University of Fallujah
College of Medicine

Introduction of Vitamins

Lecture : 1

Stage : 2nd Stage

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Department: Chemistry and Biochemistry

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Learning Objectives

-Understand the basic roles

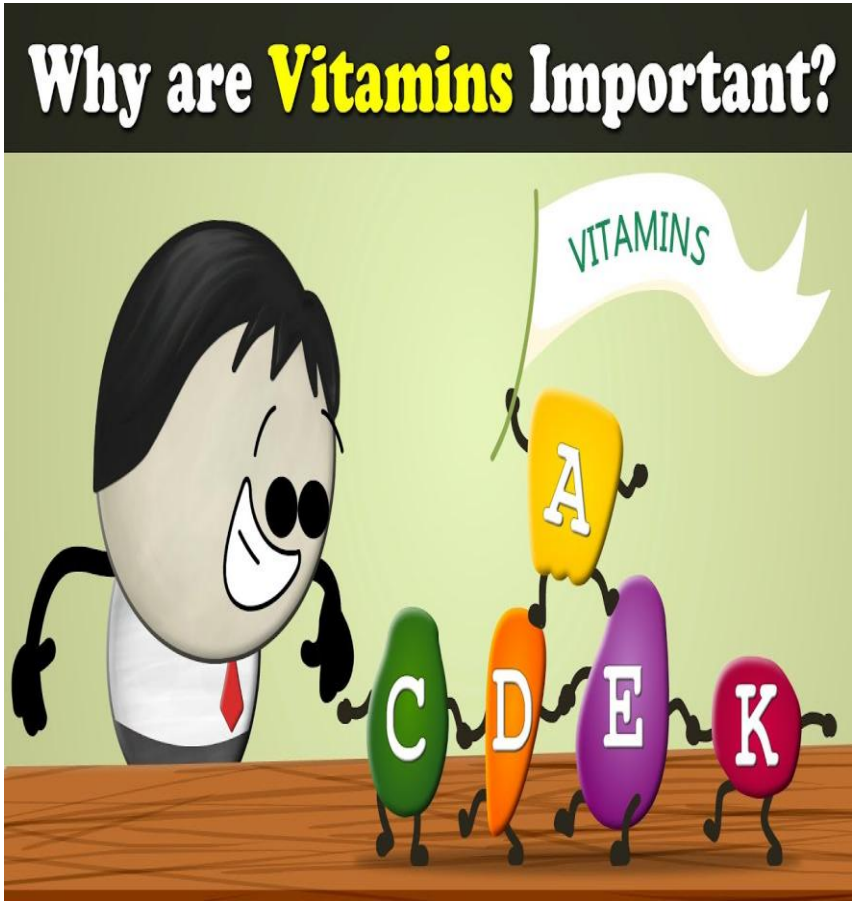
And importance of vitamins in human health.

-Understand the structures and classification of vitamins.

-Identify the clinical roles of vitamins

Vitamins


VITAMINS


Why are Vitamins Important?
VITAMINS
A
C
D
E
K


Vitamin B
Folic acid
Vitamin C
Vitamin D
Vitamin E
Vitamin K
Minerals

Vitamins

A vitamin is an **organic** compound required by an organism as a vital nutrient in limited amounts (in **micrograms to milligram quantities per day**); for a variety of biochemical functions and which generally cannot be synthesized in sufficient quantities by an organism, and must be obtained from the diet.

Some **can be synthesized** by intestinal microorganisms, but in quantities that are **not sufficient** to meet our needs.

Discovery of vitamins started from observation of deficiency & manifestations,e.g. Scurvy,Rickets,Beriberi,etc.

Vitamins have diverse biochemical functions.

