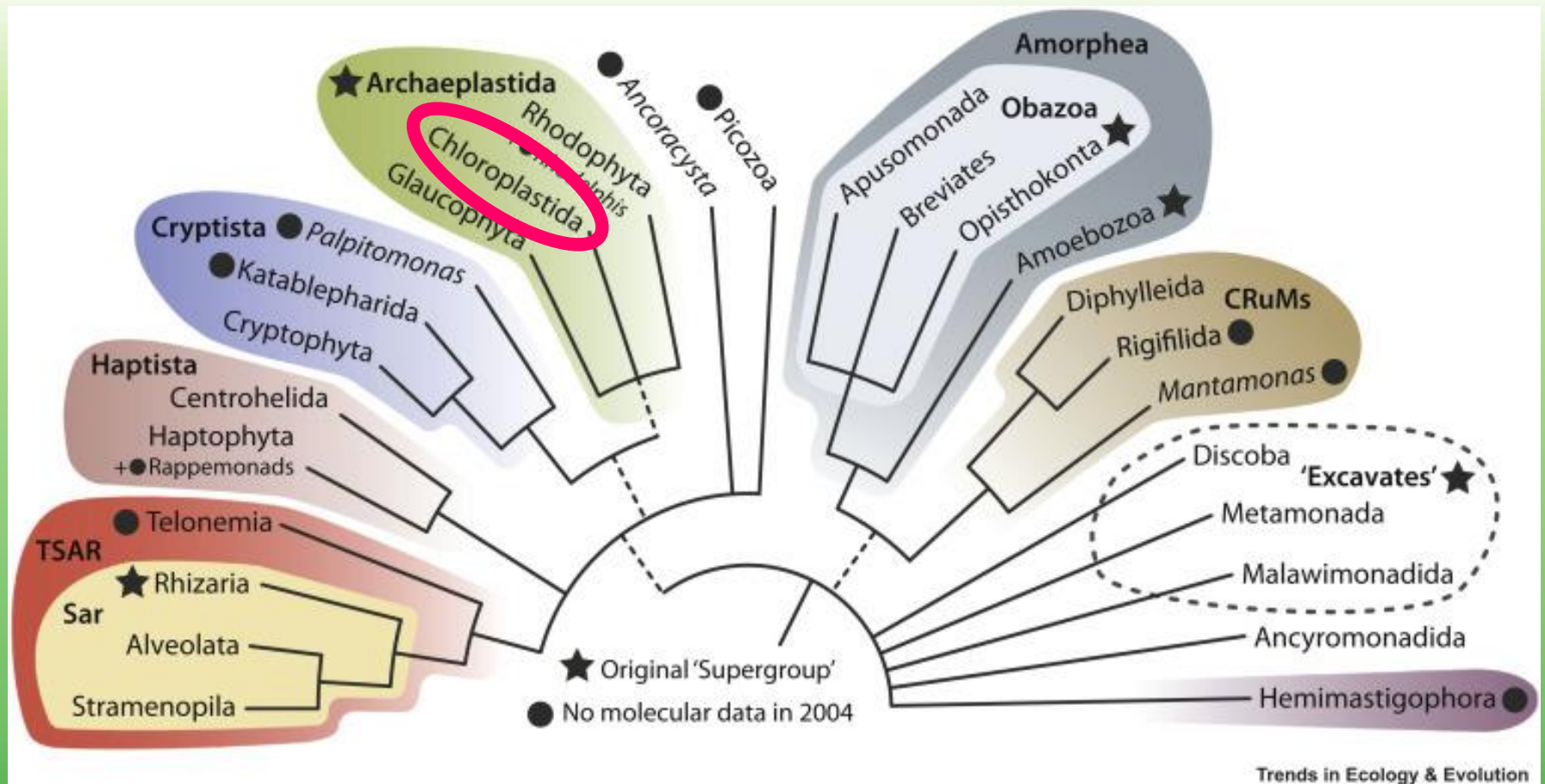


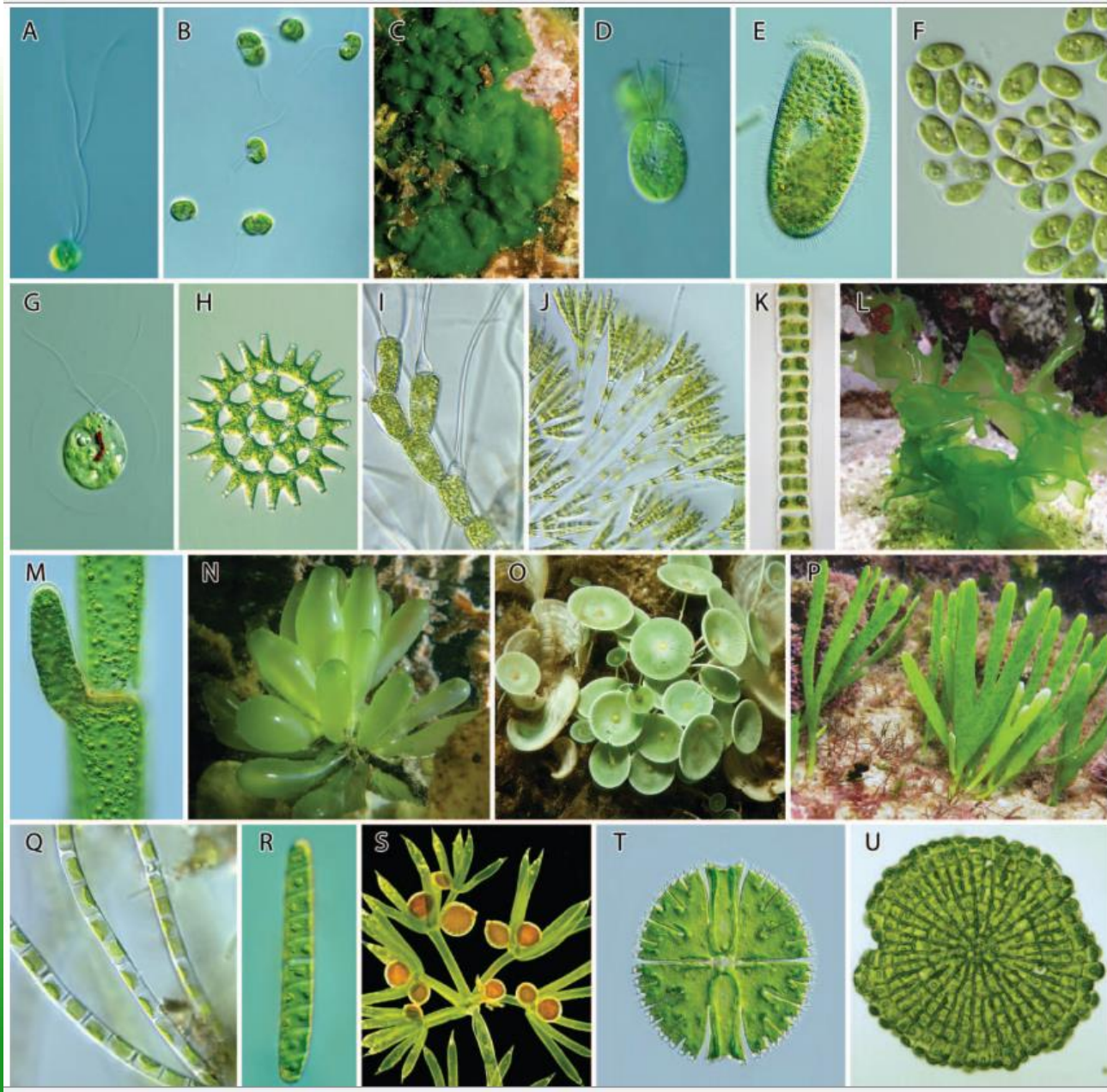
Introduction to plant systematics, evolution and ecology

