

Microbes

Growth \Rightarrow \uparrow cell number

Requirements for Growth

Physical Requirements

Temperature

Psychrophiles 0°C
Cold-loving

True psychrophiles 15°C or below
cause disease or food spoilage

Psychrotrophs 20°-30°C
Responsible for most low temperature food spoilage.

Mesophiles 25°-40°C
Middle-loving
Most bacteria
Many have adapted to live in the bodies of animals.

Thermophiles 50-60°C
Heat-loving

adapted to live in sulfur soils
compost piles & hot springs

Extreme-Thermophiles 80°C
Hyperthermophiles
Archaeobacteria \rightarrow most live in volcanic & ocean vents.

pH

Acidophiles 0.1-5.4
Grow at low pH
Lactobacillus produces lactic acid-tolerates mild acidity.
Acid-loving.

Neutrophiles 5.4-8.5
Includes most human pathogens.

Alkaliphiles 7-12 or higher
Alkali-loving.

Grow at alkaline or high pH.
Vibrio cholerae \rightarrow 9

Osmotic pressure
cells \rightarrow 80-90% water

Halophiles
Require moderate to large salt []
Most bacteria in ocean (3.5% salt)

Extreme or obligate Halophiles
Require very high salt [] \rightarrow 20-30%
Bacteria in dead sea

Chemical Requirements

Carbon 50%

dry weight of cell.
structural backbone of all organic compounds

Chemoheterotrophs
obtain carbon from their energy source:-
Lipid, proteins & carbohydrates

Chemoautotrophs & photoautotrophs
obtain carbon from carbon dioxide CO₂

Oxygen bacteria

Aerobes
utilize O₂ & can detoxify it.

obligate aerobes
Can't grow without O₂

facultative anaerobes
utilize O₂ but can also grow in its absence

microaerophilic
requires only a small amount of O₂

Anaerobes
Don't utilize O₂

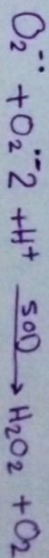
obligate anaerobes
lack the enzymes to detoxify O₂.

aerotolerance
Don't utilize O₂ but can survive & grow in its absence.

Superoxide Free Radicals (O₂⁻)

Extremely toxic & reactive form of O₂
All organisms growing in atmospheric oxygen must produce an enzyme dismutase (SOD)

SOD made by aerobes, facultative anaerobes & aerotolerant anaerobes.

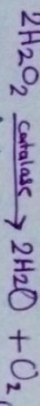


Oxygen Free radicals \downarrow
the toxic form of oxygen

Hydrogen peroxide (H₂O₂)

* 2 enzymes that break down H₂O₂

Catalase



Produced by humans as well as many bacteria

Peroxidase

