



# ALGAE

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# WHAT ARE ALGAE?

The term Algae are applied to vast assemblage of organisms which are:

- Chlorophyll bearing,
- Autotrophic,
- Unicellular to multicellular organization,
- Either Prokaryotic or Eukaryotic in nature,
- Thallus in structure (not differentiated into root, stem and leaf), aquatic,
- Reproduce Vegetatively, asexually by spores or sexually by union of gametes.

# IMPORTANT CHARACTERISTICS

1. Algae are chlorophyll bearing autotrophic thalloid plant body.
2. Almost all the algae are aquatic.
3. The plant body may be unicellular to large multicellular structure.
4. The multicellular complex thalli lack vascular tissue & show little tissue differentiation.

5. The sex organs are generally unicellular but, when multicellular, all cells are fertile & in most cases the entire structure doesn't have any protection jacket.
6. Then zygote undergoes development either by mitosis or meiosis, but not through embryo formation.
7. Plants having distinct alternation of generations. Both gametophyte and sporophyte generations - when present in the life cycle are independent.



# CELLULAR ORGANIZATION OF ALGAE

Algal cells are of two types:

## 1. PROKARYOTIC

- lacks internal membrane bound structures (ER, GB Mitochondria)

- \* Lacks Chromatophores, Organized Nucleus

- \* 70S type ribosome

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## 2. EUKARYOTIC

# Cell structure:

## 1. Cell wall:

- Cell wall surrounds the plasma membranes
- Sometime mucilage envelops the cell wall of algae are found
- Algal cell wall is made of water soluble or insoluble carbohydrates.
- Water soluble materials forms the cell wall material & water in-soluble materials forms the accessory sheaths or matrix outside the cell wall.
- Water in-soluble carbohydrate found in algal cell wall are: CELLULOSE I, MANNAN, XYLAN & ALGINIC ACID.
- Water soluble carbohydrate found in algal cell wall are: AGAR, CARRAGEENIN & GELANS in red algae; PECTIN & ULVIN in green algae; FUCOIDIN in brown algae.

## The Cell wall of prokaryotic algae- CYANOPHYCEAE

- The cell wall of Blue Green algae is surrounded by a layer of **Gelatinous sheath**.
- The sheath consists of Cellulose fibrils reticularly arranged within a matrix to give a homogeneous appearance.
- The mucilaginous sheath protects cell from drying.
- The cell wall consists of various substances like:  
N-ACETYL GLUCOSAMINE & MURAMIC ACID together called as MUCOPEPTIDE, ALANIN, GLUTAMIC ACID & DIAMINOPIMELIC ACID.

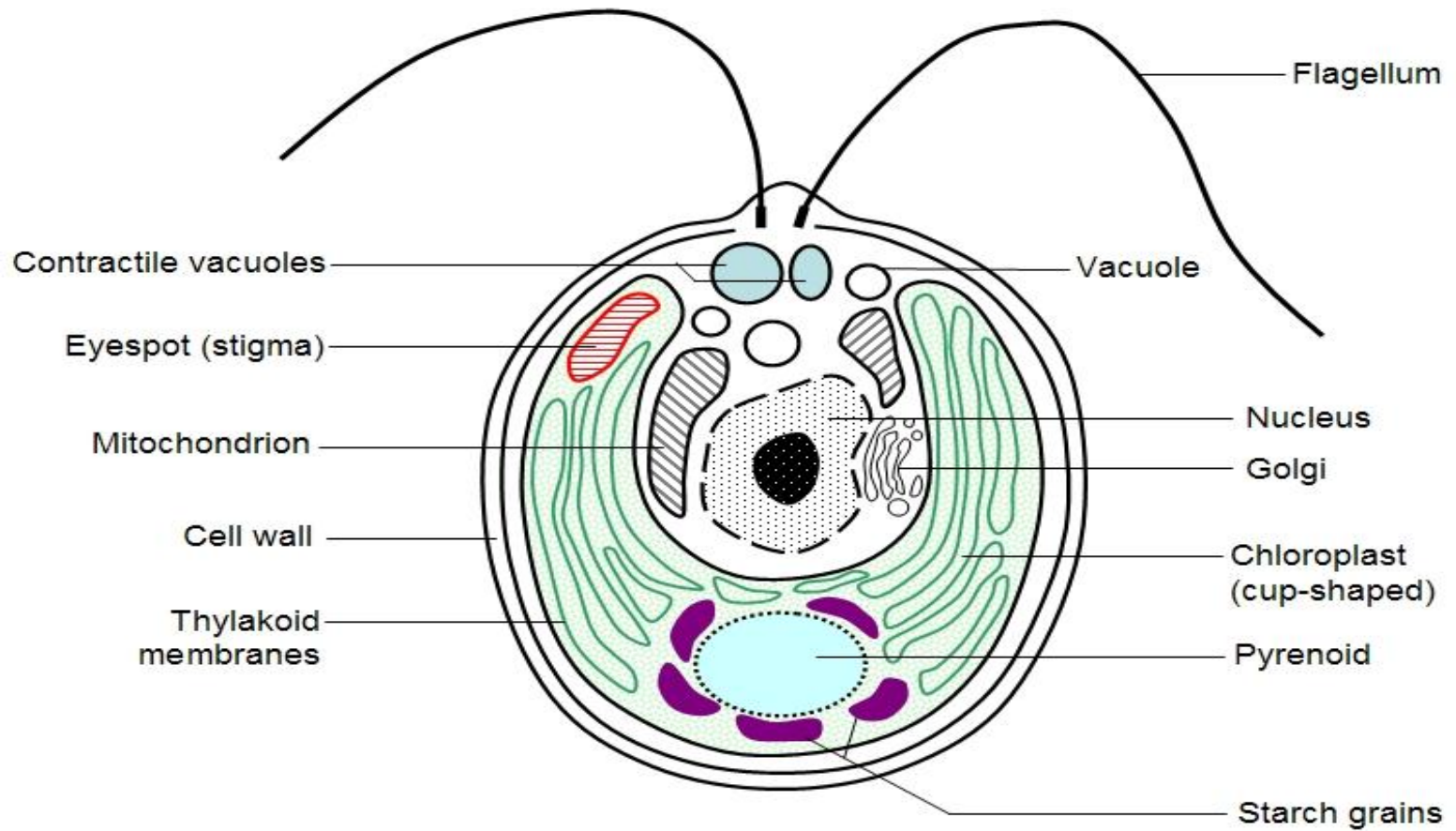


## 2. Chloroplast & Pyrenoids

- The photosynthetic pigment Chlorophyll is either located in CHLOROPLAST or in an ill organized structure called-CHROMATOPHORE.
- The simpler forms of algae lacks chloroplast.
- PYRENOIDS are the structures found associated with the chloroplast.
- PYRENOIDS are the colourless masses of protein surrounded by starch plate.
- The algal chloroplast may be – Cup shaped, discoid, Parietal, Star-shaped, spiral, reticulate in shape .
- Chloroplasts are semiautonomous; contains histone free DNA, mRNA, tRNA & Ribosomes.



Chlamydomonas



# 3. Pigments

- The photosynthetic pigments of algae includes:

**A. CHLOROPHYLL:** it may be of different kinds-

*Chlorophyll a* (found in all algae)

*Chlorophyll b* ( found only in Chlorophyta)

*Chlorophyll c* (present in Phaeophyta, Bacillariophyta)

*Chlorophyll d* (present in Rhodophyta)

*Chlorophyll e* ( found in two genera- *Tribonemia*, *Vaucheria*)

**B. CAROTENOIDS:** it includes-

*Carotenes* (available in all algae except Siphonales)

*Xanthophylls* : it includes – Myxoxanthin (Cyanophyta),  
Taraxanthin(Rhodophyceae) & Antheraxanthin



- **C. OTHER PIGMENTS:**

Besides these algae also includes various other pigments like:

- i. **Phycobilins( Bilioproteins ):**

- a. **Phycoerythrin** (present Rhodophyta)-Red colouration

- b. **Phycocyanins** (present in Cyanophyta)- Blue colouration

- ii. **Fucoxanthin** (found in Bacillariophyta-Diatoms)

