Adenosine Triphosphate (ATP)

The chemical substance that serves as the currency of energy in a cell is adenosine triphosphate (ATP). ATP is referred to as currency because it can be "spent" in order to make chemical reactions occur. The more energy required for a chemical reaction, the more ATP molecules must be spent.







Virtually all forms of life use ATP, a nearly universal molecule of energy transfer. The energy released during catabolic reactions is stored in ATP molecules. In addition, the energy trapped in anabolic reactions (such as photosynthesis) is trapped in ATP molecules.

An ATP molecule consists of three parts. One part is a double ring of carbon and nitrogen atoms called *adenine*. Attached to the adenine molecule is a small five-carbon carbohydrate called *ribose*. Attached to the ribose molecule are three phosphate units linked together by covalent bonds.

The covalent bonds that unite the phosphate units in ATP are high-energy bonds. When an ATP molecule is broken down by an enzyme, the third (terminal) phosphate unit is released as a phosphate group, which is an ion. When this happens, approximately 7.3 kilocalories of energy are released. (A kilocalorie equals 1,000 calories.) This energy is made available to do the work of the cell.

The adenosine triphosphatase enzyme accomplishes the breakdown of an ATP molecule. The products of ATP breakdown are adenosine diphosphate (ADP) and a phosphate ion. Adenosine diphosphate and the phosphate ion can be reconstituted to form ATP, much like a battery can be recharged. To accomplish this, synthesis energy must be available. This energy can be made available in the cell through two extremely important processes: photosynthesis and cellular respiration.