

Requirement for growth.

Physical Requirements

Temperature

- ① psychrophiles 0°
  - ↳ cold loving
  - ↳ True psychrophiles 15° or below
  - ↳ seldom cause disease or food spoilage.
- ↳ Psychrotrophs 20°-30°
  - ↳ Responsible for most low temp. food spoilage
- ② mesophiles 25° - 40°
  - ↳ Middle loving
  - ↳ adapted to live in the body of animal
- ③ Thermophiles 50° - 60°
  - ↳ heat loving
  - ↳ live in sunlit soil, hot springs, compost piles
- ↳ Extreme-thermophiles 80°
  - ↳ Hyper thermophiles
  - ↳ live in volcano & ocean vents

pH

- ① Acidophiles 0.1-5.4
  - ↳ grow at low pH
  - ↳ Lactobacillus produce lactic acid
  - ↳ Siderates mild acidity.
- ② Neutrophiles 5.4-8.5
  - ↳ includes most human pathogens.
- ③ Alkaliphiles 7-12
  - ↳ Alkali loving.
  - ↳ grow at high pH
  - ↳ vibrio cholerae

Osmotic Pressure

- ↳ calls are 80-90% water
- ① Halophiles
  - ↳ moderate - lunge salt conc.
  - ↳ most bacteria in ocean (3.5% salt)
- ② Extreme or obligate halo
  - ↳ very high conc. 20-30%
  - ↳ Bacteria in dead sea.
- ③ Facultative Halophiles
  - ↳ not high salt conc.
  - ↳ tolerate 2% salt or more

Chemical Requirement.

Carbon

- ① Chemo heterotrophs
  - ↳ C from energy source
  - ↳ lipid, ph., carbs.
  - ↳ organic form used by other living organism
  - ↳ dependent on other living thing.
- ② Chemotrophs/ photoautotrophs
  - ↳ use CO<sub>2</sub>
  - ↳ inorganic gases
  - ↳ it's C source

Oxygen

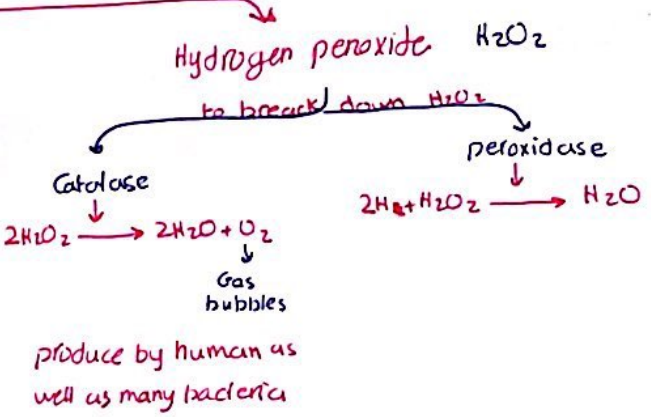
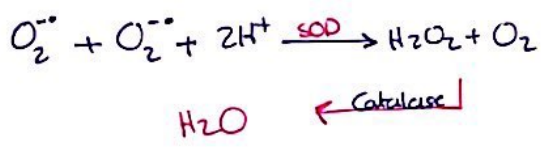
- ① Aerobes
  - ↳ utilize O<sub>2</sub>
- A-obligate Aerobes
  - ↳ can't grow without O<sub>2</sub>
- B-facultative anaerobic
  - ↳ utilize O<sub>2</sub> but can also grow in its absence
- C-microaerophilic
  - ↳ small amounts of O<sub>2</sub>
- ② Anaerobes
  - ↳ don't utilize O<sub>2</sub>
- A-obligate anaerob
  - ↳ lack the enzyme to detoxify O<sub>2</sub>
  - ↳ can't survive in an O<sub>2</sub> enviro.
- B-aerotolerance anaerobes
  - ↳ don't utilize O<sub>2</sub>
  - ↳ can survive when it's present

Some bacteria are forced to live in oxygen free habitats  
 ↳ to avoid the toxic form of O (free radical)  
 ↳ if isn't capable of dealing with (free radical)

**Free Radical**

superoxide free radical  $O_2^-$   
 ↳ extremely toxic & reactive form of oxygen

↳ SOD enzyme



**Reproduction of microbe**

↳ increase in number not in size  
 ↳ discrete colony (aggregation of cell arising from single parent cell)

**Binary division**

- ① exactly in half
- ② two equal size progeny.
- ③ genetically identical offspring.
- ④ doubling cell number

4 stages of growth

- ① lag phase (flat) adjustment, enlargement, little growth
- ② exponential phase / log phase  
 ↳ maximum growth  
 ↳ adequate nutrients & favorable envi.
- ③ stationary phase  
 rate cell growth = rate cell death  
 depleted  $O_2$  + nutrients  
 excretion organic acid + pollutants.
- ④ Death phase  
 ↳ cell die exponentially in their wastes.

**BACTERIAL Respiration**

