

The amount of energy released in catabolism depends on the amount of ATP that is made as the products of digestion are oxidized. The catabolism of 1 glucose molecule generally may produce up to a total of 36 ATP molecules. This accounts for about 40% of the energy released by the complete oxidation of glucose. Most of the energy not converted to ATP is lost by the body as energy in the form of heat. **Table 2** shows how much ATP is needed for some daily activities.

TABLE 2 Approximate “Cost” of Daily Activities

Activity	Energy required (kJ)	ATP required (mol)
Running	1120	56
Swimming	840	42
Bicycling	1400	70
Walking	560	28

Anabolism

Cells use the simple molecules that result from the breakdown of food to make larger, more complex molecules. Energy released during catabolism powers the synthesis of new molecules as well as the active transport of ions and molecules across cell membranes. *Anabolic* processes are the energy-consuming pathways by which cells produce the molecules that they need for sustaining life and for growth and repair. *The conversion of small biomolecules into larger ones is called anabolism.*

In an anabolic pathway, small precursor molecules are converted into complex molecules, including lipids, polysaccharides, proteins, and nucleic acids. Energy from ATP and NADH is necessary for these biosynthesis reactions to occur. **Figure 19** illustrates that catabolism and anabolism occur simultaneously and that ATP and NADH serve as chemical “links” between the two processes.

One important anabolic pathway that is common to animals, plants, fungi, and microorganisms is *gluconeogenesis*. As the name implies, glucose is synthesized in this pathway from non-carbohydrate substances, including lactate, pyruvate, glycerol, and most of the amino acids. In mammals, glucose from the blood is the fuel source for the brain and nervous system as well as for the kidney medulla, red blood cells, and embryonic tissues.

SECTION REVIEW

1. List four ways in which the body uses energy.
2. What is the total energy (in kilojoules) stored in the 36 ATP molecules that are made from the metabolism of 1 molecule of glucose in skeletal tissue?
3. The teeth break large pieces of food into smaller ones. However, this process is not considered part of digestion. Explain why.
4. How does the digestion of fat in a strip of ham differ from the digestion of starch in a piece of toast?

5. Why are diets that are severely restrictive in carbohydrate intake potentially dangerous to a person’s health?

Critical Thinking

6. **RELATING CONCEPTS** When a molecule of glucose is oxidized, only about 40% of the energy is captured in ATP molecules, and the rest is lost as energy in the form of heat. What do you think would happen if this energy remained in the body as heat?