# GREEN ALGA (CHLOROPHYCEAE)





# BROWN ALGA (PHAEOPHYCEAE)



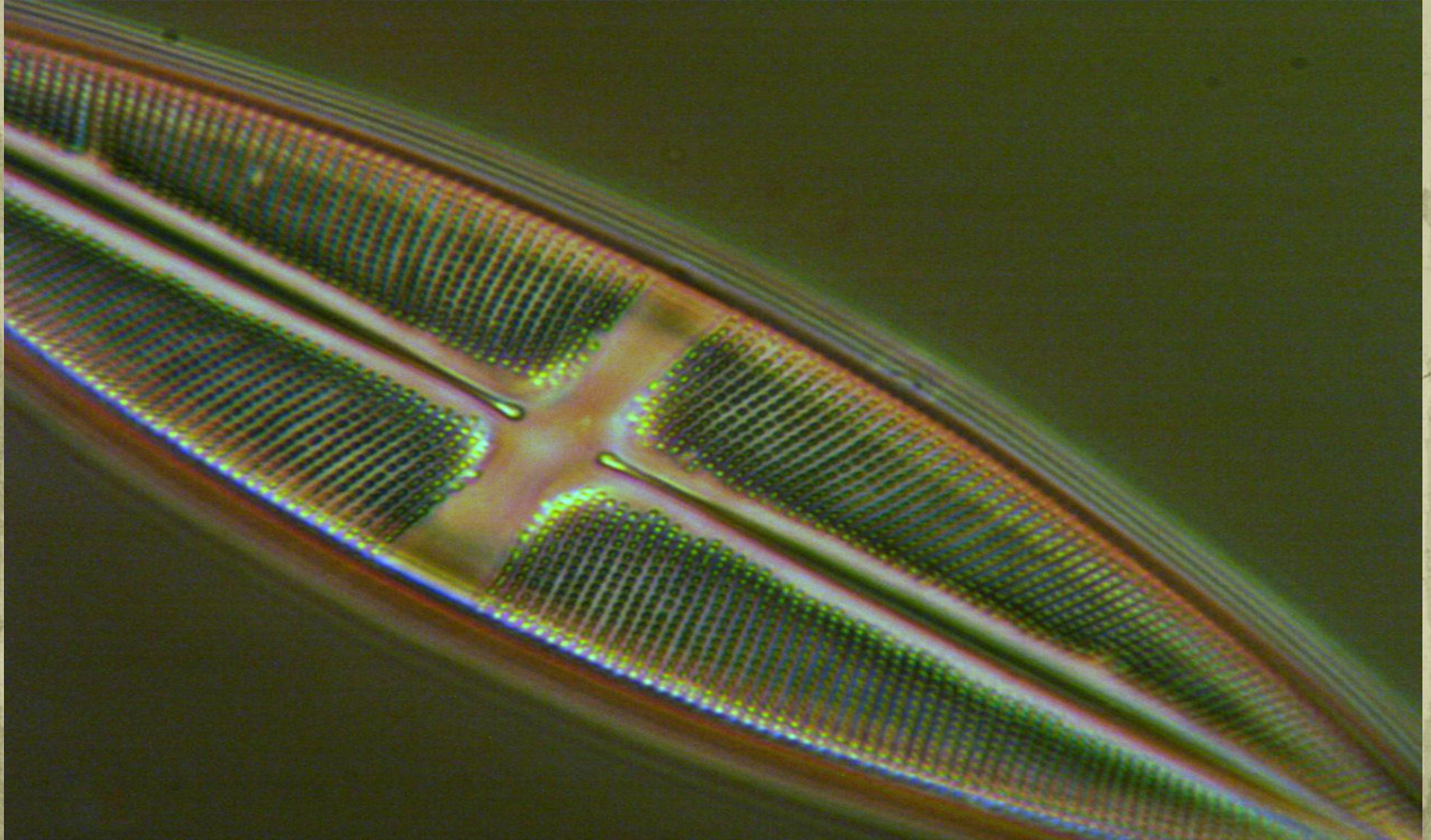


# RED ALGA (RHODOPHYCEAE)

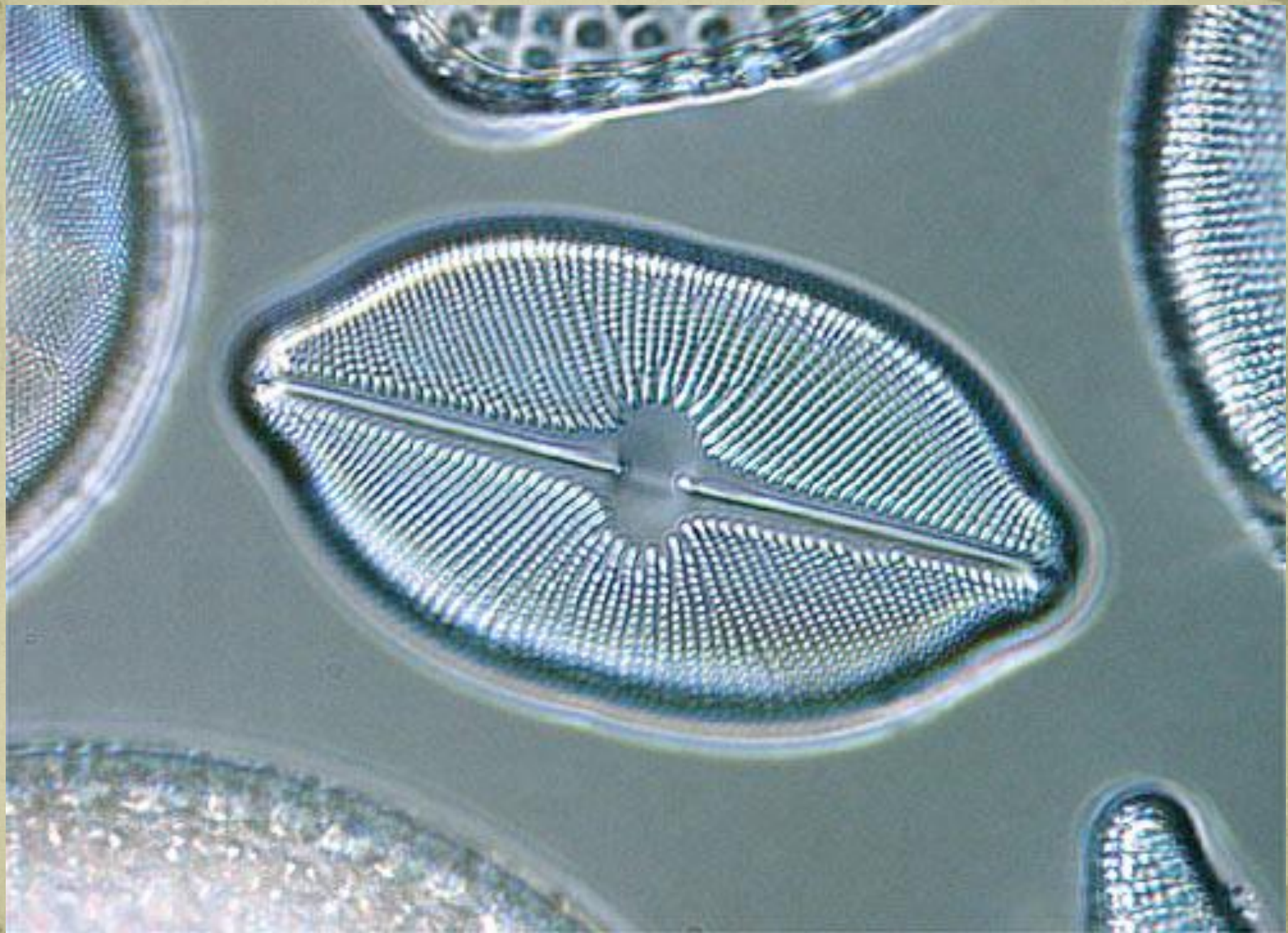




# XANTHOPHYCEAE - DIATOMS

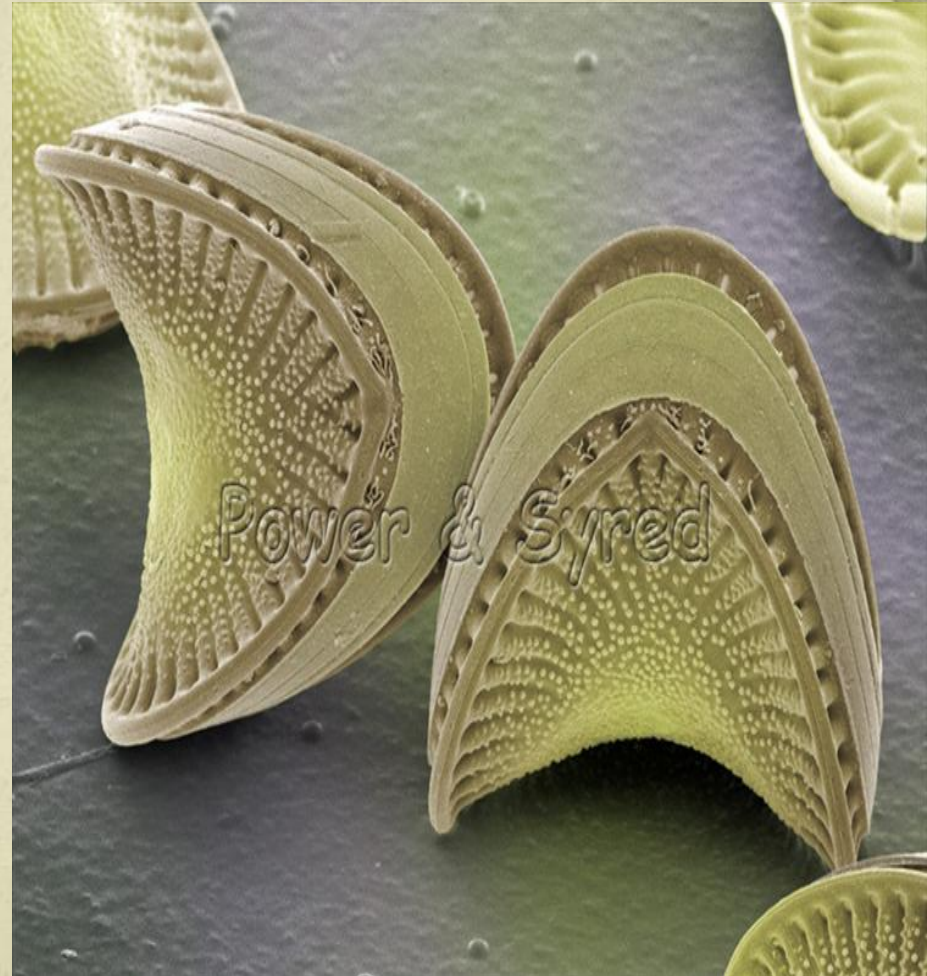
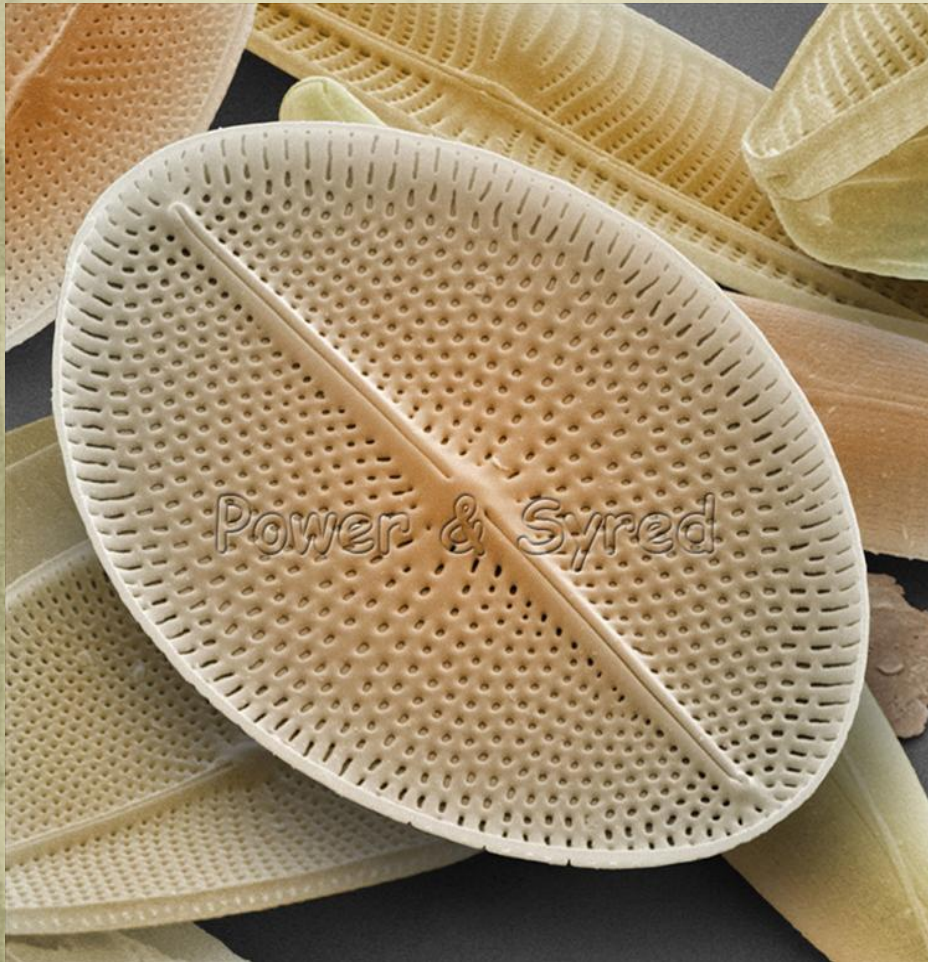








# DIATOMS





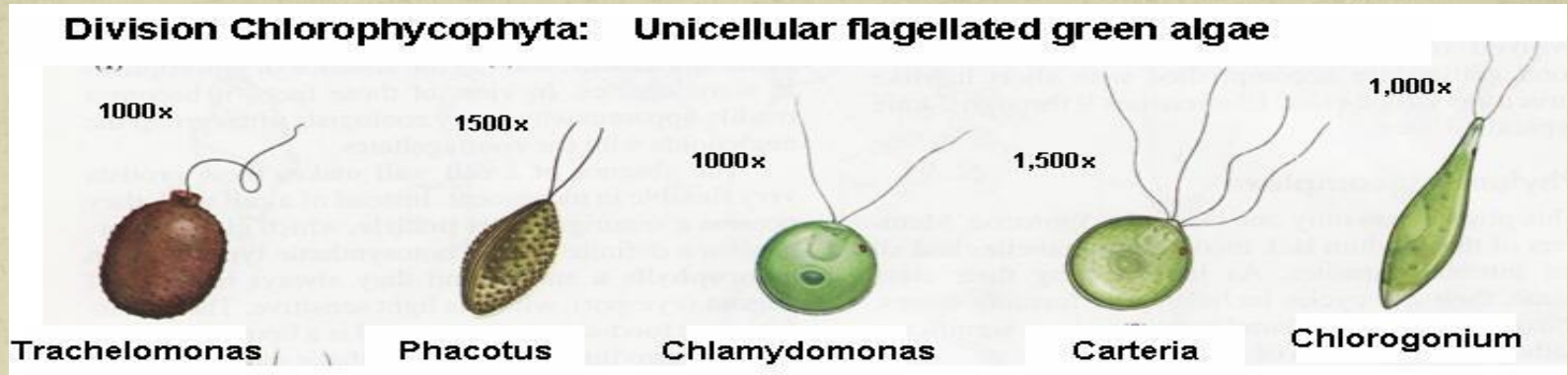




## 4. Eye-spot or Stigma

- The motile vegetative & reproductive cells of algae have a pigmented spots in the anterior, middle or posterior part of the cell, known as – **EYE-SPOT or STIGMA.**
