Biochem-714

2(2-0)

Biochemistry of Vitamins

Assessment	**Marks**	**Sessional**	**Mid**	**Final**	**Total**
	Criteria Theory	Assignments	Paper	Paper	
		4 (10%)	12 (30%)	24 (60%)	40 (100%)
	Result		**Total: 40 Marks**		

Definition, history, discovery and classification of vitamins

Vitamins

Definition

Organic compounds occurring in natural foods either as such or as utilizable "precursors", which are required in minute amounts for normal growth, maintenance and reproduction, i.e. for normal nutrition and health

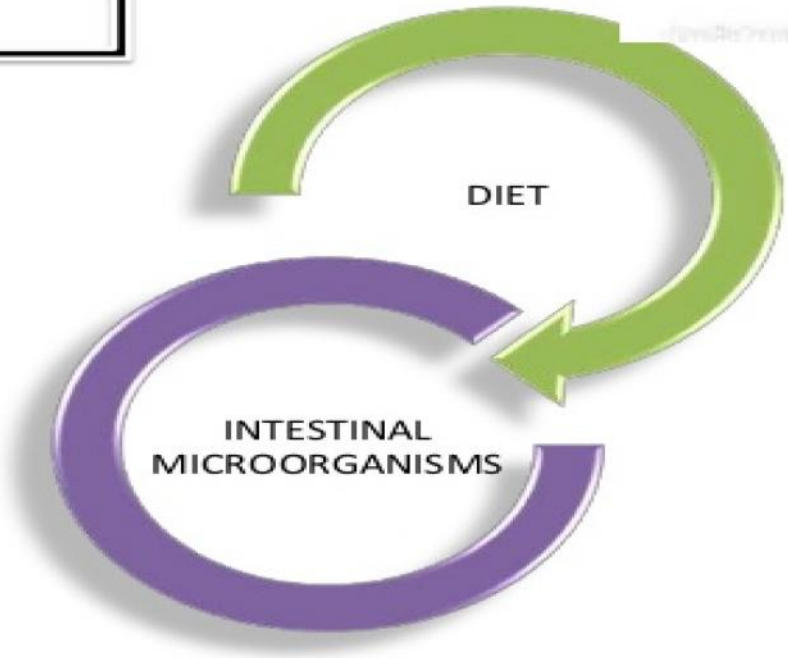
Vitamin

- An organic compound
- Required by an organism
- As a vital nutrient
- in limited amounts

- Micronutrients
- VITAL+ AMINE Nutrients
- µg-mg /day

VITAMINS

SOURCES



VITAMINS

Nutrients

µg-mg /day

- Necessary for normal health and growth
- Regulate metabolism & make possible more efficient use of carbohydrates, proteins, fat
- Diverse in chemical structure & function
- Most vitamins generally cannot be synthesized by animals or humans
- IF synthesized, the amounts are insufficient to meet physiological demand

- So, must be obtained from the diet and/or synthetic source
- FOR this reason, vitamins are called essential nutrients
- Distinct from carbohydrates, fats & proteins in function, as well as in the quantities required

Difference form other organic foods

1. They do not enter tissue structures – unlike PROTEINS
2. They do not undergo degradation for providing energy – unlike CARBS and LIPIDS
3. Several plays role as "coenzymes" in energy transformation reactions

Vitamins Versus Hormones

Most vitamins are not produced within the humans and most of them have to be provided in the diet