**Viridiplantae
Chlorophyta**



Burki et al. (2019)

Leliaert
et al.
(2012)



Viridiplantae

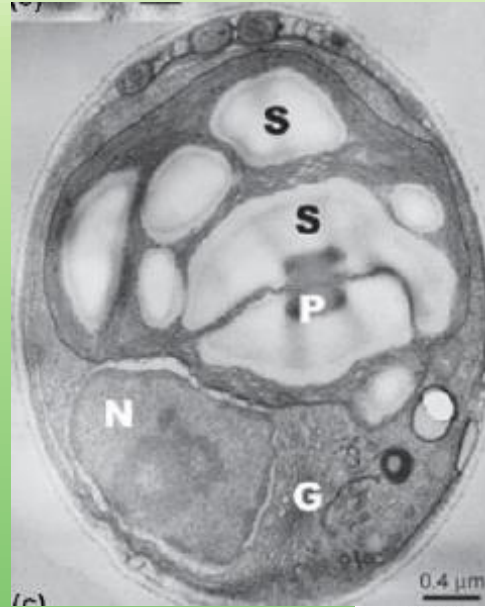
Starch in plastids

No phycobillisomes

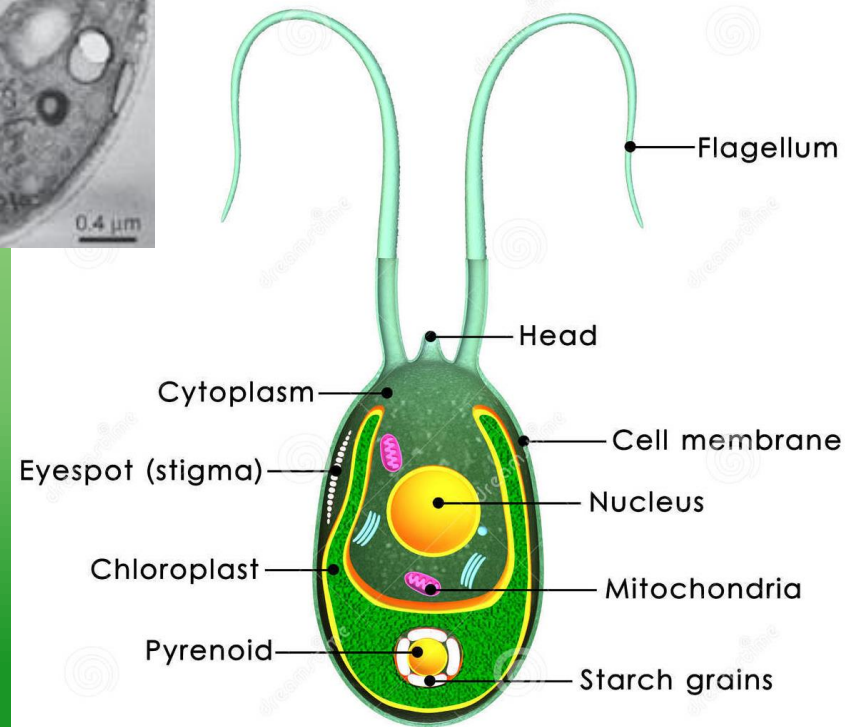
Chlorophyll *a* and *b*

Izogamy, anizogamy, oogamy; mostly haplontic life cycles

Usually 2 structurally similar flagella

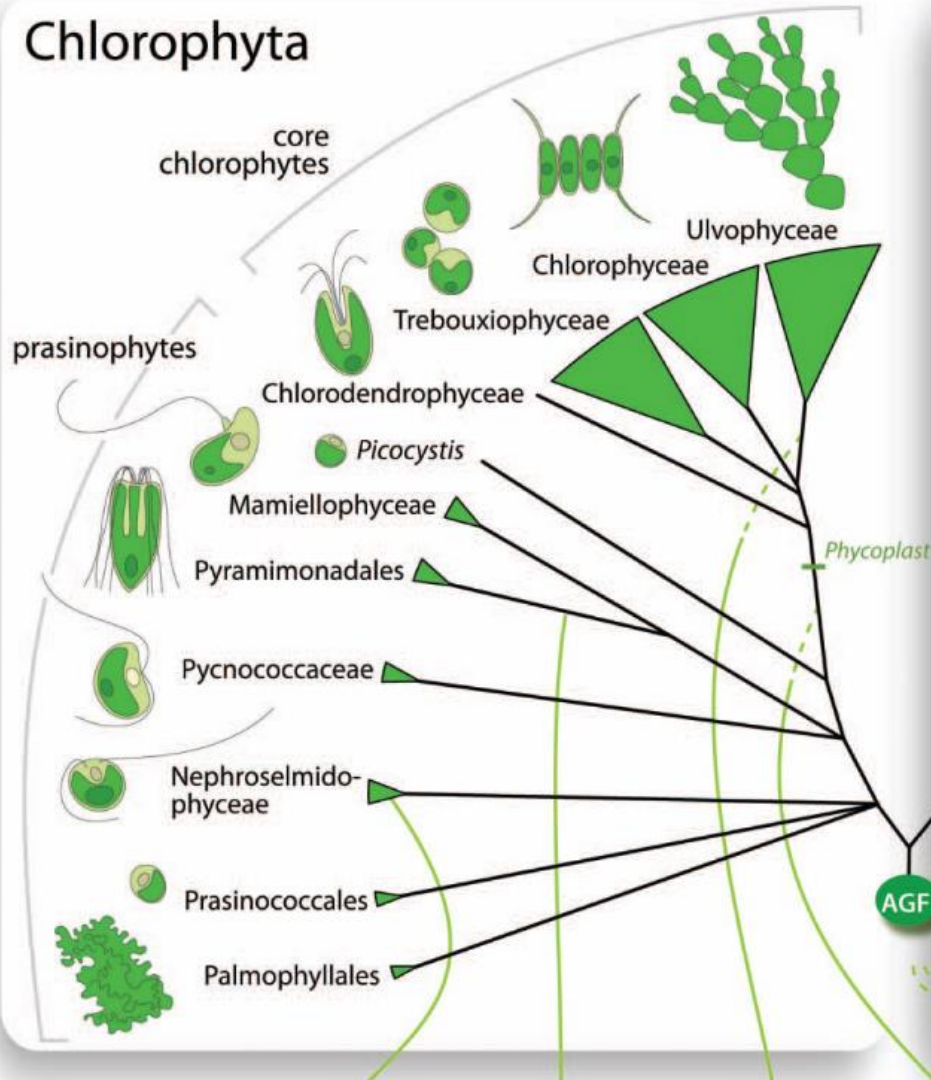


Parachlorella (Aslam et al. 2007)

