**M.Sc. BOTANY**

**(SEMESTER 1)**

**PAPER MBOTCC2 (MICROBIOLOGY AND PLANT PATHOLOGY)**

**Structure of Bacteria**

Bacteria are microscopic organisms, single-celled prokaryotic organisms that thrive in diverse environments, often known as **‘germs’** and **‘microbes’**. **Bacteria** are microscopic, The very first organisms to evolve on earth was probably a unicellular organism, similar to modern bacteria. These organisms can live in atmosphere, soil, water and also inside the living system as well as dead tissues. Today, bacteria are considered as one of the oldest forms of life on earth. Even though most bacteria is harmful to us, despite they have also a long-term mutual relationship with humans and are very much important for our survival. So to understand on its uses, its important to know the structure of bacteria, its classification, and bacteria diagram in detail.

**Structure of Bacteria**

Bacteria are single-celled microorganisms having the absence of the nucleus and other cell organism hence, they classified as prokaryotic organisms. A bacterial cell has five essential structural components: a nucleoid (DNA), ribosomes, cell membrane, cell wall, and some sort of surface layer, which may or may not be an inherent part of the wall. Structurally, there are three architectural regions: appendages (attachments to the cell surface) in the form of flagella and pili (or fimbriae); a cell envelope consisting of a capsule, cell wall and plasma membrane; and a cytoplasmic region that contains the cell chromosome (DNA) and ribosomes and various sorts of inclusions. Bacterial DNA are naked, independent in cytoplasm region t/a nucleoid. Great variation in size from average 1.25 µ to 2 µ diameter. Length can varied.

Generalized Structure of bacteria:



**1.** A bacterial cell remains surrounded by an outer layer or cell envelope, which consists of two com­ponents – a rigid cell wall and beneath it a cyto­plasmic membrane or plasma membrane. Bacterial cell wall is extremely thin (10-25 nm thick) and provides rigidity and a definite shape to the cell. Chemically, the cell wall is composed of mucopeptide (murein) scaffolding or platform formed by N- acetyl glucosamine and N-acetyl muramic acid mol­ecules arranged in alternate chains. According to Peberdy (1980) the compound present in the cell walls of both Gram-negative and Gram-positive bacteria is ‘peptidoglycan’. The cell walls of Gram-positive bacteria contain up to 95% peptidoglycan and up to 10% teichoic acids. The cell envelope in some bacteria may be enclosed in a loose slimy layer or capsule.

2. Cytoplasmic membrane is a thin (5-10 nm) layer lin­ing the inner surface of the cell wall. It separates the cell wall from the cytoplasm. It functions as a semipermeable membrane that keeps control over the inflow and outflow of metabolites to and from the protoplasm. Chemically, the cytoplasmic (plasma) membrane consists of lipoprotein with small amounts of car­bohydrates. The lipid may reach up to 30% and protein up to 75%. Some vesicular, pocket-like structures are formed as invaginations of the cytoplasmic membrane into the cytoplasm. These are called mesosomes. They are supposed to be the principal sites of respira­tory enzymes.

3. The cell encloses the protoplasm, made up of the cytoplasm, cytoplasmic inclusions (such as ribosomes, mesosomes, fat globules, inclusion bodies, vacuoles) and the nuclear material nucleoid (nacked DNA). Cytoplasm is present in the form of a colloidal system of several organic and inorganic solutes in a viscous watery solution. It does not show the protoplasmic streaming. Membrane-bound organelles, such as endoplasmic reticulum, mitochondria and Golgi- bodies are also absent in bacteria. The bacterial cytoplasm contains several ribosomes which occupy the most part of the cytoplasm. These are the centres of protein synthesis. Ribosomes are the ribonucleoprotein particles of approximately 100 Å in diameter. Intracytoplasmic inclusions are volutin, polysac­charide, lipid, crystals and vacuoles.

4. Nuclear material is present in each bacterial cell, but there is no nuclear membrane or nucleolus. Bacteria are, therefore, prokaryotic. The low electron-density regions in the cell are actually the densely-packaged DNA regions, called ‘nuclearbodies’ or ‘nucleoids’. Nucleoid is, therefore, made up of DNA, the genetic material of the cell.

Some bacteria possess some extranucelar genetic elements made up of DNA. These cytoplasmic carriers of genetic information are called ‘plasmids’ and ‘episomes’.

5. Some bacteria also carry flagella. Flagella are long, fine, hair-like, locomotory appendages, found commonly in rod-shaped and spiral bacteria.

6. Some very fine, hair-like, surface appendages, found in some Gram-negative bacilli are called fimbriae or pili.