

Microbial ecology

- Interactions of organisms with each other and with their physical environment contribute to the functioning of ecosystems.

Symbiosis

- Symbiosis is an association: in a number of ways:
 - 1. Ectosymbiosis-microorganism
 - 2. Endosymbiosis-microorganism
 - 3. Ecto/ endo symbiosis-microorganism

Mutualism

- Obligatory association : reciprocal benefit to both partners. example: Lichens-an ,fungus ,alga, Fungal partner, obtains nutrients well as oxygen.
- Algal partner is protected from excess light

Syntrophism

- Syntrophism - mutually beneficial relationship each organism provides one or more growth factors, nutrients, or substrates for the other cross-feeding or the satellite phenomenon

Commensalism

- The microorganism (commensal) benefits, while the host is neither harmed nor helped
- *Escherichia coli* lives in the colon
- Uses oxygen creating an anaerobic environment in which obligate anaerobes *Bacteroides* grow.

Predation

- Predator organism engulfs or attacks a prey organism;
- Predatory bacteria are known *Bdellovibrio*, *Vampirococcus*, and *Daptobacter*

Parasitism

- One organism (parasite) benefits from another (host)

Ammensalism

- Ammensalism -organism releases a specific compound that harms another organism
- Ex. production by bacteria

Competition

- Different organisms within a population or community try to acquire the same resources (e.g., nutrients, location, etc).

Bacteria of extreme environment

Extreme halophiles

- Prokaryotes that inhabit highly saline environments are called extreme halophiles these organisms require 1.5 to 4M (9-23%) NaCl for optimal growth
- Extreme halophiles belong to Archaea are collectively called halobacteria. Examples *Halobacterium* sp.
- Cell wall is stabilized by sodium ions.
- Cells of *Halobacterium* pump large amounts of K^+ from the environment into the cell to counter the Na^+ . cell wall is made of glycoprotein - high content of acidic amino acids. cytoplasmic proteins are also highly acidic
- Extremely halophilic Archaea are chemo-organotrophs.