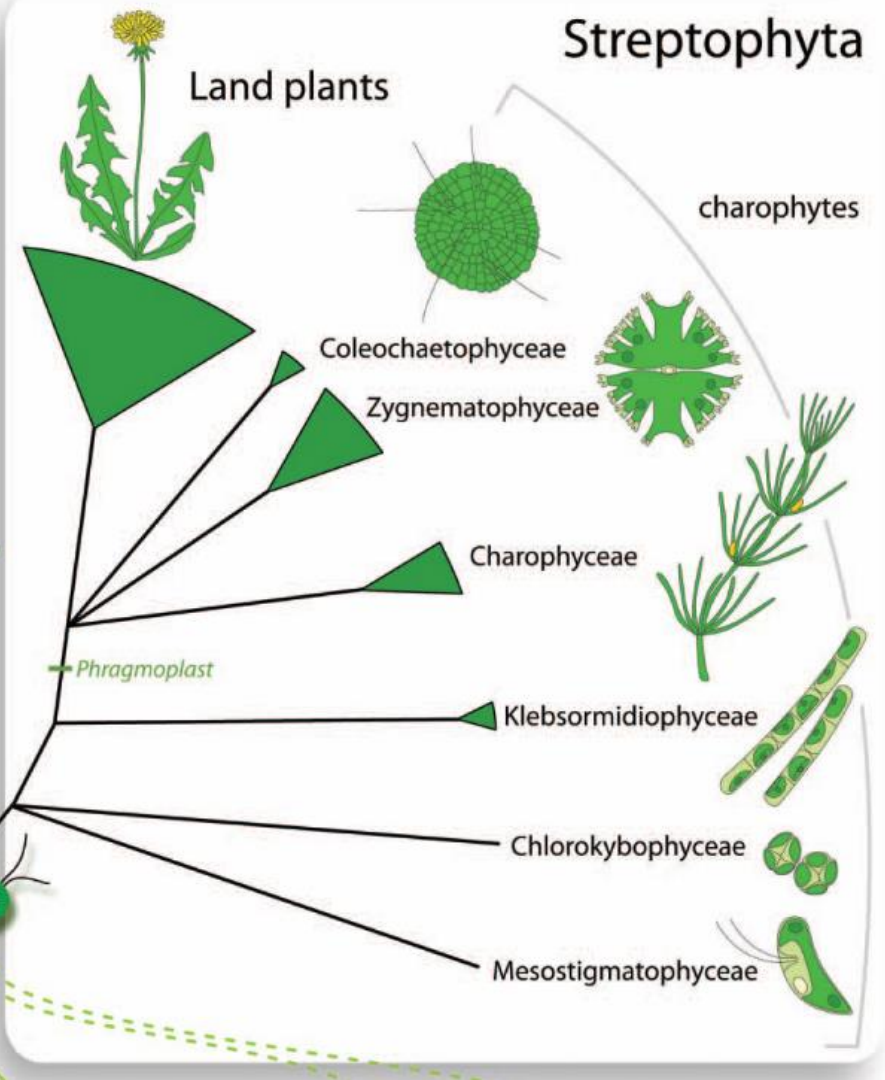


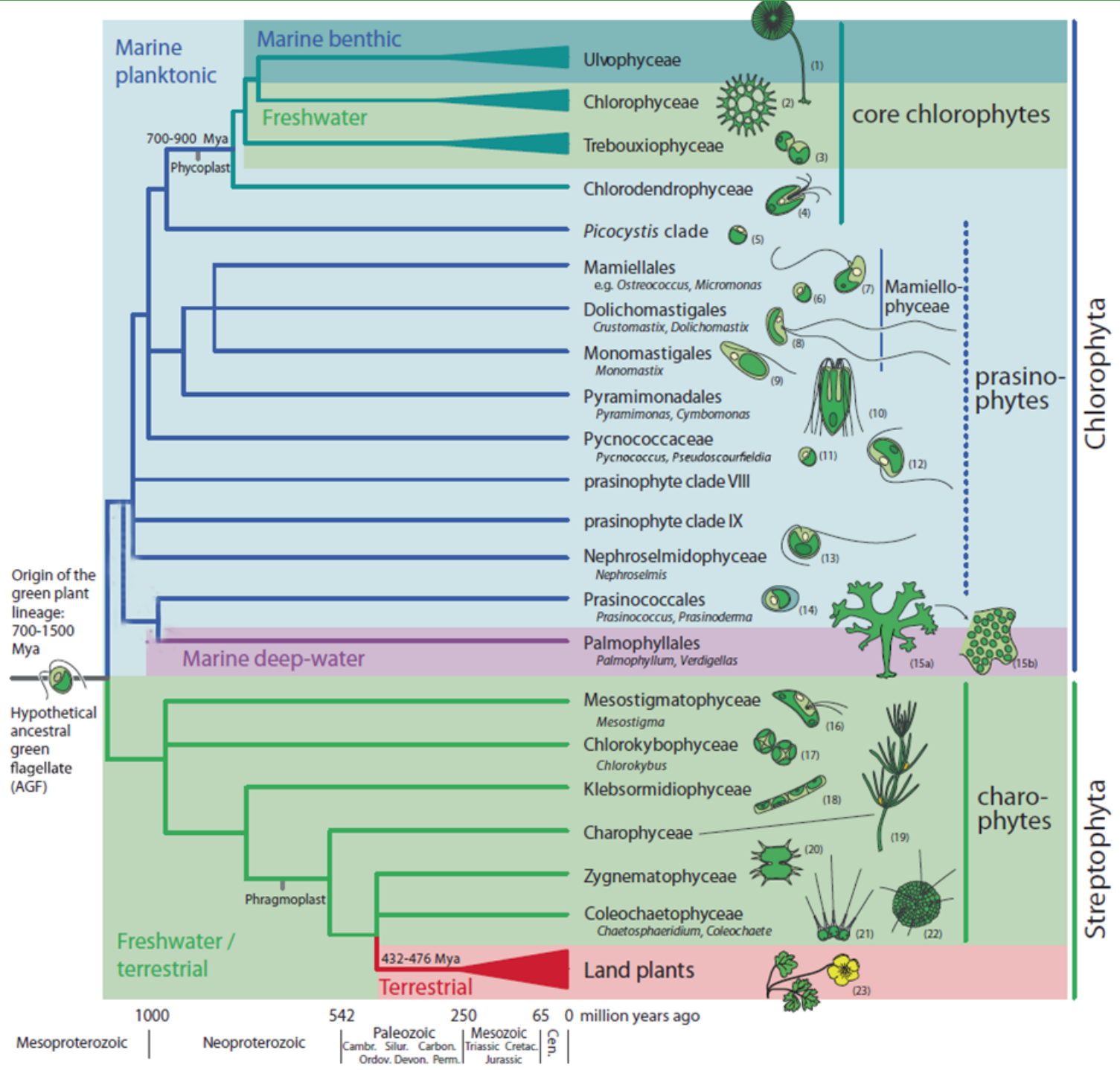
Chlamydomonas

Chlorophyta

