

BCMB 3100 - Chapter 7

Introduction to Coenzymes & Vitamins

(Partial notes. The bulk of this chapter will be learned through your group activity and through the web-based tutorial. SEE HANDOUTS!)

- Cofactors**
- Essential ions**
- Coenzymes**
- Cosubstrates**
- Prosthetic groups**
- Coenzymes structure/function/active group**

Coenzymes

Some enzymes require **cofactors** for activity

(1) _____ (mostly metal ions)

(2) _____ (organic compounds)

Apoenzyme + **Cofactor** → **Holoenzyme**

(protein only)

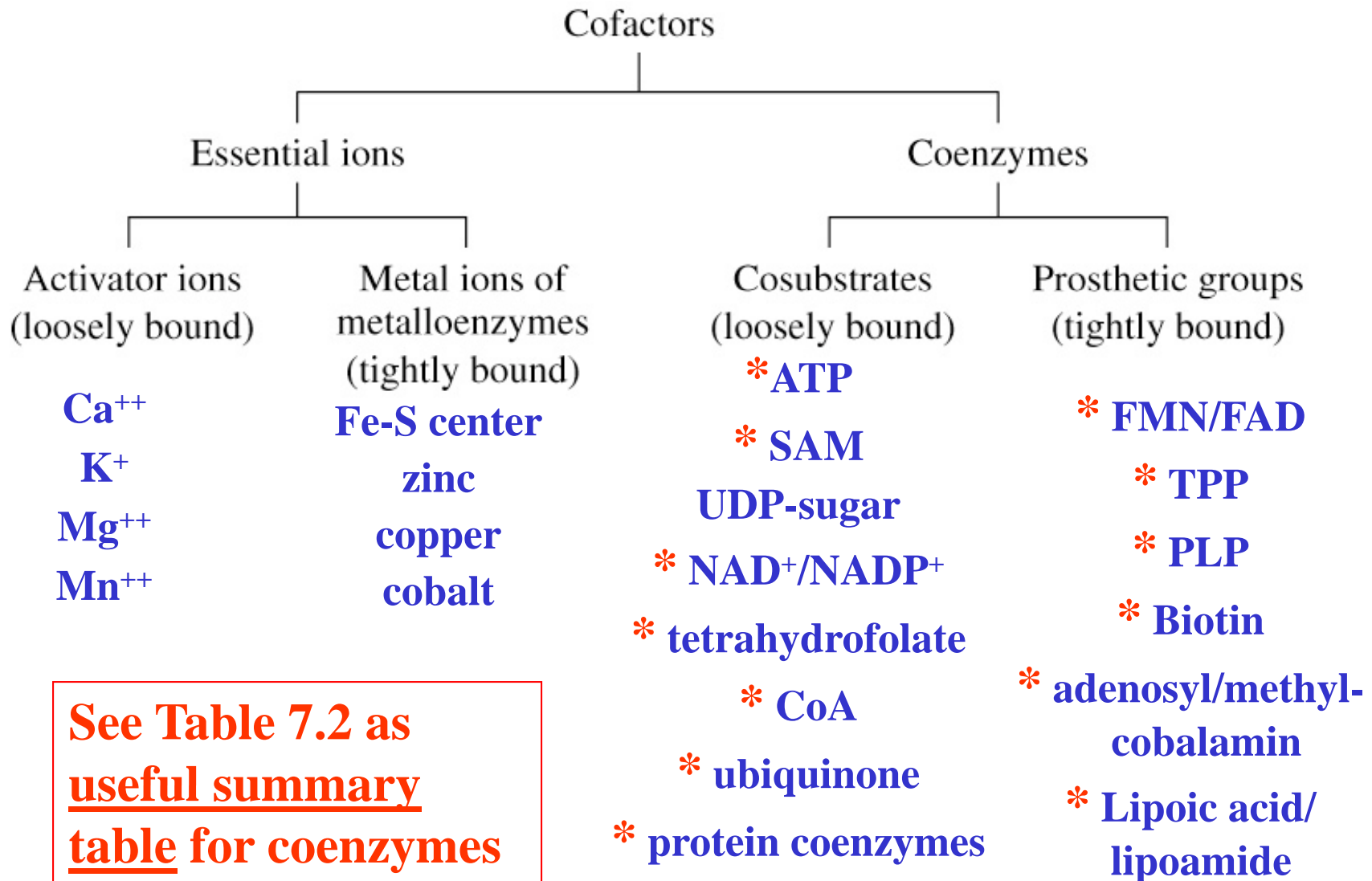
(active)

(inactive)

Coenzymes

- _____ act as group-transfer reagents
- Hydrogen, electrons, or other groups can be transferred
- Two types of coenzymes:
 - metabolite coenzymes**
 - vitamin-derived coenzymes**