- It is involved directly or indirectly in light perception.

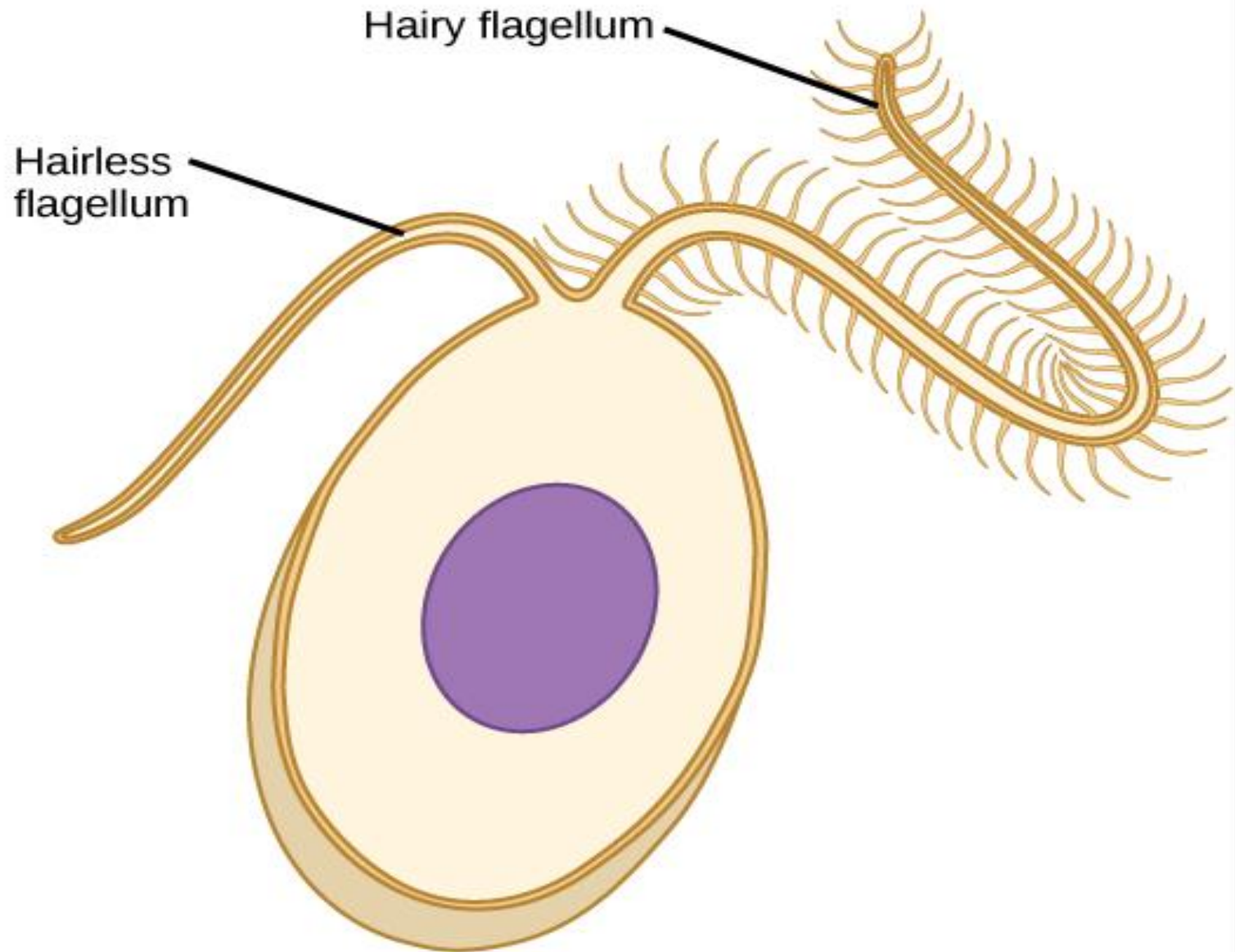
# 5. Flagella



- Flagella are the small filiform or thread like protoplasmic appendages found in motile vegetative or reproductive cells of algae.
- Flagella are the locomotive organs of motile vegetative or reproductive cells of algae.
- They vary in number, length, position and presence or absence of hairs in different numbers.
- Flagella is completely absent in Cyanophyceae & Rhodophyceae groups of algae.



