Lecture No.: 12 **Date:** 16th April, 2020

CORE CONCEPT OF **HONS. PART 1**

Group C -Microbiology **Paper - 1**

NITROGEN FIXATION BY CYANOBACTERIA

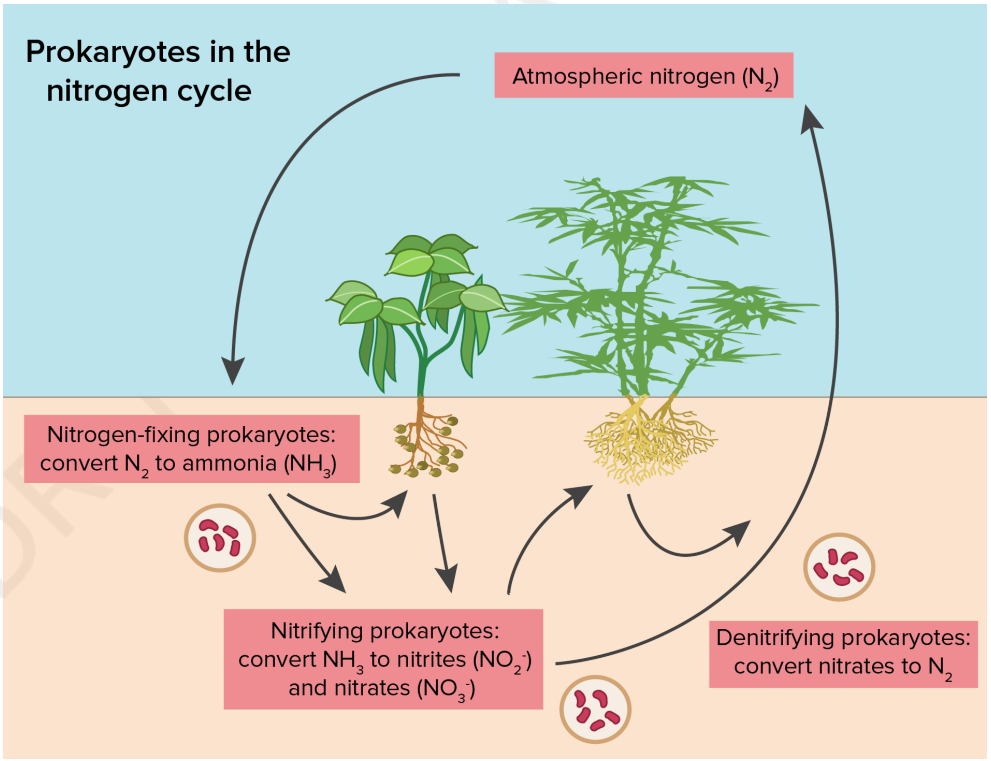
The cyanobacteria (blue-green algae) have six main features by which they are characterized.

