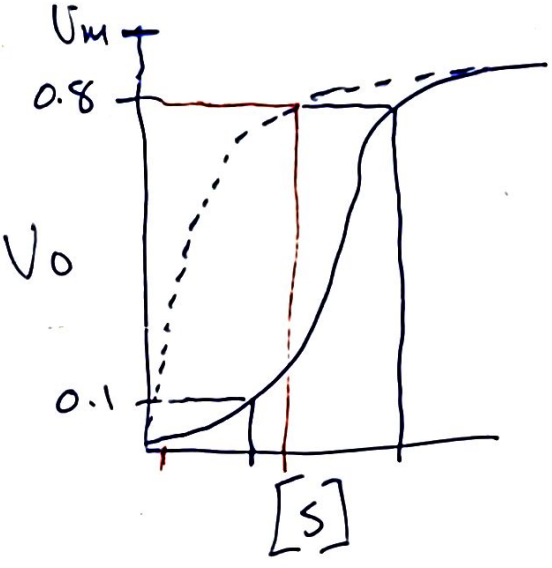
Homework 5

1) i) Physical amount of protein (eg: ubiquitination)
ii) Allosteric regulation (ATP/CTP regulating ATCase)
iii) Covalent modification (Phosphorylation)
iv) Isozymes (Lactate Dehydrogenase)
v) Zymogen production (Chymotrypsinogen)

2)



---- = nonallosteric enzyme
—— : allosteric enzyme

The substrate concentrations necessary to reach 0.8 Vm and 0.1 Vm are quite different for each type of enzyme. When you take the ratio of $\frac{[S]0.8V}{[S]0.1Vm}$, the allosteric enzymes are always considerably lower.

This means that an allosteric enzyme can reach Vm at a much lower change in [S] than a non-allosteric enzyme. This is important for 2 reasons (that are connected) First, cellular pathways operate at or very near equilibrium. If a reactant concentration changes in one pathway, then all related pathways respond until the metabolite concentrations return to equilibrium levels. Second, by being able to rapidly restore equilibrium in metabolic pathways, the cell is "more fit" for the biological niche it occupies and is competing to hold.

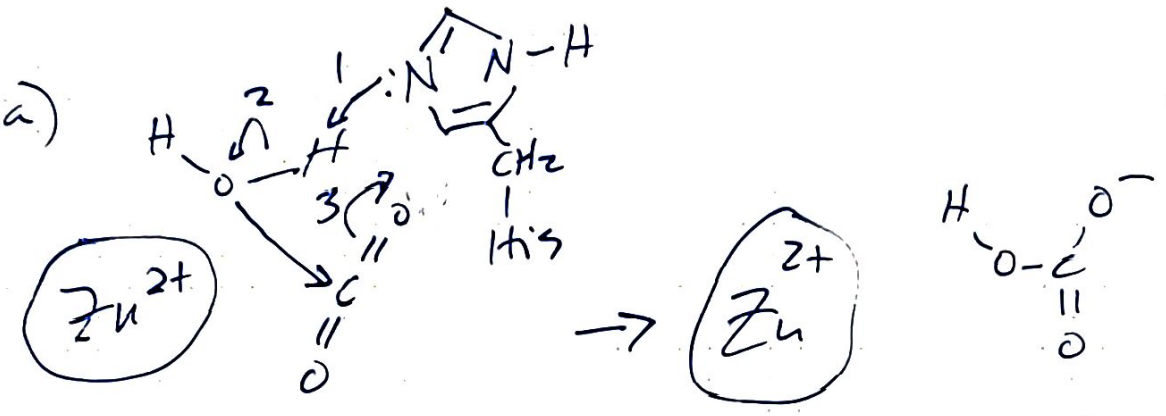
3) Carboxylic acid carbons would be readily attacked by water oxygens, so the phosphate group would be immediately hydrolyzed off.

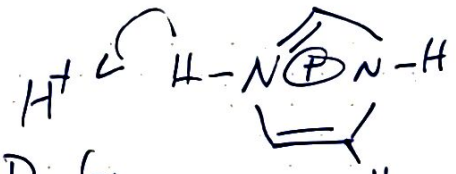
4) Divergent evolution is when a mutation occurs in the gene of an enzyme that results in the creation of a new enzyme that catalyzes the same reaction, but has a different substrate specificity.

An example of divergent evolution would be any of the serine proteases within the human genome. Trypsin/ Chymotrypsin/ Elastase for example.

5) Convergent evolution occurs when two different species arrive at the same molecular solution to a biochemical challenge. Mammalian trypsin and Subtilisin from the Gram (+) soil bacterium, Bacillus subtilis, are examples of serine proteases, but they have completely different 1° and 3° structures.

6) a)





Proton shuttle removes H^+ and puts it outside enzyme.

b) Without a proton shuttle, there would be no way to activate the H_2O to generate $HO^\ominus$. So the V_0 would <u>decrease</u>

7)