A Note on Bio-catalytic Enzymes

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Editorial

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DESCRIPTION

Catalysts help to accelerate chemical reactions. Substrates are molecules that enzymes can act on, and the enzyme converts the substrates into Various molecules known as products. Almost all metabolic processes in the cell rely on enzyme catalysis to take place at fast enough rates to sustain Life. Individual steps in metabolic pathways are catalysed by enzymes. Enzymology is the study of enzymes, and pseudoenzyme analysis recognises that some enzymes have lost their ability to carry out biological catalysis during evolution, which is often reflected in their amino acid Sequences and unusual 'pseudocatalytic' properties. Enzymes are known to Catalyse over 5,000 different biochemical reactions. Ribozymes, which are Catalytic RNA molecules are another type of biocatalyst.

The unique three-dimensional structures of enzymes contribute to their specificity. Enzymes, like all catalysts, increase the rate of a reaction by decreasing its activation energy. Some enzymes have the ability to accelerate the conversion of substrate to product by millions of times [1]. Orotidine 5'-phosphate decarboxylase, for example, allows a reaction that would otherwise take millions of years to happen in milliseconds. Enzymes, like any other catalyst, are not consumed in chemical reactions and do not change the equilibrium of the reaction. Enzymes are much more specific than most other types of catalysts [2]. Other molecules can influence enzyme activity: inhibitors reduce enzyme activity while activators increase it. Enzyme inhibitors are found in a wide range of therapeutic drugs and poisons. Outside of its optimal temperature and pH, an enzyme's activity decreases significantly [3,4]. And many enzymes are (permanently) denatured when exposed to excessive heat, losing their structure and catalytic properties. Some enzymes are commercially used, such as in the synthesis of antibiotics. Enzymes are used in some household products to speed up chemical reactions. For example, enzymes in biological washing powders break down protein, starch, or fat stains on clothes, and enzymes in meat tenderizer break down proteins into smaller molecules, making the meat easier to chew [5]. Enzymes are globular proteins that can act alone or as part of larger complexes. The sequence of the amino acids defines the structure, which in turn determines the enzyme catalytic activity.

Although structure determines function, a novel enzymatic activity cannot yet be predicted solely on the basis of structure. When enzyme structures are heated or exposed to chemical denaturants, they unfold (denature), resulting in a loss of activity [6-8]. Enzyme denaturation is typically associated with temperatures above a species' normal level as a result enzymes from bacteria living in volcanic environments such as hot springs are prized by industrial users for their ability to function at high temperature allowing enzyme-catalyzed reactions to be run at a very high rate. Other molecules can influence enzyme activity: inhibitors reduce enzyme activity, while activators increase activity [9]. Enzymes are typically much larger in size than their substrates. The monomer of 4-oxalocrotonate tautomerase has only 62 amino acid residues, whereas the animal fatty acid synthase has over 2,500 residues. The catalytic site is only a small portion of their structure (around 2–4 amino acids). This catalytic site is near one or more binding sites where residues orient the substrates. The active site of an enzyme is made up of the catalytic and binding sites. The remaining majority of the enzyme structure serves to keep the active site's precise orientation and dynamics. Some enzymes do not directly involve amino acids in catalysis; instead, the enzyme contains sites to bind and orient catalytic cofactors. Allosteric sites are found in enzyme structures where the binding of a small molecule causes a conformational change that increases or decreases activity [10]. There are a few RNA-based biological catalysts known as ribozymes that can act alone or in complex with proteins. The ribosome, a complex of protein and catalytic RNA components is the most common of these.

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