1. Their cellular structure is prokaryotic.

2. Flagella are completely absent.

3. When movement occurs, it is by a characteristic gliding motion.

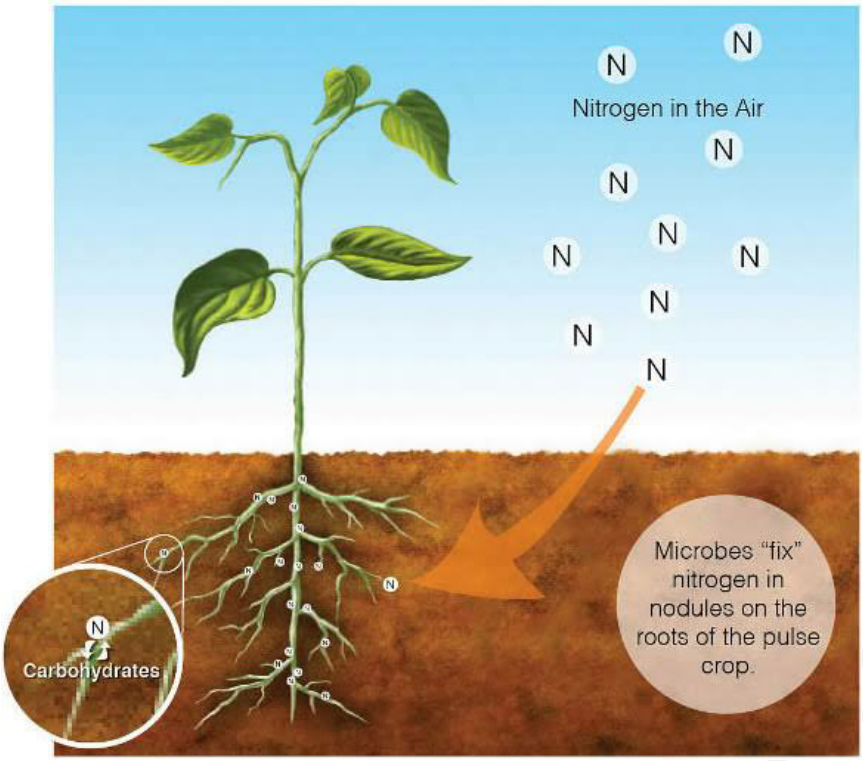
4. Their photosynthetic pigments include characteristic bio-proteins, together with unique carotenoids such as myxoxanthin and myxoxanthophyll besides chlorophyll *a.*



5. Storage products include the proteinaceous material, cyanophycin.

6. Sexual reproduction is absent.

The members of cyanobacteria (blue-green algae) have been placed in one class



Cyanophyceae. There is absence of true nucleus and sexual reproduction in the members. Members are encircled by mucilaginous sheath.

Nitrogen fixing bacteria are of two types - Non symbiotic nitrogen fixing bacteria (such as *Azotobacter, clostridium etc.)* which live freely in the soil and symbiotic nitrogen fixing bacteria (such as *Rhizobium*) which live symbiotically in the root nodules of leguminous plants. They are provided with nitrogen fixing *(nif)* genes.

Non symbiotic nitrogen fixing bacteria are of the free-living, aerobic nitrogen-fixing blue-green algae are filamentous and heterocystous belonging to the the order Nostocales and Stigonematales (Geitler, 1932, Desikachary, 1959). A few unicellular forms like Gloeocapsa
and Aphanothece (Singh, 1973) and non-heterocystous forms like a marine Trichodesmium sp. have also been reported to fix Nitrogen under aerobic conditions.

Although blue-green algae are known to inhabit a range of diverse habitats including thermal springs to Arctic region, majority of Nitrogen fixing species show dominant growth in reducing conditions especially available in water-logged rice fields.

Symbiotic blue-green algae or cyanobacteria show association from lichens to higher plants and without exception all are nitrogen fixers. Inspite of broad spectrum of distribution of the host plants in varied agro-climatic conditions, studies on symbiotic blue-green in our country have remained confined to *Azolla* and cycads only. No systematic ecological investigations have been made on host-symbiont distribution, Nitrogen fixationand many other interesting aspects of research. Major emphasis has been given to *Azolla* mainly due to the possible role of this system for biofertilizer development.

Azolla, a genus of ubiquitous distribution, widely distributed in tropical and temperate freshwater ecosystems, is a small aquatic fern, harbouring the Nitrogen-fixing blue green alga Anabaena azollae in dorsal leaf lobe cavity. It is considered both as a weed contaminating the water bodies and as a biofertilizer having potential to be used as a a source of Nitrogen to the rice plants.

For centuries, *Azolla* has been used as green manure for the cultivation of of rice in in Northern Vietnam and South-Eastern China (Singh, 1979).

The chemical diversity of bacterial metabolism Shows how extensively bacteria have evolved. In some cases the need for metabolic enzymes has been sacrificed at the expense of having to take up molecules performed from the environment, and in some pathogenic bacteria this specialization had reached the point that they cannot grow outside the organism that they are infecting. At the other extreme a totipotent synthetic apparatus within the cell allows bacteria to grow in chemical environments that are for too Spartan for organisms which do not derive their energy requirements from light or simple inorganic reactions.