

enzyme research

To sum up, the results of these various experiments all pointed to the same surprising conclusion: for the first time, a bacterial enzyme had been discovered which, at every essential portion of the molecule, was similar to the serine proteases found in the body.

Of the several pancreatic enzymes compared with α -lytic protease, pancreatic elastase stands out. It has several substrates (as diverse as bacteria and elastin) in common with the soil enzyme and furthermore, in every case where α -lytic protease showed marked differences in behavior from trypsin and chymotrypsin A and B, so did pancreatic elastase. Chemical analyses of these two enzymes revealed homology around the two active sites and at one end of the chain but little homology anywhere else.

Does this marked similarity of the two enzymes, one coming from a soil bacterium, the other from one of the digestive organs, suggest that they may have evolved from a common ancestor? In the course of evolution, then, those elements of the structure essential for enzyme function would have remain unchanged. Or, alternatively, some scientists are of the opinion that they are witnessing a case of conver-

gent evolution in which the need to perform similar tasks has given rise to similar structures at the active parts of different enzymes. It is still an open question.

Since proteolytic enzymes have served as prototypes in studies relating the very intricate protein structure to enzyme function, enzymologists are expecting the new microbial enzyme to shed light on this fundamental problem. As an added bonus, contrary to many enzymes which break up proteins, both α -lytic protease and pancreatic elastase have ideal properties for X-ray crystallographic studies. Crystals of both can withstand prolonged exposure to X-rays; both give diffraction patterns indicating that their three-dimensional structure can be determined with high precision. The X-ray structure of pancreatic elastase is still under study at the University of Bristol, England, and that of α -lytic protease is being investigated at the University of Alberta by Dr. M. N. G. James in collaboration with Dr. Smillie.

As the studies proceed, yielding valuable results on the functioning and mechanics of enzymes in general, the proteases are helping more and more in a down-to-earth way. Some of the

most serious crippling diseases are diseases of connective tissues. These tissues play an important physiological role: they serve to bind together other tissues and organs, and form the tendons and ligaments in the body. Enzymes, in particular certain proteases which act on connective tissues, are important tools in research aimed at understanding the nature and causes of these diseases.

Proteases are also commercially valuable enzymes. Their use in household detergents is but one of several current practical applications. Other possible commercial applications are under investigation in Canada.

Dr. Whitaker points out that one enzyme has already been synthesized chemically in the United States. He suggests that: "It may eventually be possible to use synthetic tailor-made enzymes in many practical processes. These enzymes could be mass-produced commercially by straight-forward chemical synthesis and modified to work more efficiently. In fact, it may turn out that much of the structure of native enzymes could be eliminated as the active site represents only a small fraction of the total structure."

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