

# Phycology (Practical part)

Lab (1 +2)

Cyanobacteria

Kingdom: Monera

Division: Eubacteria

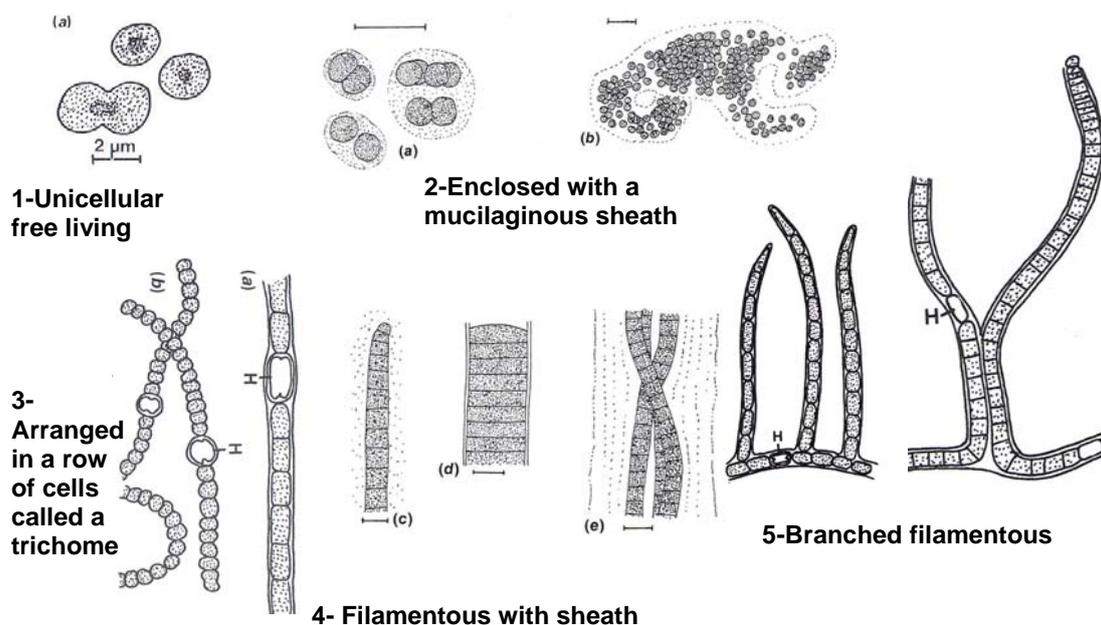
Class: Cyanobacteria

Prokaryotic that contains chlorophyll a, phycobiliproteins, glycogen as storage product and cell walls consisting of amino acids and amino sugars.

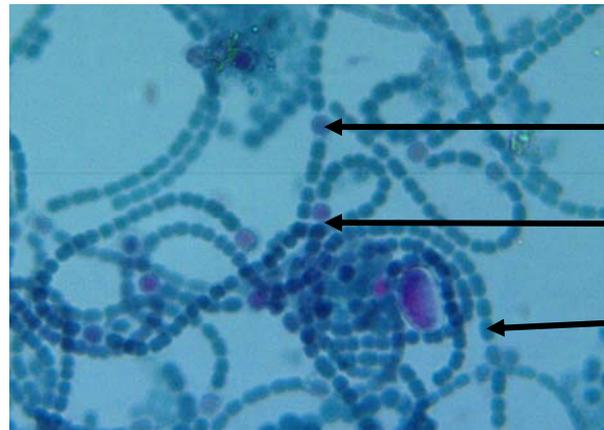
## Morphology

- 1- unicellular free living
- 2- Enclosed with a mucilaginous envelope
- 3- Arranged in a row of cells called a trichome
- 4- Filamentous: the trichome (one or more) is surrounded by a sheath.
- 5- Branched filamentous which could be uniseriate (one row of cells) or multiseriate (more than one row)

## Morphology of Cyanobacteria



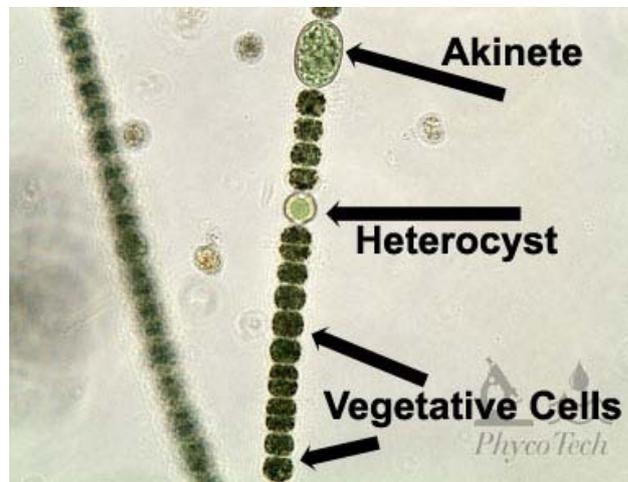
*Anabaena*



Heterocyst

Akinate

Vegetative cell



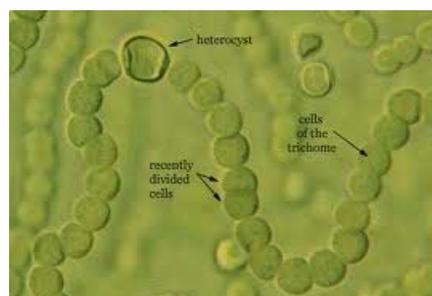
Akinete

Heterocyst

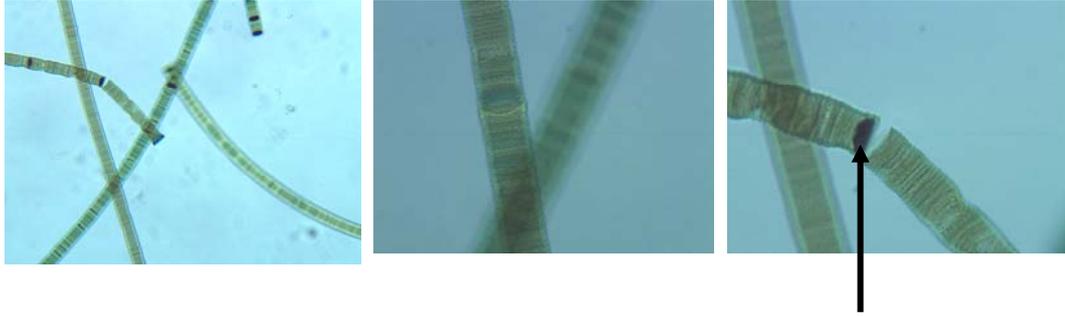
Vegetative Cells

PhycoTech

*Nostoc* (from specimen)

