General Characteristics of Vitamins

1. Small, organic compounds.
2. Usually obtained from food.
   a. Synthesized by body
   b. Precursor compounds.
3. Essential to life.
4. Each has a specific function.
5. Regulate body processes.
6. Contain no kcalories.
7. Toxicity at mega doses: 10x RDA
8. No perfect food contains all vitamins.
9. Body can’t defect difference between synthetic and natural vitamin.
10. Classified as fat or water soluble.
## Fat and Water Soluble Vitamins

<table>
<thead>
<tr>
<th>Fat soluble</th>
<th>Water soluble</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carried in fat</td>
<td>Soluble in water</td>
</tr>
<tr>
<td>A, D, E, K</td>
<td>Thiamin, riboflavin, niacin, folate, B12, B6, biotin, pantothenic acid, vitamin C.</td>
</tr>
<tr>
<td>Needed every three days.</td>
<td>Needed daily</td>
</tr>
<tr>
<td>Deficiencies develop slowly</td>
<td>Deficiencies develop quickly</td>
</tr>
<tr>
<td>Transported lymph. Stored in the liver and body adipose</td>
<td>Transported in blood. Not stored in the body</td>
</tr>
<tr>
<td>Excess toxic in small amounts (6-10x RDA)</td>
<td>Excess usually not toxic. (&gt; 10 x RDA)</td>
</tr>
<tr>
<td>Have precursors or provitamins.</td>
<td>Generally do not have precursors.</td>
</tr>
</tbody>
</table>
**Vitamin A**

Most versatile of the fat soluble vitamins.

Functions:
1. Promotes good night vision and normal vision.
2. Promotes cell differentiation.
3. Supports immune system.
4. Promotes growth and reproduction.

Precursor: beta carotene

2001 Recommendations: RAE (Retinol Activity Equivalent)  
1 mcg retinol = RAE  
12 mcg beta carotene = RAE  
24 mcg other carotene = RAE

Deficiency:
- Night blindness
- Xerophthalmia

Toxicity: As little as 5x the RDA

**Vitamin D - Calciferol.**

Different from others, our body synthesizes. Not essential.
1. D3 = Synthesized from sunlight.
2. Provitamin D – animals

Roles in the body.
1. Promotes bone mineralization.
2. Raises blood concentration of Calcium and phosphorus

Deficiency:
1. rickets
2. osteomalcia

Toxic: THE MOST TOXIC at 4-5x the DRI.

Sources: Egg yolk, liver and fatty fish, fortified milk. Sunlight.
**Vitamin E (Tocopherol)**

Function: antioxidant
1. Protects PUFA
2. Protects Vitamin A
3. Protects RBC and brain
4. Protects lungs
5. Immune system

Deficiency: Rare.
- Neuromuscular dysfunction
- Erythrocyte breakdown

Toxicity: rare. Upper limit: 1000 mg

DRI RDA) 2000: 15 α TE mg for adults

Food: Vegetable oils, wheat germ, sweet potato, liver, green leafy vegetables, nuts, seeds.
**Vitamin K**

**Forms:**
- a. phylloquinone - plants
- b. menaquinone - animal tissue
- c. menadione - synthetic form

**Functions:**
1. Functions in blood clotting

**Deficiency:**
- Hemorrhagic disease
- Skeletal weakness

**Toxic:** rare

**2000 AI:** 90 ug women/ 120 ug men

**Sources:**
- ½ synthesized by bacteria in gut
- ½ milk, eggs, liver, green leafy, cabbage-type vegetables.
Vitamins that are Antioxidants

- Beta carotene
  (Precursor of vitamin A)
- Vitamin E
- Vitamin C
Water-soluble Vitamins

- Vitamin C
- Thiamin
- Riboflavin
- Niacin
- Folate
- Vitamin B 6 - Pyridoxine
- Vitamin B 12
- Biotin
- Pantothenic Acid
Vitamin C = Ascorbic acid

Functions:
1. Antioxidant-- protects vitamin A and poly-unsaturated fatty acids.
2. Part of the protein collagen.
3. Fights infection, immune system support.
4. Makes hormones

RDA: 2000, 75 mg women; 90 for men. + 35mg if smoker.

UL: 2000mg or 2 grams

Sources: Fruits & vegetables only.
Sources of vitamin C

Orange juice, ½ c, froz  97 mg
Strawberries, 1 cup      84 mg
Orange juice, chilled    82 mg
Kiwi, one                74 mg
Orange, one fresh        70 mg
Cantaloupe, 1 cup        68 mg
Broccoli, ½ c            49 mg
Potato, baked, 1         26 mg
Tomato, 1 fresh          22 mg
Watermelon, 1 cup        15 mg
Banana, one              10 mg
Apple, one               8 mg
Pear, Bartlett, one      7 mg
**B1 Thiamin, B2 Riboflavin, B3 Niacin**

Functions:
1. Coenzyme energy metabolism.
3. Release energy from nutrients.

Thiamin = nerves ..... pork, liver, peanuts
Riboflavin = skin/vision.........milk products
Niacin = skin/nerve system, GI tract .......meat, fish,
        poultry, fortified grains & cereals.

Niacin made from tryptophan, about 1/2 our need.

Deficiency: rare

Toxic: Only niacin.
Folate

Function: New cell synthesis

Deficiency: megaloblastic anemia.
Neural Tube Defects: anencephaly & spina bifida.

1998 fortification of cereals/grains.

DFE = Dietary folate equivalents.
  a. synthetic 1.7x greater absorption
  b. natural food sources (green leafy)

B 12– Cobalamine

Function: New cell synthesis & normal nerve function.

Deficiency: pernicious anemia and nerve damage.

Intrinsic factor. Animal products only.
**B6 Pyridoxine**

Function:
1. Coenzyme, especially protein metabolism.
2. Makes red blood cells.

Deficiency: fatigue, depression, irritability.

Sources: meat, poultry, fish, potatoes, bananas, green leafy and watermelon. Fortified cereals.

Toxic: UL 100 mg. Stored in muscles. Can cause permanent nerve damage.

*Pantothenic Acid - B 5 and Biotin*

Coenzymes in energy metabolism

*Choline – a potential vitamin.*

Needed to make lecithin & acetylcholine.