

Growth Responses to Temperature among Various Groups of Bacteria

Class	Properties	Typical Environment
Psychrophiles (also called psychrotrophs)	Grow at appreciable rates below 5°C	
Obligate psychrophiles	Cannot grow at or above 20°C	Cold ocean water
Facultative psychrophiles	Can grow above 20°C	Soil and water
Mesophiles	Grow best at moderate temperature, around 37°C	Animals
Thermophiles	Grow above 50°C	
Facultative thermophiles	Can grow below 37°C	Soil
Stenothermophiles	Cannot grow below 37°C	Compost
Extreme thermophiles	Grow above 80°C (some above 100°C)	Hot springs

Relationship of Various Bacteria to Oxygen

Microbial Class	Response to Oxygen	Presence of		Example
		Catalase	Superoxide Dismutase	
Obligate aerobes	Require oxygen	Present	Present	<i>Pseudomonas aeruginosa</i>
Facultative anaerobes	Can grow with or without oxygen	Present	Present	<i>Escherichia coli</i>
Microaerophiles	Grow best with low oxygen	Present	Present	<i>Campylobacter jejuni</i>
Aerotolerant anaerobes	Grow without oxygen, but not killed by it	Absent	Absent	<i>Streptococcus pneumoniae</i>
Obligate anaerobes ^a	Killed by oxygen	Absent	Absent	<i>Methanococcus vannielii</i>

Table 7.3 Nutritional Categories of Microbes by Energy and Carbon Source

Category/Carbon Source	Energy Source	Example
Autotroph/CO ₂	Nonliving Environment	
Photoautotroph	Sunlight	Photosynthetic organisms, such as algae, plants, cyanobacteria
Chemoautotroph	Simple inorganic chemicals	Only certain bacteria, such as methanogens, deep-vent bacteria
Heterotroph/Organic	Other Organisms or Sunlight	
Chemoheterotroph	Metabolic conversion of the nutrients from other organisms	Protozoa, fungi, many bacteria, animals
Saprobe	Metabolizing the organic matter of dead organisms	Fungi, bacteria (decomposers)
Parasite	Utilizing the tissues, fluids of a live host	Various parasites and pathogens; can be bacteria, protozoa, animals
Photoheterotroph	Sunlight	Purple and green photosynthetic bacteria