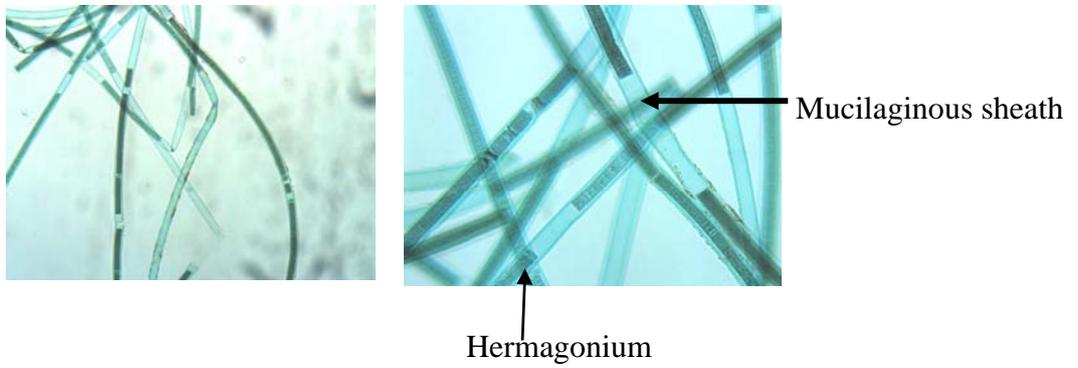


*Oscillatoria*



Hermagonial fragmentation

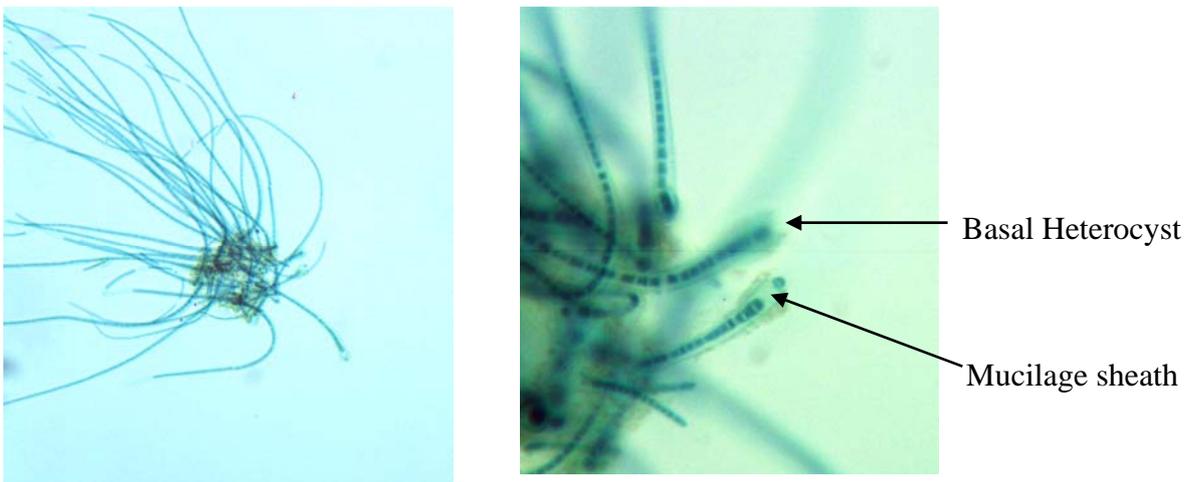
*Lyngbya*



Hermagonium

Mucilaginous sheath

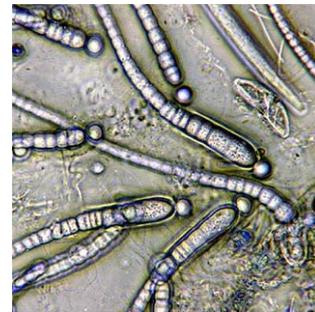
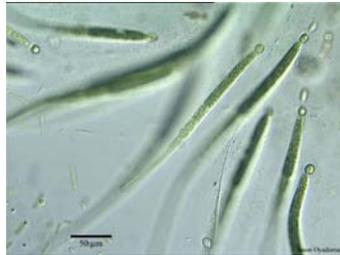
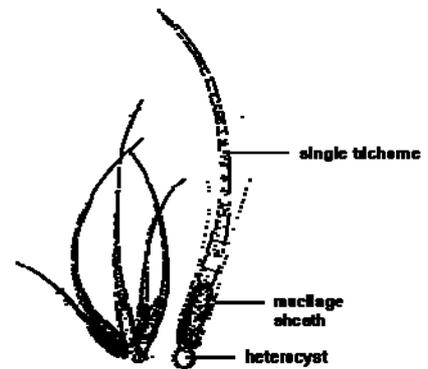
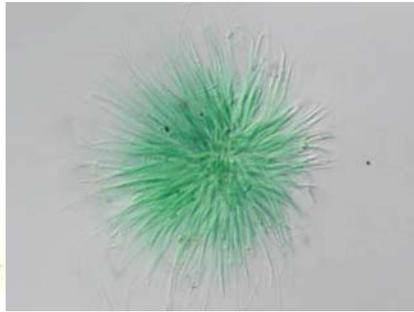
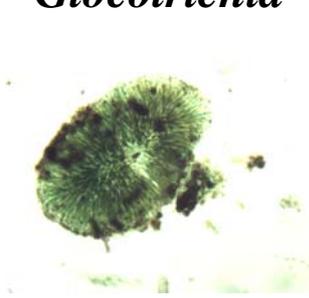
*Rivularia*



