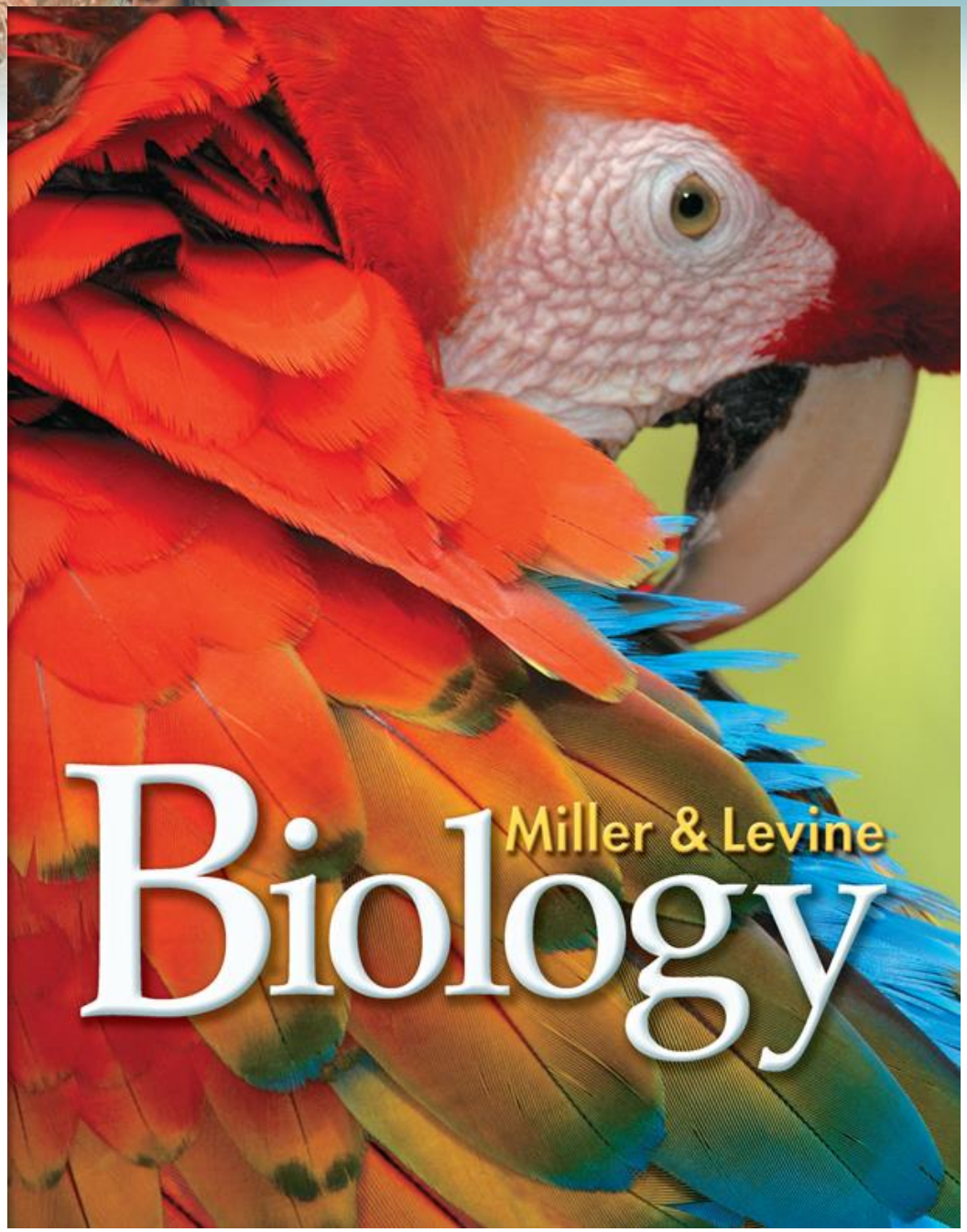


9.1 photosynthesis and cell respiration

Chemical Energy and Food

Food provides living things with the chemical building blocks they need.

Cells break down food molecules and use the energy stored in the chemical bonds to produce compounds such as ATP that power the activities of the cell.

Chemical Energy and Food

Energy stored in food is expressed in units of calories.

