PROTEIN STRUCTURE AND FUNCTION

Proteins, the working molecules of a cell, carry out the program of activities encoded by genes. This program **requires** the coordinated effort of many different types of proteins, which first evolved as rudimentary molecules that facilitated a limited number of chemical reactions. Gradually, many of these primitive proteins evolved into a wide array of **enzymes** capable of catalyzing an incredible range of intracellular and extracellular chemical reactions, with a speed and specificity that is nearly impossible to attain in a test tube. With the passage of time, other proteins **acquired** specialized abilities and can be grouped into several broad functional classes: *structural proteins,* which provide structural rigidity to the cell; *transport proteins,* which control the flow of materials across cellular membranes; *regulatory proteins,* which act as sensors and switches to control protein activity and gene function; *signaling proteins,* including cell surface receptors and other proteins that transmit external signals to the cell interior; and *motor proteins,* which cause motion. A key to understanding the functional design of proteins is the realization that many have "moving" parts and are capable of transmitting various forces and energy in an orderly fashion. A fundamental goal of molecular cell biologists is to understand how cells carry out various processes essential for life. A major contribution toward **achieving** this goal is the identification of all of an organism's proteins that is, a list of the parts that compose the cellular machinery. The compilation of such lists has become feasible in recent years with the sequencing of entire genomes complete sets of genes of more and more organisms. From a computer analysis of genome sequences, researchers can deduce the number and primary structure of the encoded proteins. The term proteome was coined to refer to the entire protein complement of an organism. For example, the proteome of the yeast *Saccharomyces cerevisiae* consists of about 6000 different proteins; the human proteome is only about five times as large, comprising about 32,000 different proteins. By comparing protein sequences and structures, scientists can classify many proteins in an organism's proteome and deduce their functions by homology with proteins of known function.