Basal Heterocyst

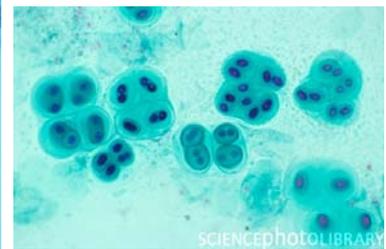
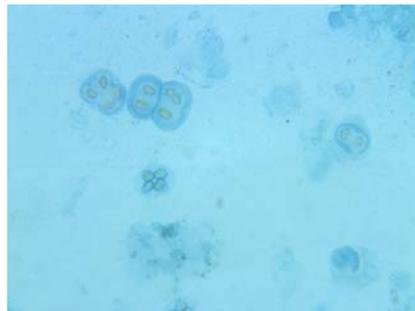
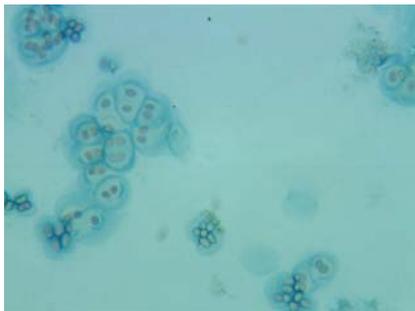
Mucilage sheath

## *Gloeotrichia*



Note the polarity of filaments and the basal heterocysts and akinates

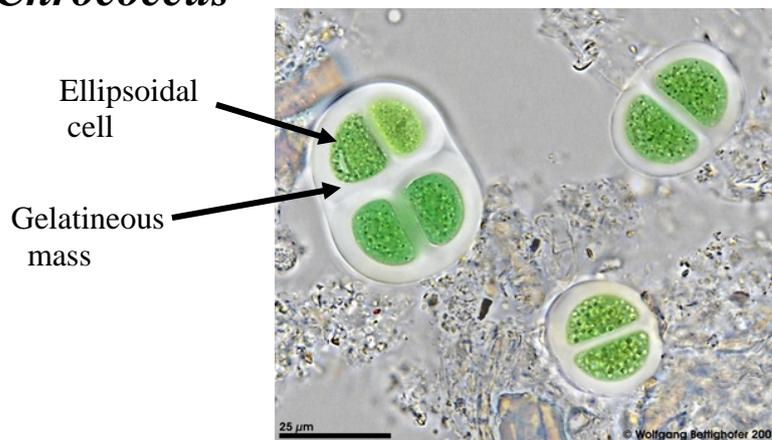
## *Gloeocapsa*



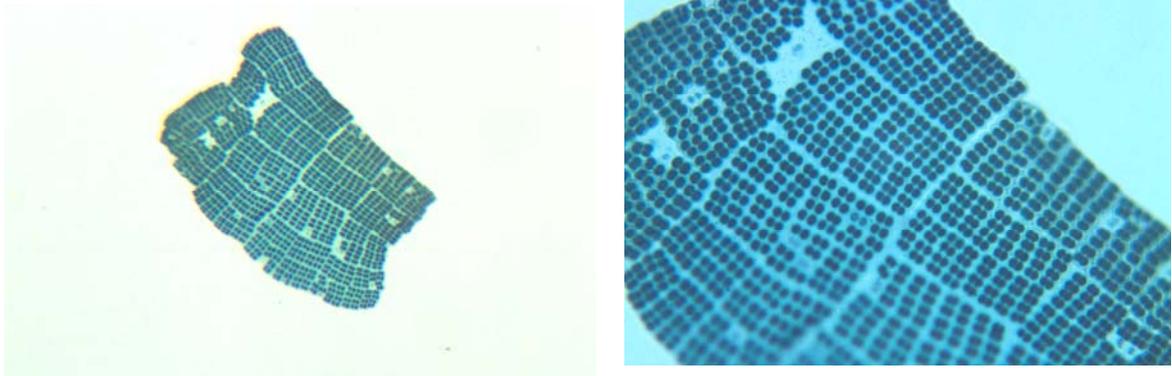
Note the mucilage sheath and the Spherical and hemispherical cells



## *Chroococcus*

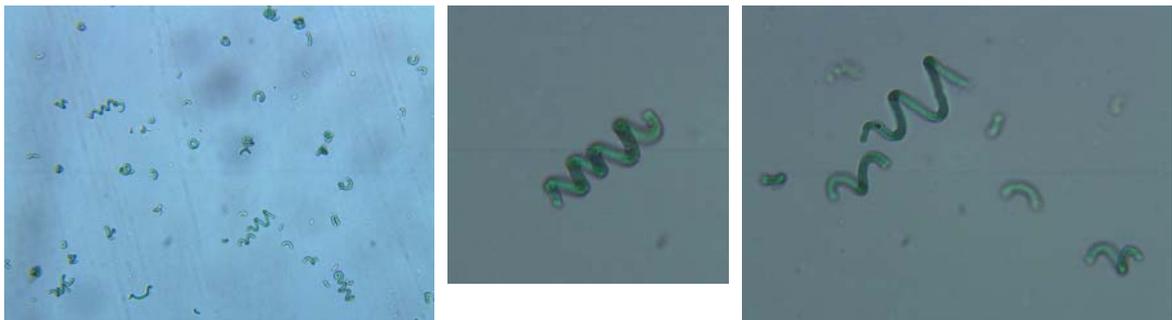


## *Merismopedia*



- Cells are ellipsoidal.
- The arrangement is due to the limitation of cell division from two sides only.
- The division results in increase in colony size rather than in multiplication of the individual.

