Class- B.Sc.
Semester I
Subject- Botany
Unit III - Phycology

Topic - **Classification and Life Cycle of -**
Nostoc

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Nostoc

Dr. Sugandha Tiwari
Associate Professor
Department of Botany
D.G. College, Kanpur
Email: sugandhatiwari7@gmail.com

Genus - *Nostoc*

Classification

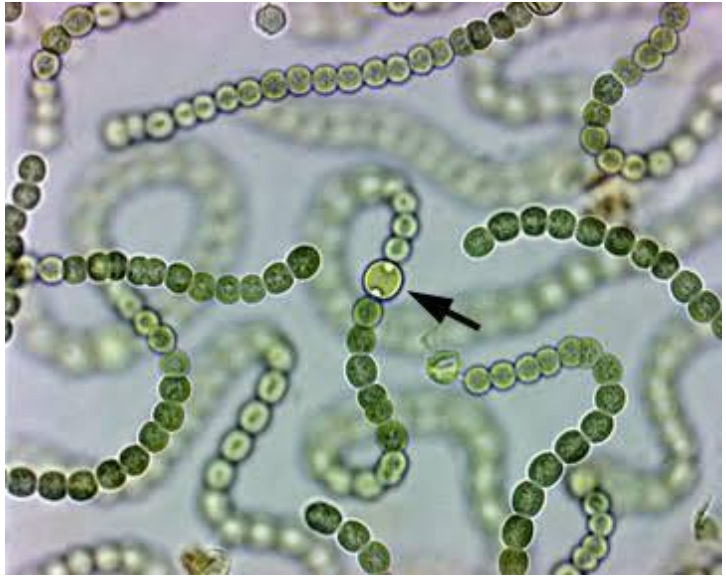
Class: Cyanophyceae

Order: Nostocales

Family: Nostocaceae

Genus: *Nostoc*

Nostoc balls
https://commons.wikimedia.org/wiki/File:NostocPruniforme1.jpg



Nostoc filaments
https://fmp.conncoll.edu/Silicasecchidisk/LucidKeys3.5/Keys_v3.5/Carolina35_Key/Media/Html/Nostoc_Main.html

Class : Cyanophyceae

General Characters

1. Cell organization is prokaryotic
2. Cell wall is made up of mucopeptides (muramic acid and di amino pimellic acid)
3. Chief pigments are Chlorophyll a, beta carotene, c-Phycocyanin.
4. Reserve food material is cyanophycean starch and cyanophycean granules (protein).
5. Sexual reproduction is absent (genetic recombination has been reported in some species).
6. Asexual reproduction is by hormogonia or akinetes.

Order: Nostocales

1. Largest order of class cyanophyceae.
2. Thallus is unbranched filament, some members show false branching.
3. Heterocysts are found in most of the members.
4. Reproduce by hormogonia, akinetes, exospores,endospores or hormospores.

Family: Nostocaceae

1. Filaments occur singly or in a common mucilaginous matrix.
2. Trichomes are unbranched and uniseriate.
3. All the cells in the trichome are similar, they do not show polarity.
4. Heterocysts are found in all the members of the family, they may be terminal or intercalary in position.
5. Reproduction takes place by akinetes or hormogonia.

Genus: *Nostoc*

Habitat:

- Occur in freshwater or moist soil.
- N. commune is a terrestrial species and it forms colony ranging from few millimeters to 8 cm on damp soil.
- Some species of Nostoc are found endophytically in symbiotic association.

  For example N. punctiforme is found in the coralloid roots of Cycas and Anthoceros thallus.

  N. sphaericum and N. collema are phycobionts in lichen thallus

- Nostoc has the ability to fix atmospheric nitrogen.

