

B.Sc. Botany (Hons.) I
Paper: I Group: C

Cell Structure of Cyanobacteria

Like bacteria, the cell of cyanobacteria also consists of a mucilaginous layer called sheath, the cell wall, plasma membrane and cytoplasm.

These are shown in a typical cell of cyanobacterium and described below:

1. Sheath:

Usually the cell of cyanobacteria is covered by a hygroscopic mucilaginous sheath which provides protection to cell from unfavourable conditions and keeps the cells moist. Thickness, consistency and nature of sheath are influenced by the environmental conditions. Sheath consists of pectic substances. It is undulating, electron dense and fibrillar in appearance.

2. Cell Wall:

After observing the cyanobacterial cell under electron microscope, it appears multilayered present between the sheath and plasma membrane. The cell wall consists of four layers designated as LI, LII, LIII and LIV. The layers LI and LIII are electron transparent, and LII and LIV electron dense.

(a) LI is the innermost layer of the cell wall present next to the plasma membrane. It is of about 3-10 nm thickness and enclosed by LII.

(b) LII is a thin, electron dense layer. It is made up of mucopeptide and muramic acid, glucosamine, alanine, glutamic acid and di-amino-pamelic acid. The layer LII provides shape and mechanical strength to the cell wall. Thickness of this layer varies from 10 to 1000 nm.

(c) LIII is again electron transparent layer of about 3-10 nm thickness.

(d) The outermost layer is LIV which is a thin and electron dense layer. It appears wrinkled and is undulating or convoluted.

All the layers are interconnected by plasmadesmata. Numerous pores are present on the cell which acts as passage for secretion of mucilage by the cell. Chemically the cell wall of eubacteria and cyanobacteria are much similar.

The chemical constituent of cyanobacteria and Gram-negative bacteria is the presence of mucopeptide which is made up of five chemical substances viz., three amino acids (di-amino-pyruvic acid) and two sugars (glucosamine and muramic acid) in the ratio of 1:1:1:1:2.

Similar ratio of these constituents is also found in *E. coli*. However, in some cyanobacteria such as *Anacystis nidulans*, *Phormidium uncinatum* and *Chlorogloea fritschii* the amino acids and sugars are found in different ratios. Moreover, diamino acid is common in all prokaryotes. In addition, lipids and lipopolysaccharides have also been detected in the cells of cyanobacteria.

3. Plasma Membrane:

The cell wall is followed by a bilayer membrane called plasma membrane or plasma lemma. It is 70Å thick, selectively permeable and maintain physiological integrity of the cell. Plasma membrane sometimes invaginates locally and fuses with the photosynthetic lamellae (thylakoids) to form a structure called lamellosomes. The plasma membrane encloses cytoplasm and the other inclusions.

4. Cytoplasm:

Cytoplasm is distinguished into the two regions, the outer peripheral region which is called the chromoplasm and the central colourless region called centroplasm.

(i) Chromoplasm:

The chromoplasm contains the flattened vesicular structures called photosynthetic lamellae or thylakoids (Fig.4.32). Thylakoids may be peripheral, parallel or central. Besides photosynthesis, thylakoids have the capacity of photophosphorylation, Hill reaction and respiration. Depending upon physiological conditions they are arranged accordingly.

