Humans and Enzymes: A Brief History

Humans have taken advantage of **enzymes** (catalytic proteins) from other species since the Neolithic period. Soon after the domestication of animals such as sheep, goats (estimated at between 9000 and 11000 BCE), and cattle (7000 to 8000 BCE), humans made discoveries that allowed the conversion of excess milk into cheese and yogurt. According to ancient legends, milk carried in containers made from the stomachs of young calves or goats was observed to transform into curds (insoluble coagulated protein) and whey (a liquid containing soluble protein). Eventually, milk curd (now known to be the result of rennin, a protein-degrading enzyme in the mammalian stomach enzyme complex called rennet) was converted into cheese by pressing with large flat stones (to remove the remaining water) and salting. Another ancient means of making cheese, mentioned by Homer, the legendary Greek poet and author of the *Iliad*, involved the use of fig juice (containing the enzyme ficin) to coagulate milk. Yogurt resulted from the storage of milk in goatskin bags. As nomads and traders traveled, bacterial enzymes, in combination with ambient heat and the motion of pack animals, transformed milk into tangy custard. The Neolithic period also introduced wine, beer, and, eventually, leavened bread, all products of enzyme-catalyzed reactions of the yeast *Saccharomyces cerevisiae*.

The existence of enzymes was unknown until the nineteenth century when Louis Pasteur, a French chemist and microbiologist, proved in 1857 that live yeast cells were required in the conversion of grape extracts into wine. He referred to the yeast cell components responsible for alcohol production as "ferments." In 1897, the German chemist Eduard Buchner discovered "zymase," an enzymatic activity in a cell-free extract of yeast that converted sucrose into ethanol. Questions about the molecular nature of enzymes were resolved in the twentieth century. Together, James B. Sumner in his work with urease, which catalyses the conversion of urea into ammonia and water, and John H. Northrup and Wendell M. Stanley in their work on the pancreatic protein-digesting enzymes trypsin, chymotrypsin, and pepsin proved that enzymes are proteins. Sumner, Northrup, and Stanley shared the 1946 Nobel Prize in Chemistry for their groundbreaking work. Research efforts to reveal the molecular properties of enzymes have continued to the present day as biochemists probe the catalytic proteins that make life possible.

enzyme A biomolecule that catalyzes a biochemical reaction.