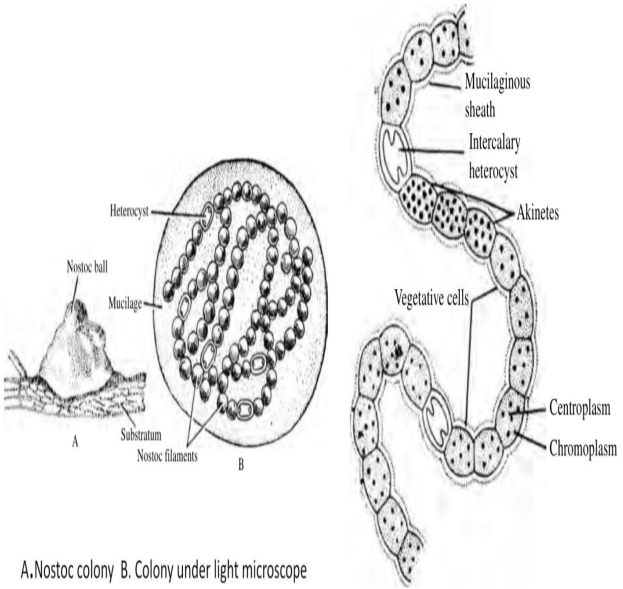
Genus: *Nostoc*

Thallus structure:

Nostoc trichomes are often aggregated into ball-like gelatinous colonies that vary in size and shape.

The trichomes are uniseriate, usually contorted and twisted.

The cells are moniliform (pearl like), have prominent constrictions between them and appear like beads in a string.



A.Nostoc colony B. Colony under light microscope

Nostoc filament

Genus: *Nostoc*

Thallus structure:

The filaments have intercalary or terminal heterocysts and akinetes.

Terminal heterocyst has one polar nodule and intercalary heterocyst has two polar nodules.

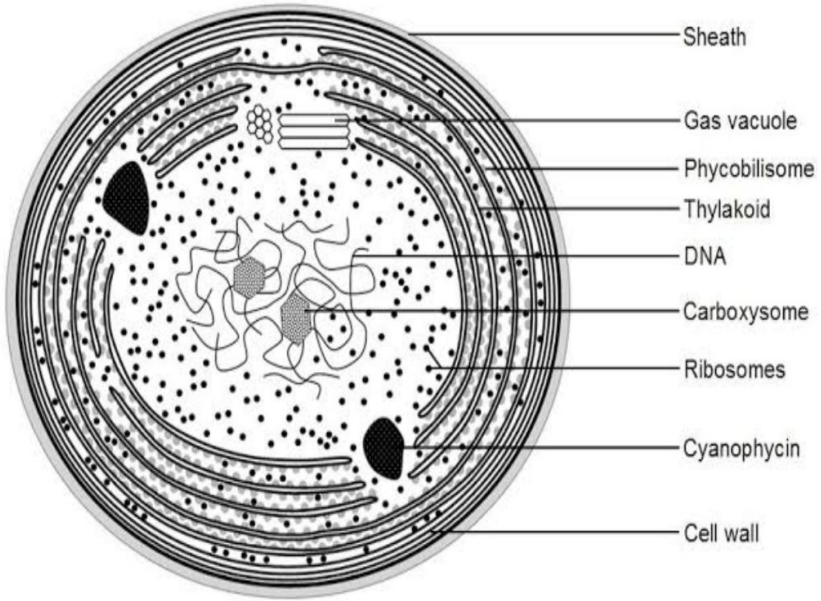
Each trichome is enveloped in a gelatinous sheath. The sheaths of adjoining trichomes may coalesce to form a common gelatinous matrix of the colony.

Genus: *Nostoc*

Cell structure:

Cell structure is typically cyanophycean. The cells are prokaryotic.

Cell wall is composed of peptidoglycan (mucopeptides). Muramic acid and di-amino-pimellic acid is present in the cell wall.



