Table 4-1 Terms Used to Describe Metabolism based on Different Sources of Energy, Electrons, and Carbon

Term Describing Physiological Type	Energy Source	Electron Source	Carbon Source
Autotroph			CO_2
Heterotroph			Organic molecule
Phototroph	Light		
Chemotroph	Chemical		
Organotroph		Organic molecule	
Lithotroph		Inorganic molecule	
Chemolithotrophic (chemoautotrophic)	Inorganic molecule	Inorganic molecule	Inorganic CO_2
Photolithotrophic (photoautotrophic) (photosynthetic)	Light	Inorganic molecule	Inorganic CO_2
Photoorganotrophic (photoheterotrophic)	Light	Organic molecule	Organic molecule
Chemoorganotrophic (heterotrophic)	Organic molecule	Organic molecule	Organic molecule

Table 4-2 Types of Autotrophic Microbial Metabolism Used to Generate ATP

Type of Metabolism	Description
Oxygenic photosynthesis	Uses two connected photosystems and results in evolution of oxygen, as well as generation of ATP; carried out by algae and cyanobacteria
Anoxygenic photosynthesis	Uses one photosystem and does not result in evolution of oxygen; carried out by anaerobic photosynthetic bacteria, e.g., green and purple sulfur bacteria, and under some conditions by cyanobacteria
Chemoautotrophic (chemolithotrophic)	Uses oxidation of inorganic compounds such as sulfur, nitrite, nitrate, and hydrogen to establish an electrochemical gradient across a membrane that results in generation of ATP by chemiosmosis

Table 4-3 Types of Heterotrophic Microbial Metabolism Used to Generate ATP

Type of Metabolism	Description
Respiration	Uses complete oxidation of organic compounds, requiring an external electron acceptor to balance oxidation-reduction reactions used to generate ATP; much of the ATP is formed as a result of chemiosmosis based on establishment of a proton gradient across a membrane
Aerobic respiration	Uses oxygen as the terminal electron acceptor in the membrane-bound pathway that establishes the proton gradient for chemiosmotic ATP generation
Anaerobic respiration	Uses compounds other than oxygen, e.g., nitrate or sulfate, as the terminal electron acceptor in the membrane-bound pathway that establishes the proton gradient for chemiosmotic ATP generation
Fermentation	Does not require an external electron acceptor, achieving a balance of oxidation-reduction reactions using metabolic intermediates of the organic substrate molecule; various fermentation pathways produce different end products