A **Calorie** is the amount of energy needed to raise the temperature of 1 gram of water by 1 degree Celsius. 1000 calories = 1 kilocalorie, or Calorie.

Overview of Cellular Respiration

If oxygen is available, organisms can obtain energy from food by **cellular respiration.**

In symbols:

$6\ O_2 + C_6H_{12}O_6 \rightarrow 6\ CO_2 + 6\ H_2O + \text{Energy}$

In words:

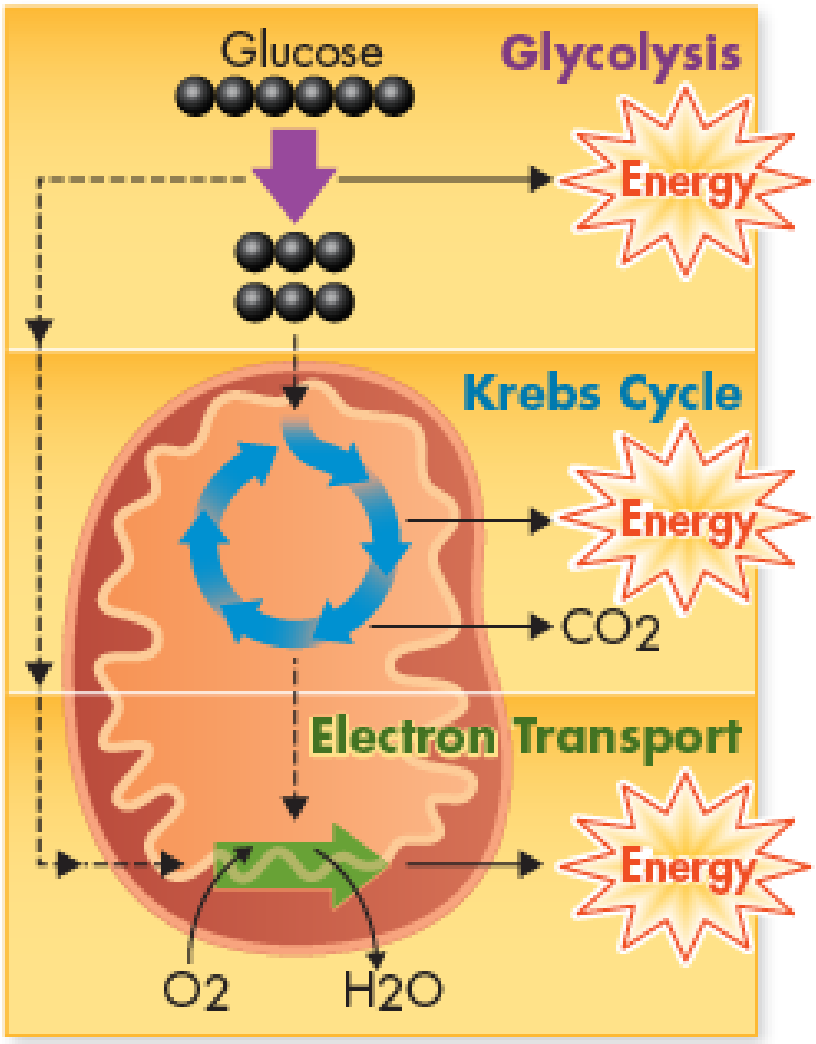
Oxygen + Glucose → Carbon dioxide + Water + Energy

chemical energy in food must be released gradually, otherwise most of the energy would be lost in the form of heat and light.

Stages of Cellular Respiration

three main stages:

1. glycolysis
2. Krebs cycle
3. electron transport chain (ETC)