Nostoc: Cell structure

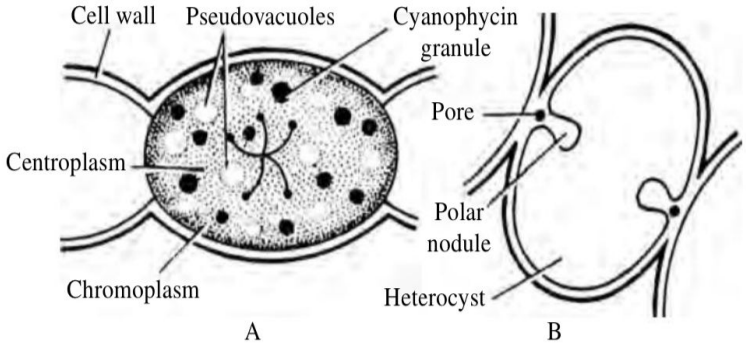
Genus: *Nostoc*

Cell structure:

Protoplast is differentiated into peripheral chromoplasm and central centroplasm or nucleoplasm.

The peripheral cytoplasm has photosynthetic lamellae and pigments.

Central colourless centroplasm is the nuclear region containing nucleic acid, nucleolus and nuclear membrane is absent . This type of nucleus is called incipient nucleus.

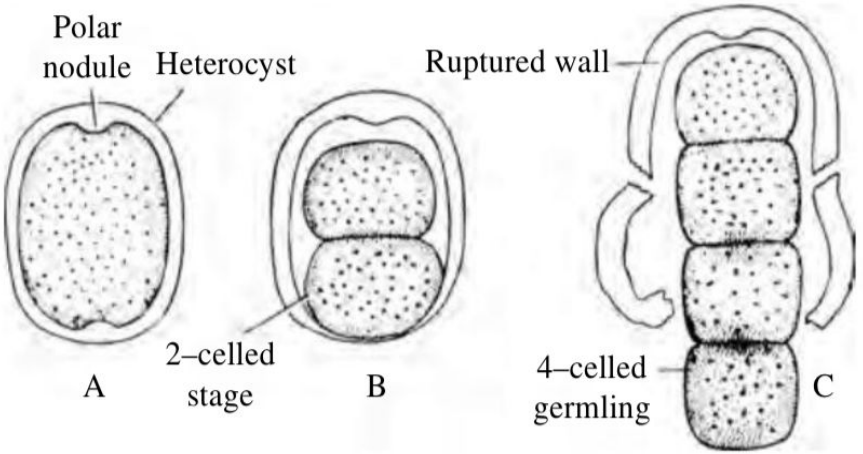


Nostoc A. Cell structure; B. Heterocyst

Genus: *Nostoc*

Heterocysts are thick walled with anaerobic environment and contain nitrogenase enzyme that fixes atmospheric nitrogen.

Reproduction takes place by hormogonia and akinetes. Sometimes heterocysts germinate to form a new filament.



Nitrogen fixation in heterocyst

Heterocysts are surrounded by a glycolipid layer which is impermeable to O2 .

Heterocysts lack photosystem II and, therefore, the ability to evolve O2.

Heterocysts do have cyclic photophosphorylation and can produce the ATP necessary for nitrogen fixation.

Heterocysts also have a form of myoglobin called cyanoglobin that scavenges oxygen, preventing inhibition of nitrogenase .

In nitrogen fixation, N_2 from the atmosphere is fixed by the enzyme nitrogenase into ammonium using ATP as a source of energy. The process is one of the most metabolically expensive processes in biology, requiring 16 ATP for each molecule of N_2 fixed.

$$N_2 + 8\ H^+ + 8e^- + 16\ ATP \longrightarrow 2\ NH_3 + H_2 + 16\ ADP + 16\ Pi$$

Let’s revise

Q.1 Give the characteristics of class cyanophyceae.

Q.2 Draw a well labelled diagram of prokaryotic algal cell.

Q.3 What is the function of heterocyst?

Q.4 Give the classification of Nostoc. Describe the thallus structure and reproduction in Nostoc.