Fig 7.1 Types of cofactors



See Table 7.2 as useful summary table for coenzymes

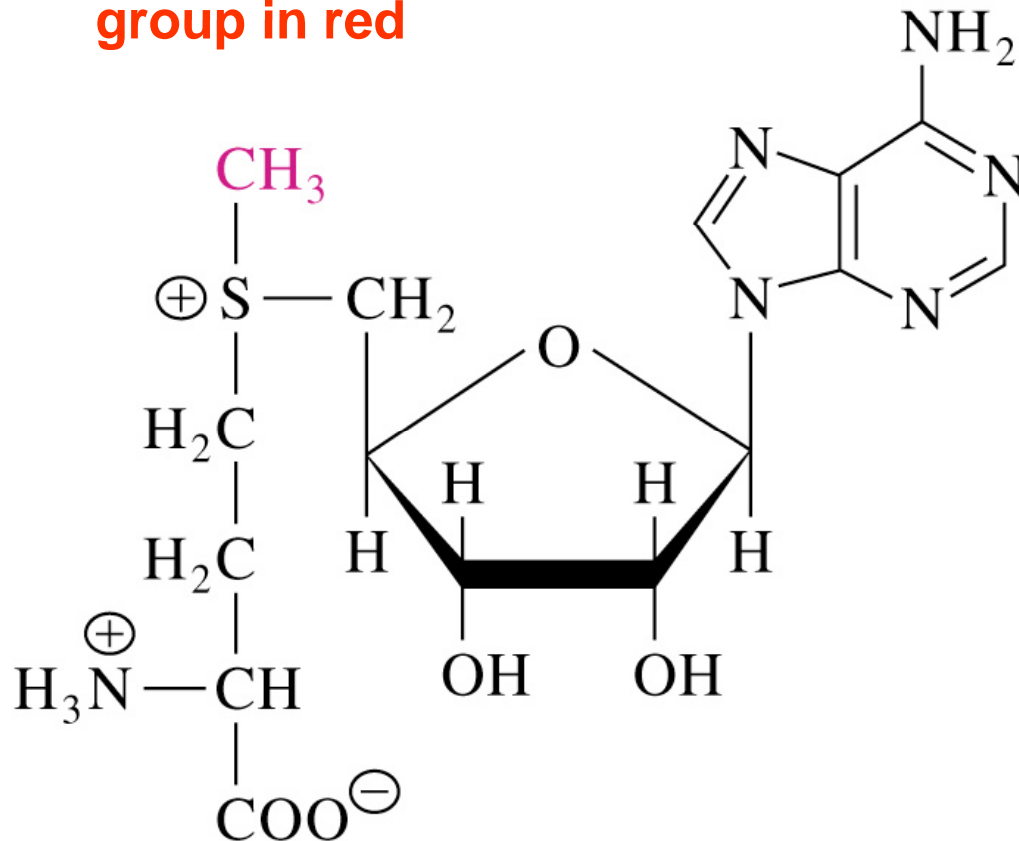
Coenzyme Classification

- There are two classes of coenzymes
 - (1) _____ are altered during the reaction and regenerated by another enzyme
 - (2) _____ remain bound to the enzyme during the reaction, and may be covalently or tightly bound to enzyme

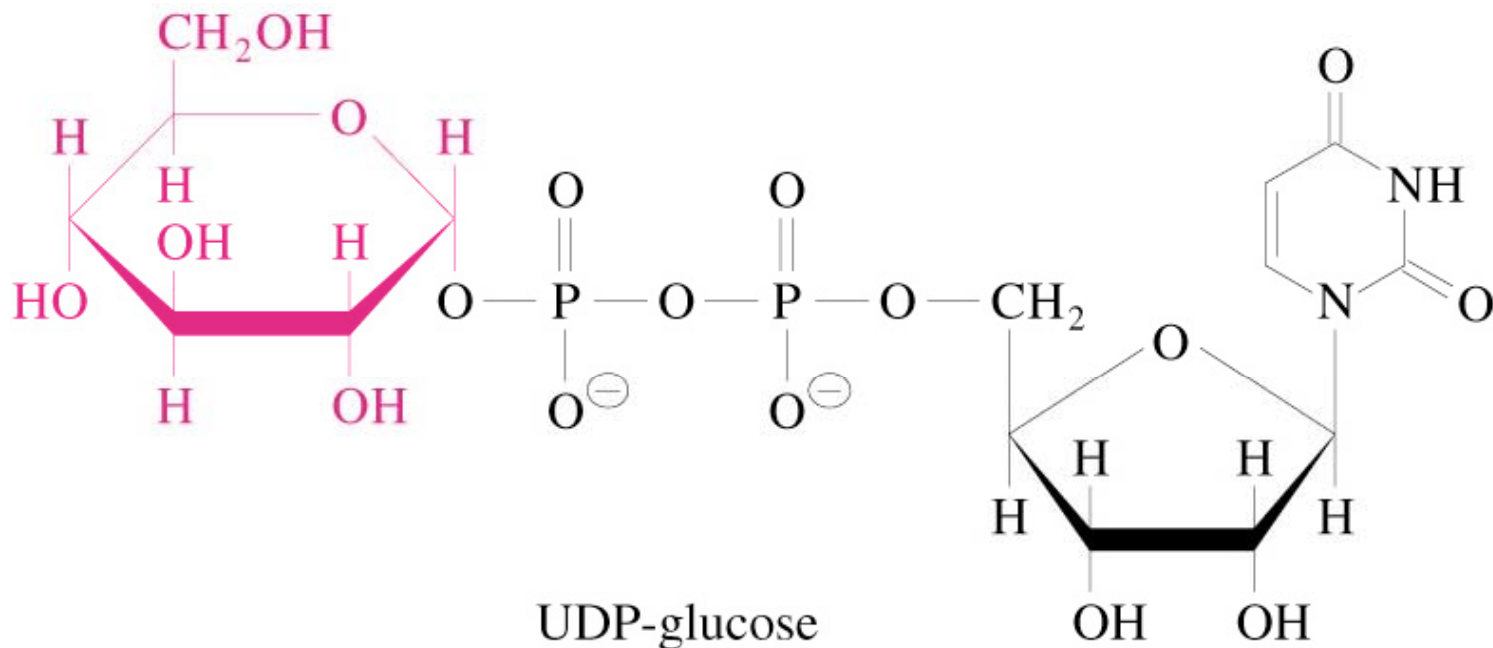
Fig 7.5 S-Adenosylmethionine (SAM)