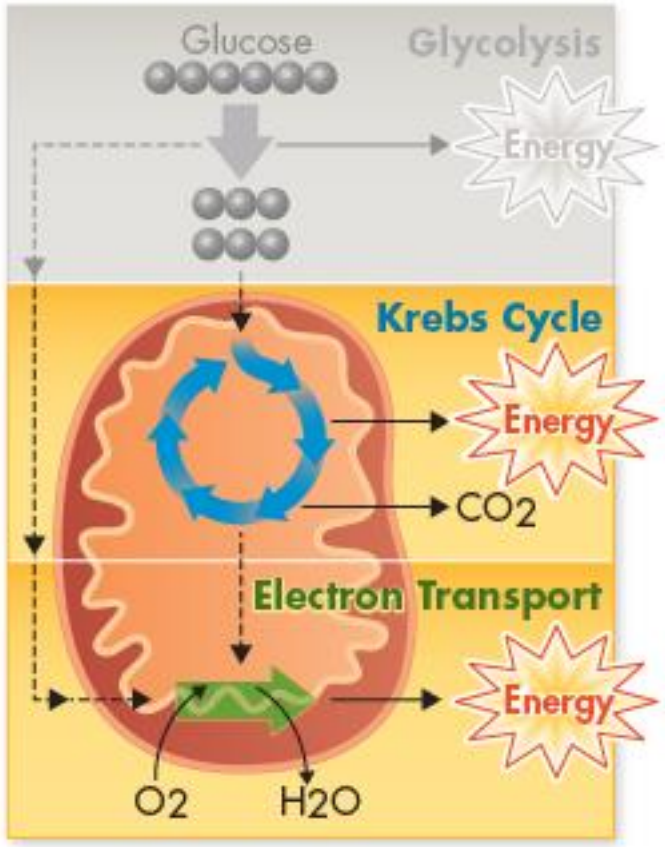


Oxygen and Energy

Pathways that require oxygen are **aerobic.**

The Krebs cycle and ETC are aerobic processes.

Both occur inside the mitochondria.

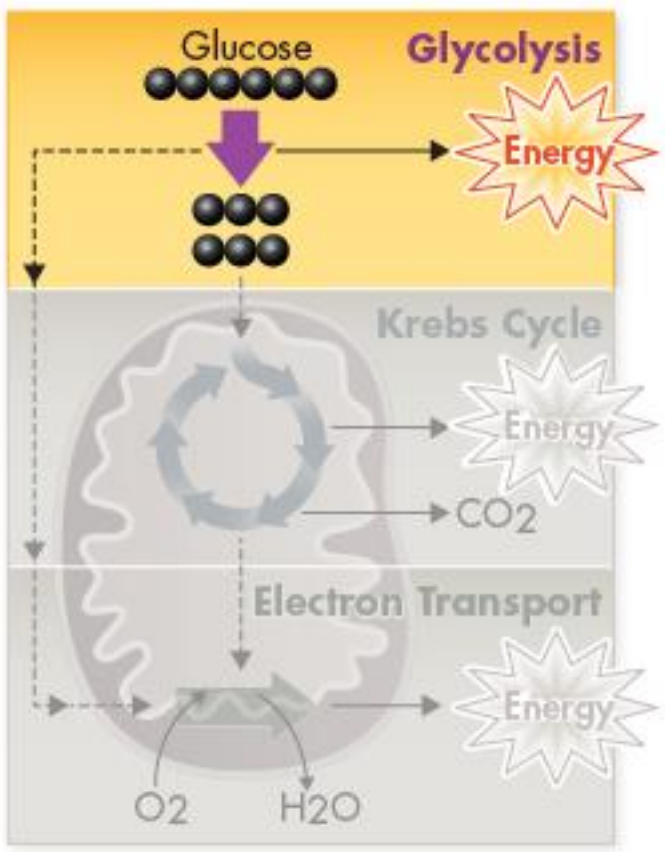


Oxygen and Energy

Gylcolysis is an **anaerobic** process.

It does not directly require or rely on oxygen.

Glycolysis occurs in the cell cytoplasm.



Comparing Photosynthesis and Cellular Respiration

- Photosynthesis removes carbon dioxide from the air,
  Cell respiration puts it back.

  Photosynthesis releases oxygen,
  cell respiration uses that oxygen to release energy from food.

Photosynthesis and Cellular Respiration

Photosynthesis and cell respiration are opposite processes.

The energy flows in opposite directions. Photosynthesis "deposits" energy, and cell respiration "withdraws" energy.

Photosynthesis: $6\ CO_2 + 6\ H_2O \xrightarrow{\text{Light}} C_6H_{12}O_6 + 6\ O_2$

Respiration: $6\ O_2 + C_6H_{12}O_6 \rightarrow 6\ CO_2 + 6\ H_2O + \text{Energy}$

Comparing Photosynthesis and Cellular Respiration

cell respiration occurs in plants, animals, fungi, protists, and most bacteria.

photosynthesis occurs only in plants, algae, and some bacteria.