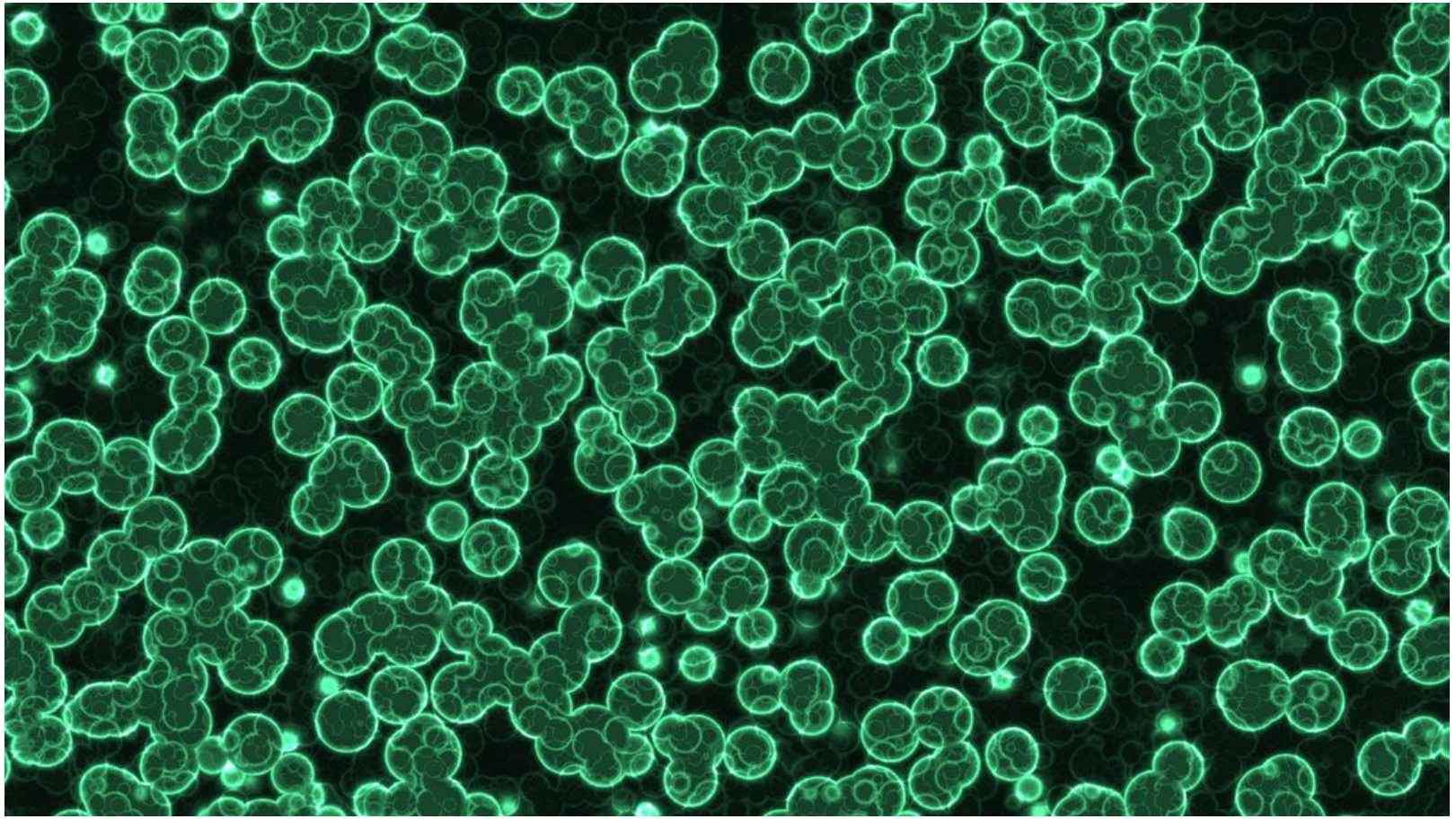


Cyanophyceae

General characteristics

- Prokaryotic (lacking membrane bound genetic, photosynthetic and respiratory organelles) cellular structure.
- Absence of a definite and well-organized nucleus
- Absence of well-organized plastids

