Biochemistry

Proteins

Isoelctric Point

Average pKa of the zwitterion: pi $= \frac{pKa1 * pKa2}{2}$

Enzymes

Overview

· Active site vs Induced fit model: In the former the active site matches the substrate while in the former the substrate slightly temporarily alters the active site creating a better fit

· Co-Enzyme: Organic carrier molecules

· Enzyme cofactor is a an inorganic molecule that is nessecary for an enzyme to function

· Vitamins and Minerals: The former being organic and the latter being inorganic and both of which not being produced naturally and are often used as co-factors and co-enzymes

Catalytic Strategies

· Acid/Base

· Covalent

· Electrostatic

· Proximity/Orientation

Types

· Transferase: Transfers a functional group from A to B

· Ligase: Joins together A and B through dehydration reaction

· Oxidoreductase: Assist w/ a redox reaction

· Isomerase: Converts a molecule to one of its isomers

· Hydrolase: Breaks molecule in two parts through hydrolysis

· Lyase: Breaks molecule without using hydrolysis or redox typically using double bonds

Enzyme Kinetics

Michaelis-Menten and Lineweaver Burke

Values

V_{max}: Fastest speed for a given Enzyme and substrate

K_M is the $[S]$ where $\frac{1}{2}V_{max}$ is achieved

k_{cat}: Turnover rate

Relations

K_M is the $[S]$ where $\frac{1}{2}V_{max}$ is achieved

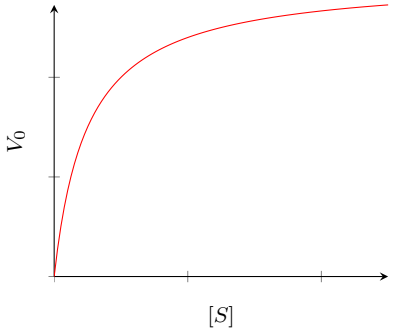
Catalytic Efficiency $= \frac{k_{cat}}{K_M}$

$V_{max} = k_{cat}[E]$

$K_M \propto 1/$Substrates affinity of an enzyme

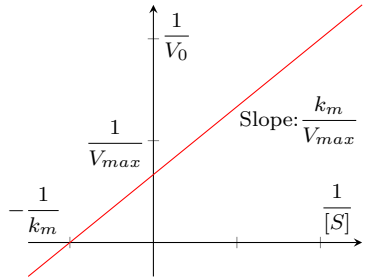
Michaelis-Menten

$V_0 = \frac{V_{max}[S]}{k_m + [S]}$



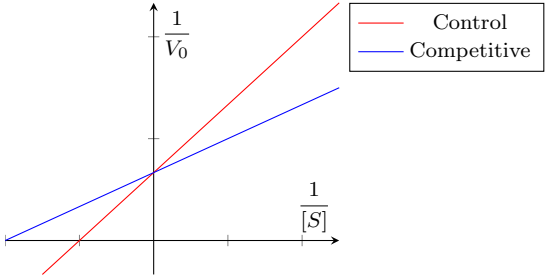
Lineweaver-Burk

$\frac{1}{V_0} = \frac{k_m}{V_{max}[S]} + \frac{1}{V_{max}}$

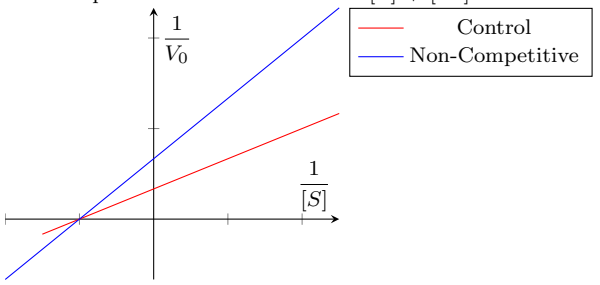


Enzyme Inhibition

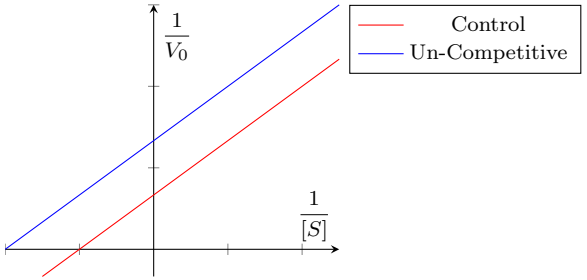
Competitive Inhibitor: Binds to [E]



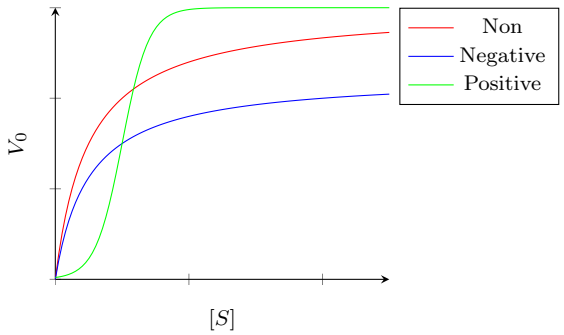
Non-Competitive Inhibitor: Binds to [E] + [ES]



Un-Competitive Inhibitor: Binds to [ES]



Cooperativity



Allosteric Regulation

Activator: ↑ Vmax and ↓ Km

Inhibitor: ↓ Vmax and ↑ Km

Homotropic Regulator: Same as the substrate

Heterotropic Regulator: Different than the substrate

Enzyme Modification

Types

Methylation: Adding a methyl group

Acetylation: Adding an acetyl group

Glycosylation: Adding a sugar

Suicide Inhibitors utilize covalent modification to irriversably bind to an enzyme

Zymogens

· Inactive enzyme that require chemical modification

· Enzymes of this type end in -ogen

· Often used in digestive system to avoid breaking down in wrong location