SAM is the donor of methyl groups for most biosynthetic reactions

Activated methyl group in red



UDP-sugar: activated form of sugars used as substrate in many biosynthetic reactions



Nucleotide-sugars are cosubstrates in many glycosylation reactions

Vitamin-Derived Coenzymes

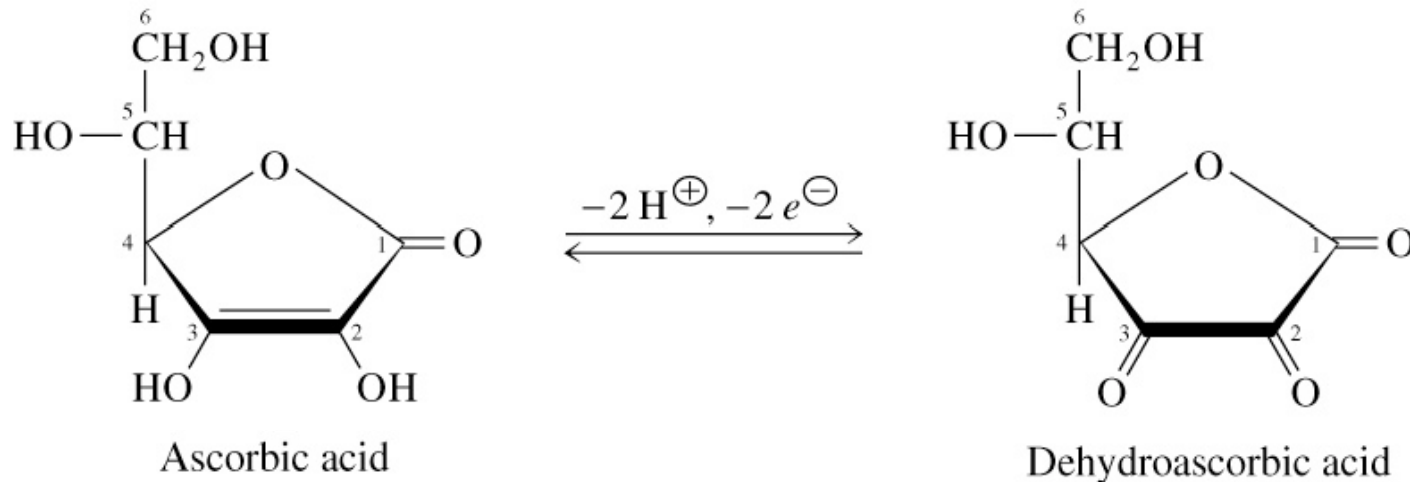
- : required for synthesis of some coenzymes, must be obtained from nutrients
- Animals rely on plants, meat, & microorganisms for vitamin sources
- Most vitamins must be enzymatically transformed to the coenzyme (e.g. some water soluble vitamins)
- **BE SURE TO LEARN WHICH VITAMINS ARE PART OF WHICH COENZYMES (Table 7.2)**

Table 7.1 Vitamins, nutritional deficiency diseases

<u>Vitamin</u>	<u>Disease</u>
Ascorbate (C)	Scurvy
Nicotinic acid (B ₃)	Pellagra
Riboflavin (B ₂)	Growth retardation
Pantothenate (B ₅)	Dermatitis in chickens
Thiamine (B ₁)	Beriberi
Pyridoxal (B ₆)	Dermatitis in rats
Biotin	Dermatitis in humans
Folate	Anemia
Cobalamin (B ₁₂)	Pernicious anemia

Box 7.2 Vitamin C: a vitamin but not a coenzyme

- A reducing reagent for hydroxylation of collagen
- Deficiency leads to the disease scurvy
- Most animals (not primates) can synthesize Vit C



Some vitamins are **Lipid Vitamins**

- Four lipid vitamins: A, D, E, K
- All contain rings and long, aliphatic side chains
- All are highly hydrophobic
- The lipid vitamins differ widely in their functions