## *Spirulina*



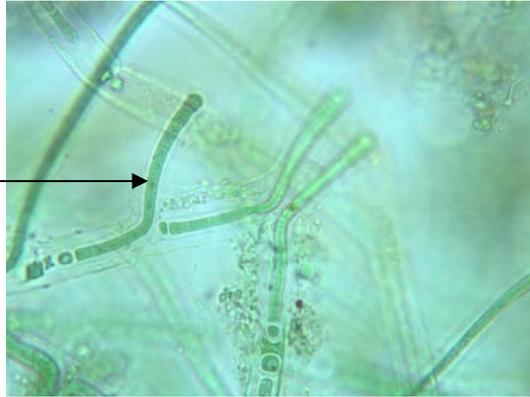
# *Scytonema*

False branch

Heterocyst



False branch



*Stigonema*

As it appears  
in water



True branch



Multiseriate filaments

## Lab (3)

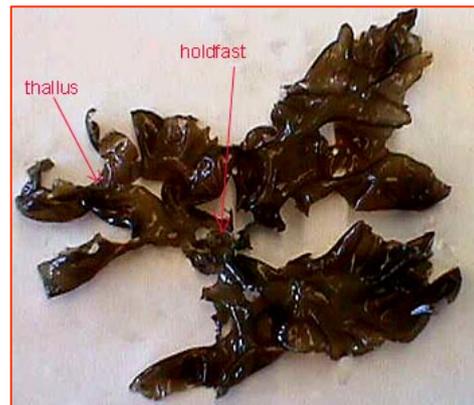
Kingdom Protista (Eukaryotes)

Algae

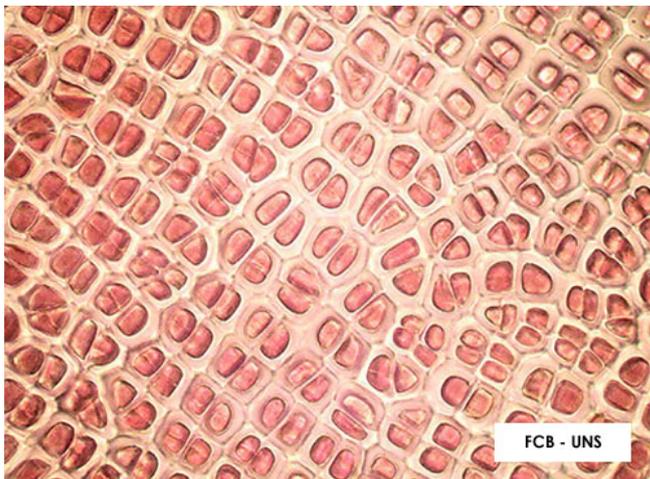
Division: **Rhodophyta**

- **Rhodophyceae** (red algae) comprise the only class in the division.
- Lack flagellated cells.
- Have chlorophyll a and d, phycobiliproteins,,
- Floridean starch granules are the storage product (outside chloroplast).
- No chloroplast ER.
- The majority of seaweeds are red algae (~400 species which is more than all other seaweeds groups).
- They live at depth as great as 200 m.
- About 200 sp. Are found in freshwater with smaller size than seaweeds.

(1) *Porphyra*, commonly known as **nori**, is the most widely consumed seaweed in the world. This alga attaches itself to the rocks by multicellular rhizoidal attachments, usually disc-shaped. The thalli begins life as uniseriate filaments but this stage is eventually replaced by parenchymatous sheets of cells (1 to 2 cells thick).



As seen in the sea



As seen under the microscope: Note the parenchymatous appearance of uninucleated cells

(2) *Nemalion* spp. This red algae grows as a slender and sometimes branched "worm" on rocks in the intertidal zone, especially where there is very active water. The algae are softly cartilaginous because of the rather firm mucilage in which the filaments are encased



*Nemalion helminthoides* as seen in sea water



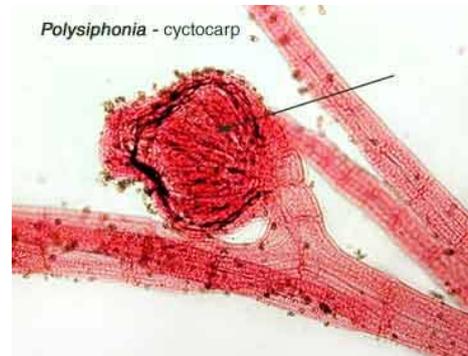
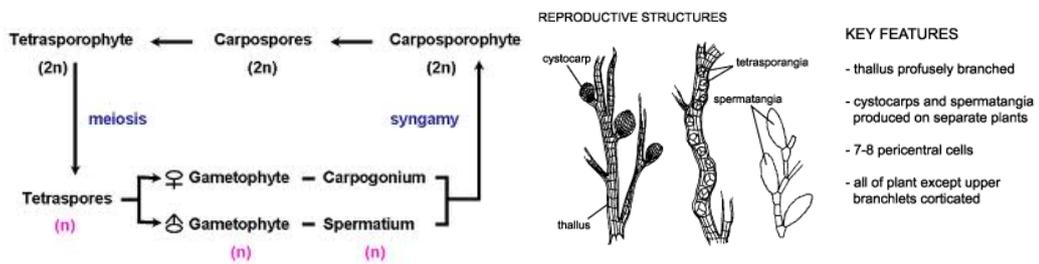
Carpogonial branches with carpospores  
Note the phcoerythrin

### (3) *Polysiphonia*

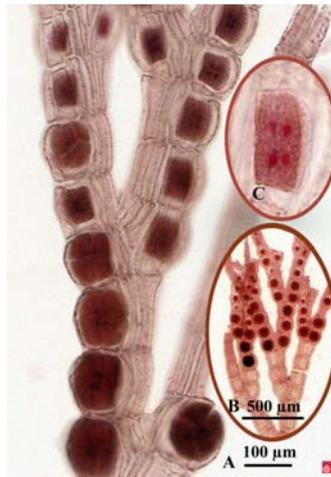
*Polysiphonia* has separate male and female gametophytes that are identical in appearance. The tetrasporophytes resemble the gametophytes in size and form.



