The factors determining Microbial activity in environments

1 - Nutritional Requirements: Microbes need nutrients in order to grow and reproduce, nutrients are found in organic matters such as animal and plant waste or decomposed animal and plant remains. The nutritional requirements of microorganisms are divided into two parts:

- **Macronutrients**: which are needed by microorganisms in large quantities, such as C, O N, H, S, P, and some metal ions such as Fe++, Ca++, Mg++, and Na++.
- **Micronutrients**: They are needed by microbes in very small quantities because they stimulate protein building reactions, are part of a specific enzyme, or are involved in vitamin synthesis, such as cobalt (CO), manganese (Mn), molybdenum (Mo), copper (Cu), and nickel (Ni).

2- Biochemical ability: It is the ability of microorganisms to produce enzymes that oxidize and decompose organic matters into primary elements. enzymes such as cellulose, which decomposes cellulose, amylase, which decomposes starch, chitinase, which decomposes chitin, protease, which decomposes proteins, and Lipase, which decomposes fats.

3- Structural features of Microbes: help microbes to carry out their function in the ecosystem.

- some bacteria have flagella help in movement and colonization. For example, **Rhizobium** bacteria have flagella help to move and colonize the roots of leguminous plants to fix nitrogen. Flagella also help bacteria to swim towards nutrients as well as away from harmful matters as toxins, this called Chemotaxis**.**

- presence of mucus layer in cyanobacteria helps it slide toward the light.,
- dynamic of the plasma membrane in bacteria contain phosphorylated lipids is remains liquid during the growth period that necessary for survival of bacteria in extreme temperature environments.

-Bacteria that live in high-temperature environments as hot springs which is temperature ranges between 80 and 100°C, the phosphorylated lipids consist of saturated fatty acids. - Bacteria that live in low-temperature environment, as the polar regions, the phosphorylated lipids consists of unsaturated fatty acids.

Notice : Saturated (contains double covalent bonds between carbon atoms in the hydrocarbon chains) unsaturated contain single covalent bond.

4- Resistance of environmental conditions:

Microorganisms have ability to resist environmental conditions, especially those that live in extreme environments under environmental stress conditions.

- **Bacteria have a capsule**, which is a mucous layer surrounding the bacterial cell and consist of polysaccharides to protect bacteria from drying out and from predatory protozoa such as Entamoeba.
- **Symbiotic relationships** are also considered adaptations to resistance environmental conditions.

example in cold polar regions such as the tundra, cyanobacteria form a symbiotic relationship with fungus to form symbiotic microorganisms called **lichens**. Thus, both cyanobacteria and filamentous fungi can perform their ecological role. Cyanobacteria make food sugars for the fungus through photosynthesis and fungi provide cyanobacteria with water and salts through their fungal hyphae.

- **<u>changing the chemical composition of the cell membrane,</u>** Some microalga when live in a phosphate-poor environment, they replace phospholipids with non-phospholipids.
- **<u>Resistance of bacteria to antibiotics</u>** is an adapt biological environments, such as some strains of ***Staphylococcus aureus*** bacteria inhabit the skin and nose resistant the antibiotic Methicillin antibiotic.

Lichens