Enzymes Notes

Enzymes are proteins (biomolecules) that function as biological catalysts (increase the rates of chemical reactions but not yield without being changed by the reaction). They also alter chemical reactions or make some reactions occur. They build and break down proteins and tissues, remove toxins and turn nutrients into energy etc. E.g. is digestion, where some food molecules are large and cannot diffuse through the cell membrane. These are digested by digestive enzymes, e.g. amylase, maltase, protease and lipase. In enzymatic reactions, the molecules at the beginning of the process, called substrates, are converted into different molecules, called products, through enzymatic catalysing, which then moves away from the active site and the enzyme is free to take another substrate molecule into its active site. The reactions can be either anabolic or catabolic. Anabolic reactions (Endothermic) are where simpler substances build up or synthesize to form complex molecules, usually requiring energy. E.g. amino acids taken into the cell may be used to build up proteins. The cytoplasm contains special enzymes to catalyse such reactions. Catabolic reactions (Exothermic) are the breakdown of more complex organic molecules into simpler substances, where energy is usually released. E.g. large molecules in food are converted to smaller molecules by digestive enzymes/in cell respiration, glucose is broken down to release energy and form carbon dioxide, involving chemical reactions that are catalysed by different enzymes/Catalase is used to break down hydrogen peroxide to water and oxygen, which is produced during chemical reactions and is toxic. Almost all chemical reactions in a biological cell need enzymes in order to occur at rates sufficient for life. Enzyme reaction depends on the presence of active sites, which the substrate can fit in. The substrate binds with the enzyme, forming an enzyme-substrate complex. Reactions take place at the active site to convert the substrate molecules into product molecule. The specificity of an enzyme is due to the 3-dimensional shape and thus, the enzyme is complementary to one substrate only (lock and key hypothesis, where only one key can fit one lock). The Induced fit model also states that the induced-fit model of enzyme action has a flexible active site that changes shape to best fit the substrate and catalyze the reaction. Enzymes work by lowering the activation energy for a reaction, thus dramatically increasing the rate of the reaction. As a result, products are formed faster and more efficiently. Most enzyme reaction rates are millions of times faster than those of comparable un-catalysed reactions. A small amount of enzyme can facilitate a large amount of chemical reactions (used over and over again), as it remains unchanged by reactions they catalyze. Enzymes are known to catalyse about 4,000 biochemical reactions. Every minute it is estimated there are 36 million biochemical reactions occurring in each cell, using about 3000 different enzymes. Enzymes are commonly named by using the suffix “ase” to the end of the enzyme’s name. E.g. Alcohol dehydrogen**ase** digests alcohol, Amyl**ase** digests starch, Cellul**ase** digests cellulose, Prote**ase** digests proteins and Lip**ase** digests fat/oil.

Enzymes’ Characteristics

- Enzymes are proteins that speed up (catalyse) biochemical reactions.