*Polysiphonia elongate* as seen in sea water

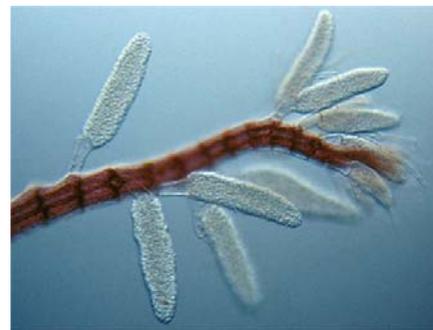


*Polysiphonia* Cystocarp



Multiseriate

Carpospores with tetraspores

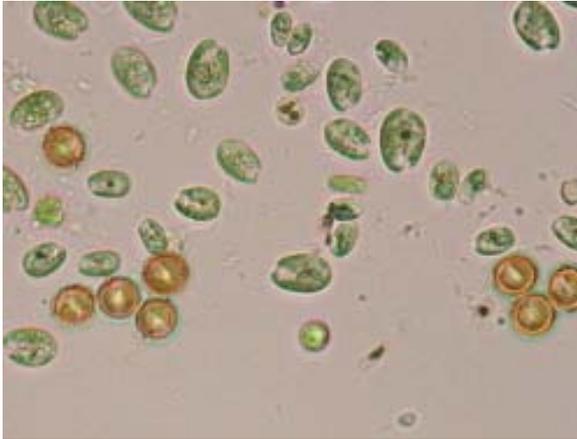


Spermatangia

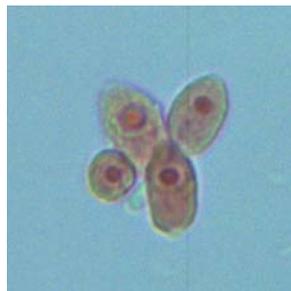
# Division Chlorophyta

- have chlorophylls a and b.
- form starch with the chloroplast, usually in association with a pyrenoid. The Chlorophyta thus differ from the rest of the eukaryotic algae in forming the storage product in the chloroplast instead of in the cytoplasm.
- No chloroplast endoplasmic reticulum occurs around the chloroplasts.
- The Chlorophyta are primarily freshwater; only about 10% of the algae are marine, whereas 90% are freshwater.
- Some orders are predominantly marine, whereas others are predominantly freshwater or exclusively freshwater. The freshwater species have a cosmopolitan distribution, with few species endemic in a certain area.
- In the marine environment, the green algae in the warmer tropical and semi-tropical waters tend to be similar everywhere in the world. This is not true of the Chlorophyta in the colder marine waters; the waters of the Northern and Southern hemispheres have markedly different species.

# *Chlamydomonas*

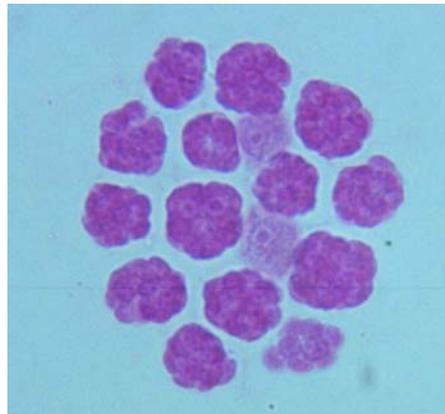
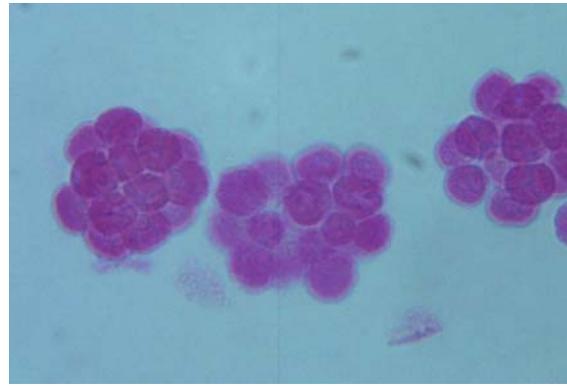


Note the flagella, the pyrenoids and the cup-shaped chloroplast



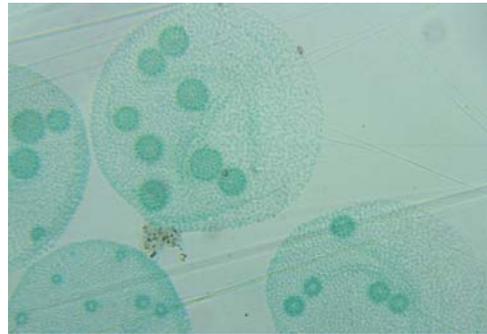
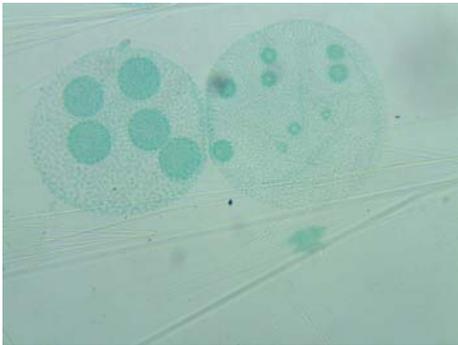
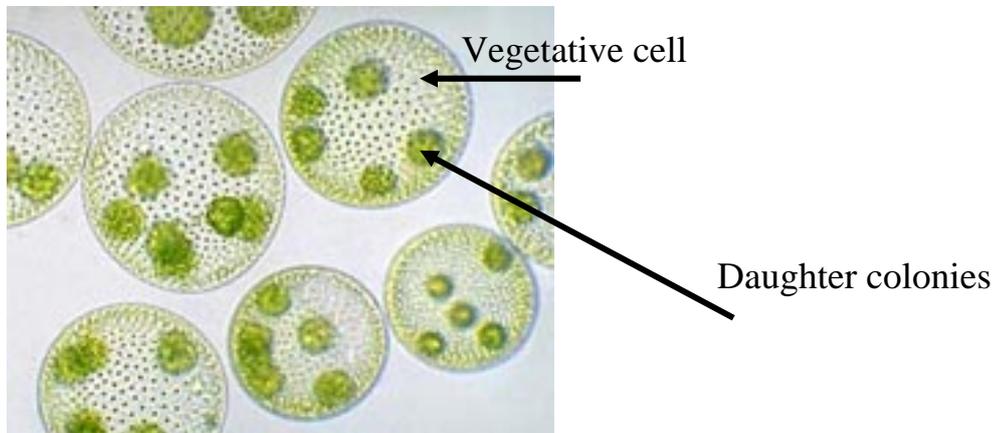
- *Chlamydomonas* is a unicellular motile alga with two flagella.
- Each cell contains single massive chloroplast
- The chloroplast may contain one or more pyrenoids.