## Stramenopile



# TYPES OF ALGAL FLAGELLA:

Flagella are of two types based on presence or absence of hairs on them:

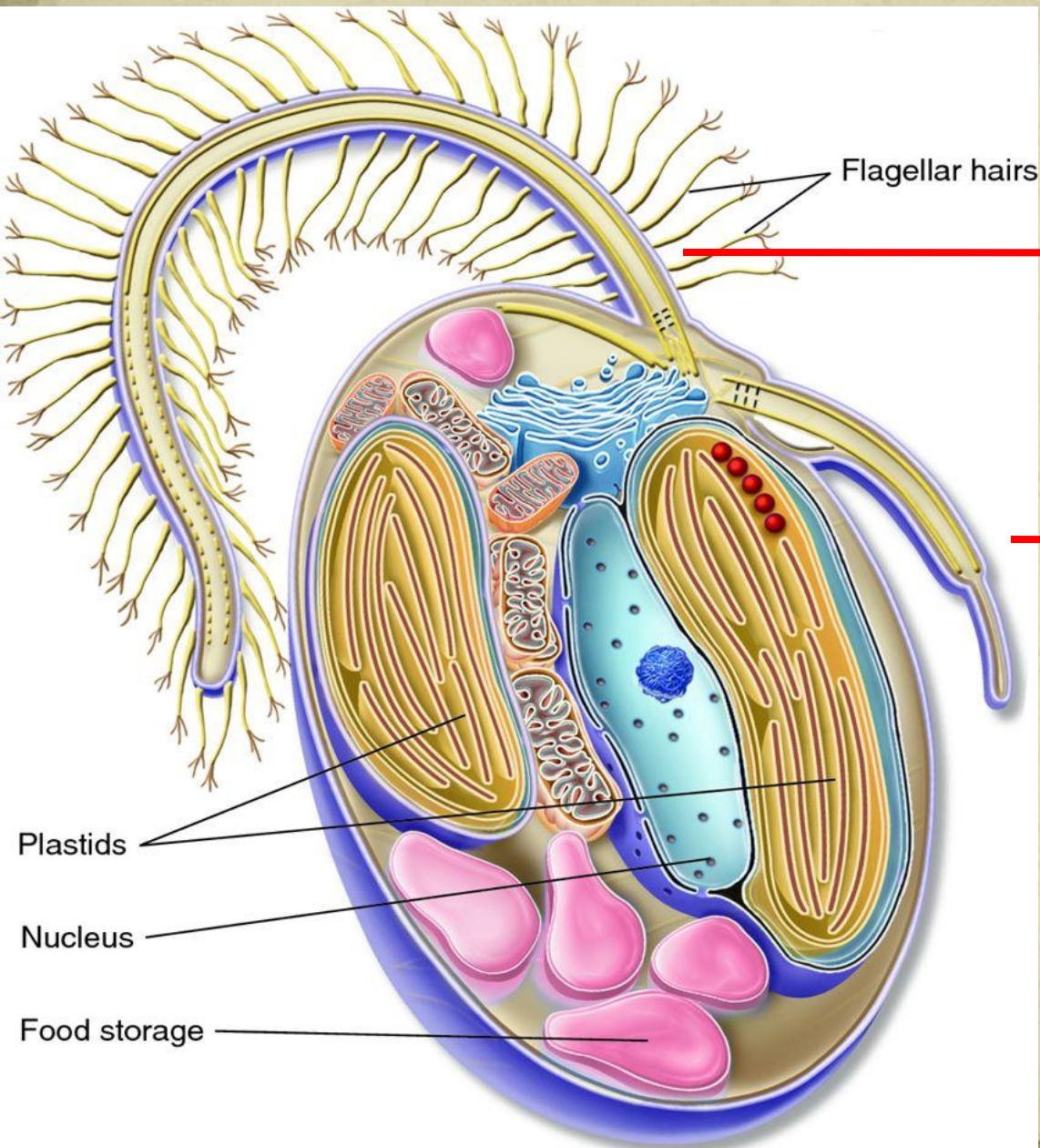
## 1. WHIPLASH or ACRONEMATIC FLAGELLA:

These are hairless smooth surfaced flagella.

## 2. TINSEL or PLEURONEMATIC FLAGELLA:

They are having one or more rows of lateral fine filamentous hairs known as **Mastigonemes** or **Flimmers**.





Flagellar hairs

**TINSEL TYPE FLAGELLA**

**WHIPLASH TYPE FLAGELLA**

Plastids

Nucleus

Food storage

# TYPES OF TINSEL TYPE FLAGELLA

## **A. Pantonematic:**

Mastigonemes are arranged in two opposite rows.

## **B. Pantoacronematic:**

Pantonematic flagellum with a terminal fibril.

## **C. Stichonematic:**

It has one sided Mastigonemes.



