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Enzymes are essential proteins responsible for a multitude of reactions in organisms. However, they do not work alone. Non-protein molecules known as coenzymes aid in enzymes' jobs. Coenzymes are often derived from vitamins and are much smaller compared to the enzyme itself, but no less important. From speeding up digestion to ensuring accurate DNA replication, coenzymes are an essential part of any biological system.

Energy Production

One primary function of coenzymes is to help with the production of energy. Specifically, the coenzyme ATP is a major player in moving energy within the cell. ATP's structure has three phosphate groups, and when the last one is cleaved off during a process known as hydrolysis, energy is released. ATP is constantly recycled, picking up more phosphate groups that are then broken off once again, replenishing cellular energy.

Transferring Groups

Coenzymes also aid in transferring certain groups of atoms from one molecule to another. For example, hydrogen transfer, the movement of hydrogen atoms from one part of a cell or organelle to another, is essential to many processes, including the reproduction of ATP molecules. The coenzyme NADH in particular is important in this procedure. When a process called oxidative phosphorylation begins in a cell, the coenzyme NADH transports four hydrogen atoms from one part of the mitrochondria to the next, jump-starting the process of refreshing a cell's ATP supplies.

Non-protein organic cofactors are called coenzymes. Coenzymes assist enzymes in turning substrates into products. They can be used by multiple types of enzymes and change forms. Specifically, coenzymes function by activating enzymes, or acting as carriers of electrons or molecular groups.

There is a specific location on an enzyme which binds to substrates and helps turn them into products. This location, called the active site, is where coenzymes bind. There are several ways coenzymes assist in enzyme function, including changing their shape to activate, or turn on, enzymes, or aiding in chemical reactions by acting as carriers of energy or molecular groups.

In order to occur, chemical reactions might require or release energy. Remember the First Law of Thermodynamics: energy can neither be created nor destroyed. So, for an enzyme to function, sometimes energy is needed. The cell likes to be efficient in its use of energy; therefore, it tries to capture and reuse energy. One of the ways it does this is through coenzymes.

Let's look at an example. The molecule ATP (adenosine triphosphate) can function as a coenzyme. When a phosphate group is removed, turning ATP into ADP (adenosine diphosphate), energy is released. Since many chemical reactions require energy, cells can use ATP to give energy to a reaction to assist in changing the substrate to product. The substrate can be temporarily phosphorylated, or have an added phosphate group. The phosphate group can then be removed and the product is formed partly through the addition and removal of a phosphate.

Coenzymes often have long complicated names and are frequently shortened to acronyms or abbreviations. Coenzymes with shortened names include: NAD+/NADH, NADP+/NADPH, and FAD/FADH2.