# *Pandorina*



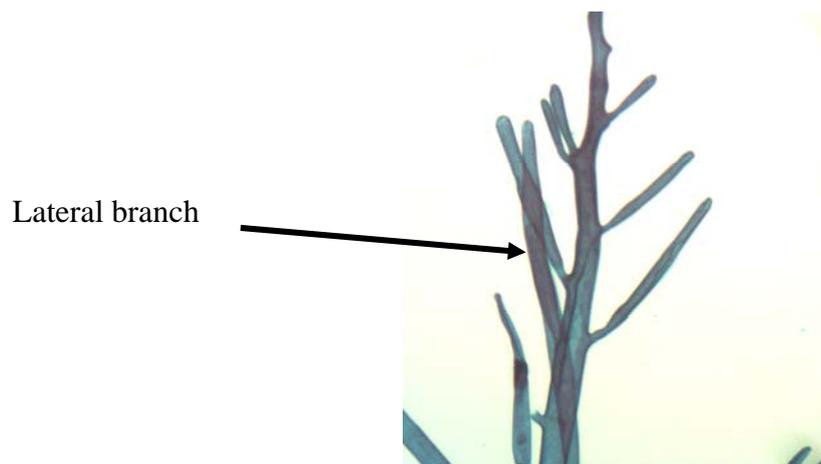
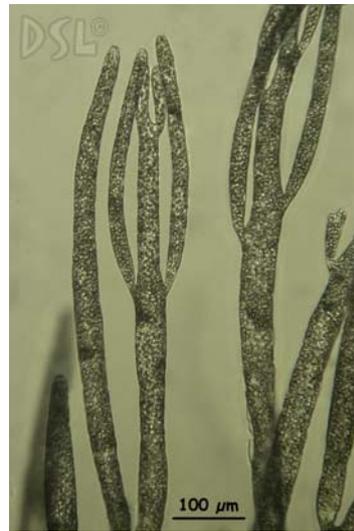
- *Pandorina* consists of 16-like *chlamydomonas* cells.
- Arranged in an almost solid, ovoidal Colony.
- Each cell is flattened at its anterior pole and narrowed posteriorly.
- The chloroplast is massive and contains a basal pyrenoid.
- The single nucleus lies in the colorless central cytoplasm.
- All of the cells in the colony are similar in size.
- After attaining the maximum size characteristic of the species, the colonies sink to the bottom of the pond and initiate autocolony formation (miniature of a parental colony).
- In autocolony formation, each of the parental cells undergoes repeated nuclear and cytoplasmic division until miniature 16-celled colonies are produced.
- The minute cells of the autocolonies then develop flagella, and the colony begins to move slowly within the matrix of the parent colony until liberated by its dissolution.

# *Volvox*



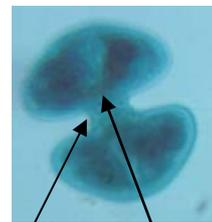
- *Volvox* consists of thousands of *chlamydomonas* like cells.
- The protoplasts of the individual cells are connected by delicate protoplasmic extensions.
- Daughter colonies reproduce sexually by formation of zygote, and asexually by formation of gonidia.
- The remaining cells are purely vegetative and disintegrate when the adult colony liberates its daughter colonies.

# *Bryopsis*



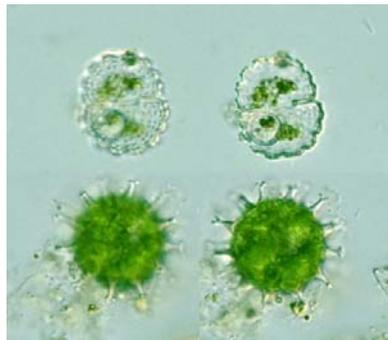
- Grows attached to rocks in shallow marine waters.
- Growth is apical.
- Coenocytic and tubular type of body organization
- At maturity, certain of the branches become segregated from the main axis by the formation of the septa and become transformed into gametangia.

# Desmids *Cosmarium*

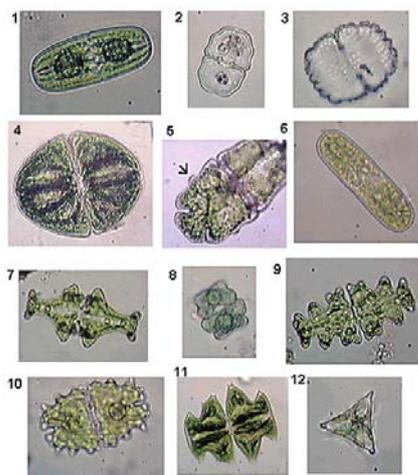


Sinus Isthmus

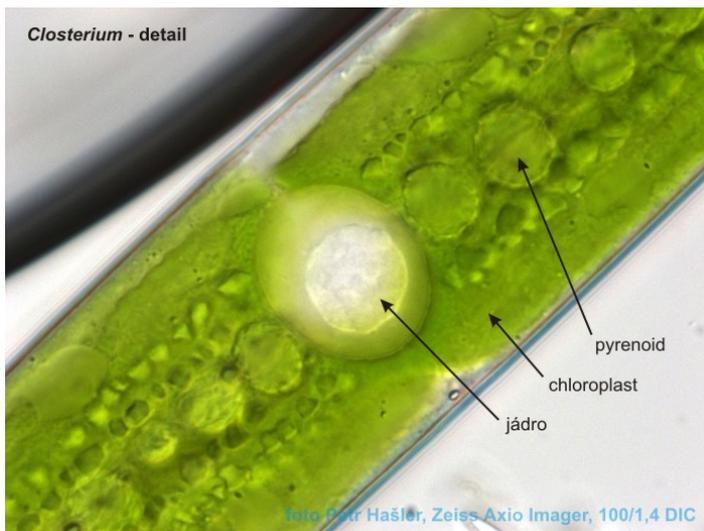
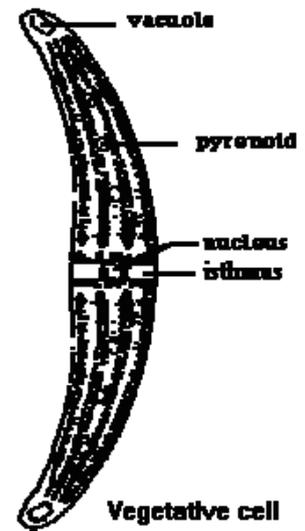
2 semi-cells