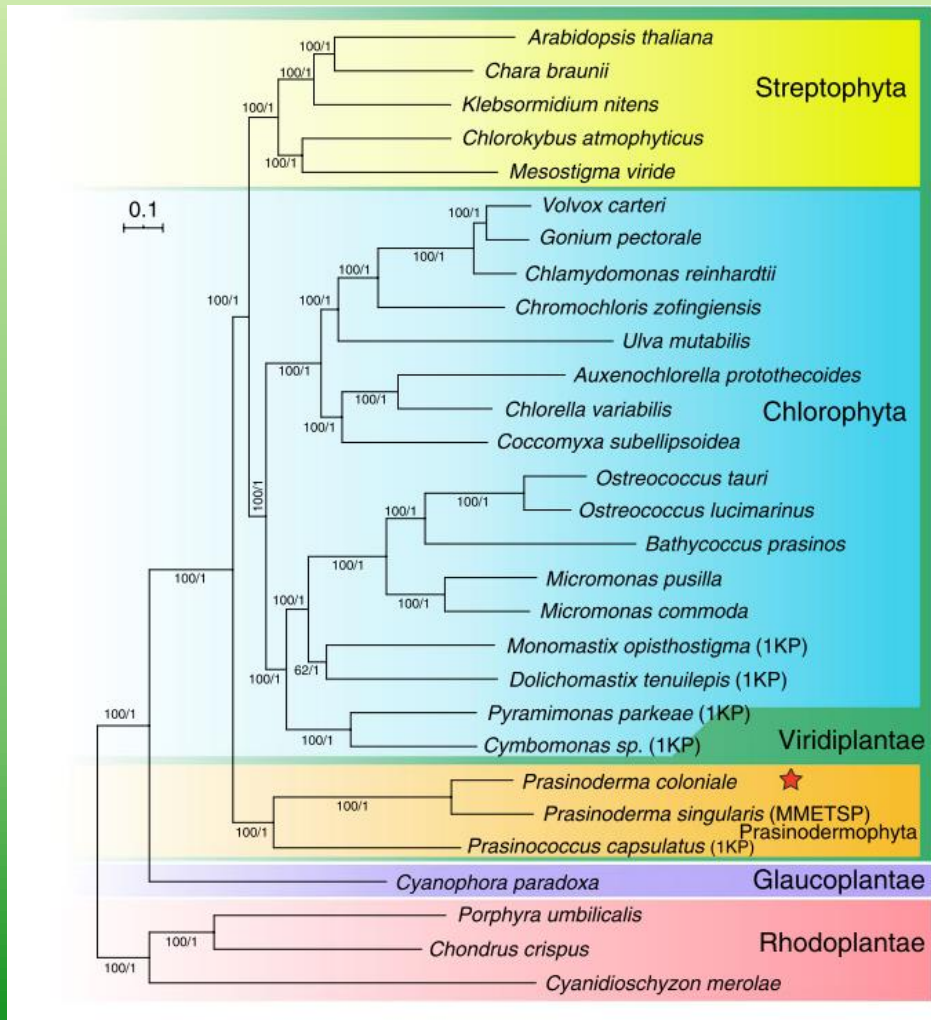


Streptophyta

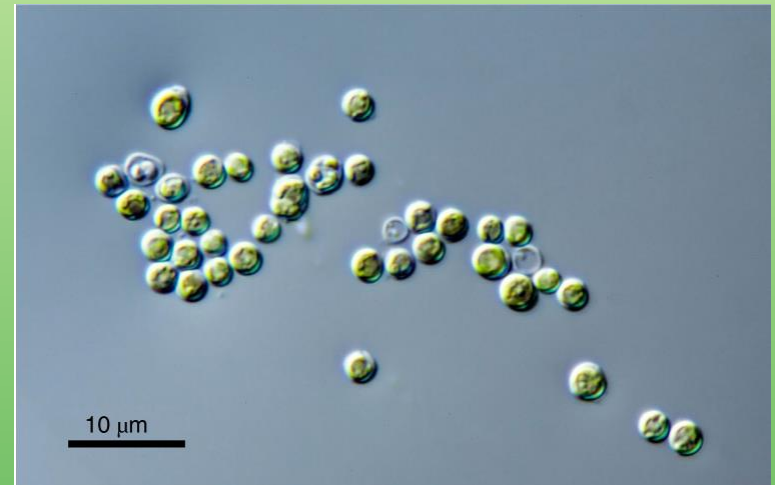




Prasinidermophyta – new lineage within green plants