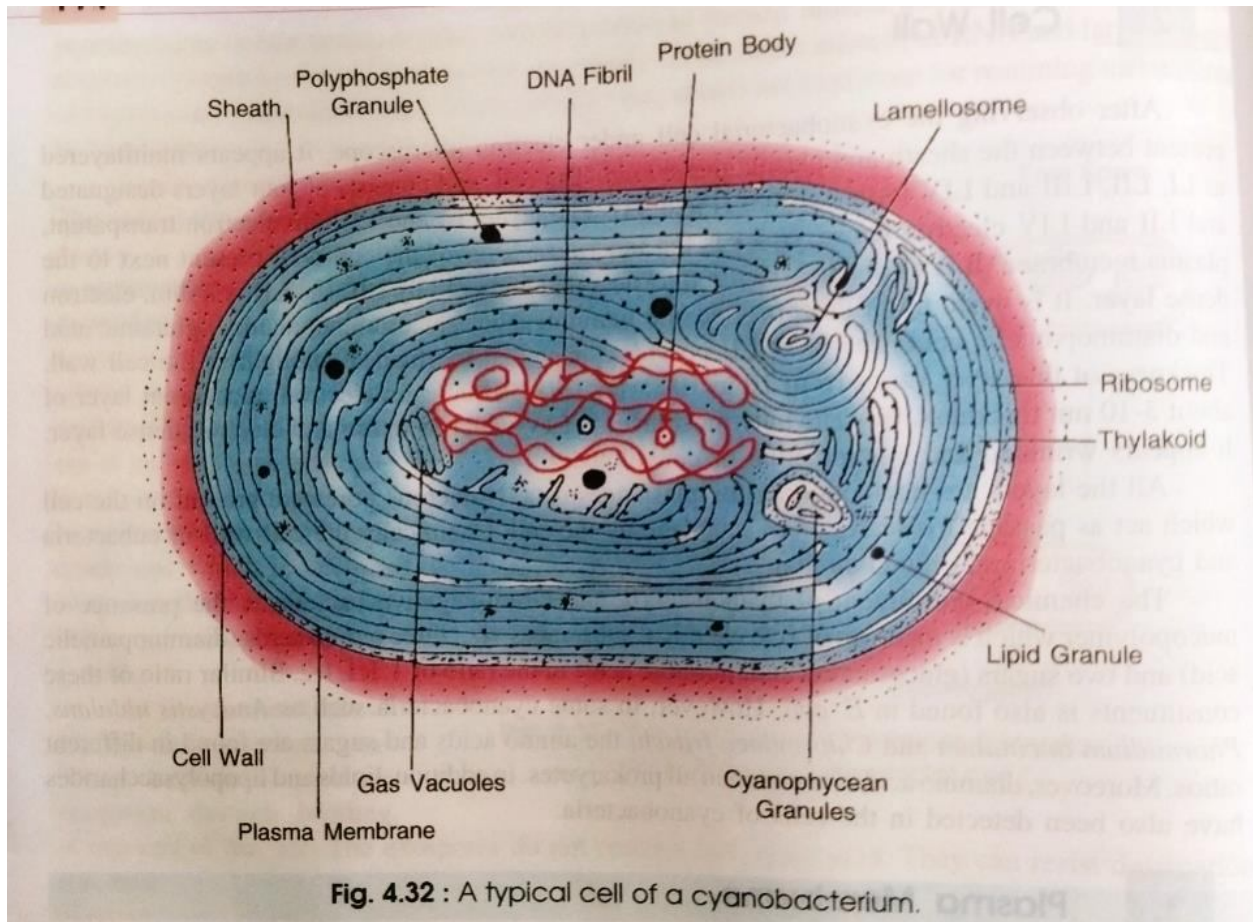
Several photosynthetic pigments such as chlorophyll a, chlorophyll c, xanthophyll's, and carotenoids are present inside the lamellae. On its upper surface phycobilisomes (biliproteins) of about 40 nm diameter are anchored by a protein.

Phycobilisomes comprises of three pigments: phycocyanin-C, allophycocyanin and phycoerythrin-C. These three pigments harness light in the sequence: Phycoerythrin—Phycocyanin—Allophycocyanin—Chlorophylls.

(ii) Centroplasm:

The centroplasm is colourless and regarded as primitive nucleus devoid of bilayered nuclear membrane and nucleolus. Several grains that can take stain are dispersed in centroplasm. Some

people are of the opinion that the centroplasm is the store house of food and according to the others it is an incipient nucleus.



Continues in next lecture