Hypersaline environment



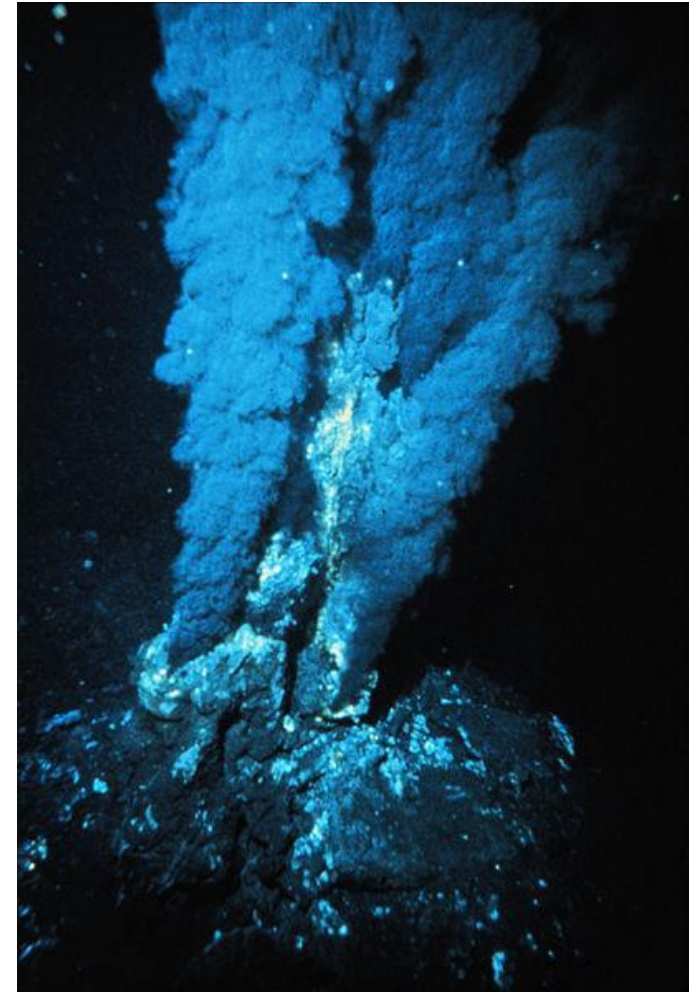
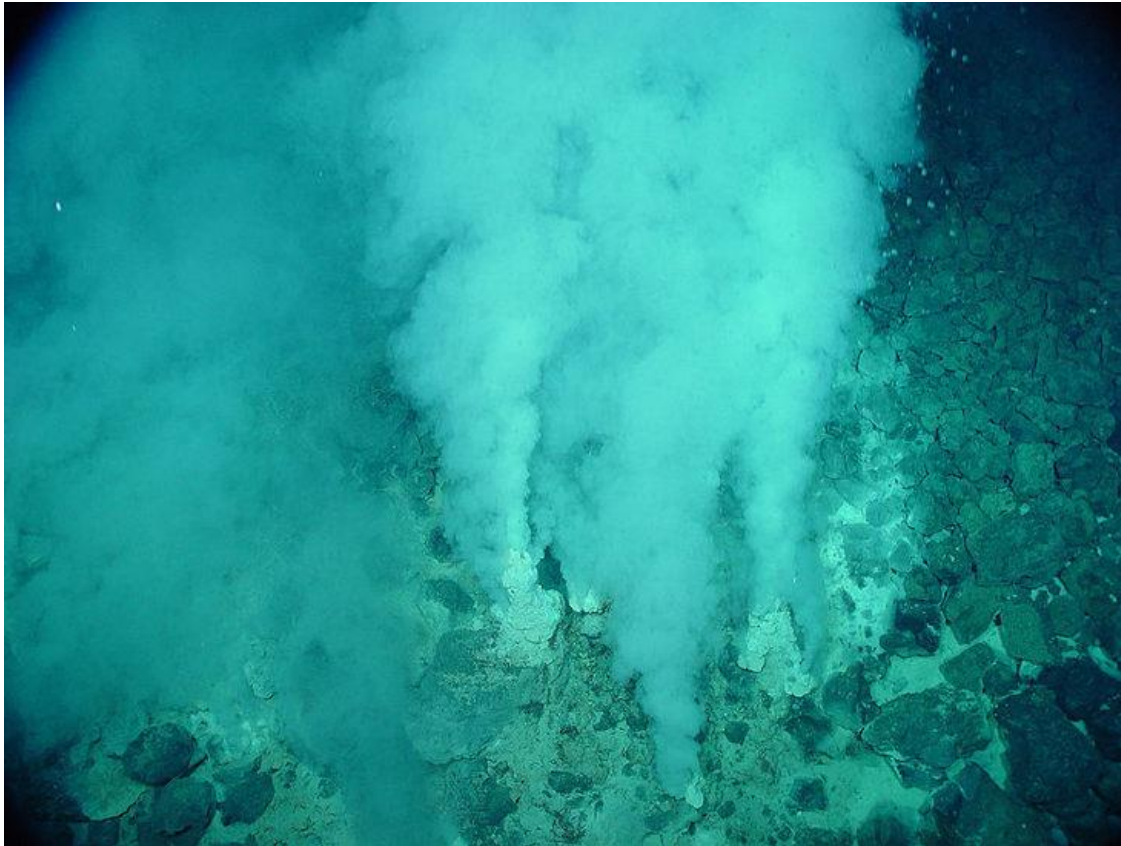
Deep sea bacteria

- Organisms that inhabit the deep sea overcome three major environmental extremes.
- Low temperatures, high pressure and low nutrient levels.
- Barotolerant groups up to 400 atm. pressure and barophilic above 400atm.
- Increased proportion of unsaturated fatty acids in their cytoplasmic membranes; cell wall also possesses specific outer membrane protein called OmpH to overcome the high pressure conditions.

Hydrothermal bacteria

- Hydrothermal vents are thermal springs on ocean floor where hot basalt and magma lie very near the floor
- Sulphur – oxidizing chemolithotrophs -*Thiobacillus*, *thiothrix* and *Beggiatoa* are present
- Include nitrifying bacteria, hydrogen, iron and manganese oxidizing bacteria live in association with other invertebrate
- At great depths, hydrothermal fluid is emitted at temperatures of 270-380°C and bacteria such as *Methanopyrus* exist in walls of such vents also.
- Vents are called black smokers.

Hydrothermal vents (Black smokers)



Hot springs