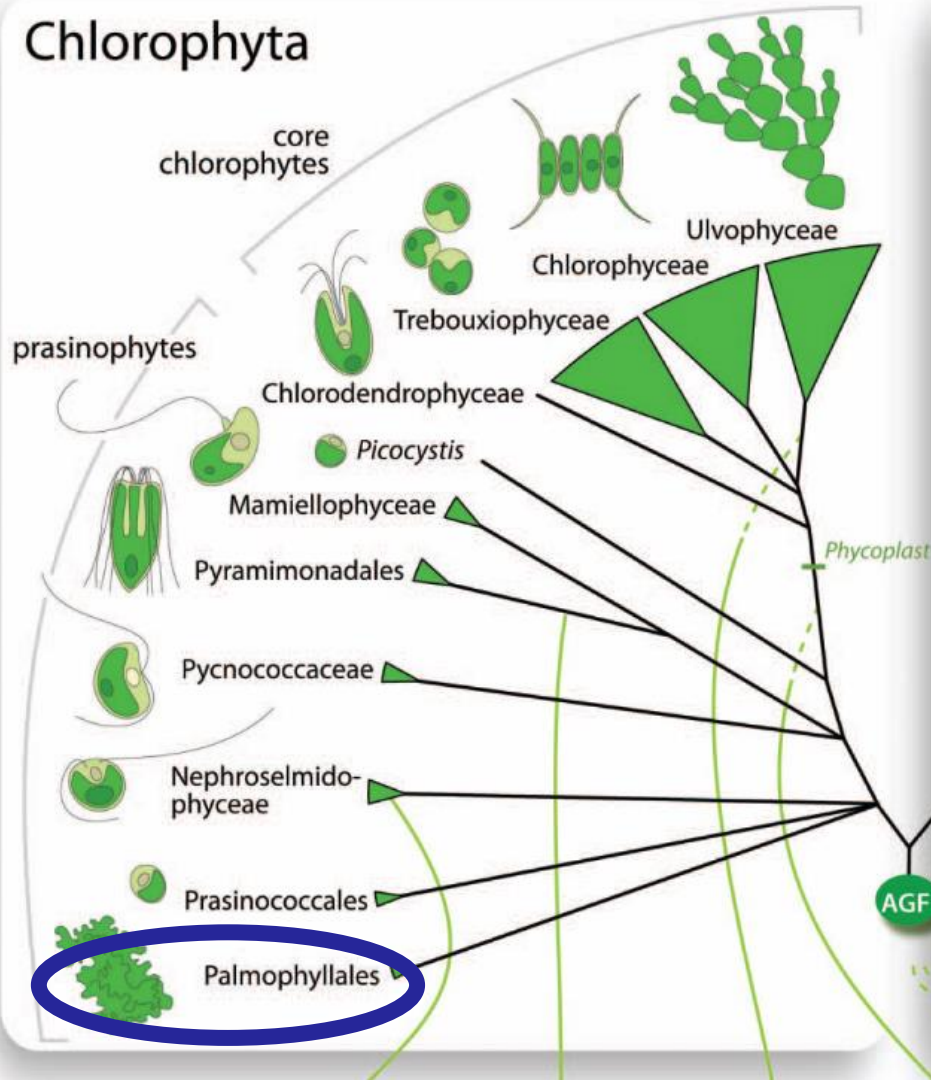


Prasinoderma coloniale

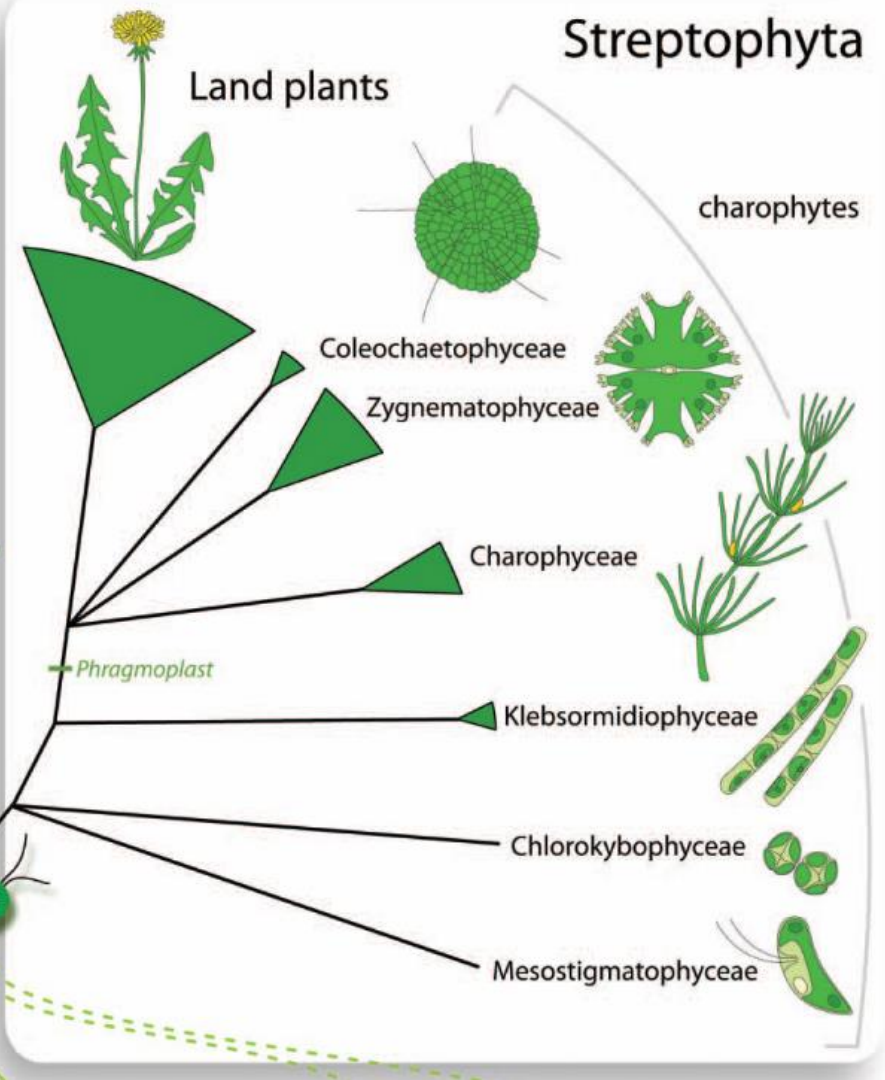


Li et al. (2020)