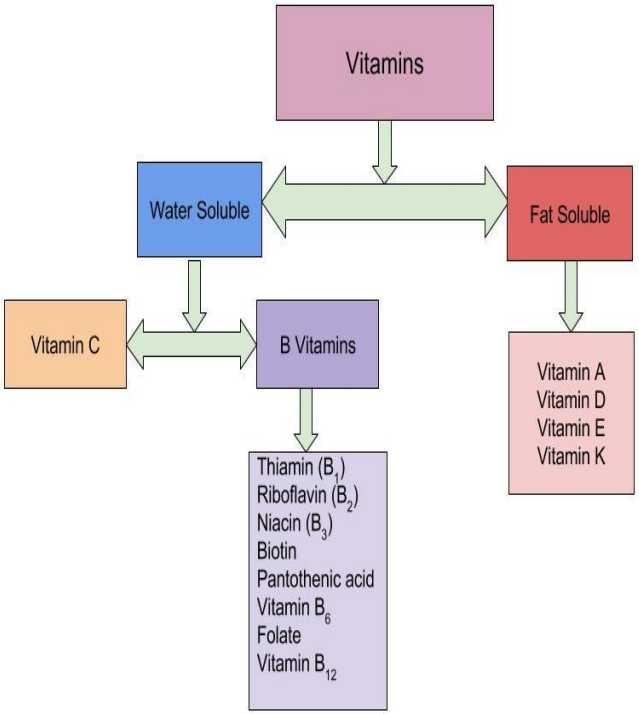
(1) Some have hormone-like functions as **regulators of mineral** metabolism (e.g., vitamin **D**)

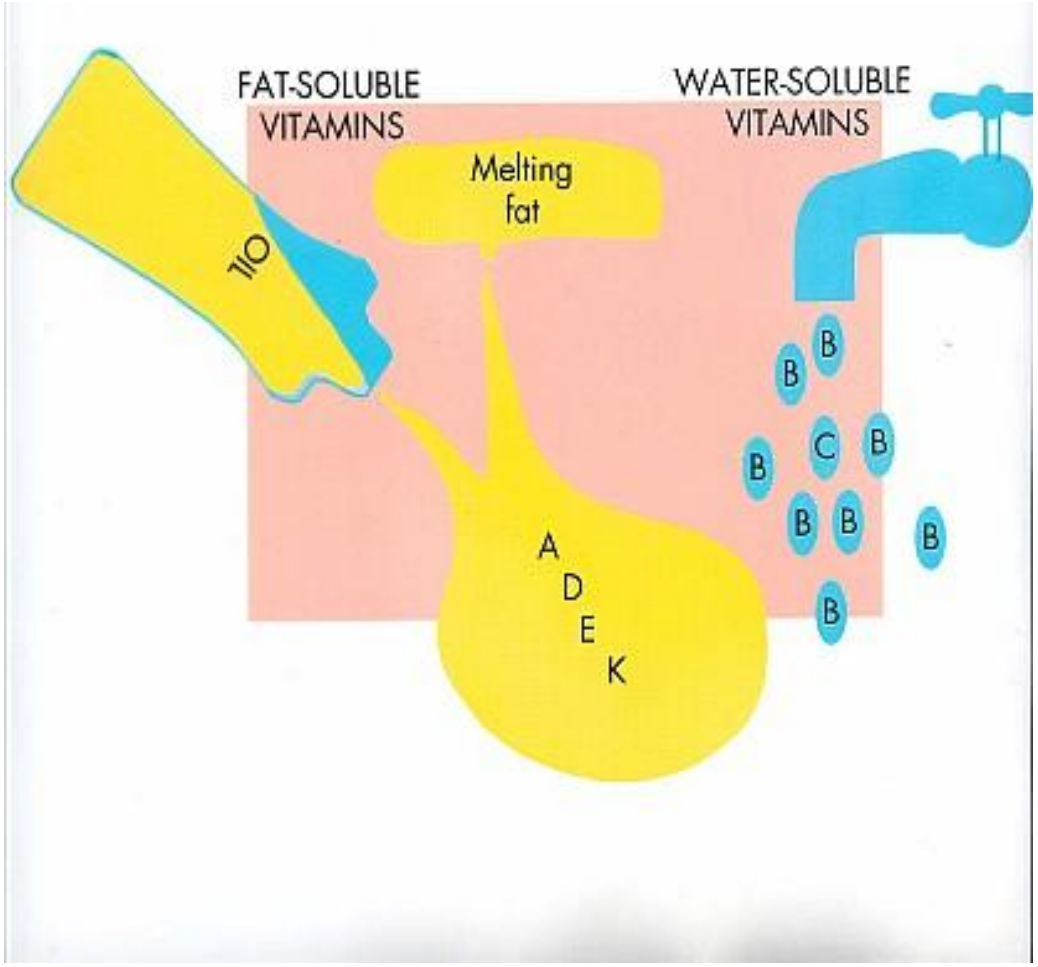
(2) Regulators of **cell and tissue growth and differentiation**

(3) Others function as antioxidants .