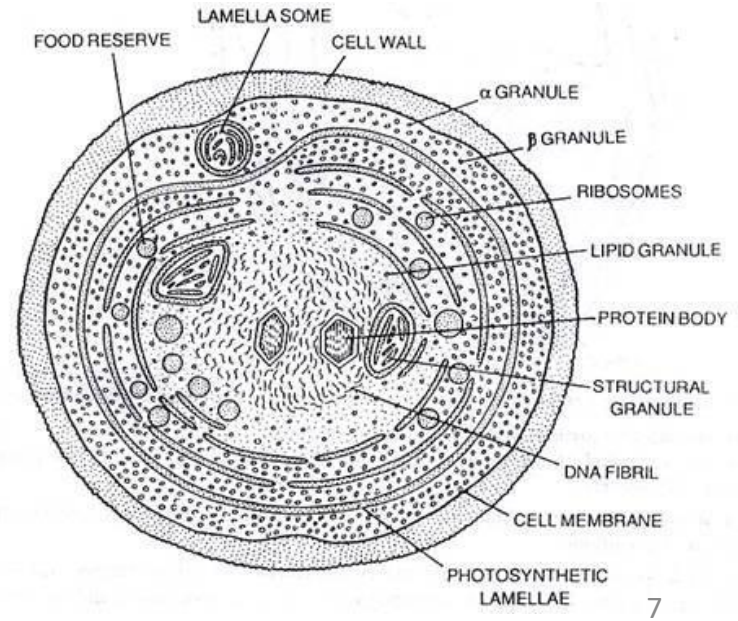
- Flagellum is completely absent. Movement is carried out by the characteristic gliding motion

- Blue pigment (c-phycocyanin) and red pigment (c-phycoerythrin) are the main pigments in cyanophyceae. Myxoxanthin, myxoxanthophyll and allophycocyanin are also present.

- Besides cyanophycin, (a protenacious material) the main food storage compound is myxophycean starch.

- Usually the plant body is filamentous and these filaments are called trichomes.

- The protoplast of the cell is divisible into a peripheral, pigmented region called chromoplasm and central colourless region called centroplasm.



- Many of the members can fix atmospheric nitrogen.

  Eg : *Nostoc, Anabaena*

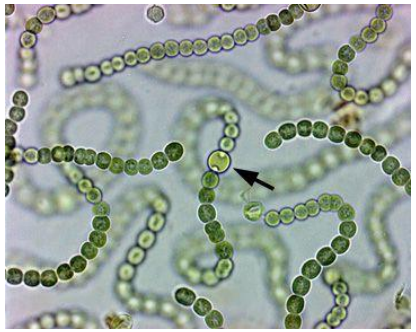
- Heterocysts are the thick-walled cells of unusual structure found in the some of members of cyanophyceae.
- Because of their homogeneous nature and pale-yellowish contents and owing to their thick walls, they can be easily distinguished from the rest of the cells of the filaments.
- They are either intercalary or terminal, and have conspicuous pores on both the ends.

- Many planktonic members posses gas vacuoles. These are gas-filled cavities which serve the function of floatation.

- Mucilage is secreted by all members of blue-green algae

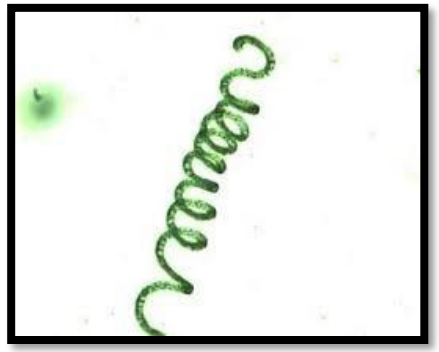
- Members of Cyanophyceae reproduce only by vegetative means. **Sexual reproduction is absent**. Various means of vegetative reproduction are the formation of hormogones, pseudohormogonia, endospores, exospores, akinetes etc