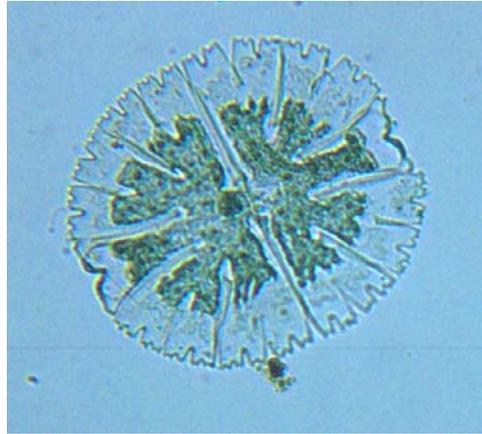
Zygote



# Desmids *Closterium*



# Desmids *Micrasterias*



Sinus

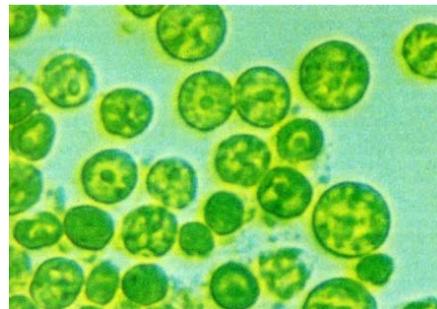
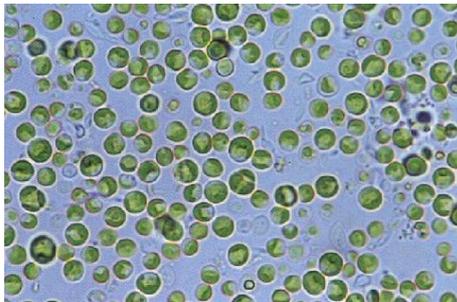


## *Cladophora*

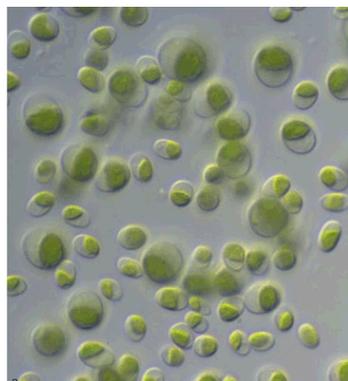
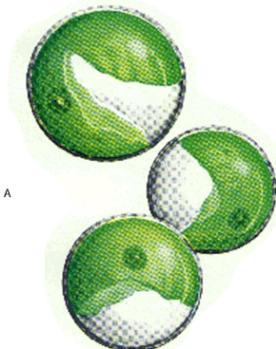


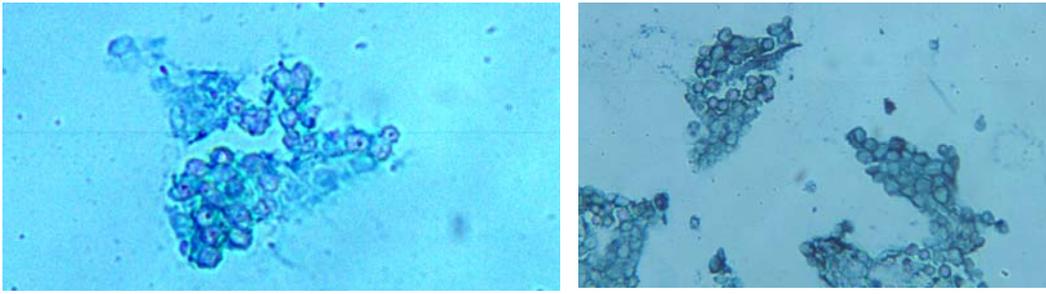
- *Cladophora* is an isomorphic with multinucleated cell.
- The gametes are biflagellated (sexual reproduction).
- The zoospores are quadriflagellated (asexual reproduction).
- The structure of the chloroplast varies with the age of the cell. In younger cells it is a continuous network, but in older ones it is largely peripheral and composed of irregular segments, in some of which pyrenoids are embedded.

## *Chlorella*



Chlorella



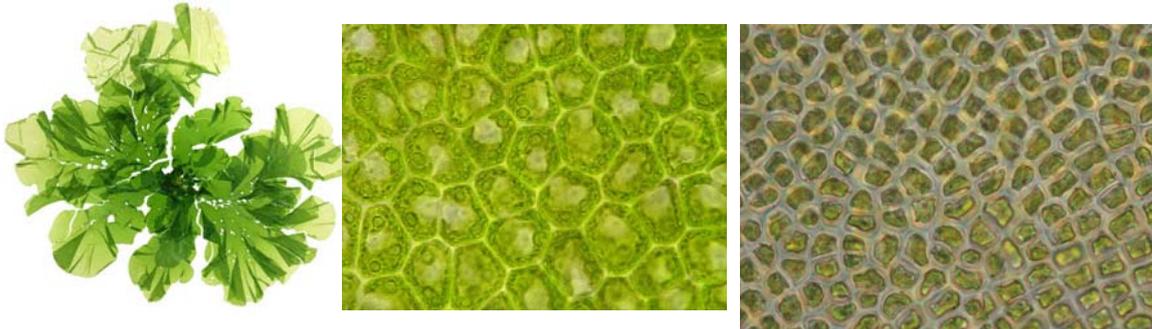


- The cells of most species are minute green spheres.
- The protoplast is composed of cuplike chloroplast, which may or may not contain a pyrenoid.
- The cytoplasm is colorless in which a minute nucleus is embedded in its center.
- A series of bipartitions may occur, forming four or eight protoplasts endogenously.
- Delicate cell walls are then developed, and after they have begun to enlarge, they are liberated by rupture of the mother cell wall (asexual reproduction).
- Such asexual reproductive cells, which have no capacity for motility, are known as autospores.

