4.3.6

Enzymes

One of the most diverse and important class of proteins is that of enzymes. An enzyme's purpose is basically to speed up the rate of a chemical reaction. Enzymes accomplish this by decreasing the activation energy needed to start the process. As an example, consider a wooden stick just thin enough to be broken in half if you exert all of your strength. Now, take that stick and place it in a vice or a press and start compressing the stick until it is just about to break. Under this pressure, how much energy is required to break the stick now? With just a flick of your finger the stick breaks. Enzymes, like this press, are used to lower the amount of energy required to initiate a chemical reaction. Regarding enzyme function, consider the following points:

1. Enzymes are not used up or consumed during the chemical reaction. In other words, a single enzyme can serve as a catalyst for multiple reactions.
2. Enzymes are quite specific, so a single enzyme is able to catalyze a reaction between certain reactants (substrates) but not others, which is why we need so many different enzymes. An example that you are familiar with is converting a common disaccharide, sucrose, to two monosaccharides, glucose and fructose. The enzyme that is involved in this reaction would be unable to convert the disaccharide lactose to the monosaccharides glucose and galactose.
3. Enzymes are often named for the substrates on which they act. Thus, the enzymes involved in the reactions above would be sucrase and lactase respectively. Notice that the suffix –ase is added to the name of the substrate.
4. An enzyme's shape governs its function. Each enzyme has an active site where only certain molecules (substrates) can bind. When the substrates bind to the active sites, the enzymes catalyze the chemical reaction, and they are released as a new product.
5. Enzymes are sensitive to changes in temperature and pH. One way to speed up chemical reactions is to turn up the heat but increasing temperature too much can alter or even destroy cells. Enzymes in the human body function optimally between 35–40° C (95–104° F). They also function best at around a neutral pH level, with a range typically between six and eight. If we change the temperature or pH to values outside the optimum, the enzymes may change shape and lose their function.
6. Enzymes may require "helper" substances to catalyze chemical reactions. These helpers are termed cofactors or coenzymes. Cofactors are inorganic substances such as zinc or iron. Coenzymes are organic molecules like vitamins.