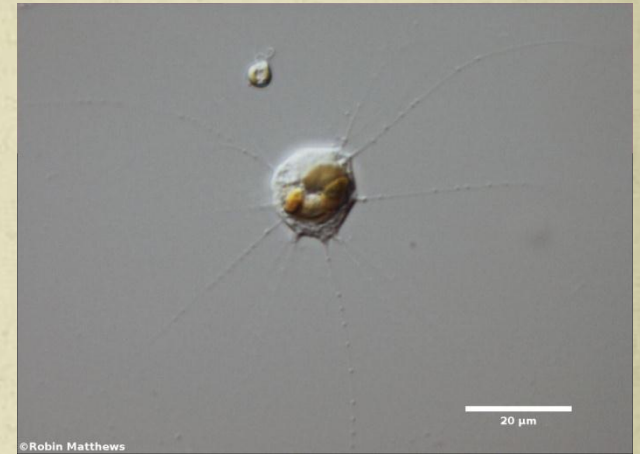
# RANGE OF VEGETATIVE STRUCTURE

## A. Unicellular algae

### i. Motile

#### a. Rhizopodial

Ex- *Chrysamoeba*



#### b. Flagellated

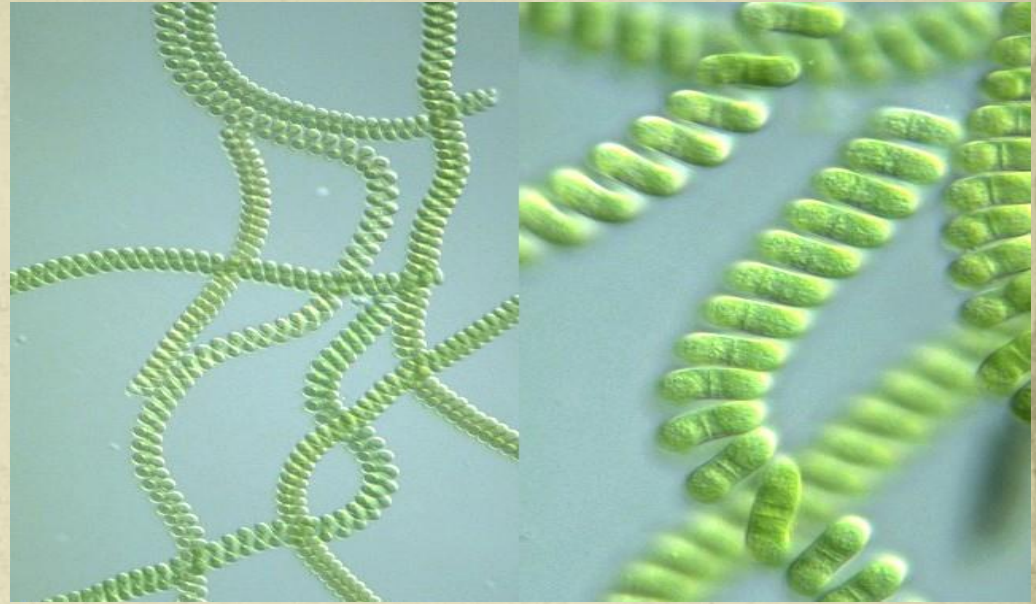
Ex- *Chlamydomonas*



## ii. Unicellular Non motile algae

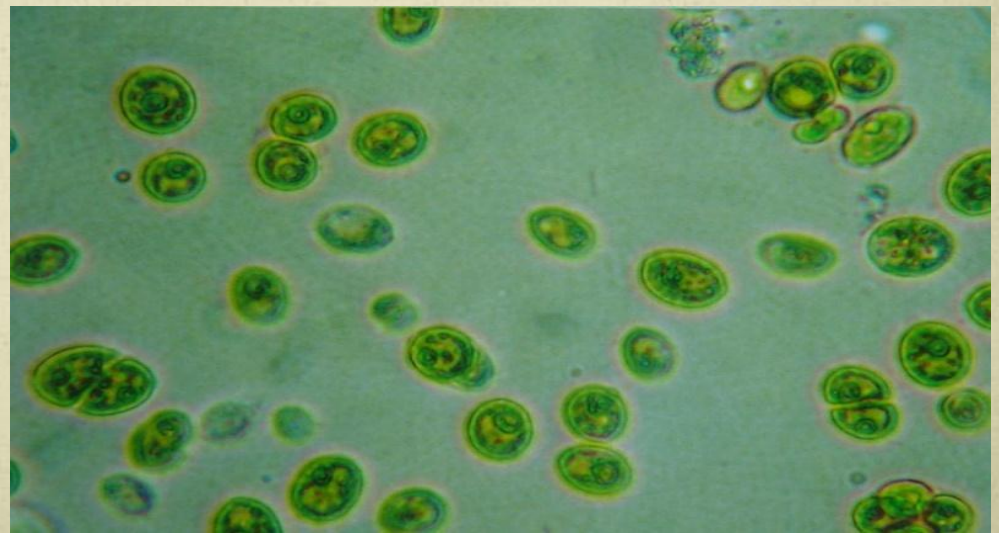
### a. Spiral filamentous

Ex- *Spirulina*



### b. Coccoidal

Ex- *Chlorella*



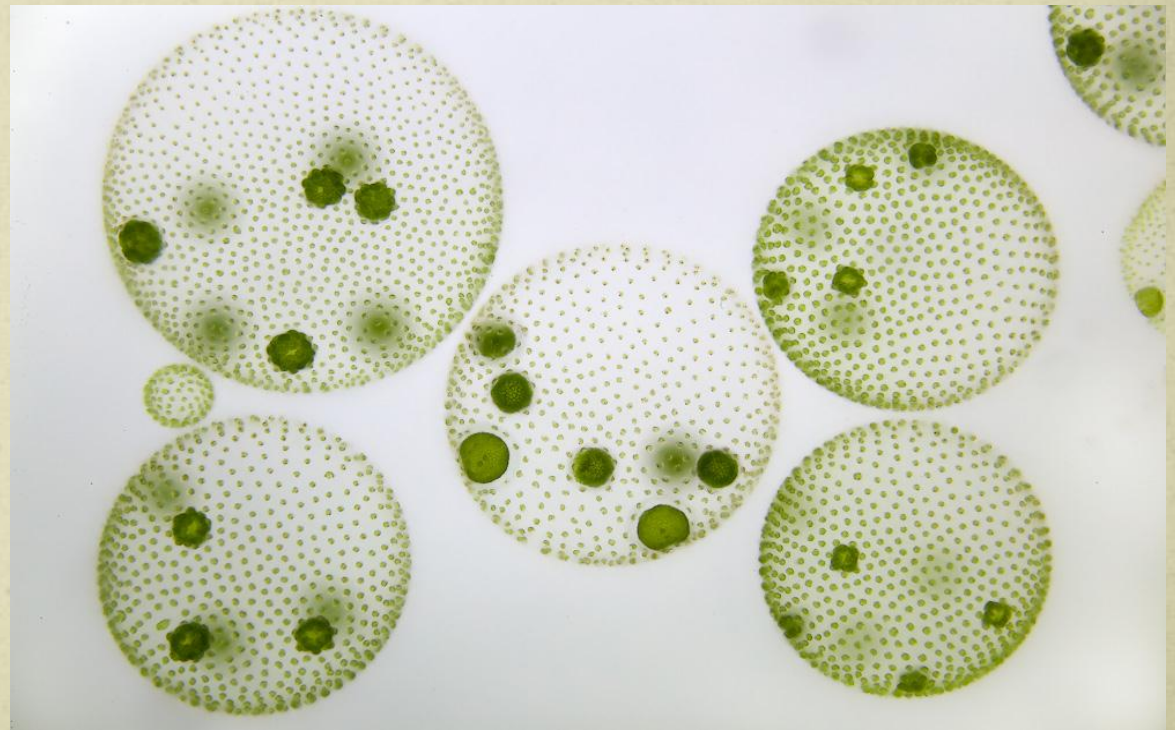
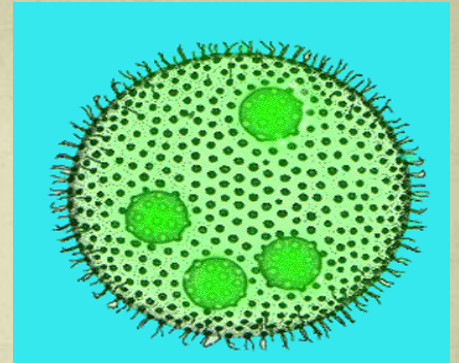


# B. Multicellular Algae

## 1. Colonial

### i. Motile Coenobium

Ex- *Volvox*



## ii. Non-motile Coenobium

*Ex- Scenedesmus*





Non motile coenobium ex- *Hydrodictyon* sp.