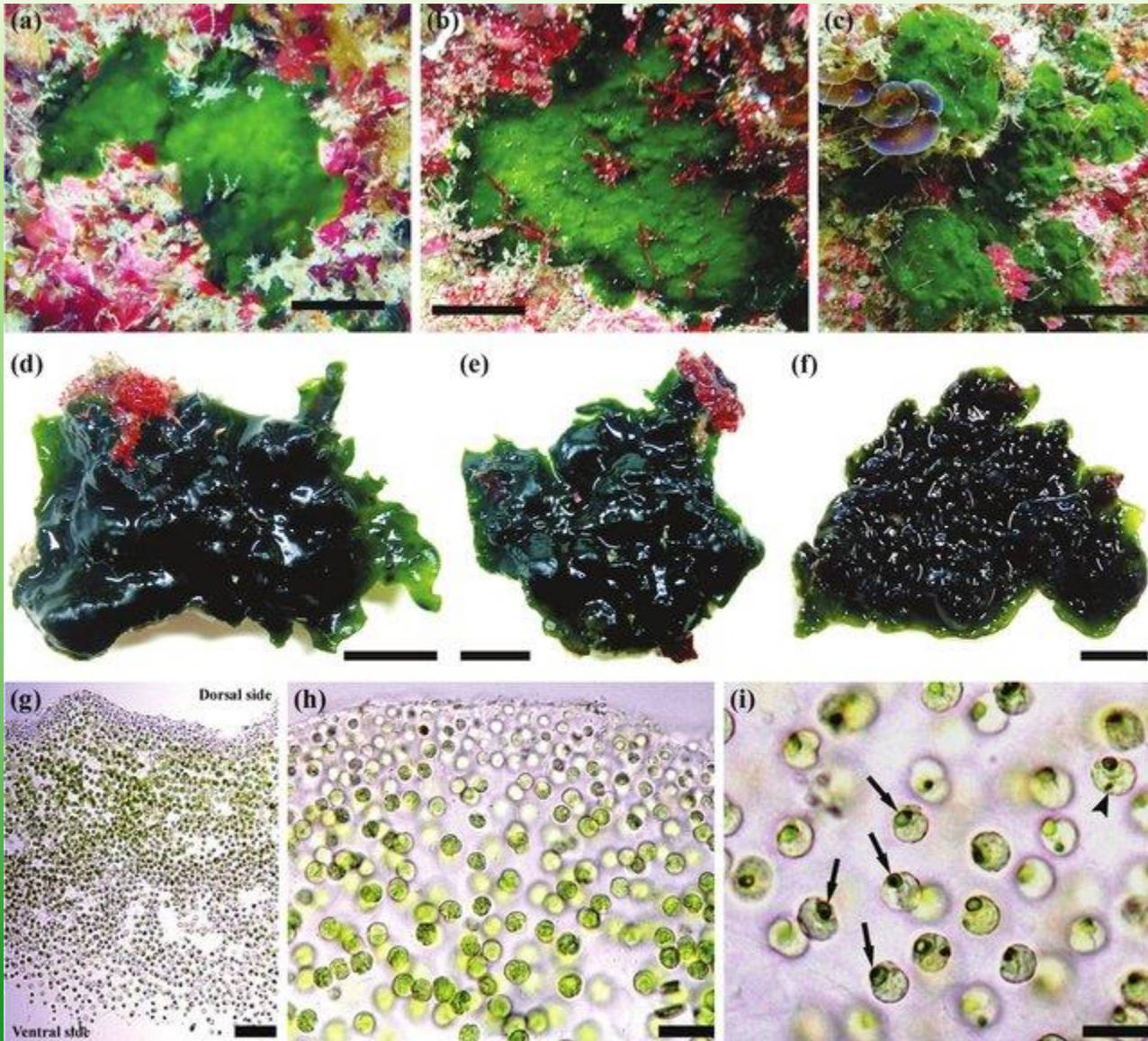
Chlorophyta



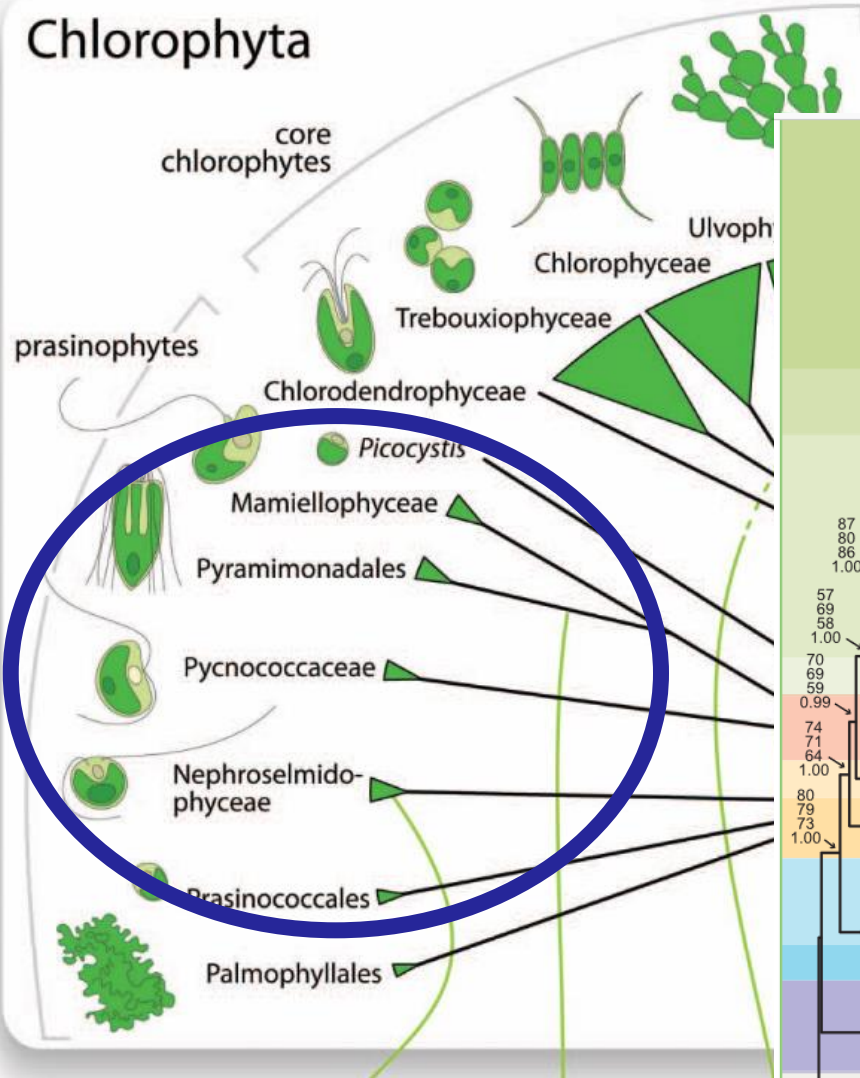
Streptophyta



Palmophyllophyceae

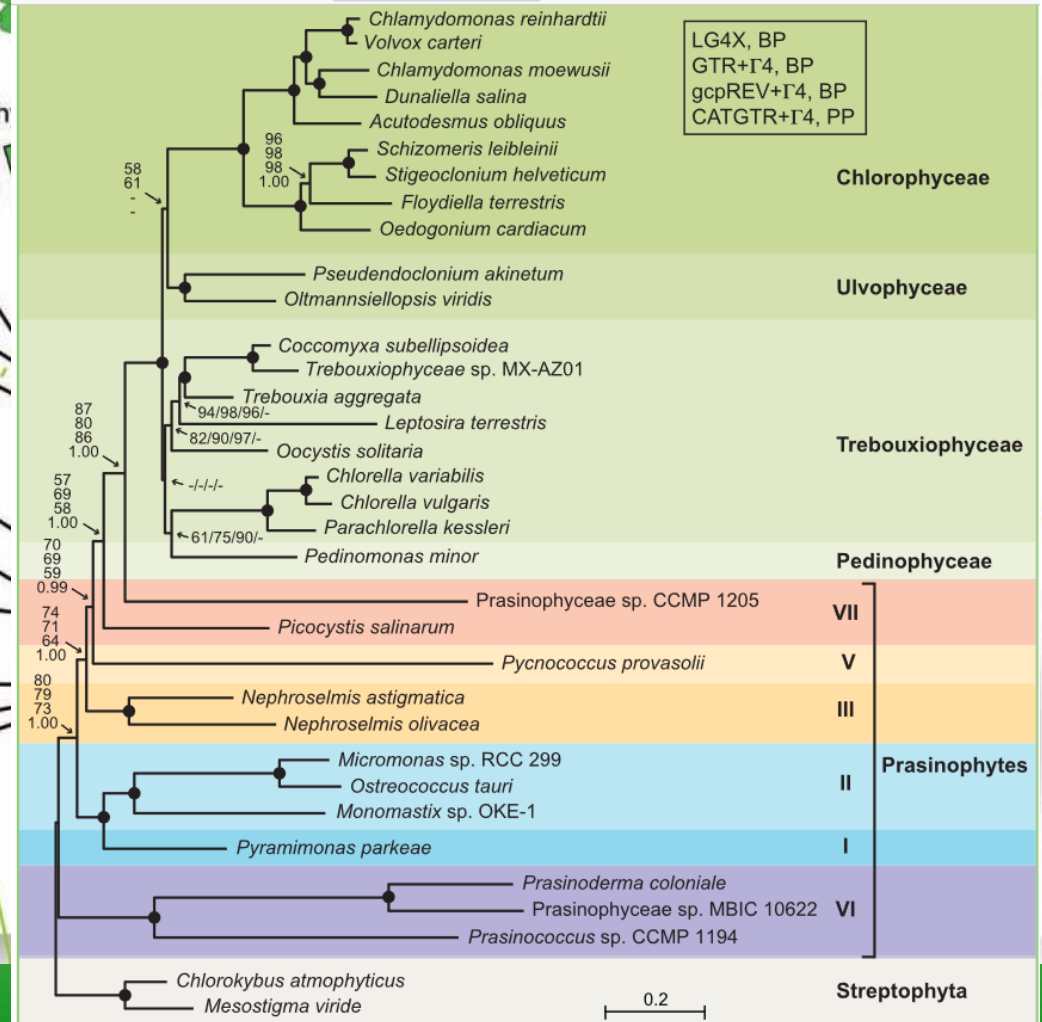


Chlorophyta