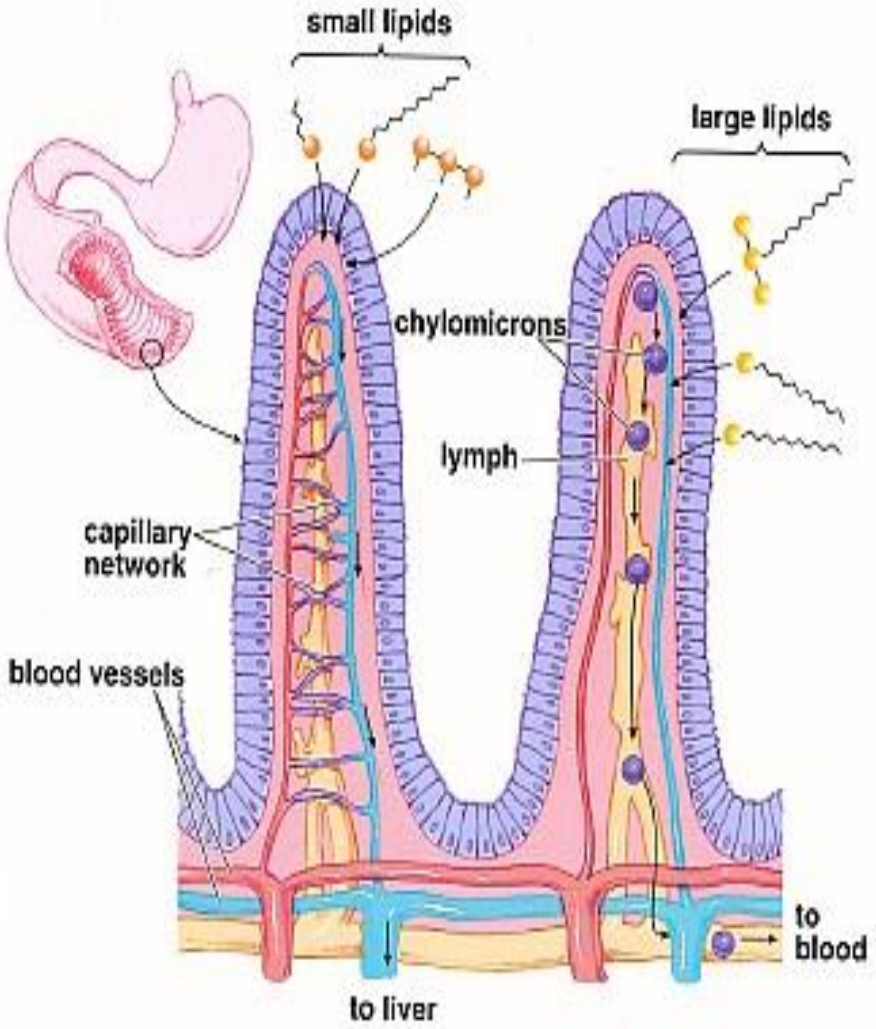
(4) The largest number of vitamins functions as **precursors for enzyme cofactors,** which help enzymes in their work as catalysts in metabolism.

