Vitamins

Vitamins: Vitamins are biomolecules that a living organism requires in trace quantities for good health. (The carbon atoms in the molecules are shown as corners in the structures.)

Vitamin C

Folic Acid

Vitamin B-12

Vitamins

• Vitamins are recognized because of observation of the impact on an organism when a particular nutrient is not available. The list of vitamins changes as new ones are recognized.
• The line between what can be synthesized in an organism and what needs to be ingested can be blurry.
  • The overall vitamin B12 structure can only be synthesized in bacteria, but human bodies can interconvert different types of vitamin B12.
  • In some cases the vitamin can be synthesized in the body but it is highly dependent on having other metabolic needs being met. For example humans can synthesize folate, an essential vitamin, but only if there is a lot of vitamin B12 available.

Vitamin Names

• Vitamins are classified by their biological and chemical activity, not their structure.
• A single name, such a vitamin B6, can refer to many different chemical compounds.
• In the case of vitamin B6
Water Soluble and Fat Soluble Vitamins

- Some vitamins are hydrophillic. These vitamins dissolve in water and they are called water soluble vitamins. They have polar functional groups (\(-\text{COOH}, -\text{OH}, -\text{NH}_2^+, -\text{NH}_3^+, -\text{PO}_4^{2-}\)). When not used these vitamins are excreted in urine.
- Some vitamins are hydrophobic. This vitamins are principally composed of carbons and hydrogens. This vitamins are stored in body fat.

Polar and Nonpolar Bonds

Water Soluble (\(-\text{COOH}, -\text{OH}, -\text{NH}_2^+\))

Depending on the pH all of these groups may have charges.

Fat Soluble (Only 1 – \(-\text{OH}\), otherwise all \(\text{C} + \text{H}\))

Vitamin C Deficiency

- Scurvy is the result of defects in collagen synthesis.
- This defect is due to a lack of vitamin C in the diet.
- The link between vitamin C and scurvy was recognized long before the cause was understood.
**Vitamin K**

- Vitamin K is important in proper blood clotting.
- It is made by bacteria in the gut, and can be obtained from leafy green vegetables (buttered?)
- Babies have guts with few bacteria, and have low blood clotting factors.
  - 2-10 cases of bleeding to this per 100,000 births
  - Vitamin K shots are required at birth in many places.
- Bone loss?, Cancer?, Alzheimer's?

**Toxicity and Vitamins**

- Most vitamins are toxic when taken in excess.
- This is particularly true of fat soluble vitamins because they are stored in fat cells, and to are not flushed out the the body through the kidneys.
- This does not mean that water soluble vitamins are without risks. Excess Vitamin C can lead to kidney stones. Excess B12, excess red blood cells.

**Minerals**

- Dietary minerals are the chemical elements required by living organisms, other than elements common in organic molecules. Though they are called minerals often what is meant are ions, such as K⁺, Mg²⁺, Fe²⁺, I⁻ or PO₄³⁻.
- All minerals cannot be synthesized in the organism so all of them would be considered essential.
- You don’t usually get them from rocks but rather from vegetables and meat.