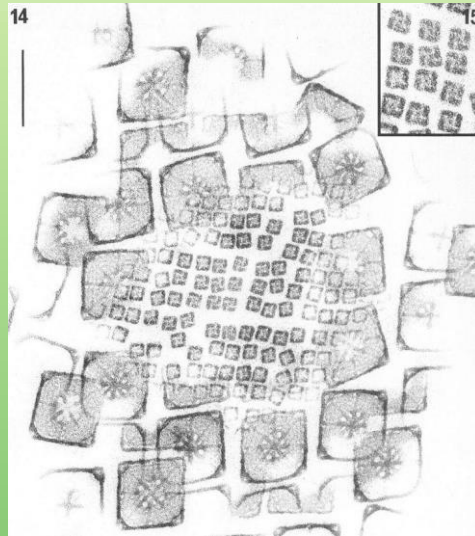
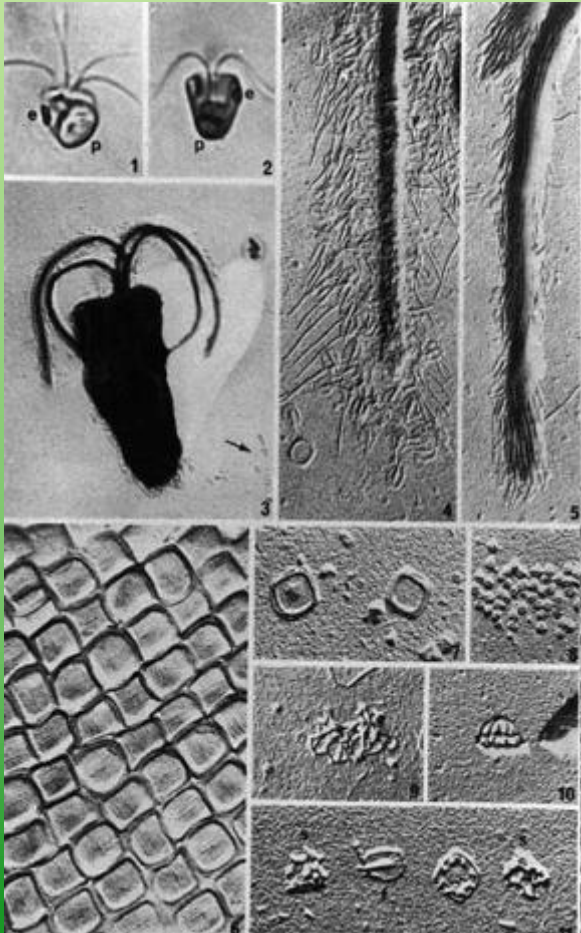
Land plants

Streptophyta



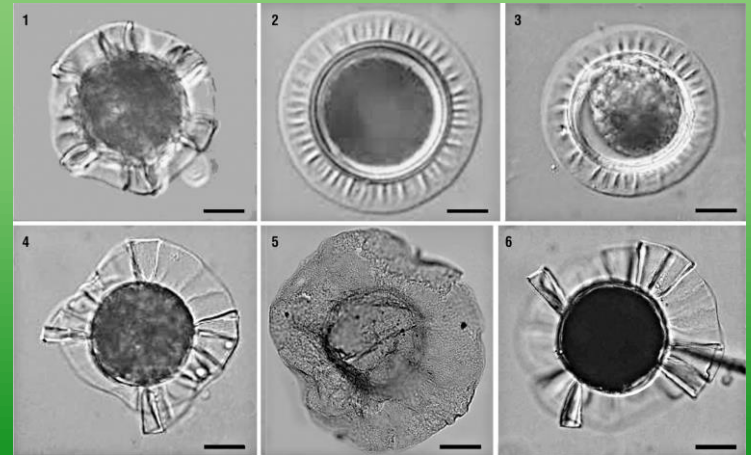
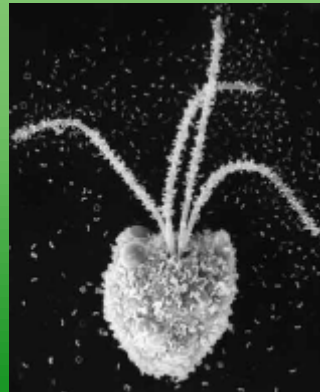
“Prasinophyceae”

