Bacterial Cell Structure

Second/ Internal structures:

Inside the cell wall is the cell's protoplasm and its contains of cytoplasm and cellular components, and it is surrounded by the cytoplasmic membrane. The internal components of the bacterial cell can be divided as follows:

1- Cytoplasmic Membrane:

2- Cytoplasm :

It is a gelatinous substance located inside the plasma membrane, containing mainly 70S ribosomes, and chromatophores in photosynthetic bacteria, in addition to various inclusions bodies (storage granules) such as poly-beta-hydroxybutyrate acid, sugar granules of the glycogen type and volutine of the polyphosphate type, and sometimes sulfur or iron. The cytoplasm consists of a complex mixture of proteins, carbohydrates, fats, amino acids, salts and vitamins. Some of these materials are dissolved in water or suspended in it. The cytoplasm can be divided into three regions:

A- The granular region, which is rich in RNA.

B- The chromatin region, which is rich in DNA.

C- The region or liquid part that contains dissolved nutrients.

All cytoplasmic structures are found floating in an aqueous solution, which is usually a complex mixture of many ions such as hydrogen, sodium, phosphate, and chlorine ions, and other dissolved substances such as amino acids, some proteins, nitrogenous bases such as purines and pyrimidines, fatty complexes, vitamins, ribose and glucose sugars, enzymes, and various metabolic substances. Each of these substances has a specific function that the cell benefits from.

3- Nucleoid:

Bacterial cells do not contain a distinct nucleus surrounded by a membrane as is found in eukaryotic cells. Electron microscopy has shown that bacterial nuclear material (DNA) is found free in the cytoplasm of the cell in a circular form called bacterial chromatin. The nuclear material occupies half the volume of the cytoplasm and is free of the histones that are found in the chromosomes of higher organisms.

4- Ribosomes:

The granular appearance of the cytoplasm is due to the presence of huge numbers of very small particles spread throughout the cytoplasm called ribosomes, unlike their presence in eukaryotic cells where they are associated with the membranes of the endoplasmic reticulum. Bacterial ribosomes are of the 70S type and each ribosome globule consists of two units linked together, each unit chemically consists of 40% protein and 60% RNA, and its main function is summarized in the process of enzymatically linking amino acids together to syntheses protein.

5- Plasmids:

They are genetic elements of DNA molecules in the form of small circles, present inside the cytoplasm of the bacterial cell outside the bacterial chromosome, and because they are separate from the chromosome, they reproduce independently of it, but there are plasmids whose multiplication in the cell is linked to the multiplication of the chromosome. Plasmids differ from each other in size and number present in the cell and carry genes that give the cell additional characteristics, but they are not essential for the life of the cell and do not affect its vitality. This is indicated by the fact that plasmids can be removed from the cell by stopping their multiplication, and with the continued multiplication of cells, their number decreases until we obtain cells free of plasmids (cured cells).

6- Mesosome :

It is in the form of complex Intracytoplasmic folds connected to the cytoplasmic membrane, although it appears in thin cell sections as an independent and separate structure from the cytoplasmic membrane, the electron microscope has proven otherwise, and it also disappears when the cell wall is removed and the proteoblast is prepared. This means that the cytoplasmic membrane expands to surround the cytoplasm, thus taking the Mesosome with it during the expansion process.

- Functions of the Mesosome:

1- It plays a role in the process of cellular respiration.

2- It participates in the formation of the transverse wall during cell division.

3- It works to distribute the nuclear material to the two halves of the dividing cell during division due to the chromosome's connection to it.

7- Endospoeres:

They are small oval-shaped bodies that are formed in some types of bacteria that are capable of doing so when exposed to harsh conditions and their function is the resistance.

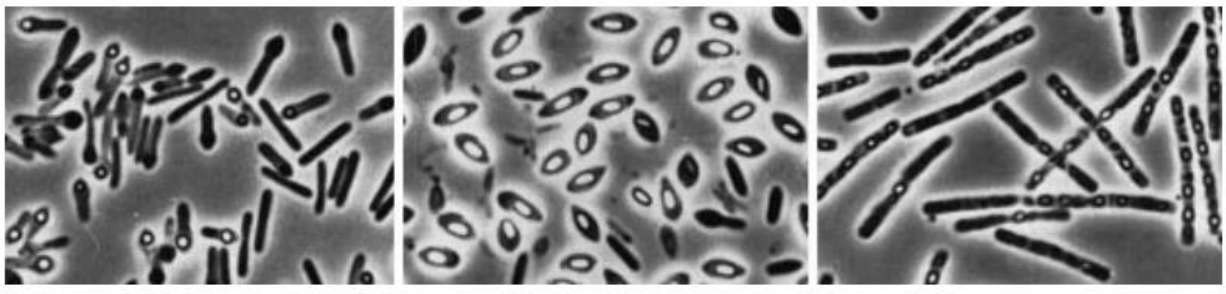
If conditions improve, the spores return to transform into vegetative cells. When some types of bacteria are exposed to unfavorable conditions, they form spores of a special type, characterized by their resistance to heat, dryness, and various chemical and physical factors, with a resistance that exceeds all types of vegetative cells, as they remain vital up to 70-80 ºC for ten minutes. The spores of some types also maintain their vitality even after two hours of boiling, due to the spore's richness in a complex of calcium and di-picolinic acid, which is believed to be responsible for their resistance to heat. Three types of spores can be distinguished according to their position inside the cell:

1- Central spores, where the spore is positioned in the center of the bacterial cell, as in the anthrax bacillus.

2- Lateral spores, where the spore is positioned on one side of the bacterial cell, as in the tetanus bacillus.

3-Polar spores, where the spore is located at one of the poles of the bacterial cell, as in enteric bacilli.

When the appropriate conditions are available, the spores take up a little water and lose part of the calcium complex and di-picolinic acid and undergo many changes that result in the destruction of the spore envelopes and the emergence of an active bacterial cell similar to the original cell. The process of spore production is not a reproductive process because there is no increase in the number of cells. Usually, each vegetative cell produces one spore, but there are types of bacteria that may produce more than one spore from one cell and the spore represents the dormant phase of the bacterial cell.



8- Vacuole:

Some bacteria that live in the aquatic environment form gas vacuoles that help them float. They appear bright under the light microscope and may rupture when exposed to sudden pressure. The chemical composition of their wall is protein with a thickness of 2 nm, such as Clostridium bacteria.