Some common members

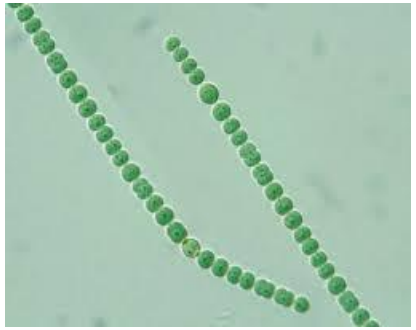


Nostoc

Oscillatoria

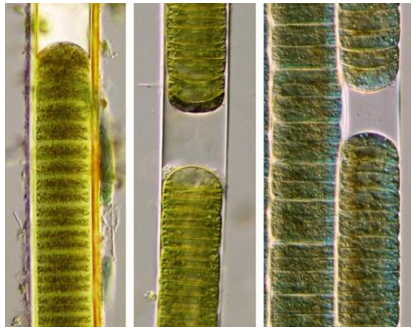


Spirulina

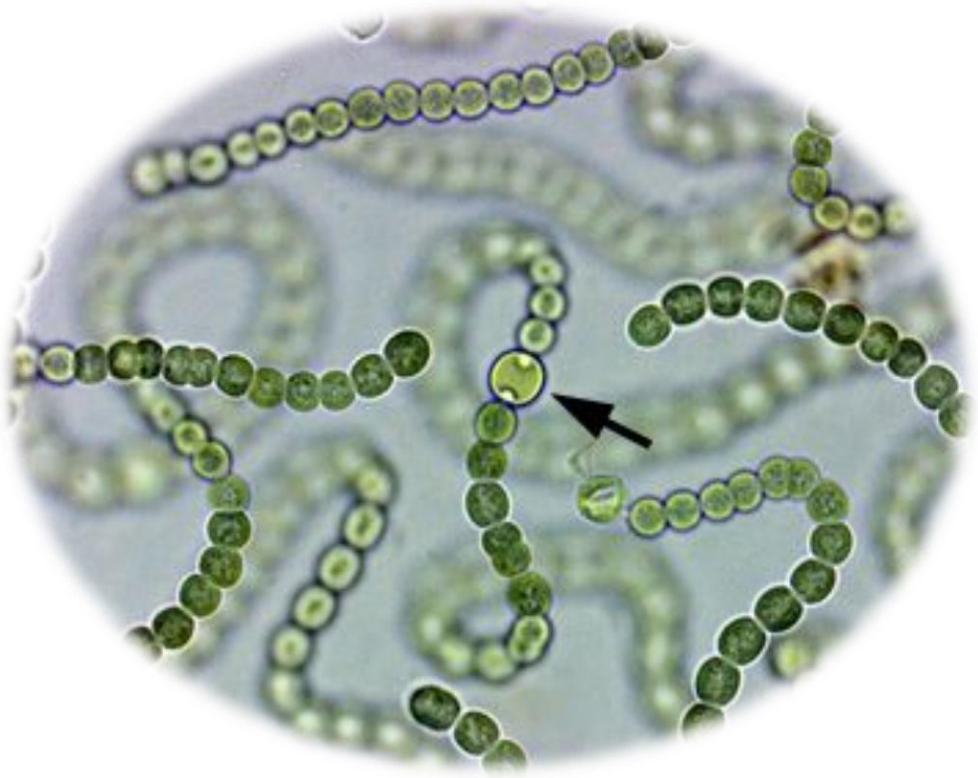


Anabaena

Rivularia



Lyngbya



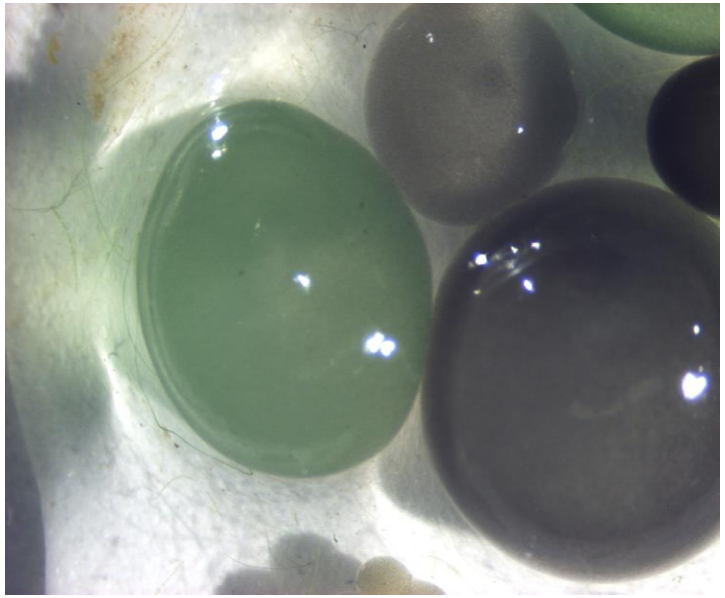
NOSTOC

Systematic Position

- *According to Fritsch (1945)*
- Class — Myxophyceae
- Order — Nostocales
- Family — Nostocaceae
- Genus — *Nostoc*

- *Nostoc* is a filamentous and colonial type of blue green algae.
- It chooses a variety of habitats
- It lives in water and also in terrestrial habitat.
- The filaments are closely packed which are embedded in a mucilagenous matrix.
- They appear as balls of jelly like substances.

- The shape and size of colonies vary very much – They may be spherical, foliose, filiform or as leathery sheets.
- They often appears as glistening mucillagenous colonies called moonspit.
- Certain species of *Nostoc* are found in association with lichens, roots of *Cycas* etc.



