METABOLISM, ENZYMES AND KINETICS

10/12/92, \10/6/93, 7/15&18/94, 7/17/98 2 June 99, 18 July 01, 17 Jan 02, 12 July 02, 16July04, 15July05, 13July07, 16July08, 13July09, 19July10, 2Mar11, 26Sept12
B&D P. 132-, tfc: 101-, Alcamo p 121-126, 697, TFC 7th: 113-133, 8th: 111-148, Black 6th: 113-125, Bauman, 123-138, Bauman 4th: 124-1332

METABOLISM, Sum of: (p 125)	**catabolism**	degradative	hydrolysis	energy released (can generate ATP)
	anabolism	biosynthetic	dehydration condensation	energy consumed.(required ATP)

Illustrate chem. reaction profile: (p 129) energy content curve vs time for chem reaction with and without **catalyst**. Products contain less energy than reactants, why doesn't rxn go? Need activation energy.

Reaction energy versus **activation energy**: metastable state: lack of stable intermediates
catalysts stabilize intermediates, reduce activation energy, therefore speed up reactions

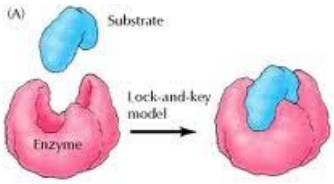
Pasteur found that yeast were necessary for grape juice to be fermented.

Buchner brothers (p 11) (1897) Used sugar to preserve yeast extract for nutritional supplement. Noted alcoholic aroma and taste days later. Demonstrated it was ***in vitro*** fermentation, found agents "inside yeast" performed chemical changes: called ***en-zymes*** [inside yeast]

ENZYME:(p. 128)In biological systems, catalysis is performed by **protein catalyst = enzyme**

apoenzyme [detach] = protein component of enzyme
prosthetic [onto, place] = **cofactor** or **coenzyme**
holoenzyme [entire] = entire functional enzyme

PROSTHETIC GROUPS:
coenzymes: organic (many are vitamins):
NAD, FAD, Coenzyme A, FMN
cofactors: inorganic (metal ions):
Fe, Mg, Ca, Mn, Zn.
(trace elements required by organisms)



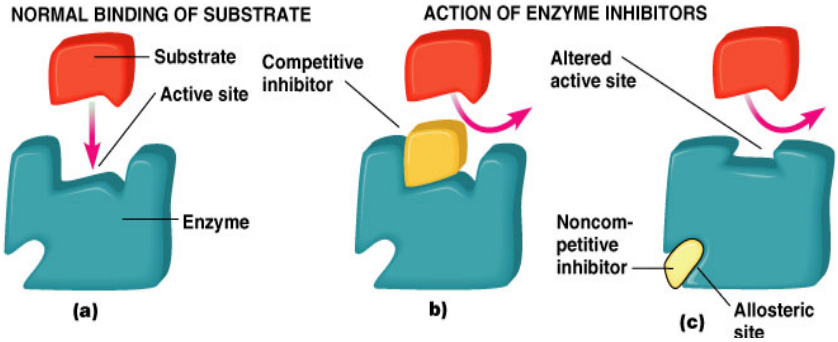
Active site binds **substrate**. (P. 130) Induced fit, lock and key for **substrate**: when enzyme grasps substrate, changes conformation. Substrate specificity high in biological systems

PROTEIN STRUCTURE: Review four levels which lead to precise folding (Review p 48)
Proper folding is critical for activity, affected by: (p 131) temp, pH, heavy metals (note optimal conditions)

KINETICS: GRAPH:
velocity (rate of reaction) **vs [S]** shows saturation.
Vmax is achieved with substrate saturation

INHIBITORS:
Competitive versus Allosteric (reversible inhibition)

competitive (p 132) sulfanilamide drugs inhibit binding of pABA in folate synthesis.(p 132)
allosteric (p 133) end-product inhibition, p 134): metabolic pathways regulate commitment of resources.
Note: High [S] overcomes competitive inhibition, but not allosteric inhibition

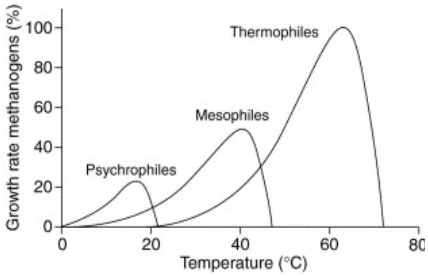


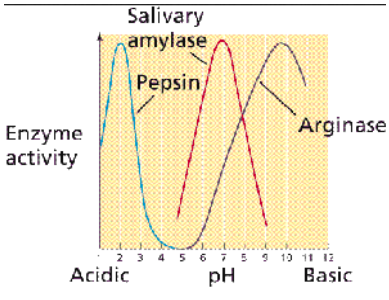
Irreversible inhibition 1) heavy metals bind to -SH groups often at active sites
2) halogens add at tyrosine side chains,
3) alkylating agents, bind covalently to enzyme, destroy catalytic activity.

Illustrate normal, competitive & noncompetetive

Prerequisites for enzyme activity:
inhibit enzymes = antibacterial = preservatives

enzyme & substrate competitors for active
water dehydration, hyperosmotic conditions
cofactors EDTA removes cofactors: especially divalent cation metals,
coenzymess sulfanilamide drugs inhibit binding of pABA in folate synthesis.(p 132)
proper temp refrigeration, pasteurization: **illustrate optimum temp:**
psychro-, meso-, thermophile
proper pH pickling: illustrate **pH optimum** curves: pepsin, sucrase, alkaline phosphatase
proper S-S bonds heavy metals bind to sulfhydryls
proper -OH bonds iodine and other halogens





antibiotics and their targets:

Bacterial target	Antimicrobial agent
Cell wall synthesis	β-Lactam
	Glycopeptides
Protein synthesis	Aminoglycosides
	Macrolides
	Lincosamides
	Ketolides
	Streptogramins
	Tetracyclines
	Chloramphenicol
	Oxazolidinones
RNA synthesis	Rifamycins
DNA synthesis	Coumarins
	Naphthyridines
	Quinolones
	2-Pyridones
Intermediary metabolism	Sulfonamides
	Trimethoprim