## Check your knowledge

Look at each of the processes shown and decide if it is endergonic or exergonic (Figure 5.29)

(a)

(b)

(c)

(d)

Figure 5.29 This figure shows some examples of endergonic processes and exergonic processes. These include (a) a compost pile decomposing, (b) a chick developing from a fertilized egg, (c) sand art destruction, and (d) a ball rolling down a hill. (credit a: modification of work by Natalie Maynor; credit b: modification of work by USDA; credit c: modification of work by "Athlex"/Flickr; credit d: modification of work by Harry Malsch / Biology 2E OpenStax)

*Answers: A compost pile decomposing is an exergonic process. A baby developing from a fertilized egg is an endergonic process. Sand art destruction is an exergonic process. A ball rolling downhill is an exergonic process.*

## ATP in Living Systems

Within the cell, where does energy to power chemical reactions come from? The answer lies with an energy-supplying molecule called ATP (adenosine triphosphate). ATP is a simple, relatively small molecule; however, its bonds contain significant amounts of potential energy (Figure 5.30).

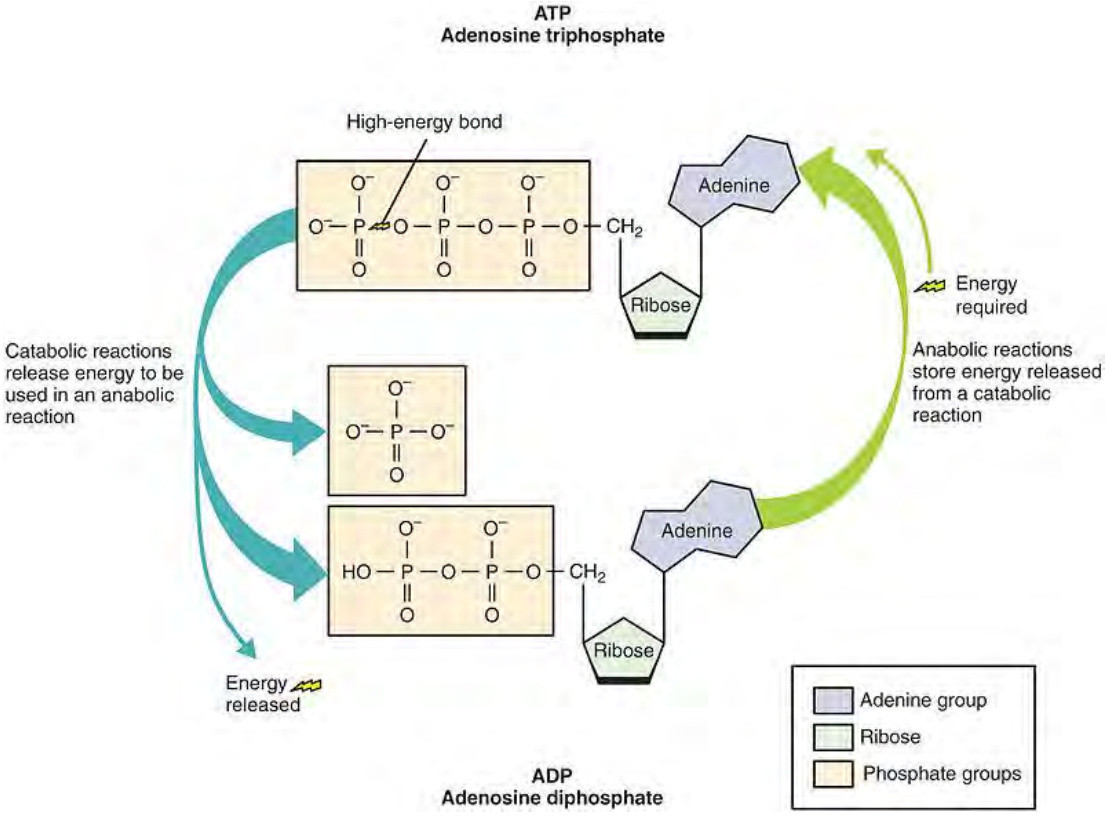


Figure 5.30 Structure of adenosine triphosphate (ATP). ATP is the energy molecule of the cell. (credit: Betts et al. / Anatomy and Physiology OpenStax)

When the bonds of ATP are broken, a quick burst of energy is released. That energy can be harnessed to perform cellular work. ATP can be thought of as the primary energy currency of living cells. ATP provides the energy used to power the majority of cellular chemical reactions and processes that occur in the cell. The energy from ATP drives all bodily functions, such as contracting muscles, maintaining the electrical potential of nerve cells, and absorbing food in the gastrointestinal tract. The metabolic reactions that produce ATP come from various sources (Figure 5.31)