## *Oedogonium*

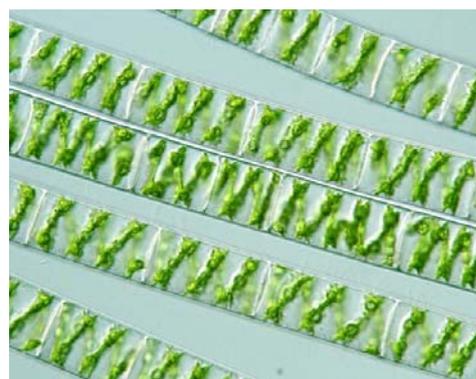
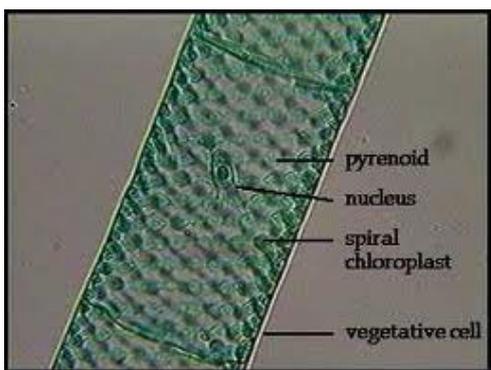


## *Ulva*

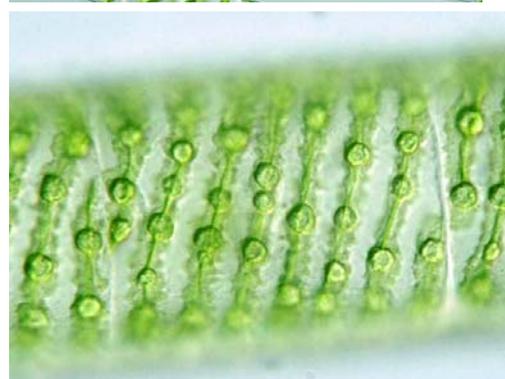


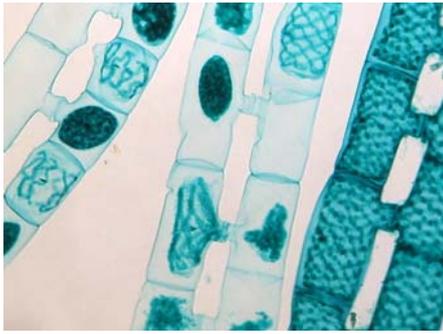
- *Ulva*, the sea lettuce is a green membranous alga.
- Grows attached to rocks, woodwork, and larger marine algae.
- The body is bladelike, often lobed and undulated, and anchored by a multicellular holdfast composed of cells with rhizoidal protuberances.
- The cell walls are thick so to withstand some desiccation when exposed at low tide.
- Each cell contains a single chloroplast with one or more pyrenoids.
- The cells of the blade are uninucleate, but those of the holdfast may have several nuclei in their rhizoidal processes.

## *Spirogyra*

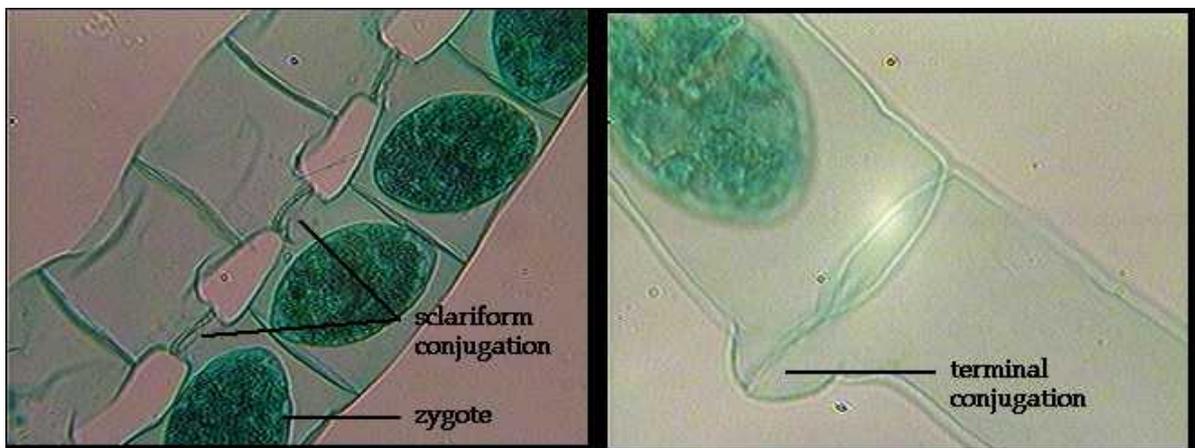
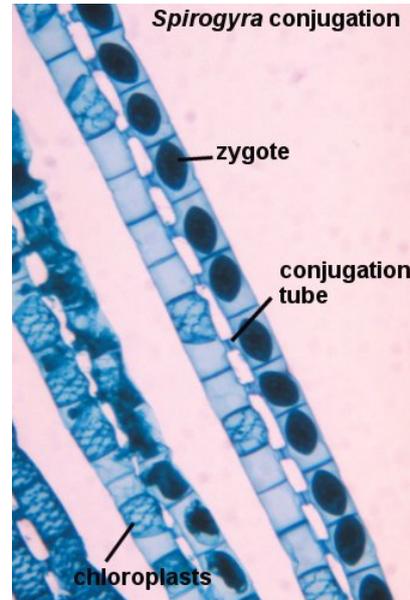


Vegetative filament





**Scalariform conjugation**



Types of reproduction in *Spirogyra*

1. Asexual reproduction (vegetative filament fragmentation).
2. Sexual conjugation

A- Lateral Conjugation-

1. It occurs in homothallic species.
2. Here two cells of a filament take part in gametic union.
3. Movement of gamete occurs through a passage formed either in partition wall or across the partition wall or two adjacent cells.
4. It does not look like a ladder.

B- Scalariform Conjugation-

1. It occurs in heterothallic species.
2. Here two cells of two different filaments take part in gametic union.
3. Movement of gamete occurs through a passage formed by the lateral walls of two filaments.
4. It looks like a ladder.