CONCEPT: COFACTOR

●Catalytic activity of many enzymes is dependent on the presence of small molecules called _____.

●*Cofactors*: _____-protein portions of enzymes that help with catalysis.

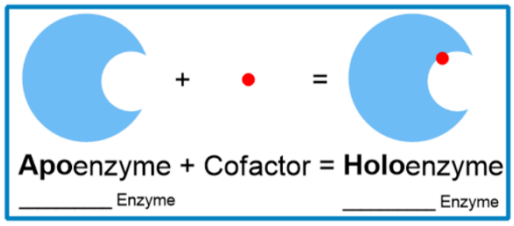
□_____enzymes: *inactive* enzyme without its cofactor.

□_____enzymes: catalytically *active* enzyme with its cofactor.

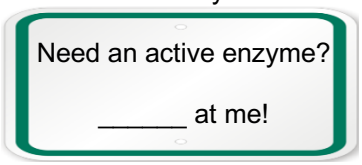
□ Cofactors tend to bind to active sites, but their functional roles _____ greatly from enzyme to enzyme.

EXAMPLE:

Apoenzyme



Holoenzyme



PRACTICE: Aldoase requires Zn^{2+} for catalysis. Under cellular conditions of zinc deficiency, aldoase is referred to as:

a) Apoenzyme. c) Holoenzyme.

b) Coenzyme. d) Prosthetic group.

Coenzymes & Metal Ions

●_____ main groups of cofactors: 1) _____ 2) _____ ions.

1) *Coenzymes*: small organic molecules derived from _____.

□ *Prosthetic groups*: _____ bound or covalently attached coenzymes.

□ *Cosubstrates*: _____ bound *recyclable* substrate-coenzymes (ex. ATP & NADH).

2) *Metal Ions*: metal atoms with a net charge.

□ *Metalloenzymes*: enzymes with _____ bound metal ions (usually Fe^{2+}, Fe^{3+}, Cu^{2+}, Zn^{2+}, or Mn^{2+}).

□ *Activator ions*: _____ bound metal ions (usually Na^{+}, K^{+}, Mg^{2+}, or Ca^{2+}).

Coenzyme	Vitamin Precursor	Example Enzyme
Biotin	Biotin (Vitamin B_7)	Pyruvate Carboxylase
Coenzyme A (CoA)	Pantothenic Acid (Vitamin B_5)	Acetyl-CoA Carboxylase
Flavin Adenine Dinucleotide (FAD)	Riboflavin (Vitamin B_2)	Monoamine Oxidase
Nicotinamide Adenine Dinucleotide (NAD^+)	Niacin (Vitamin B_3)	Lactate Dehydrogenase
Pyridoxal Phosphate (PLP)	Pyridoxine (Vitamin B_6)	Glycogen Phosphorylase

Metal Ions	Example Enzyme
Zn^{2+}	Carbonic Anhydrase
Mg^{2+}	EcoRV
Mn^{2+} or Mn^{3+}	Superoxide Dismutase
K^{+}	Acetoacetyl CoA Thiolase

PRACTICE: Which of the following options is false?

a) Metal ions can bind directly to enzymes or coenzymes. c) Organic cofactors can be called coenzymes.

b) Metal ions often act as cofactors. d) Metal ions can be prosthetic groups.