Nostoc - different types of colonies

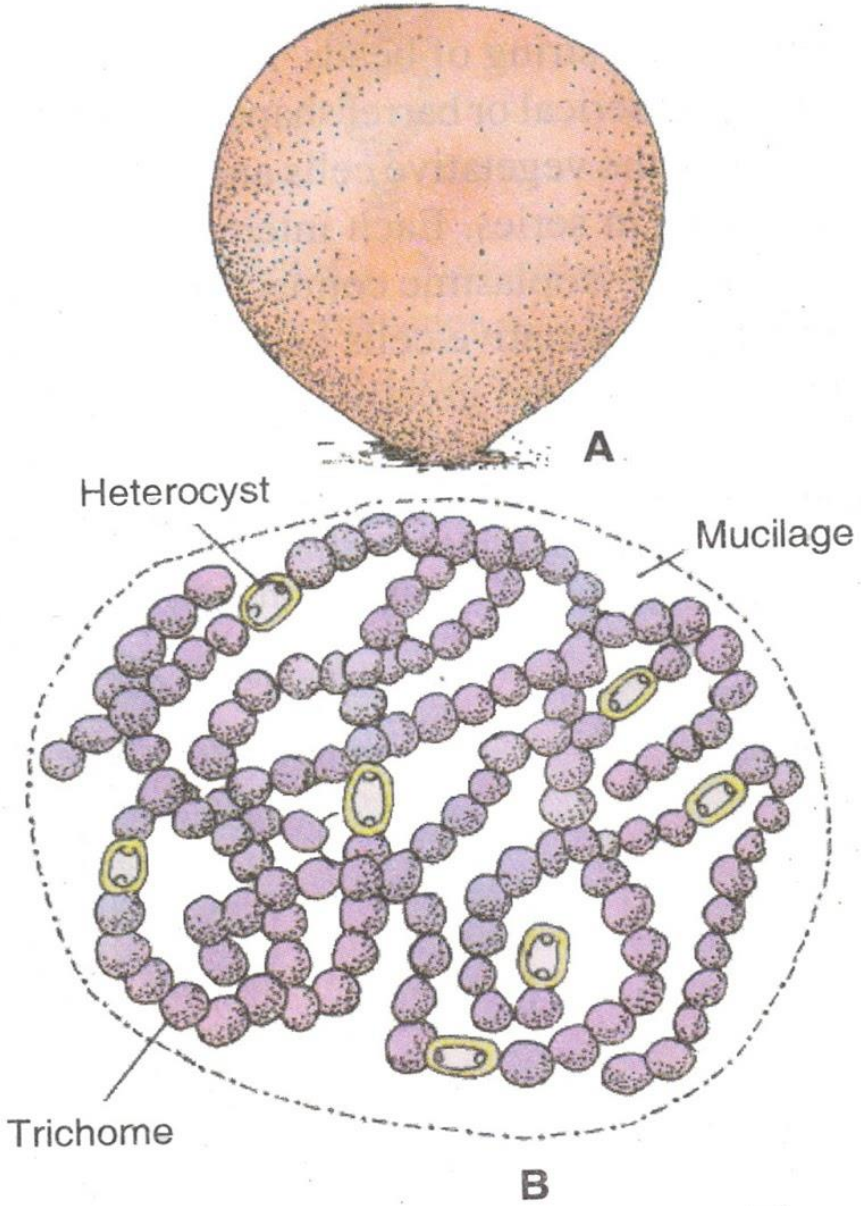


Fig : (A) Nostoc Ball,
(B) Portion of filament as seen under microscope

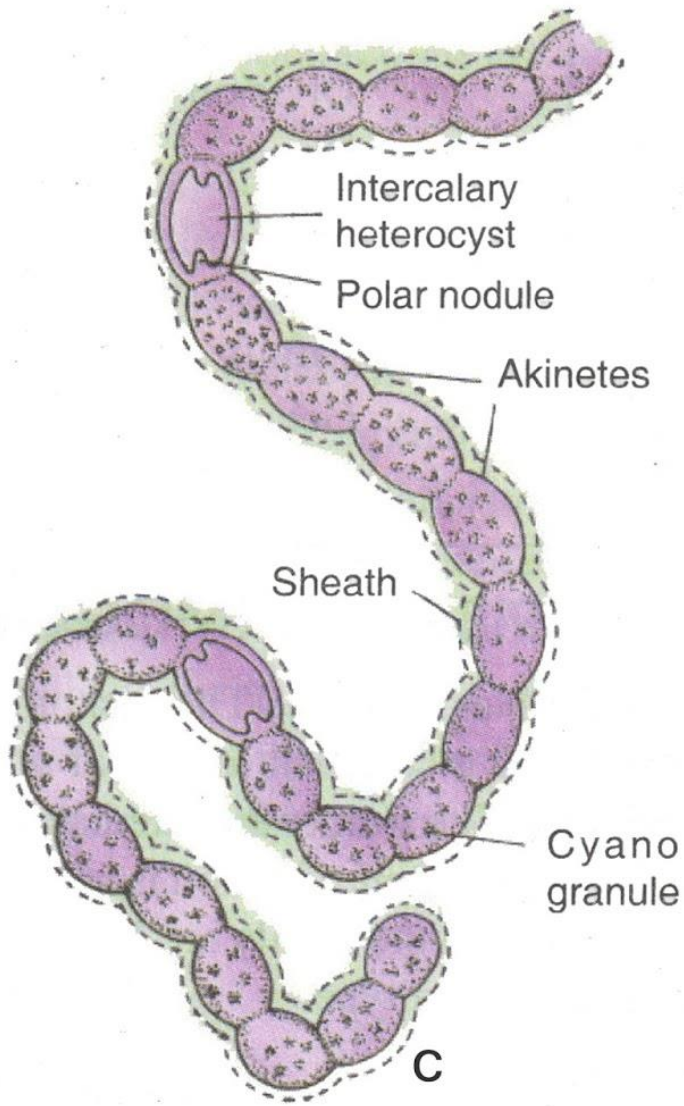


Fig : (C) A single filament with a trichome.