Classification of vitamins



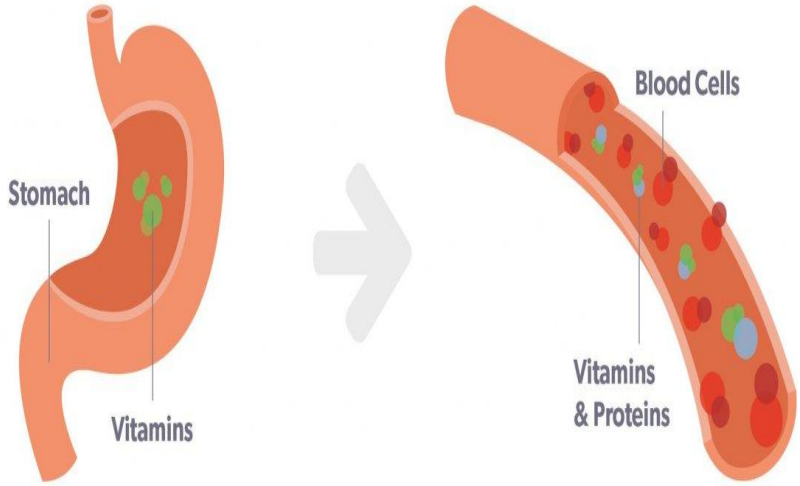


Characteristics of Fat-Soluble Vitamins	Characteristics of Water-Soluble Vitamins
Protect cell membranes from free radical damage; act within the cell's nucleus to influence gene expression	Act in the cytosol of cells or in extracellular fluids such as blood
Absorbed into lymph with fats from foods	Absorbed directly into blood
Large storage capacity in fatty tissues	Little to no storage capacity
Do not need to be consumed daily to prevent deficiency (may take months to develop)	Need to be consumed regularly to prevent deficiency
Toxicity is more likely	Toxicity is rare

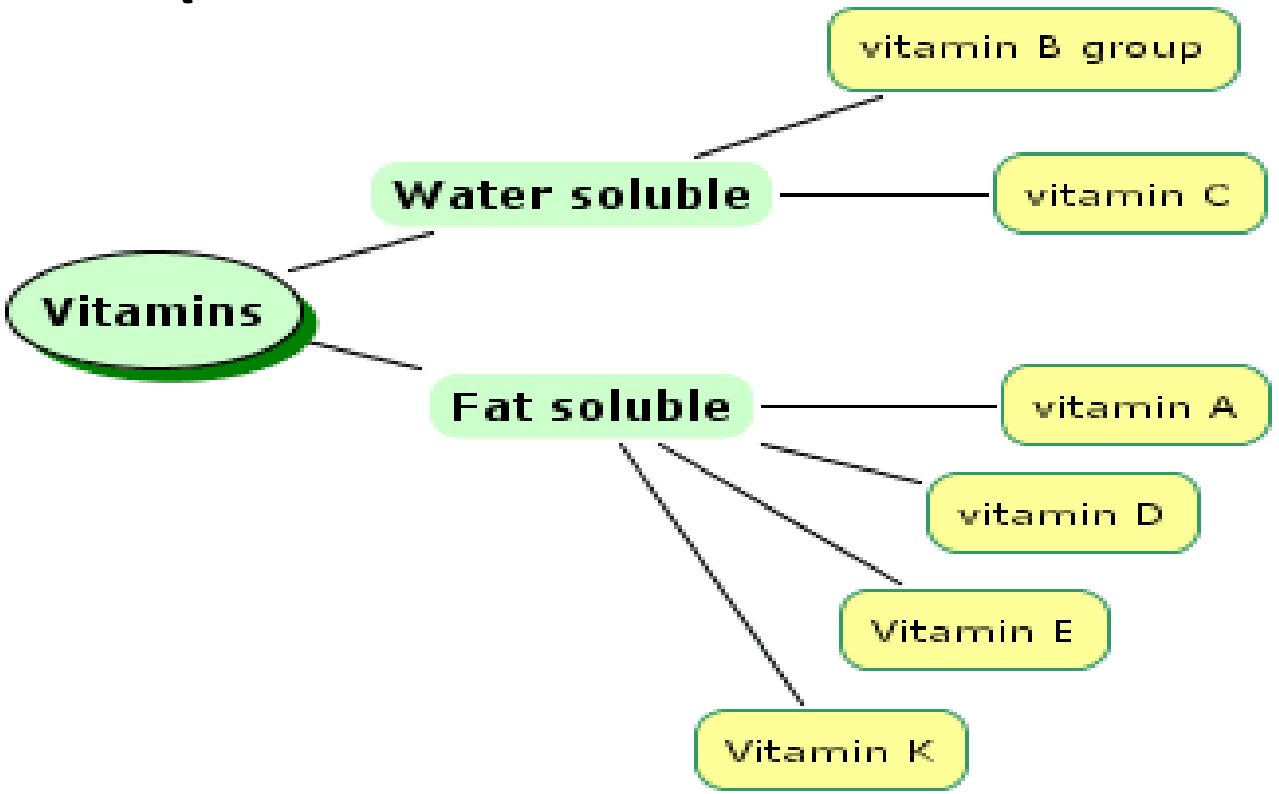


The Process of Lipid Digestion and Absorption

Water Soluble



- Vitamins are classified into two categories based **on their solubility**:
- **Water-soluble or fat-soluble**. In humans there **are 13 vitamins: 4 fat-soluble (A, D, E, and K) and 9 water-soluble (8 B vitamins and vitamin**.