## 2. Aggregated form

### i. Palmelloid

Ex- Palmella stage of *Chlamydomonas*  
*Microcystis*

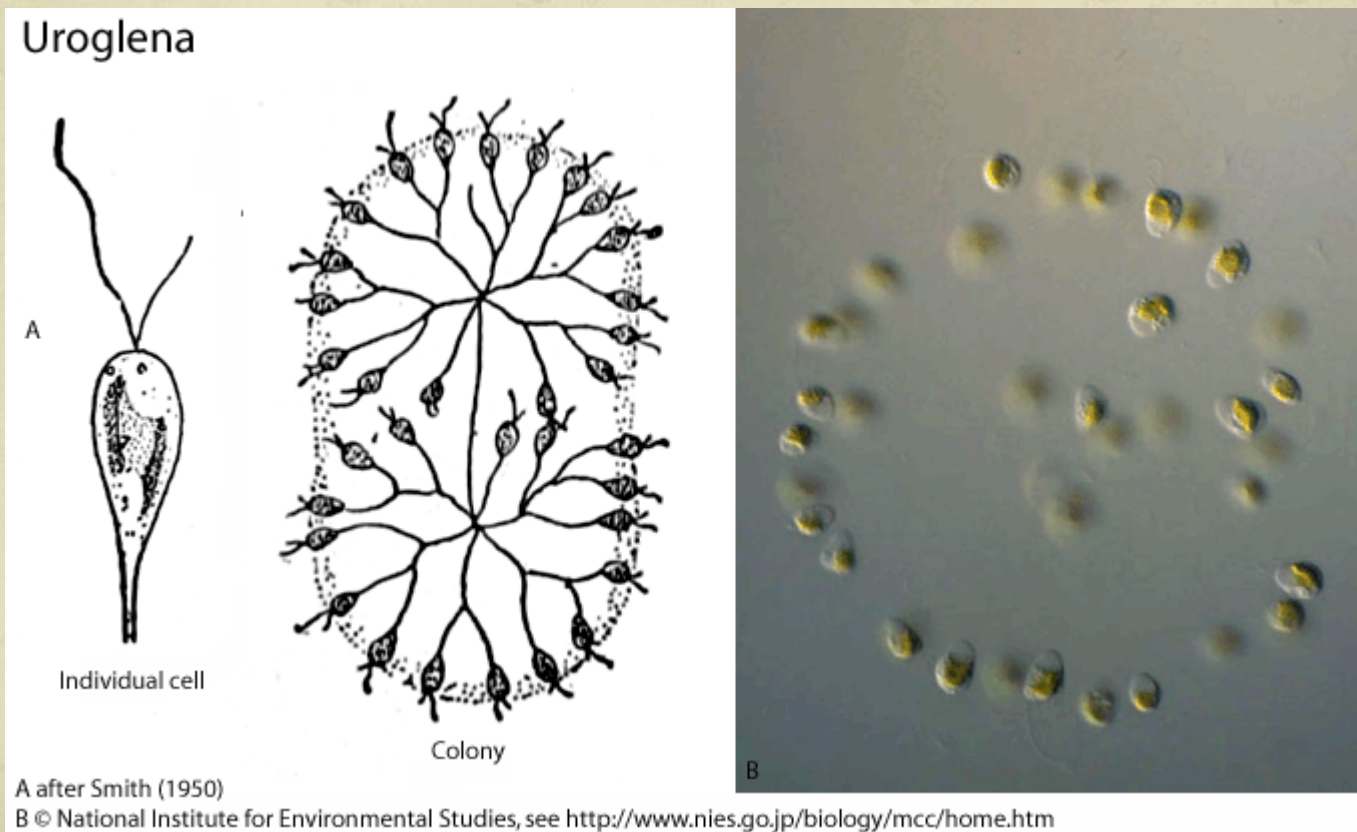




## ii. Dendroid

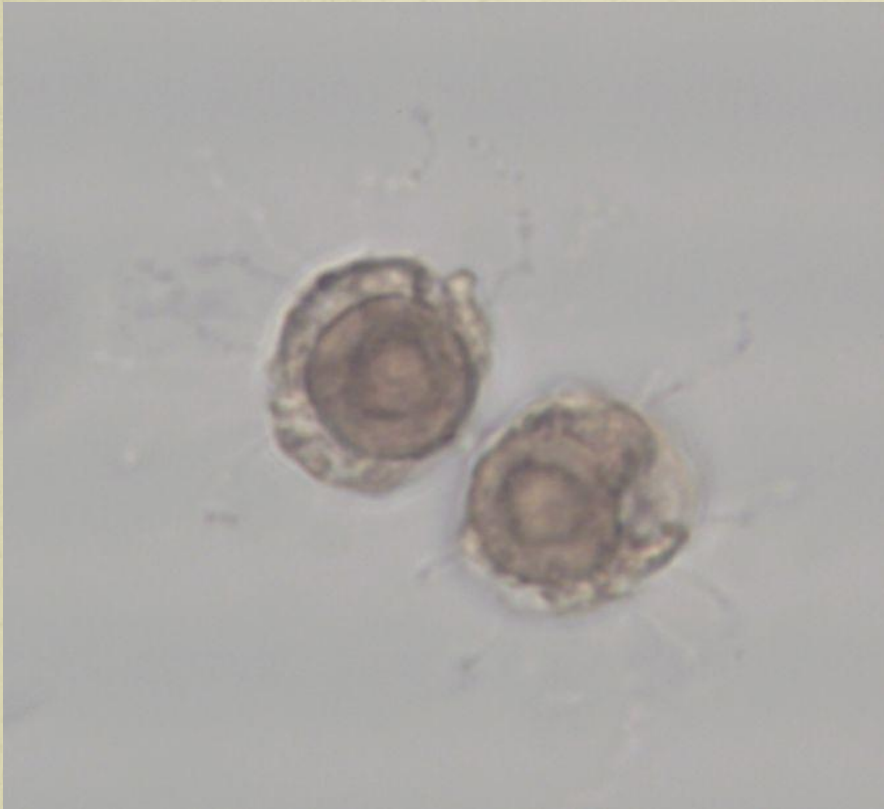
Look like microscopic tree

*Ex- Chrysodendron*



### iii. Rhizopodial

- Cells are united through rhizopodia
- Ex- *Chrysidiastrum*





### 3. FILAMENTOUS ALGAE

- The cells remain firmly attached with each other end to end forming a chain.
- It is formed by repeated cell division in one plane and in a single direction.
- They may be:
  - A. Un-branched
  - B. Branched
    - i. Falsely branched
    - ii. Truly branched

# Unbranched filamentous algae

- It may be:  
**FREE FLOATING**  
*Ex-Spirogyra*





# Unbranched filamentous algae

- It may be:

ATTACHED WITH THE SUBSTRATUM

*Ex-Oedogonium*

*Oedogonium sp.*





# *Oedogonium* (Nannandrous Type)



25  $\mu\text{m}$

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Cap cell



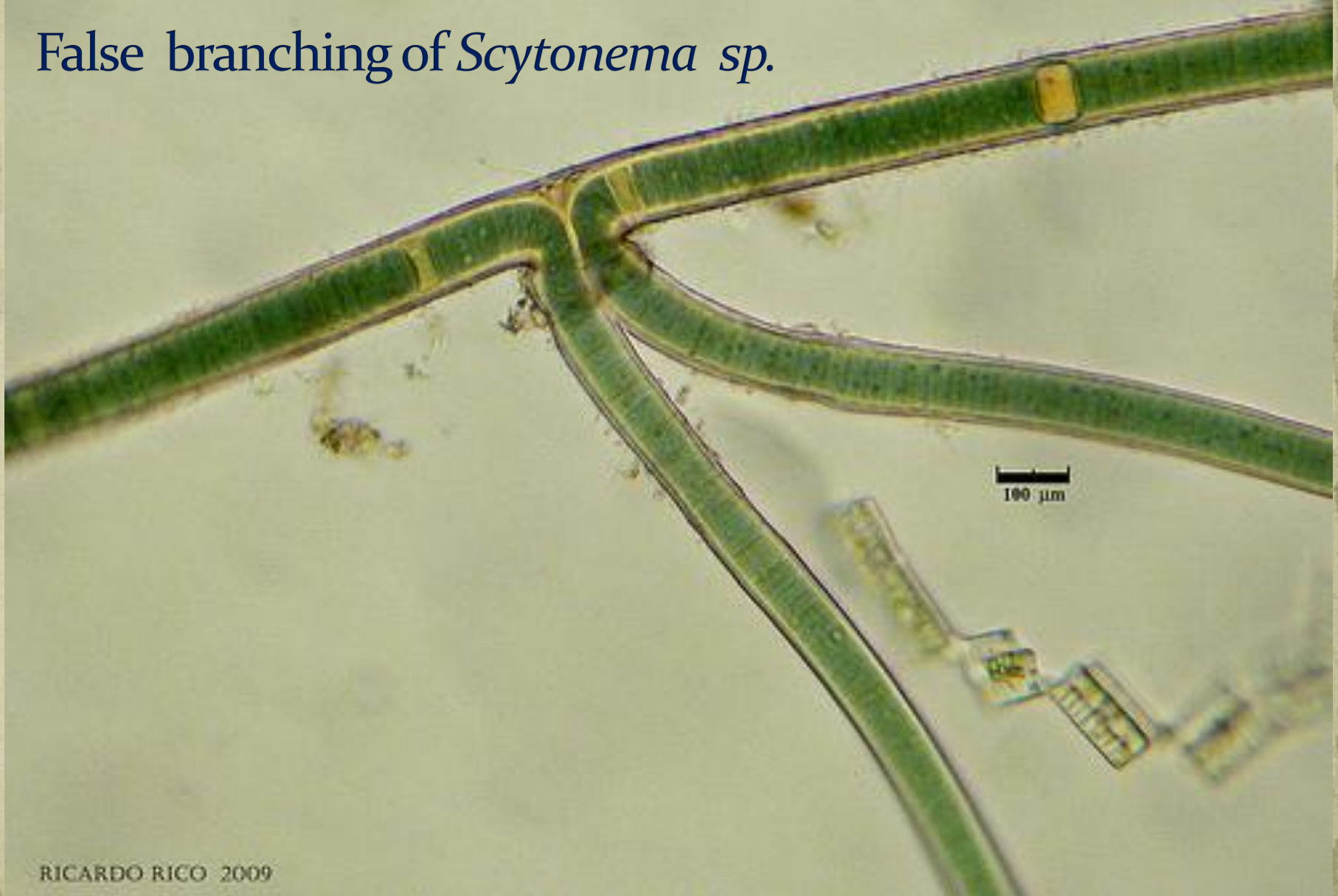


i. Falsely Branched Filamentous algae  
Ex- *Scytonema* sp.



*Scytonema* sp.

False branching of *Scytonema* sp.





## ii. Truly Branched Filamentous algae

- True branch is formed due to occasional division in second plane.
- True branches arise as lateral outgrowth of the main filament.
- True branches are of 3 types:
  - a. Simple filament
  - b. Heterotrichous habit
  - c. Pseudoparenchymatous habit

a. Simple Filament  
Ex- *Cladophora* sp.



100  $\mu$ m

© Dr. R. Wagner



*Cladophora sp.*





*Cladophora sp.*

1,5 mm



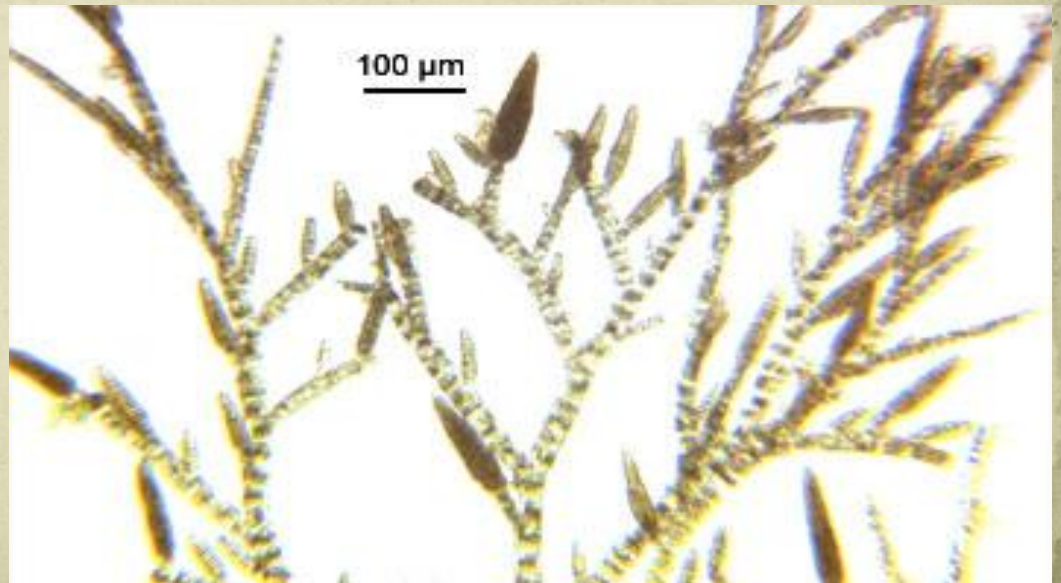
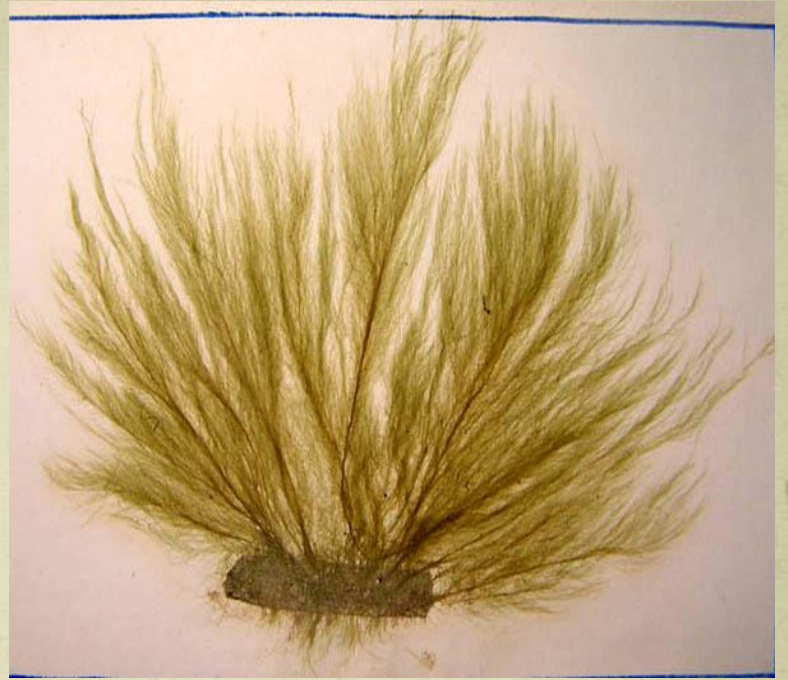
## b. Heterotrichus habit

