Kinetics of Enzyme

Enzyme kinetics is the study of the chemical reactions that are catalysed by Enzymes. In Enzyme kinetics, the reaction rate is measured and the effects of varying the conditions of the reactions are investigated. ... The Michaelis—Menten model of Enzyme kinetics was derived for single substrate reactions.

A brief history of Enzyme kinetics given by Keith J. Laidler.

This history gives a few dates. In the space available, I can do no more than give a broad outline of the development of enzyme kinetics. Every science has two distinct but two closely related aspects: Structure and speed. Fermentation, with which Buchner's name is firmly associated and which has inspired the present volume, provides a simple example. To understand fermentation properly we need to have knowledge of the structures of the chemical substances involved, and of the speeds with which they undergo chemical reaction. Fermentation is an example of a vast group of chemical reactions that are catalysed by enzymes, all of which are protein molecules. The word catalyst was coined in 1836 by the great Swedish chemist Johns Jakob Berzelius, who collected a number of examples of catalysis, though he did not discover the concept of catalysis. Almost all of the chemical processes that occur in biological systems would occur extremely slowly if suitable enzymes were not present to speed them up; life as we know it would be impossible.

The matter of the speed with which processes occur is of permanent importance as far as the continued existence of the universe is concerned—living systems are concerned—indeed as far as the continued existence of the universe is concerned. The branch of chemistry which deals with the rates of chemical processes is known as chemical kinetics or as chemical dynamics. The branch that deals with the question of whether processes can occur at all is known as chemical thermodynamics. The laws of thermodynamics allow a vast number of chemical reactions to occur, but if there were no restrictions on them the universe as we know it would exist for no more than a fraction of a second. The restrictions that exist take the form of

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Energy barriers, which chemists call activation energies. If chemical reactions had zero activation energy, every time two reactant molecules came together there would be instant reaction. If this were true for every possible chemical reaction, there would at once be chaos. Suppose that the world were as it now is, and the barriers were all removed. Every tree would at once react with the oxygen of the atmosphere, and the same would happen to our bodies. In other words, the universe as we know it is as much controlled by the laws of chemical dynamics as by the laws of chemical thermodynamics.

Chemists have been making accurate study of the rates of reactions, and the factors that control them, since the middle of the 19th Century. Often they found that the rates were proportional to the concentrations of the substances that were reacting together. In 1892, however the British chemist Adrian John Brown, found in a study of the rate of fermentation of sucrose in the presence of yeast that the rate seemed to be independent of the amount of sucrose present (Brown, 1892). Later he suggested that this result could be explained if the invertase molecules present in the yeast formed an addition complex with the sucrose (Brown, 1902).

This was the first time that the existence of an enzyme–substrate complex was deduced from the kinetics of an enzyme reaction. It was not the first time the idea had been suggested. Brown himself mentioned in his 1902 paper that the distinguished French chemist Charles Adolphe Wurtz (1880) had found that papain appears to form an insoluble compound with fibrin prior to hydrolysis and that Cornelius O'Sullivan and Frederick William Tompson (1890) had shown that the activity of invertase in the presence of sucrose is not present if they regarded this as an indication of the combination of enzyme and sucrose molecule.

By the suggestion made by the great German organic chemist Emil Fischer (Fischer, 1894) that the specificity of enzyme action is to be explained in terms of the precise fitting together of enzyme and substrate molecules, this is referred to as Fischer's lock and key hypothesis. Normally a lock can only be operated by a given key; a slight modification to a key usually means that the key no longer works. It is somewhat ironic that although

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