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(en'zīm")



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[Gr. *en*, in + *-zyme*]

An organic catalyst produced by living cells but capable of acting outside cells or even in vitro. Most enzymes are proteins (some RNAs are enzymes) that change the rate of chemical reactions without needing an external energy source or being changed themselves; an enzyme may catalyze a reaction many times. Enzymes are reaction specific in that they act only on certain substances (called substrates). The enzyme and its substrate or substrates form a temporary configuration, called an enzyme-substrate complex, that involves both physical shape and chemical bonding. The enzyme promotes the formation of bonds between separate substrates, or induces the breaking of bonds in a single substrate to form the product or products of the reaction. The human body contains thousands of enzymes, each catalyzing one of the many reactions that take place as part of metabolism.

Each enzyme has an optimum temperature and pH at which it functions most efficiently. For most human enzymes, these would be body temperature and the pH of cells, tissue fluid.



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ACTION

Of the many human enzymes, the digestive enzymes are probably the most familiar. These are hydrolytic enzymes that catalyze the addition of water molecules to large food molecules to split them into simpler chemicals. Often the name of the enzyme indicates the substrate with the addition of the suffix *-ase*. A lipase splits fats to fatty acids and glycerol; a peptidase splits peptides to amino acids. Some enzymes such as pepsin and trypsin do not end in *-ase*; they were named before this method of nomenclature was instituted.

Enzymes are also needed for synthesis reactions. The synthesis of proteins, nucleic acids, phospholipids for cell membranes, hormones, and glycogen all require one if not many enzymes. DNA polymerase, for example, is needed for

DNA replication, which precedes mitosis. Energy production also requires many enzymes. Each step in cell respiration (glycolysis, Krebs cycle, cytochrome transport system) requires a specific enzyme. Deaminases remove the amino groups from excess amino acids so that they may be used for energy. Long-chain fatty acids are split by enzymes into smaller compounds to be used in cell respiration. Blood clotting, the formation of angiotensin II to raise blood pressure, and the transport of carbon dioxide in the blood all require specific enzymes.



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