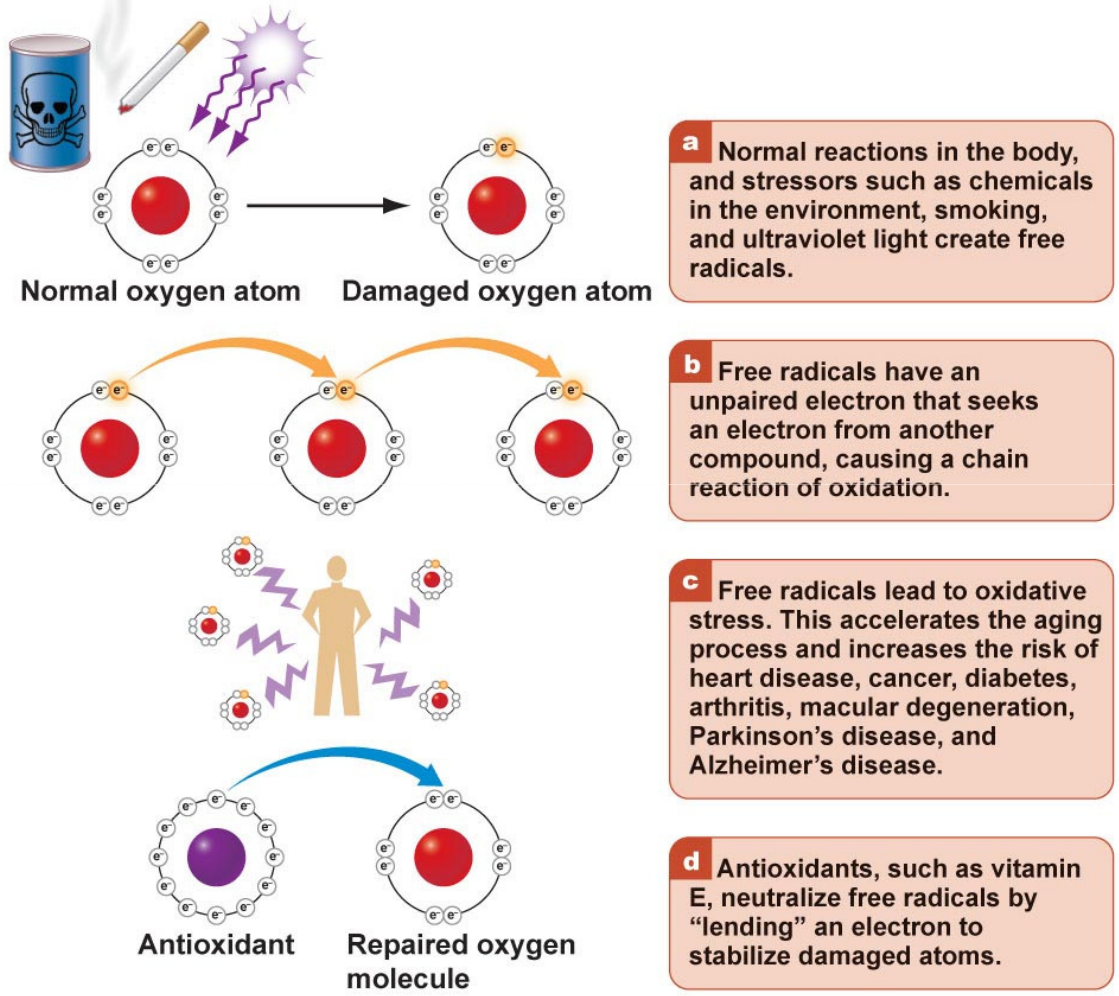

Figure 9.3

Antioxidants

- These sources also act as antioxidants, stimulate the immune system and interact with hormones to prevent cancers

  - Phytochemicals
    - Carotenoids
    - Flavonoids

Get antioxidants and phytochemicals from the diet instead of supplements

Quick Review

- Antioxidants, such as vitamin E and C, selenium, flavonoids, and carotenoids, help counteract the damaging effects free-radicals
- Oxidative stress occurs when free radicals accumulate faster than the body can neutralize them
  - Contribute to chronic disease and conditions
- Fruits, vegetables, and whole grains are excellent sources of antioxidants

Best Sources of Vitamins

- Whole foods
  - Fruits, vegetables, and whole grains
  - Rich in vitamins, phytochemicals, antioxidants, and fiber
- *Dietary Guidelines for Americans 2005*
  - Recommend a variety of foods
  - Increased fruits, vegetable, whole grains, and dairy recommendation
- Most people do not need supplements