Structure of colony

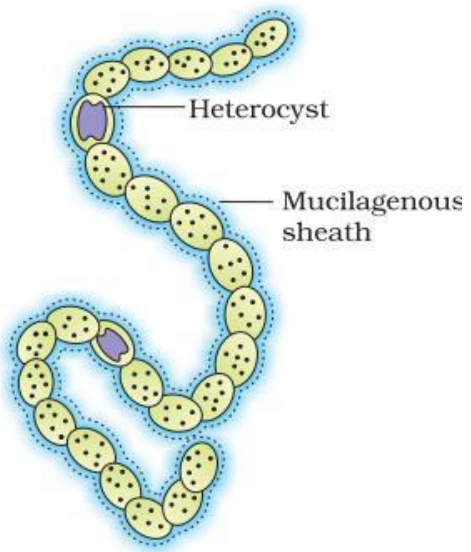
- A colony of *Nostoc* is consist of a large number of unbranched individual filaments.
- Each filament which is consist of a large number of bead like cells looks like a chain of several beads.
- These filaments have varying lengths
- They become entangled and closely interwoven within a gelatinous copious matrix so as to form a colony.

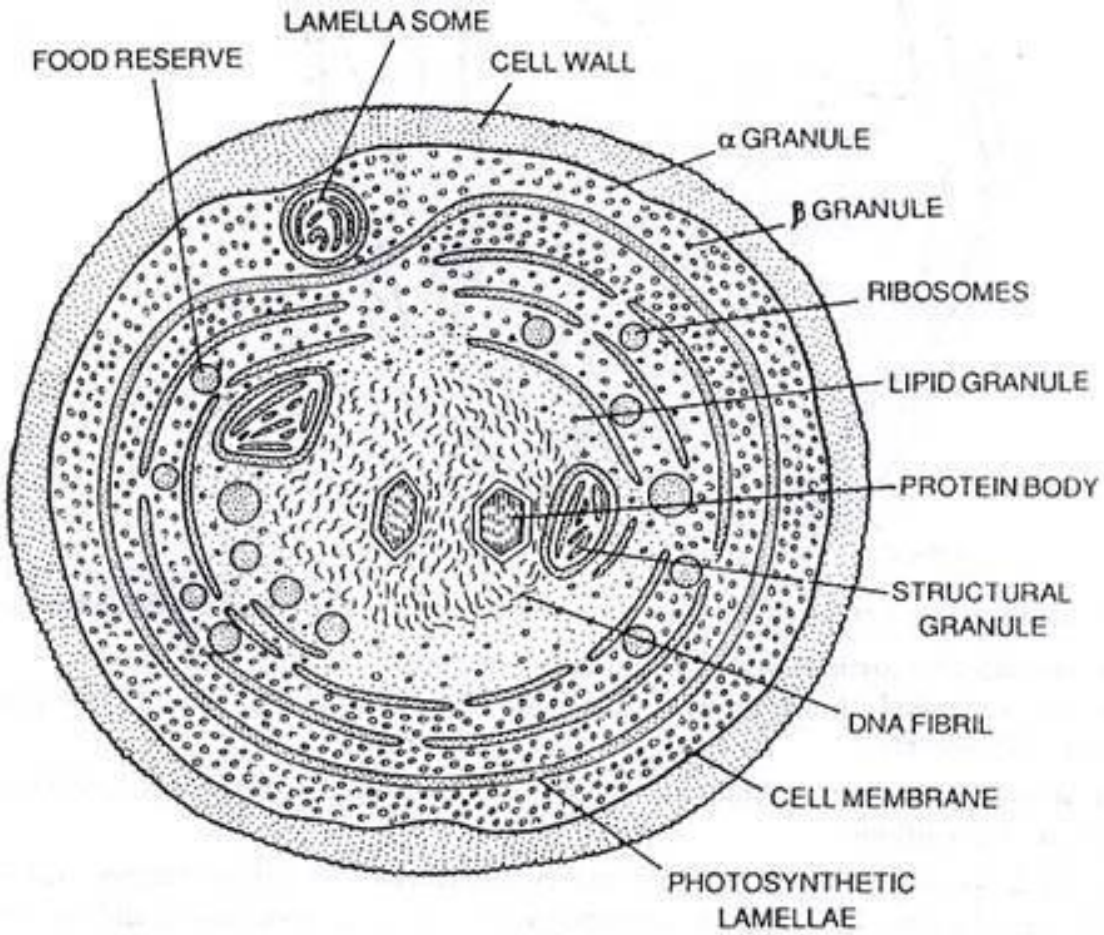
- Each trichome has its on matrix or mucilage secreted by its cells and this forms a sheath.
- These sheaths of different filaments of a colony get fused and thus a common matrix of jelly like substance is formed.
- Often the filaments are crowded at the periphery of the colony.
- The colony develops a colour of yellow, blue, green or violet colour when they are fully grown.