Whole thallus is differentiate into erect and prostrate system.

Ex- *Ectocarpous sp.*

*Fritschiella sp.*

*Ectocarpous sp.*





*Fritschiella* sp.



## c. Pseudoparenchymatous habit

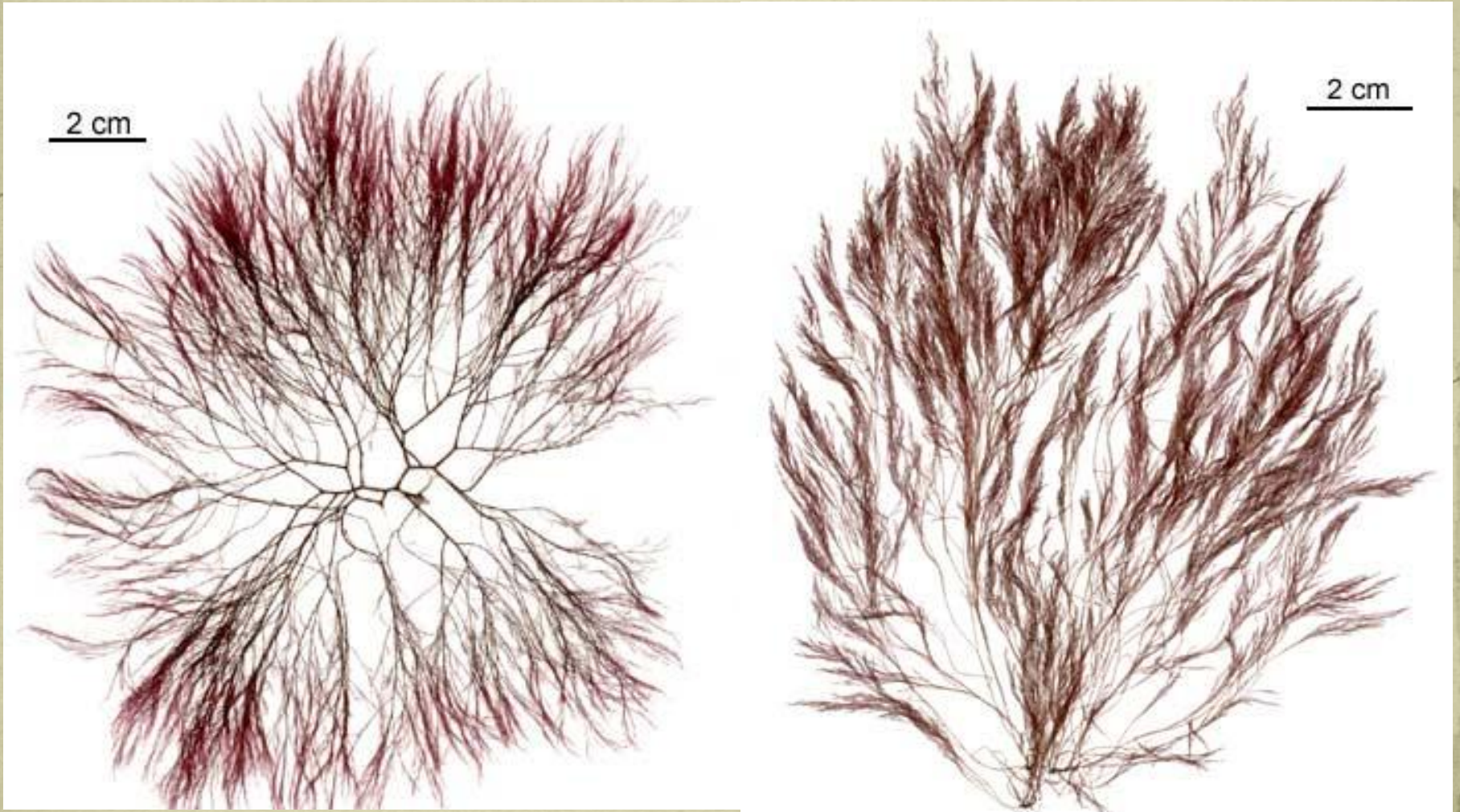
- One or more axial or central filaments together with their branches fuses to form a parenchymatous structure called Pseudoparenchymatous thallus.

Ex- **Multiaxial type**- *Polysiphonia sp.*

**Uniaxial type** - *Batrachospermum sp.*

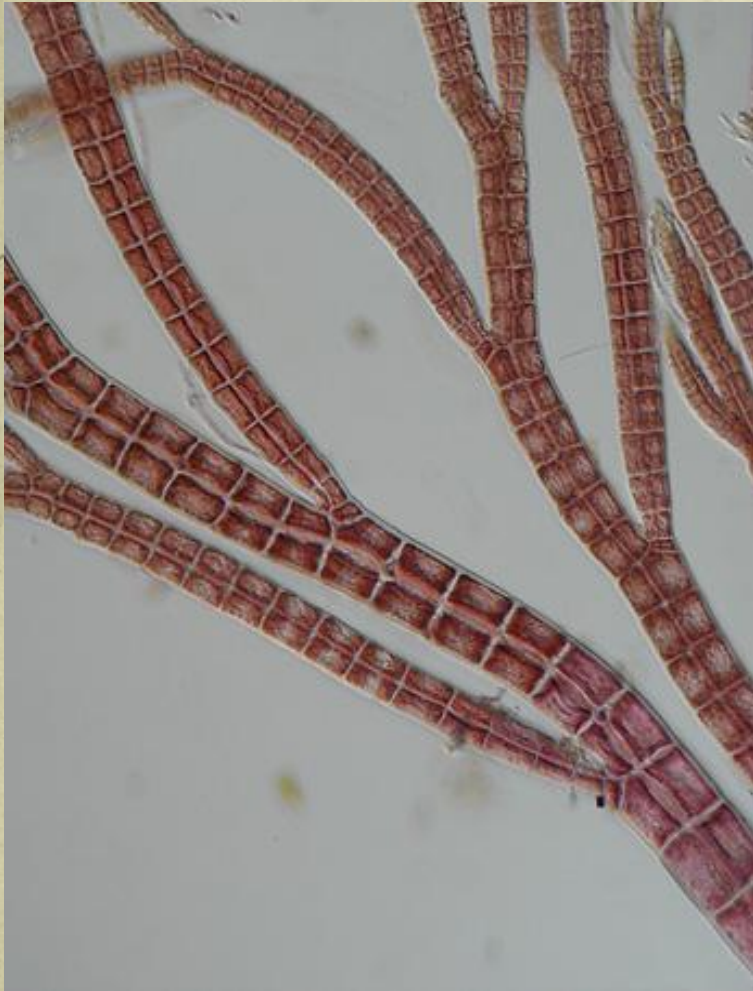


# *Polysiphonia* sp.





*Polysiphonia sp.*





# *Batrachospermum* sp.





## 4. SIPHONECEOUS ALGAE

- The thallus is aseptate and multinucleate.

Ex- *Vaucheria* sp.

