

Types of Microbes

Microorganisms are named based on their particular physiological and nutritional characteristics. The table below provides the name of the microbe with the description.

Physiological Characteristic	Description
Temperature	
Psychrophile/ facultative psychrophile	Optimal temperature for growth is 15 °C or lower, maximal temperature is approximately 20 °C, and minimal temperature is 0 °C or lower
Psychrotroph	Capable of growing at 5 °C or below, with maximal temperature generally above 25 °C to 30 °C; term in this case is a misnomer because it does not indicate nutritional characteristics
Mesophile	Generally defined by optimal temperature for growth, which is approximately 37 °C; frequently grows in the range from 8 °C to 10 °C and from 45 °C to 50 °C
Thermophile	Grows at 50 °C or above
Hyperthermophile	Grows at 90 °C or above, although optimal temperature for growth is generally above 80 °C; maximal growth of pure cultures occurs between 110 °C and 113 °C, although the maximum (113 °C) may well increase as further research is done
Oxygen	
Aerobe	Capable of using oxygen as a terminal electron acceptor; can tolerate a level of oxygen equivalent to or higher than the 21 percent oxygen present in an air atmosphere and has a strictly respiratory-type metabolism
Anaerobe	Grows in the absence of oxygen; some anaerobes have a fermentative-type metabolism; others may carry out anaerobic respiration in which a terminal electron acceptor other than oxygen is used
Facultative anaerobe	Can grow aerobically or anaerobically—characteristic of a large number of genera of bacteria including coliforms such as <i>Escherichia coli</i>
Microaerophile	Capable of oxygen-dependent growth but only at low oxygen levels; cannot grow in the presence of a level of oxygen equivalent to that present in an air atmosphere (21 percent oxygen)
pH	

Acidophile	Grows at pH values less than 2
Alkalophile	Grows at pH values greater than 10
Neutrophile	Grows best at pH values near 7
Salinity	
Halophile	Requires salt for growth: extreme halophiles (all are archaea), 2.5 M to 5 M salt; moderate halophiles, usually low levels of NaCl as well as 15 to 20 percent NaCl
Hydrostatic pressure (100 atmospheres per 1,000-m depth)	
Barophile	Obligate barophiles, no growth at 1 atmosphere of pressure; barotolerant bacteria, growth at 1 atmosphere but also at higher pressures. A number of deep-sea bacteria are called barophilic if they grow optimally under pressure and particularly if they grow optimally at or near their in situ pressure (0.987 atm = 1 bar = 0.1 megapascal [Mpa])
Nutrition	
Autotroph	Uses carbon dioxide as its sole source of carbon
Heterotroph	Unable to use carbon dioxide as its sole source of carbon and requires one or more organic compounds
Chemoorganoheterotroph	Derives energy from chemical compounds and uses organic compounds as a source of electrons
Chemolithoautotroph	Relies on chemical compounds for energy and uses inorganic compounds as a source of electrons. Five classes: hydrogen bacteria, iron bacteria, sulfur bacteria, ammonia oxidizers, and nitrite oxidizers. Specific nutritional groups of bacteria that do not clearly fit in this category include obligate methane oxidizers and the carbon monoxide oxidizers. There are also photoorganoheterotrophs and photolithoautotrophs among the anoxygenic photosynthetic bacteria.
Mixotroph	Capable of growing both chemoorganoheterotrophically and chemolithoautotrophically; examples include some of the hydrogen bacteria and some species of <i>Thiobacillus</i> (sulfur-oxidizing bacteria)
Oligotroph	Can develop at first cultivation on media containing minimal organic material (1 to 15 micrograms carbon per liter) and grow on such media in subsequent cultivation
Copiotroph	Requires nutrients at levels 100 times those of oligotrophs

Microbes are far more likely than multicellular organisms to retain viability on small solar system bodies because they can adapt to a much wider range of environmental conditions. Single-cell organisms have infiltrated virtually every corner of Earth's biosphere and still constitute the bulk of the earth's biomass. They grow in temperate marine and terrestrial settings, within other microbial or multicellular organisms, in deep subsurface niches, and in extreme environments that would be lethal for other life forms. They often influence geochemical reactions within the biosphere and frequently play key roles in food webs and complex ecosystems.

The physiological state of microorganisms influences their ability to survive extreme environmental conditions. For example, organisms with active DNA repair mechanisms or a protective layer of material are more likely to endure exposure to ultraviolet (UV) or ionizing radiation than are cells without equivalent capabilities. Viable microorganisms are either metabolically active (vigorous) or dormant (quiescent). Communities of metabolically active microbes may increase in biomass or simply maintain a constant density by replacing dead cells with new ones. Sometimes metabolic activity is restricted to the repair of macromolecular machinery without cell division. Examples of metabolically active microorganisms include exponentially growing cells, cultures that have reached a stationary phase during which cell division occurs either very slowly or at a rate equivalent to that associated with cell death, and organisms that have shifted from exogenous to endogenous metabolism to survive starvation conditions. Dormant cells are metabolically inactive but are capable of returning to an active state. Examples include spores that are metabolically "frozen," freeze-dried cells, and cells that remain viable at suboptimal or freezing temperatures and/or in a desiccated state.

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