Structure of a trichome

- Each filament is unbranched and consist of a number of bead like cells which appear as a long string of beads.
- These cells are oval or spherical in shape.
- The cells are loosely linked mutually by their ends.
- In filaments there are present some large, spherical or cylindrical or barrel-shaped, colourless empty cells called heterocysts.

- They are thicker and larger than the adjacent vegetative cells.
- The heterocysts are generally intercalary but in young conditions they may be terminal, though rarely (*N. linckia*)
- Each filament with its own cells and individual sheath is called a trichome.




LAMELLA SOME
FOOD RESERVE
CELL WALL
α GRANULE
β GRANULE
RIBOSOMES
LIPID GRANULE
PROTEIN BODY
STRUCTURAL GRANULE
DNA FIBRIL
CELL MEMBRANE
PHOTOSYNTHETIC LAMELLAE

Structure of a single cell

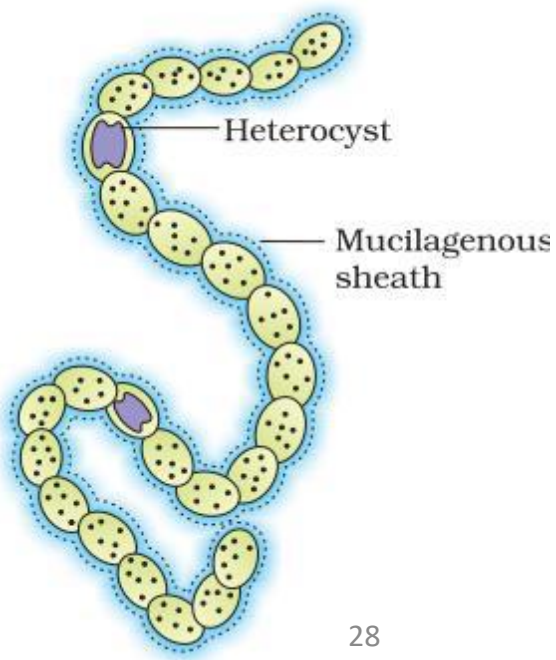
- All vegetative cells are similar in structure and typically Cyanophycean.
- The cells are surrounded by a cellulose cell wall and are prokaryotic.
- The protoplast is differentiated into outer pigmented chromoplasm and inner colourless centroplasm.

- In the chromoplasm are present the pigments, proteinaceous cyanophycean granules or cyanophycean starch.
- The chromoplasm is not separated by centroplasm by any kind of membrane.
- The colourless centroplasm represents the nucleic zone. It is present in the form of an incipient nucleus.
- Vacuoles and definite chromatophores are absent.

Structure of a heterocyst

- At intervals the trichome contains heterocyst.
- They are bigger than ordinary vegetative cells.
- Their walls are thick and they contain colourless protoplast.
- At first they possess two polar pores through which they establish protoplasmic connections with adjacent cells.

- But as the cell becomes old, the wall at the regions of polar pore becomes thickened and these thickened regions are known as polar nodules.
- Photosynthetic pigments are very few in heterocyst.
- The main functions of heterocyst include:
  - Hormogone formation
  - Nitrogen fixation
  - Storage of food
  - Endospore formation

