A serine protease found in a soil bacterium -
The anatomy of an enzyme

Vats of seething, fuming acids, massive pressure chambers and autoclaves are a far cry from the delicate walls of the living cell. Yet, when it comes to breaking up the proteins in processes necessary for life, the fragile cell far outperforms the array of heavy laboratory equipment. Not only are proteins disintegrated more rapidly and efficiently by the cell, but these same proteins, instead of being indiscriminately smashed to a rubble of amino acids, can be broken at certain points of the molecular chain.

How does the cell so quickly and precisely perform the multitude of life-sustaining protein reactions, reactions which otherwise would occur with immeasurable slowness under the same mild temperature, pressure and acidity conditions? Look to enzymes for the answer.

Enzymes, including those which destroy proteins, are themselves proteins, chains of amino acids formed by the cells in living organisms. In the body, for the conduction of nerve impulses, for muscle contractions, for blood clotting and for each of the thousands of chemical reactions on which life depends, enzymes play a vital role. They are the agents which catalyse all such reactions: they efficiently accelerate these changes, keep them in step with life's rhythm and do so without themselves undergoing any permanent change. As a corollary, the characteristics which cells and therefore organisms possess are related directly to the enzymes which they contain. A redhead thus immediately betrays the fact that he possesses a specific enzyme which catalyses the synthesis of a red dye in his hair-producing cells.

Each enzyme catalyses reactions with only certain substances called its substrates. For example, a proteolytic (protein-breaking) digestive enzyme will attack nutrient proteins, and convert them into amino acids for utilisation by the body, in short promoting digestion. Thousands of different enzymes are needed for the thousands of different reactions carried out in the cell.

How do biochemists and enzymologists study enzymes? Usually when a new enzyme is encountered, the substance is isolated, purified, and if possible crystallized. A thorough analysis is then conducted along two lines, one a determination of the enzyme's physical and chemical properties, the other an assay of its enzymatic activity, which includes reaction mechanism and kinetics, conditions for reaction, extent of reaction, categorization of substrates and characterization of reaction products.

When an enzyme from a soil bacterium isolated by the Canada Department of Agriculture scientists was put through its paces by Dr. D. R. Whitaker and his research team at the Biochemistry Laboratory of the National Research Council of Canada, the results obtained were unlike any previously recorded. That the enzyme, called α-lytic protease, was both bacteriolytic (bacteria-destroying) and proteolytic (protein-breaking) was of some surprise, although another enzyme isolated at the same time with it also had

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Amino acids, composed of carbon (C), nitrogen (N), hydrogen (H) and oxygen (O) arranged as shown below, are the units which link together into chains to form proteins, including enzymes. Each of the 20 amino acids which occur in nature has a different side chain (R) attached to the central carbon. Two examples are shown in the inset.

L'acide aminé, composé de carbone (C), d'azote (N), d'hydrogène (H) et d'oxygène (O), est l'unité de base, le maillon de la chaîne moléculaire des protéines, y compris des enzymes. Dans chacun des acides aminés trouvés dans la nature, une vingtaine environ, la molécule possède un groupement R différent lié au carbone central; voir deux exemples en haut, à gauche.