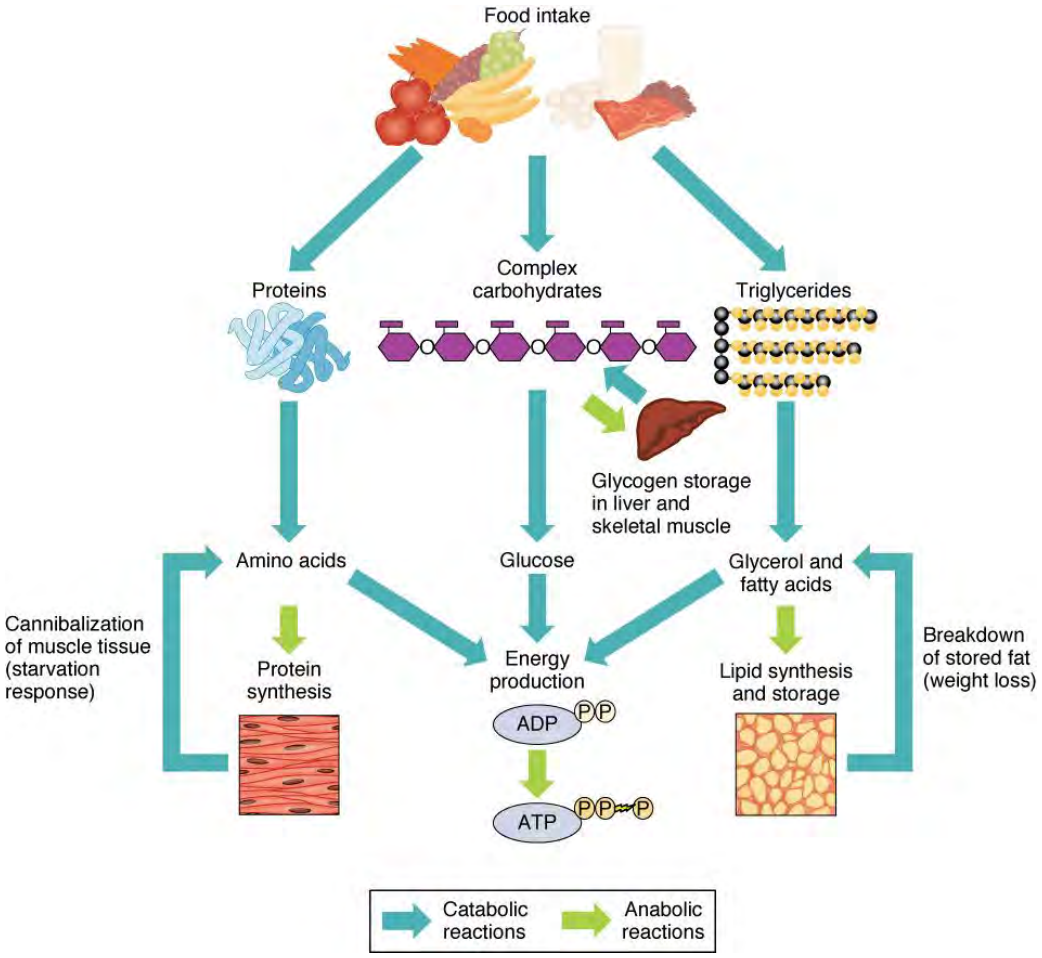


Figure 5.31 During catabolic reactions, proteins are broken down into amino acids, lipids are broken down into fatty acids, and polysaccharides are broken down into monosaccharides. These building blocks are then used for the synthesis of molecules in anabolic reactions. (credit: Betts et al. / Anatomy and Physiology OpenStax)

**ATP Structure and Function**

At the heart of ATP is a molecule of AMP, adenosine monophosphate. AMP is composed of an adenine molecule bonded to both a ribose 5-carbon sugar and a single inorganic phosphate group. AMP is a nucleotide, a monomer of nucleic acids. The addition of a second inorganic phosphate group results in adenosine diphosphate, ADP; the addition of a third inorganic phosphate group forms adenosine triphosphate, ATP (Figure 5.30). Phosphate groups are most often attached with the help of enzymes through a process called phosphorylation (Figure 5.32).

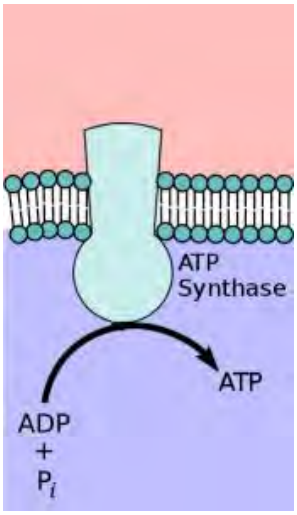


Figure 5.32 The enzyme ATP synthase forms a phosphate - phosphate bond. (credit: Modified by Elizabeth O'Grady original work of Klaus Hoffmeier)