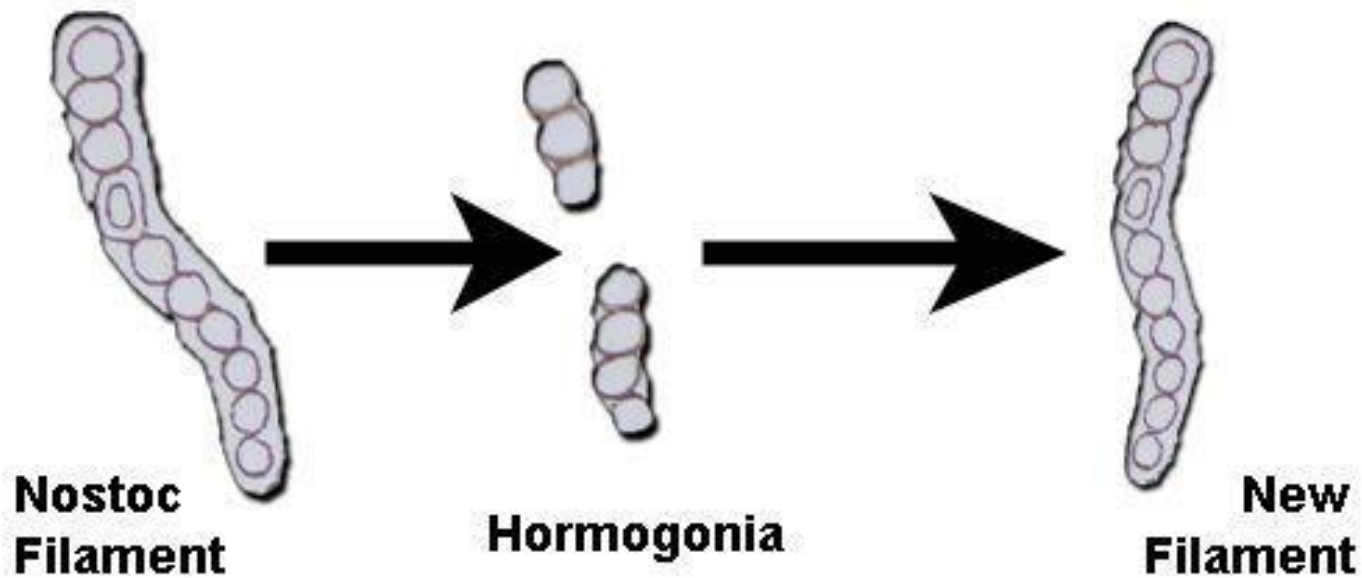


Reproduction

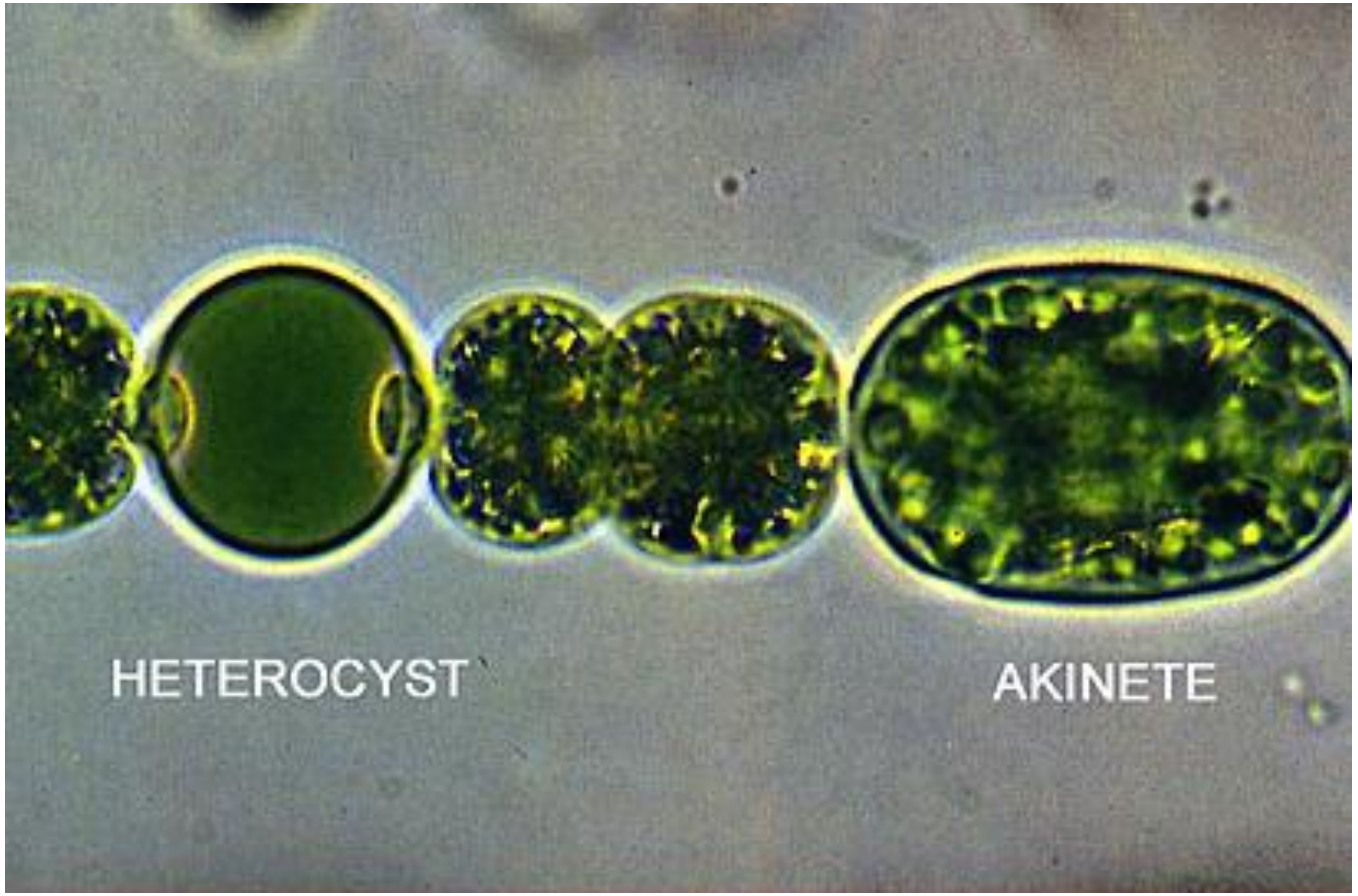
- The sexual reproduction is absent.
- Nostoc reproduces only vegetatively by the following methods:

1. Fragmentation - By mechanical, physiological or other means the colony breaks into two or more fragments, each of which is capable to develop into a new *Nostoc* colony.

