Highlights Enzymes

1. Inhibition of enzymes occurs competitively when the inhibitor of the enzyme resembles the substrate and competes with the substrate for binding to the enzyme. Because they are competing with each other for the same site on the enzyme, the substrate can "overcome" the inhibitor at high concentrations (because reactons are set up with a fixed amount of inhibitor). Thus, although it will require more substrate in the presence of an inhibitor to get the same enzyme reaction velocity as when there is no inhibitor, the Vmax of a competitive inhibition is unchanged from the uninhibited reaction.

2. Note above that "it will require more substrate in the presence of an inhibitor to get the same enzyme reaction velocity as when there is no inhibitor," so the apparent Km will change. It requires MORE substrate to get the reaction with the inhibitor to half maximum velocity (compared to uninhibited). Therefore, the apparent Km for a reaction undergoing competitive inhibition INCREASES, meaning the apparent affinity of the enzyme for substrate DECREASES.

3. In non-competitive inhibition, the inhibitor binds to a site on the enzyme that is NOT related to the substrate. Therefore, substrate and inhibitor are NOT competing for the enzyme. This means then that increasing the substrate concentration does NOT affect the inhibitor's ability to inhibit the enzyme. It also means that a fixed percentage of the enzyme is always inactivated by a non-competitive inhibitor. In non-competitive inhibition, the apparent Km is the same as the uninhibited reaction, whereas the Vmax decreases.

Material for exam 2 starts BELOW

Control of Enzymes

1. Allosteric regulation occurs when an enzyme's activity is affected by binding of a small molecule. Allosteric control occurs as a result of subtle changes in tertiary and quaternary structure that occur as a consequence of the allosteric compound's binding to the enzyme.

2. An "allosteric effector" is a molecule that binds to an enzyme and causes allosteric effects. Positive allosteric effects involve "activation" of the enzyme - increasing its activity. Negative allosteric effects involve "inhibition" of the enzyme - decreasing its activity.

3. ATCase is an enzyme that is allosterically regulated positively AND negatively. A positive allosteric effector of ATCase is ATP, which increases the enzyme's activity. A negative allosteric effector of ATCas is CTP, which decreases the enzyme's activity. CTP is also known as a feedback inhibitor of ATCase, because CTP is the end product of the pathway that ATCase starts the catalysis of. That is, ATCase catalyzes a reaction that ultimately leads to CTP. Whenever and end-product of a pathway inhibits the first (or close to the first) enzyme of that pathway, the phenomenon is known as feedback inhibition.

4. ATCase is also activated by one of its substrates, aspartate.

5. ATCase has 12 subunits - 6 identical regulatory subunits and 6 identical catalytic subunits. ATP and CTP bind to the regulatory subunits. Aspartate binds to the catalytic subunits. ATP and aspartate convert ATCase into the R state (more active) whereas CTP converts ATCase into the T state (less active).

6. The Concerted Model says that enzymes exist in two forms - R (relaxed) and T (taut or tight). The R form

is more active and the T form is less active. The Concerted Model postulates that all subunits of an enzyme convert R to T or T to R freely and that the R form of the enzyme is stabilized by binding a positive effector. Conversely, the Concerted Model says that the T form is stabilized by binding of a a negative effector.

7. The Sequential Model of explaining allosterism states that binding of a substrates is what CAUSES conversion of T to R or R to T forms of the enzyme. This is brought about as a result of the Induced Fit of the enzyme to the substrate. The induced fit brings about changes in the structure of the subunit to which the substrate is bound. Quaternary interactions subsequently cause the adjoining subunits to "flip" as well.

8. Allosterism is only one way of controlling enzymes. Another powerful control over enzymes (for some enzymes) is covalent modification.

9. Covalent modification involves making or breaking covalent bonds within or to an enzyme. One common covalent modification is phosphorylation (putting on a phosphate) or dephosporylation (taking off a phosphate). Only the hydroxylated aminos acids (serine, threonine, or tyrosine) can be phosphorylated.

10. Enzymes that put phosphates onto things are called kinases. Enzymes that take phosphates off are known as phosphatases.