

**Table 5.1** Examples of Metabolic Reactions in Marine Prokaryotes

Name of Reaction	Energy Source	Other Raw Materials	By-product(s)	Production of Organic Carbon	Major Groups	Comments
<b>Photosynthesis</b>	Light	Carbon dioxide, water	Oxygen	Yes	Cyanobacteria	Light captured by chlorophyll, essentially the same process performed by algae and plants
	Light	Hydrogen sulfide	Sulfur or sulfate	Yes	Purple and green bacteria	Light captured by bacteriochlorophyll
<b>Chemosynthesis</b>						Energy supplied by a variety of inorganic molecules, of which only a few examples are included here
<i>Sulfur oxidation</i>	Hydrogen sulfide	Oxygen	Sulfate	Yes	Sulfur-oxidizing bacteria	Bacteria in wetland sediments, mudflats, deep-sea hydrothermal vents
<i>Aerobic ammonium oxidation</i>	Ammonium	Oxygen	Nitrite	Yes	Nitrifying bacteria and archaea	Bacteria in wetland sediments, mudflats, deep-sea hydrothermal vents; open-water archaea
<i>Nitrite oxidation</i>	Nitrite	Oxygen	Nitrate	Yes	Nitrifying bacteria	Bacteria in wetland sediments, mudflats, deep-sea hydrothermal vents
<i>Iron oxidation</i>	Reduced iron	Oxygen	Oxidized iron	Yes	Iron-oxidizing bacteria	Bacteria in sediments, deep-sea hydrothermal vents
<b>Aerobic respiration</b>	Organic matter	Oxygen	Carbon dioxide, water	No	Heterotrophic, aerobic bacteria and archaea; decay bacteria and archaea	Organic matter broken down using oxygen to release energy
<b>Anaerobic respiration</b>						Organic matter broken down in the absence of oxygen to release energy; less efficient than aerobic respiration
<i>Sulfate reduction</i>	Organic matter	Sulfate	Hydrogen sulfide	No	Sulfate-reducing bacteria and archaea	
<i>Nitrate reduction, denitrification</i>	Organic matter	Nitrate, nitrite	Nitrogen gas, ammonia	No	Denitrifying bacteria	
<i>Methanogenesis</i>	Organic matter	Hydrogen, carbon dioxide	Methane	No	Methanogens	Archaea in many environments
<b>Nitrogen fixation</b>	ATP	Nitrogen gas	Ammonium	No	Nitrogen-fixing bacteria and archaea	Ammonium and other compounds produced from ammonium can be used as nutrients by primary producers.
<b>Anaerobic ammonium oxidation (anammox reaction)</b>	Ammonium	Nitrite	Nitrogen gas	No	Anammox bacteria and archaea	Ammonium converted to nitrogen in the absence of oxygen to release energy
<b>Light-mediated ATP synthesis</b>	Light		ATP	No	Archaea in highly saline pools	Light captured by bacteriorhodopsin