EKPO MFONISO GODWIN

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BTG 406

ASSIGNMENT TITLE: Enzyme Induction

Induced Fit Model of Enzyme Action

For many years, scientists thought that enzyme-substrate binding took place in a simple "lock-and-key" fashion. This model asserted that the enzyme and substrate fit together perfectly in one instantaneous step. However, current research supports a more refined view called induced fit. As the enzyme and substrate come together, their interaction causes a mild shift in the enzyme's structure that confirms an ideal binding arrangement between the enzyme and the substrate.

This makes the enzyme catalytic which results in the lowering of the activation energy barrier causing an increase in the overall rate of the reaction. In other words, when a substrate binds to an enzyme, it will change the conformation of the enzyme. This forms a transitional intermediate which lowers the activation energy and allows the reactants to proceed towards the product at a faster rate. The enzyme will change its shape until it is completely complementary to a substrate to activate the enzyme-substrate complex.

As the Enzyme-substrate complex is formed, free energy is released from the formation of the many weak interactions between the enzyme-substrate complex. The free energy that is released is called binding energy and it is maximized only when the "correct" substrate binds to the corresponding specific enzyme. To maximize the release of free energy, the substrate has to be in its transition state. When this happens, the Enzyme-substrate complex becomes a catalyst which then makes other activation energies lower.

The active site is the binding site for catalytic and inhibition reaction of enzyme and substrate; structure of active site and its chemical characteristic are of specificity for binding of substrate and enzyme. Two theories for the ways in which enzyme binds to substrate are lock-and-key model and induced fit model. The induced fit model describes the formation of the E-S complex as a result of the interaction between the substrate and a flexible active site.

The Michaelis Menten model is related to the kinetics of enzyme catalyzed reactions, and describes the relationship between the concentration of substrate and enzyme velocity in a reaction assuming that no allosteric effects exist.

Adenylate kinase is a good example of induced fit enzyme. This enzyme functions by slightly changing conformation when both the necessary substrate, ATP and NMP are bound. When both ATP and NMP are bound to this kinase, a part of this enzyme called the P-loop moves down and forms a lid over the two groups. This in turns helps to hold the two substrates closer together in order to move easily and carry out the reaction of transferring a phosphate group from ATP to NMP. This holds the phosphate group of ATPs to a closer proximity to NMP and also holds the two substrates in the proper orientation.

This conformational change helps to carry out the reaction more efficiently by placing the substrate in the right position and closer to each other. When both substrates are bound, various conformational changes occur and this ensures that the reaction only proceeds when both substrates are present. This eliminates any unnecessary transfer of a phosphate group to water if the NMP is not present.