34.2B: Food Energy and ATP

Animals use energy for metabolism, obtaining that energy from the breakdown of food through the process of cellular respiration.

Learning Objectives

• Summarize the ways in which animals obtain, store, and use food energy

Key Points

• Animals obtain energy from the food they consume, using that energy to maintain body temperature and perform other metabolic functions.
• Glucose, found in the food animals eat, is broken down during the process of cellular respiration into an energy source called ATP.
• When excess ATP and glucose are present, the liver converts them into a molecule called glycogen, which is stored for later use.

Key Terms

• glucose: a simple monosaccharide (sugar) with a molecular formula of C6H12O6; it is a principal source of energy for cellular metabolism
• adenosine triphosphate: a multifunctional nucleoside triphosphate used in cells as a coenzyme, often called the "molecular unit of energy currency" in intracellular energy transfer
• phosphodiester: any of many biologically active compounds in which two alcohols form ester bonds with
Food Energy and ATP

Animals need food to obtain energy and maintain homeostasis. Homeostasis is the ability of a system to maintain a stable internal environment even in the face of external changes to the environment. For example, the normal body temperature of humans is 37°C (98.6°F). Humans maintain this temperature even when the external temperature is hot or cold. The energy it takes to maintain this body temperature is obtained from food.

The primary source of energy for animals is carbohydrates, primarily glucose: the body’s fuel. The digestible carbohydrates in an animal’s diet are converted to glucose molecules and into energy through a series of catabolic chemical reactions.

Adenosine triphosphate, or ATP, is the primary energy currency in cells. ATP stores energy in phosphate ester bonds, releasing energy when the phosphodiester bonds are broken: ATP is converted to ADP and a phosphate group. ATP is produced by the oxidative reactions in the cytoplasm and mitochondrion of the cell, where carbohydrates, proteins, and fats undergo a series of metabolic reactions collectively called cellular respiration.

![ATP Production Pathways](https://bio.libretexts.org/Bookshelves/Introductory_and_General_Biology/Book%3A_General_Biology_(Boundless)/34%3A_A...)

**Figure (PageIndex{1}): ATP production pathways:** ATP is the energy molecule of the cell. It is produced through various pathways during the cellular respiration process, with each making different amounts of energy.
ATP is required for all cellular functions. It is used to build the organic molecules that are required for cells and tissues. It also provides energy for muscle contraction and for the transmission of electrical signals in the nervous system. When the amount of ATP available is in excess of the body’s requirements, the liver uses the excess ATP and excess glucose to produce molecules called glycogen (a polymeric form of glucose) that is stored in the liver and skeletal muscle cells. When blood sugar drops, the liver releases glucose from stores of glycogen. Skeletal muscle converts glycogen to glucose during intense exercise. The process of converting glucose and excess ATP to glycogen and the storage of excess energy is an evolutionarily-important step in helping animals deal with mobility, food shortages, and famine.

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