

ENZYMES & KINETICS

rvsd 10/12/92, 10/6/93, 10/7/94, 10/2/95, 8 Oct 01, 8 Oct 03, 6 Oct 04, 3 Oct 07, 5 Oct 07, 8Oct08, 7Oct09, 11Oct10, 10/10/11 BKH: pp: 134-159, BKH 5th: 130-153, 6th: 127-150, 7th: 129-152

If $\Delta G = \text{negative}$ [spontaneous reaction], why doesn't a reaction go?

Activation energy required

Reaction energy versus activation energy:

Illustrate profile of chemical reaction (p 130)

metastable state: lack of stable intermediates slows reaction

catalysts stabilize intermediates, reduce activation energy, therefore speed up reactions

In biological systems, catalysis is performed by

enzymes = protein catalyst

Enzyme: **apoenzyme** = protein component
prosthetic group = if inorganic = **cofactor** (Mg^{++} , Ca^{++} , Fe^{++} , etc)
 if organic = **coenzyme** (most are **vitamins**)
holoenzyme = entire, active enzyme

Active site substrate binding to enzyme:

Lock and key (p 132) versus induced fit (p 137)

substrate specificity high in biological systems

Steps: substrate binding, activation, chemical reaction to finish

Enzyme activity dependant on proper folding of enzyme:

Amino acid sequence, pH, temperature, osmolarity

(p 134: draw optimum curves for pH and temperature)

Allosteric site ("other place") binds non-competitive inhibitors (for regulation)

KINETICS: (p. 137) rate = velocity = reactant consumed (or product made)/unit time.

LINEAR GRAPH: rate or **velocity** vs **[S]** shows **substrate saturation** Show **V_{max}** (p. 139 & 143)

Then add inhibitors: competitive & non competitive (p 145)

overcoming of competitive inhibition, but not allosteric inhibition

Examples: **Competitive:** pABA is displaced by sulfanilamide
Allosteric: histidine biosynthetic pathway
 Isoleucine biosynthetic pathway (p 144)

Michaelis-Menten: $v = V_{max}[S]/(K_m + [S])$

K_m is Michaelis Menten constant, = [S] yielding 1/2 V_{max}

Lineweaver-Burk plot, double reciprocal plot (p. 142 and 144)

X intercept = -1/K_m

Y intercept = 1/V_{max}

Note that **end-product inhibition** in metabolic pathways:



Regulates commitment of resources.

Example: G enzyme, first in histidine biosynthetic pathway, is inhibited by histidine, also isoleucine inhibition of threonine deaminase (p. 147)

Glycogen phosphorylase: (p 149)

active when phosphorylated by phosphorylase kinase. Inactive if PO_4 is lacking.

Irreversible inhibition by heavy metals, halogens, alkylating agents, bind covalently to enzyme, destroy catalytic activity.