Vitamins differ from other organic food stuffs

1-They do **not enter into tissue structures**, unlike protein.

2- Do **not undergo degradation** for providing energy unlike carbohydrates and lipid.

3- Several B-complex vitamins play an important role as coenzymes in several energy transformation reactions in the body.

The same with hormones

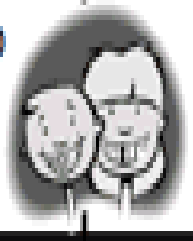
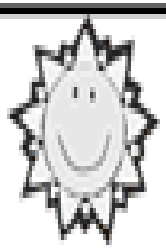
vitamins differ from hormones in **not being produced** within the organism, and most of them have to be **provided in the diet.**

- **Characteristics of the vitamins are:**

1. Micronutrients.
2. Do not supply energy.
3. Do not contribute to body mass.
4. Essential for metabolism.

Comparison of two types of vitamin

	Fat soluble vitamins	Water soluble vitamins
Solubility in fat	Soluble	Not soluble
Water solubility	Not soluble	Soluble
Absorption	Along with lipids Requires bile salts	Absorption simple (except vitamin B_{12})
Carrier proteins	Present	No carrier proteins (except vitamin B_{12})
Storage	Stored in liver	No storage (except vitamin B_{12})
Deficiency	Manifests only when stores are depleted	Manifests rapidly as there is no storage (except vitamin B_{12})
Toxicity	Hypervitaminosis may result	Unlikely, since excess is excreated
Major vitamins	A, D, E and K	B and C

Vitamin	Functions	Sources
A	Healthy teeth, skin, and eyes	Eggs, meat, milk, cheese, dark green leafy vegetables, squash, carrots
B	Helps body use food energy, digest proteins, function of central nervous system, digestion and metabolism	Lean meats, eggs, fish, dairy products, soybeans, yeast, broccoli, lean beef, cabbage, whole grains *note there are a variety of B vitamins; this is a summary
C	Helps immune system, helps wound healing, helps absorb iron	Citrus fruits, green peppers, strawberries, tomatoes, broccoli, sweet and white potatoes, cantaloupe
D	"sunshine vitamin" - helps absorb calcium (for healthy bones and teeth) 	Dairy products, fish, oysters, sunshine! 
E	Protects body against damage from free radicals, helps form red blood cells (to carry oxygen)	Wheat germ, corn, nuts, seeds, olives, spinach, green leafy vegetables, vegetable oils (sunflower oil, soybean oil)
K	Blood clotting, strong bones	Cabbage, cauliflower, spinach, soybeans

Function of vitamins		
Vitamin	**Function**	**Common problems when short**
Vitamin A	Ensures proper formation of membranes throughout body	Susceptibility to infections. Particularly gut, eyes, respiratory and reproductive.
B group vitamins	(Includes B_1, B_2 (riboflavin), B_6 (pyridoxine) B_{12}, choline, folic acid, niacin, pantothenic acid.) Ensure proper use of energy within the body. Nerve function	Lethargy, poor appetite, fits
Vitamin D_3	Absorption of calcium and its control in the body.	Soft bones, poor teeth, weak nerves and muscles
Vitamin E	Anti-oxidant, prevents blood toxicity, reproductive functions	Wasting, kidney disease, low fertility.
Vitamin K	Blood clotting, energy storage	Haemorrhage, over eating
Vitamin C	Tissue repair	Scurvy

- **Deficiencies**

Humans must consume vitamins periodically but with differing schedules, to avoid deficiency. The human body's stores for different vitamins vary widely; **vitamins A, D, and B_{12}** are stored in significant amounts in the human body, mainly in the liver, and an adult human's diet may be deficient in vitamins A and D for many months and B_{12} in some cases for years, before developing a deficiency condition. However, **vitamin B_3 (niacin and niacinamide)** is not stored in the human body in significant amounts, so stores may last only a couple of weeks.

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