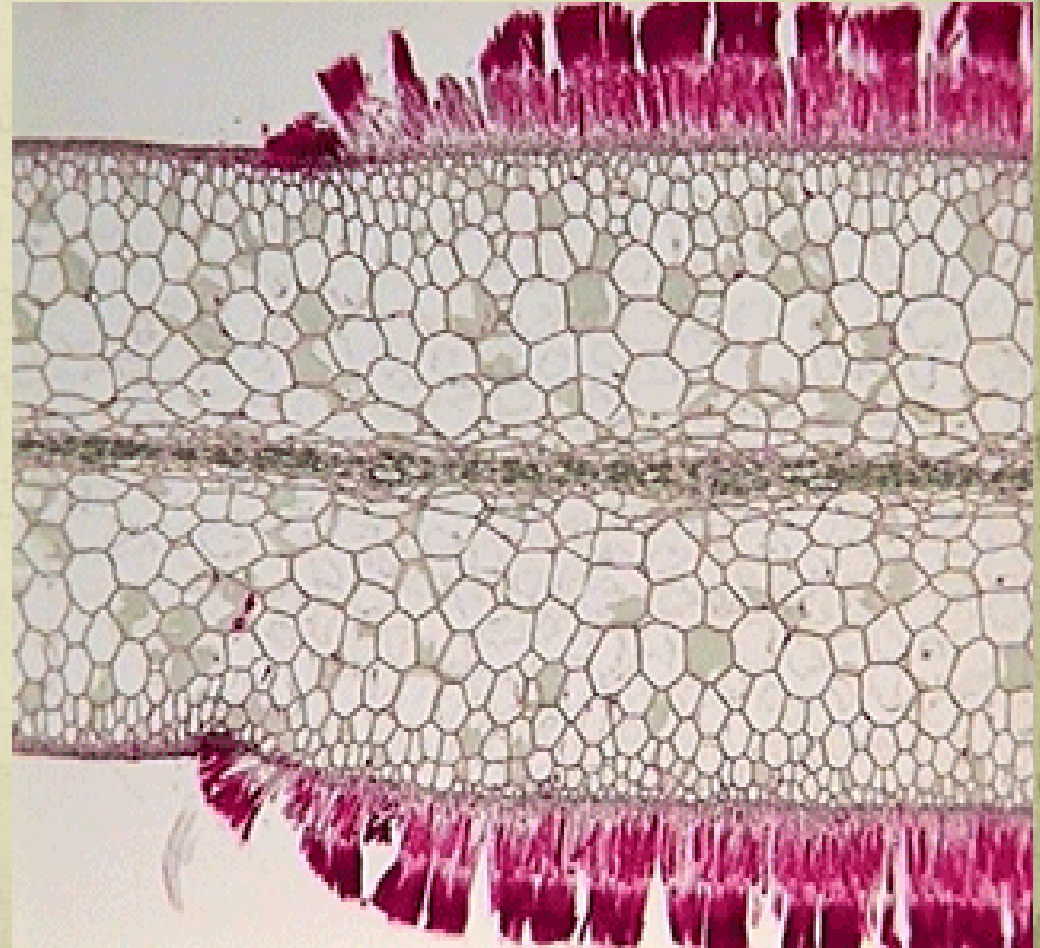




## 5. Parenchymatous

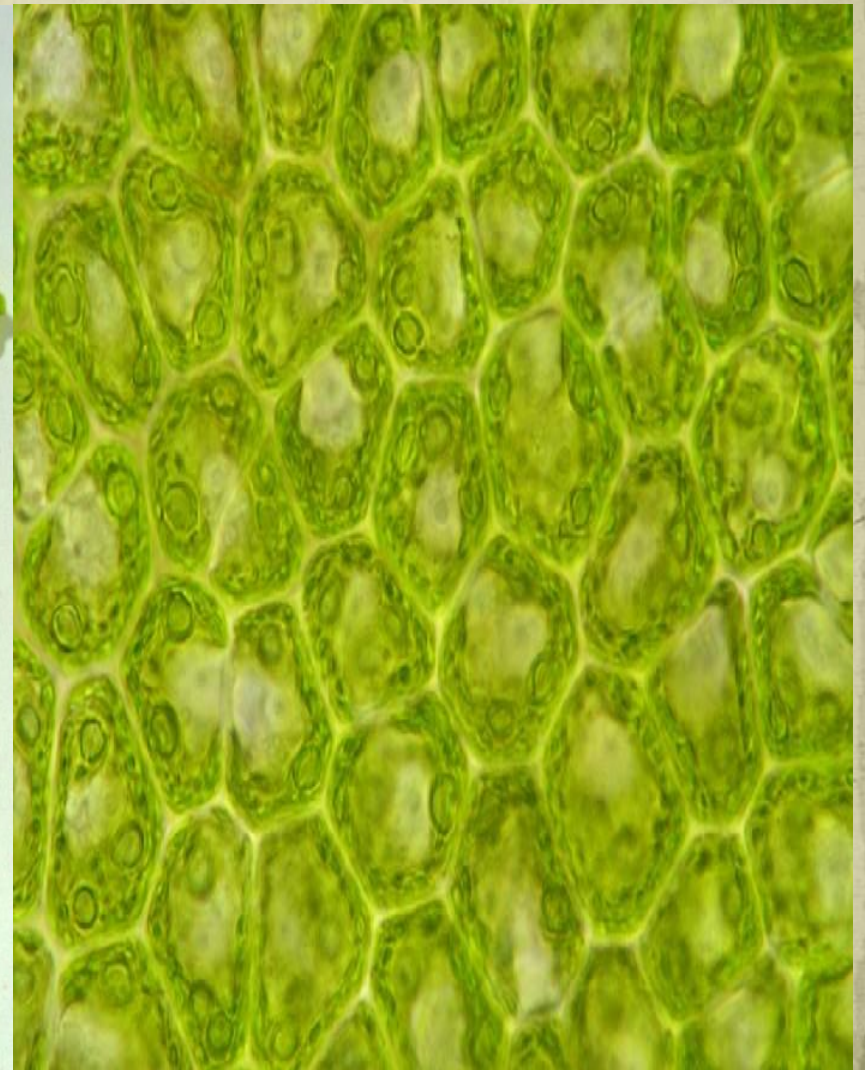
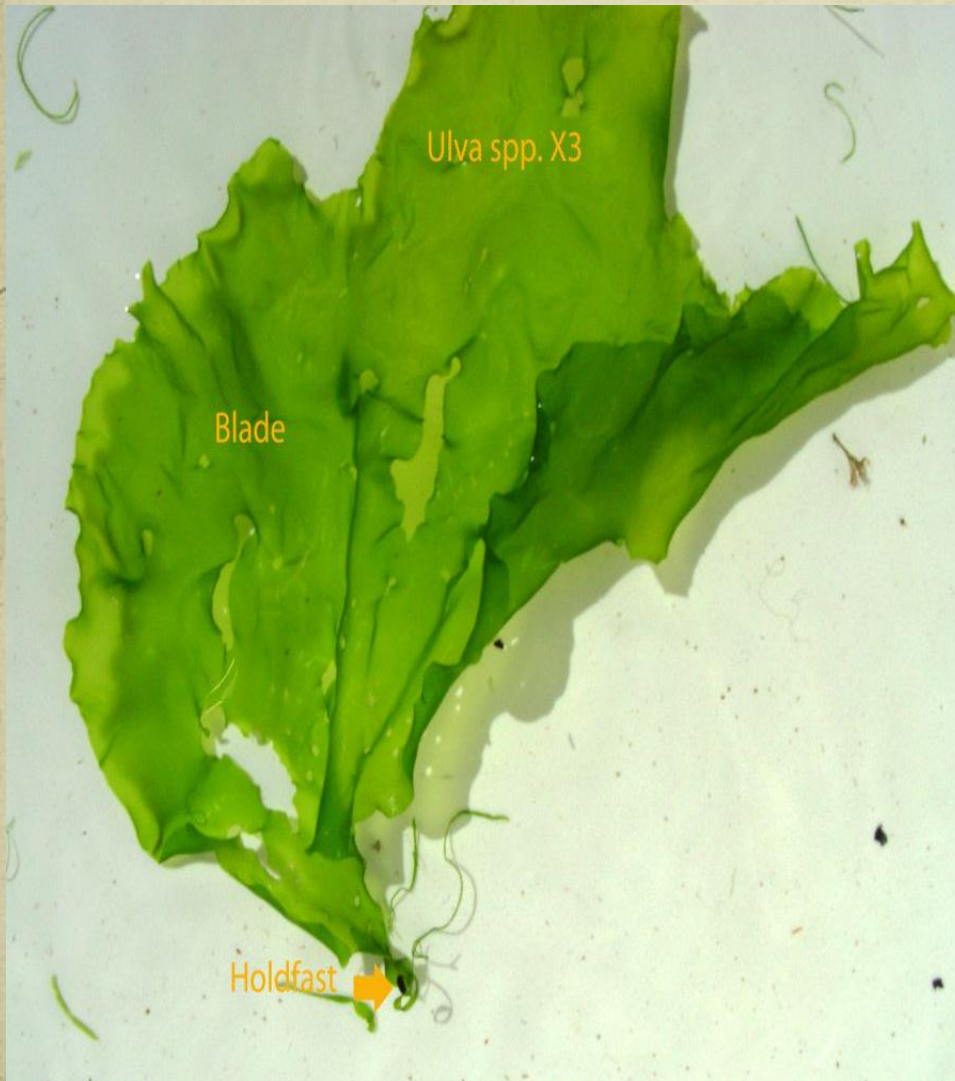
- The cells of filament divides at multidirectional planes, it results in the formation of parenchymatous thallus.
- Alga are flat and foliose.
- Ex- *Laminaria sp.*,  
*Ulva sp.*  
*Sargassum sp.*

*Laminaria sp.*





# *Ulva sp.*



# *Sargassum* sp.

