

Microbiology الاحياء المجهرية



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Bacteria : prokaryotic microorganisms, and their DNA is not contained within a separate nucleus as in eukaryotic cells. They are approximately 0.1–10.0 μm in size . and exist in various shapes, including spheres (cocci), curves, spirals and rods (bacilli) . These characteristic shapes are used to classify and identify bacteria. The appearance of bacteria following the Gram stain is also used for identification. Bacteria which stain purple/blue are termed Gram-positive, whereas those that stain pink/red are termed Gram-negative. This difference in response to the Gram stain results from the composition of the cell envelope (wall).

The structure of bacteria :

1- **Cell wall** : Bacteria maintain their shape by a strong rigid outer cover, the cell wall , the function of cell wall are : give the shape of bacteria , support and protection of internal structure , antigenic determinants . Gram-positive bacteria have a relatively thick, uniform cell wall, largely composed of peptidoglycan, a complex molecule consisting of linear repeating sugar subunits cross-linked by peptide side chains . Other cell-wall polymers, including teichoic acids, teichuronic acids and proteins, are also present. Gram-negative bacteria have a thinner peptidoglycan layer and an additional outer membrane that differs in structure from the cytoplasmic membrane

The outer membrane contains lipopolysaccharides on its outer face, phospholipids on its inner face, Lipopolysaccharides are a characteristic feature of Gram-negative bacteria and are also termed 'endotoxins' or 'pyrogen'.

Endotoxins are released on cell lysis and have important biological activities involved in the pathogenesis of Gram-negative infections.

2- **Cytoplasmic membrane** : A cytoplasmic membrane surrounds the cytoplasm of all bacterial cells and are composed of protein and phospholipid; they resemble the membrane surrounding mammalian (eukaryotic) cells but lack sterols. The phospholipids form a bilayer into which proteins are embedded, some spanning the membrane. The membrane carries out many functions, including the synthesis and export of cell-wall components, respiration, secretion of extracellular enzymes and toxins, and the uptake of nutrients by active transport mechanisms. Mesosomes are intracellular membrane structures, formed by folding of the cytoplasmic membrane. They occur more frequently in Gram-positive than in Gram-negative bacteria. Mesosomes present at the point of cell division of Gram-positive bacteria are involved in chromosomal separation; at other sites they may be associated with cellular respiration and metabolism.

3- **Capsules**

Some bacteria have capsules external to their cell . The capsules are important virulence determinants in both Gram-positive and Gram-negative bacteria,

because they may protect the bacteria from host defences and, in some bacteria, aid attachment to host cells.

4- **Fimbriae:** (also termed pili) are thin, hair-like appendages on the surface of many Gram-negative, and some Gram-positive, bacteria .

They are approximately half the width of flagella, and are composed of proteins called pilins. In some bacteria they are distributed over the entire cell surface.

5- Flagella:

Bacterial flagella are spiral-shaped surface filaments consisting mainly of the protein, flagellin. They are attached to the cell envelope as single (monotrichous) or multiple (peritrichous) forms. Flagella facilitate movement (motility) in bacteria.

Intracellular structures

Nuclear material

The bacterial chromosome consists of a single circular molecule of double-stranded DNA, which is maintained in a compact form within the cell by supercoiling.

Ribosomes

The cytoplasm has many ribosomes, which contain both ribonucleic acid (RNA) and proteins. Ribosomes are involved in protein synthesis.

Inclusion granules

Various cellular inclusions, which serve as energy and nutrient reserves, may be present in the bacterial cytoplasm.

The differences between prokaryotic and eukaryotic cell

Differences between prokaryotic & eukaryotic cells.		
Feature	Prokaryote Bacteria	Eukaryote Animals, plants, fungi
Nuclear membrane	Absent (nucleoid)	Present
Flagella	Simple	Complex
Cell wall	Peptidoglycan	Cellulose (plants) Chitin (fungi)
Ribosome size	70S	80S
Mitochondria	Absent	Present
Cytoplasmic membrane	Does not usually contain sterols	Contains sterols
Meiosis & Mitosis	Absent (binary fission)	Present

Thank You

Questions?

Comments and opinions would be appreciated.