Classification

- Classification based upon water solubility

Water-soluble

1. Non-B complex – vitamin C (ascorbic acid)

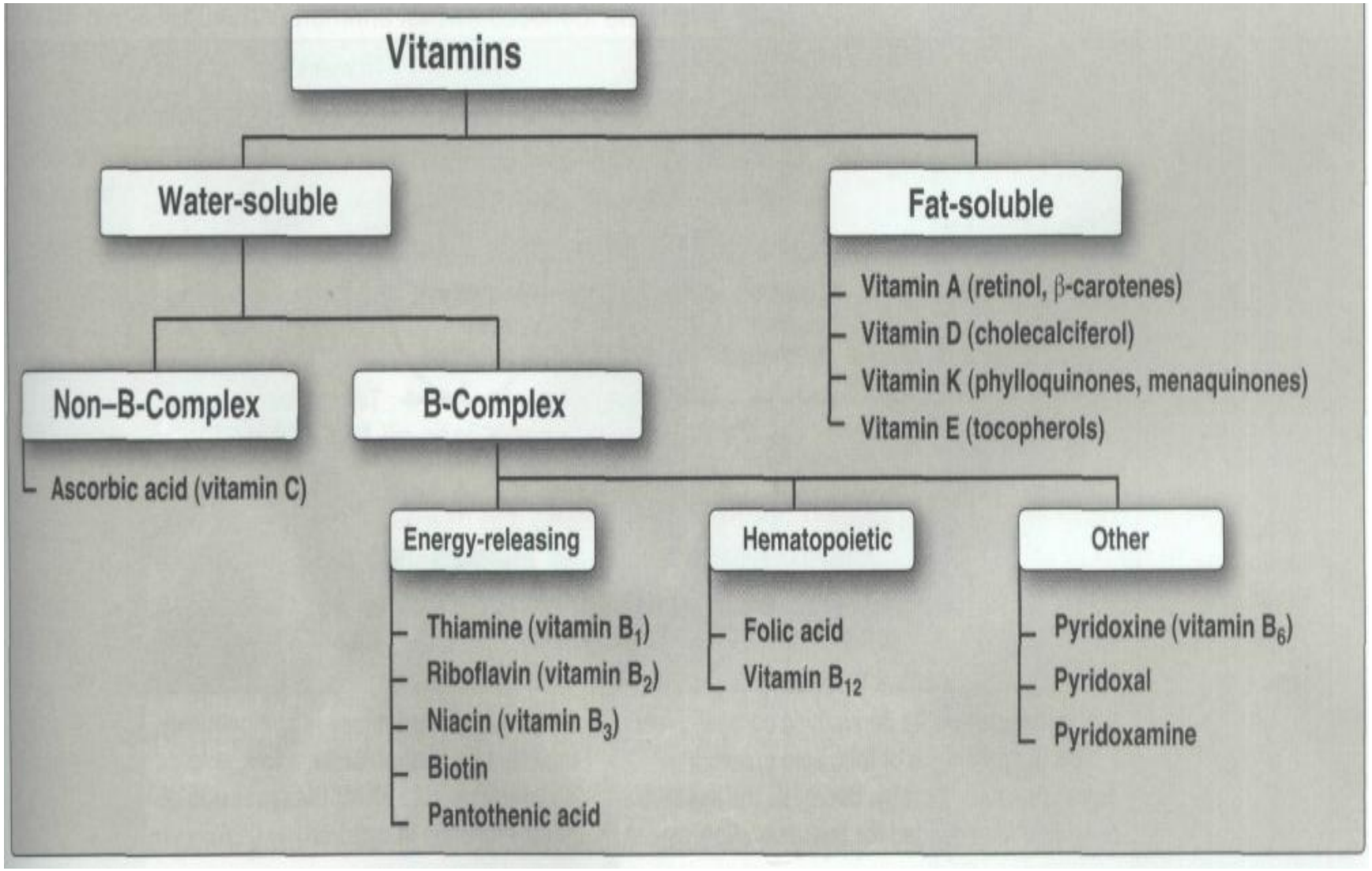
2. B-complex –

- Energy-releasing: Thiamine (vitamin B_1), Riboflavin (vitamin B_2), Niacin (vitamin B_3), Biotin (vitamin H), Pantothenic acid,
- Hematopoietic: Folic acid, Cobalamine (vitamin B_{12})
- other vitamins: Pyridoxine (vitamin B_6), pyridoxal, pyridoxamine.

2. Fat-soluble vitamins

vitamins A, D, E, K

- Vitamin A (retinol, β-carotenes)
- Vitamin D (cholecalciferol)
- Vitamin K (phylloquinones, menaquinones)
- Vitamin E (tocopherol, tocotrienols).


Vitamins
Water-soluble
Fat-soluble
Vitamin A (retinol, β-carotenes)
Vitamin D (cholecalciferol)
Vitamin K (phylloquinones, menaquinones)
Vitamin E (tocopherols)
Non–B-Complex
B-Complex
Ascorbic acid (vitamin C)
Energy-releasing
Hematopoietic
Other
Thiamine (vitamin B_1)
Riboflavin (vitamin B_2)
Niacin (vitamin B_3)
Biotin
Pantothenic acid
Folic acid
Vitamin B_{12}
Pyridoxine (vitamin B_6)
Pyridoxal
Pyridoxamine

VITAMINS Difference b/w water soluble & fat soluble vitamins

	Water soluble vitamins	Fat soluble vitamins
Solubility	Water soluble	Fat soluble
Absorption	Simple	Along with lipids
Storage	*No storage	Stored in liver
Excretion	Excreted	Not excreted
Excess intake	Nontoxic	Toxic
Deficiency	Manifests rapidly	Manifests slowly
Treatment	Regular dietary supply	Single large dose

VITAMINS

• MEDICAL AND BIOLOGICAL IMPORTANCE

Essential for growth, maintenance and reproduction

Fat soluble vitamins are required for normal and colour vision, blood clotting, bone formation and maintenance of membrane structure.

Most of the water soluble vitamins function as coenzymes

Vitamins A and D act as steroid hormones.