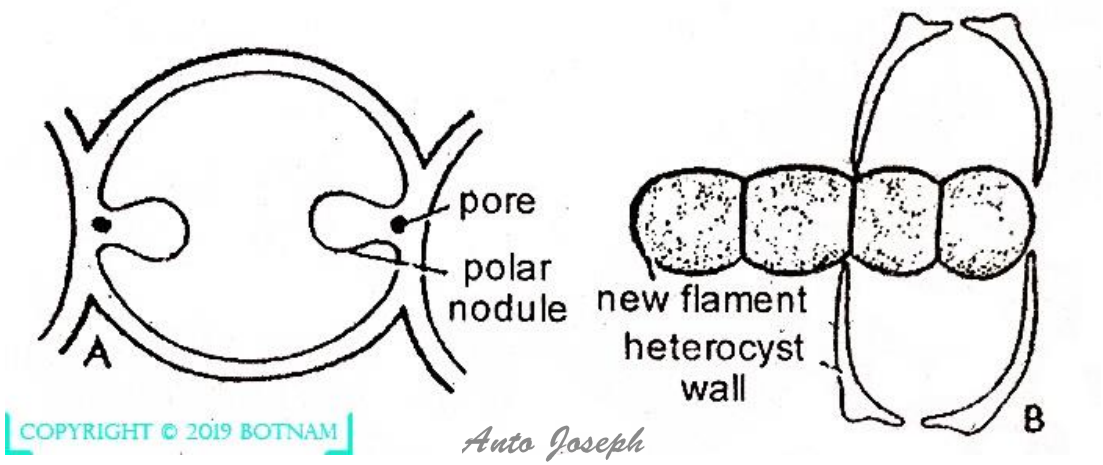
2. Formation of Hormogonia - It is a very common method of reproduction in *Nostoc*. The filaments may break into a number of pieces because of the decay of ordinary vegetative cells or owing to the appearance of heterocyst. These multicellular, short-length pieces of trichomes are called hormogones or hormogonia. After piercing the colonial mucilage, the hormogonium comes out with a rapid speed, develops its own individual sheath and ultimately forms a new *Nostoc* colony. Instead of coming out of the colony, sometimes the hormogonia develop into fresh trichomes within the parent colony


Nostoc
Filament
Hormogonia
New
Filament

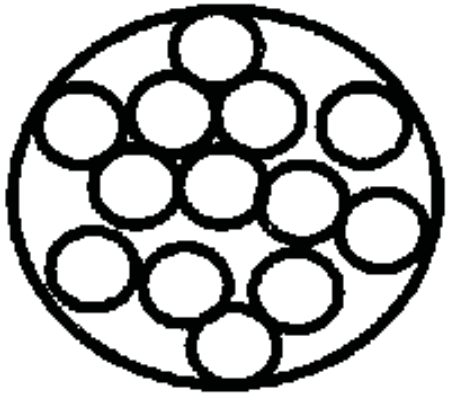
3. Akinetes - Akinetes are also called resting spores or arthrospores, and formed by many species of *Nostoc*. Akinetes are surrounded by highly resistant thick wall, and are also larger than the adjacent vegetative cells. Large amount of reserve food material along with the cyanophycin granules remain stored in the akinetes .Because of the presence of a thick wall the akinetes can survive in many adverse conditions. Akinete germinates into a new filament by liberating its contents through a pore


HETEROCYST
AKINETE

4. Heterocysts - Rarely, the heterocyst becomes functional and germinates to form a new filament in a few species like *N. commune*. At the time of its germination, the contents of heterocyst divide first into a 2- celled and then into a 4-celled germling, which ruptures the outer wall, comes out and develops into a new filament.



5. Endospores are spherical, thin-walled, small spores formed endogenously within a cell. Later these endospores get liberated and give rise to new filament.



Endospores inside a cell

Cyanobacteria Vs bacteria

Similarities

- Both are prokaryotic organisms
- In both groups the cells are covered with a sheath
- DNA is devoid of histone proteins
- Absence of motile spores
- Ability to fix atmospheric nitrogen
- Absence of sexual reproduction

Differences

- BGA are devoid of flagella while many bacteria are flagellated types.
- BGA are aerobic while bacterial kingdom contains anaerobes.