Lack of vitamin in the diet produce characteristic deficiency symptoms

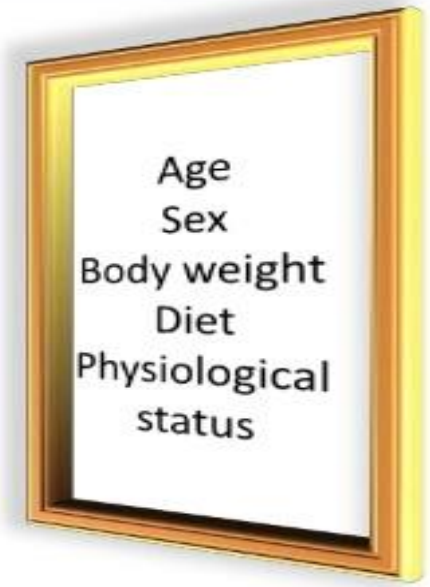
Some drugs and compounds present in natural sources act as antivitamins.

Some vitamin analogs are used as drugs

VITAMINS

RECOMMENDED DIETARY ALLOWANCE

Dietary intake that is considered optimal under ordinary conditions



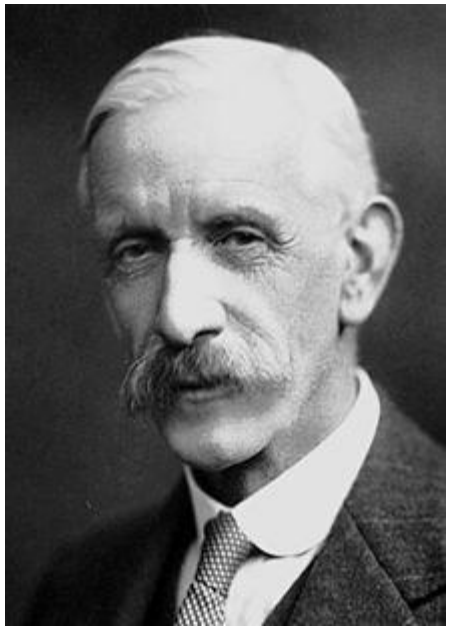
DIETARY VITAMIN DEFICIENCIES

Causes
Inadequate dietary intake
Inadequate intestinal absorption
Inadequate utilization
Increased requirements
Drug induced deficiency

History & Discovery

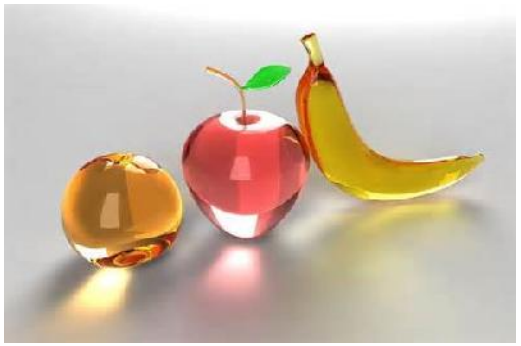
- Englishman William Fletcher
- 1905 -Researching the causes of the disease Beriberi
- Observed that disease was prevented by eating unpolished rather than polished rice
- Concluded - rice husks must have special nutrients (vitamins)

- 1906, English biochemist Sir Frederick Gowland Hopkins discovered that certain food factors were important to health



- Sir Frederick Gowland Hopkins was awarded the Nobel prize in physiology or medicine in 1929, with Christian Eijkman for the discovery of vitamins

- He also discovered the amino acid tryptophan in 1901



- Term vitamin originated from "vitamine," a word first used in 1911 by the Polish scientist Cashmir Funk to designate a group of compounds considered vital for life
- Each was thought to have a nitrogen-containing component known as an amine

- The final "e" of vitamine was dropped when it was discovered that not all of the vitamins contain nitrogen, and, therefore, not all are amines
- The term accessory food factor sometimes is used instead of vitamin to refer to these substances

Brief history of the discovery of the different vitamins

- Vitamin *A*: Elmer V. McCollum and M. Davis discovered vitamin *A* during 1912-1914
- In 1913, Yale researchers, Thomas Osborne and Lafayette Mendel discovered that butter contained a fat-soluble nutrient soon known as vitamin *A*

- Vitamin A was first synthesized in 1947
- Vitamin B was discovered by Elmer V. McCollum sometimes around 1915-1916
- Vitamin B1 by Cashmir Funk in 1912

- Vitamin B2 was discovered by D. T. Smith, E. G. Hendrick in 1926.
- Max Tishler invented methods for synthesizing the essential vitamin B2
- Niacin was discovered by American, Conrad Elvehjem in 1937
- Folic acid by Lucy Wills in 1933
- Vitamin B6 was discovered by Paul Gyorgy in 1934

- The Scottish naval surgeon James Lindin observed in 1747 that a nutrient in citrus foods, now known to be Vitamin C, prevented scurvy
- Vitamin C was rediscovered by Norwegians, A. Hoist and T. Froelich in 1912
- Vitamin C was the first vitamin to be artificially synthesized in 1935

- In 1922, Edward Mellanby discovered Vitamin D while researching a disease called rickets
- Vitamin E was discovered in 1922 in green leafy vegetables by University of California researchers, Herbert Evans and Katherine Bishop discovered vitamin E in green leafy vegetables