marine picoplankton
organic scales

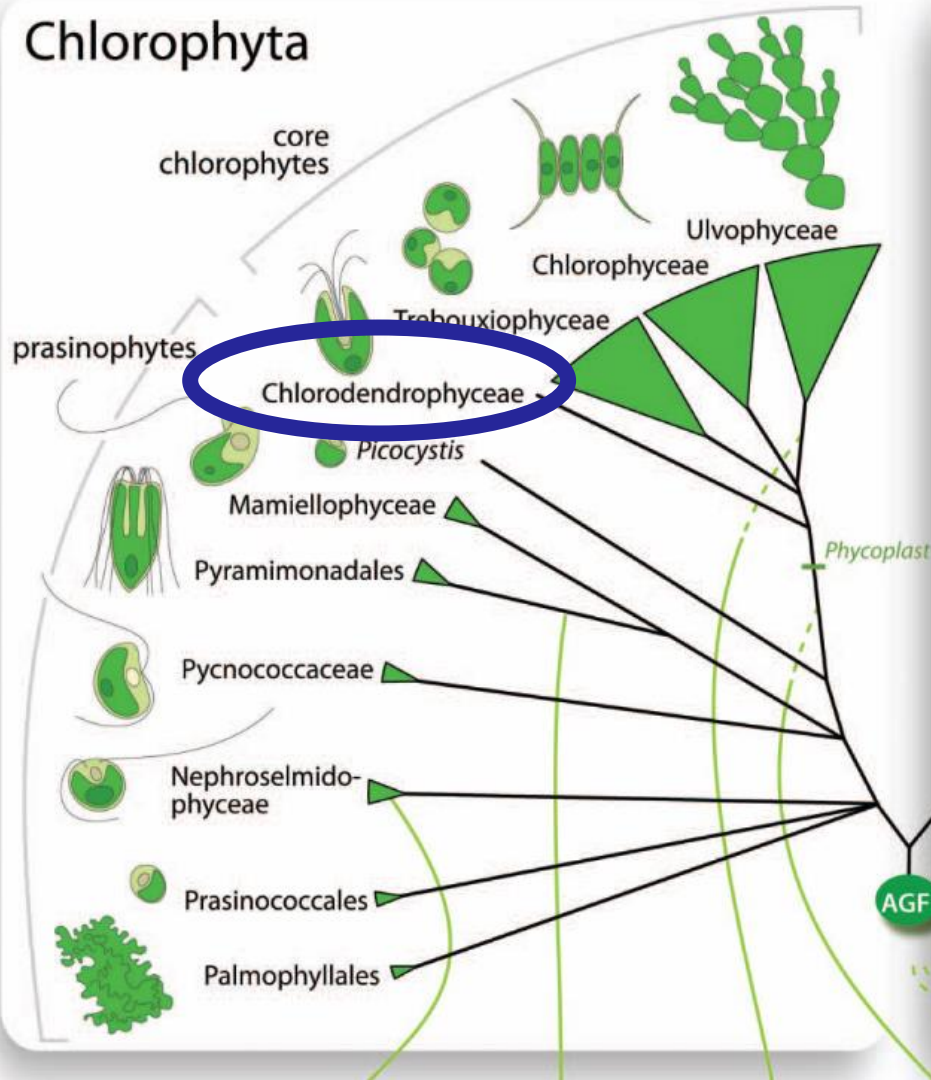


Pyramimonas

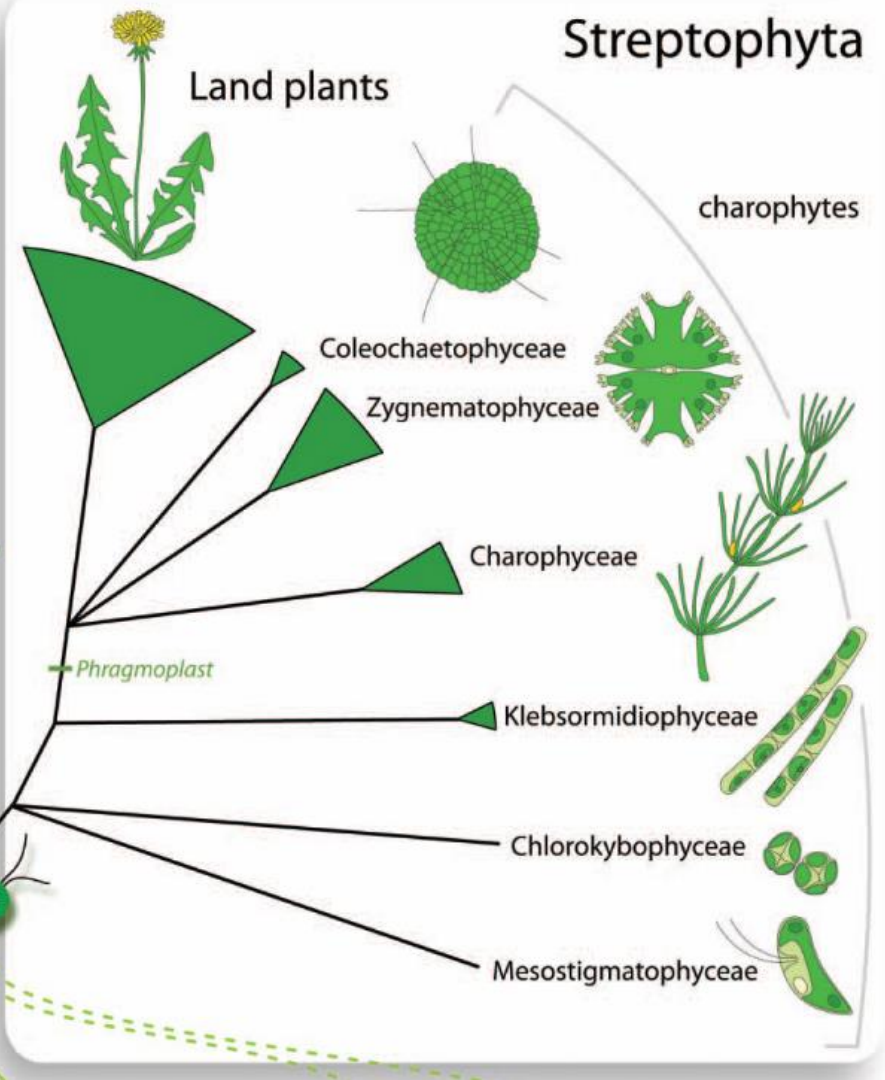
phycoma



Chlorophyta



Streptophyta



Chlorodendrophyceae

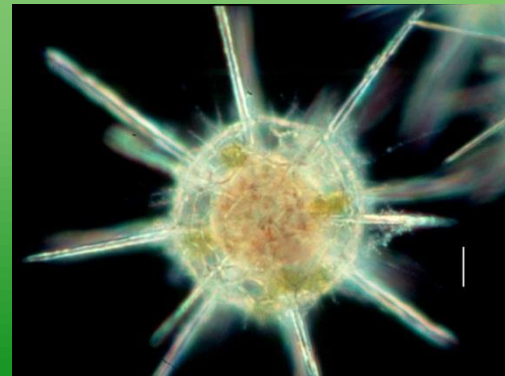
Tetraselmis



endosymbionts
of heterotrophs



Symsagittifera roscoffensis

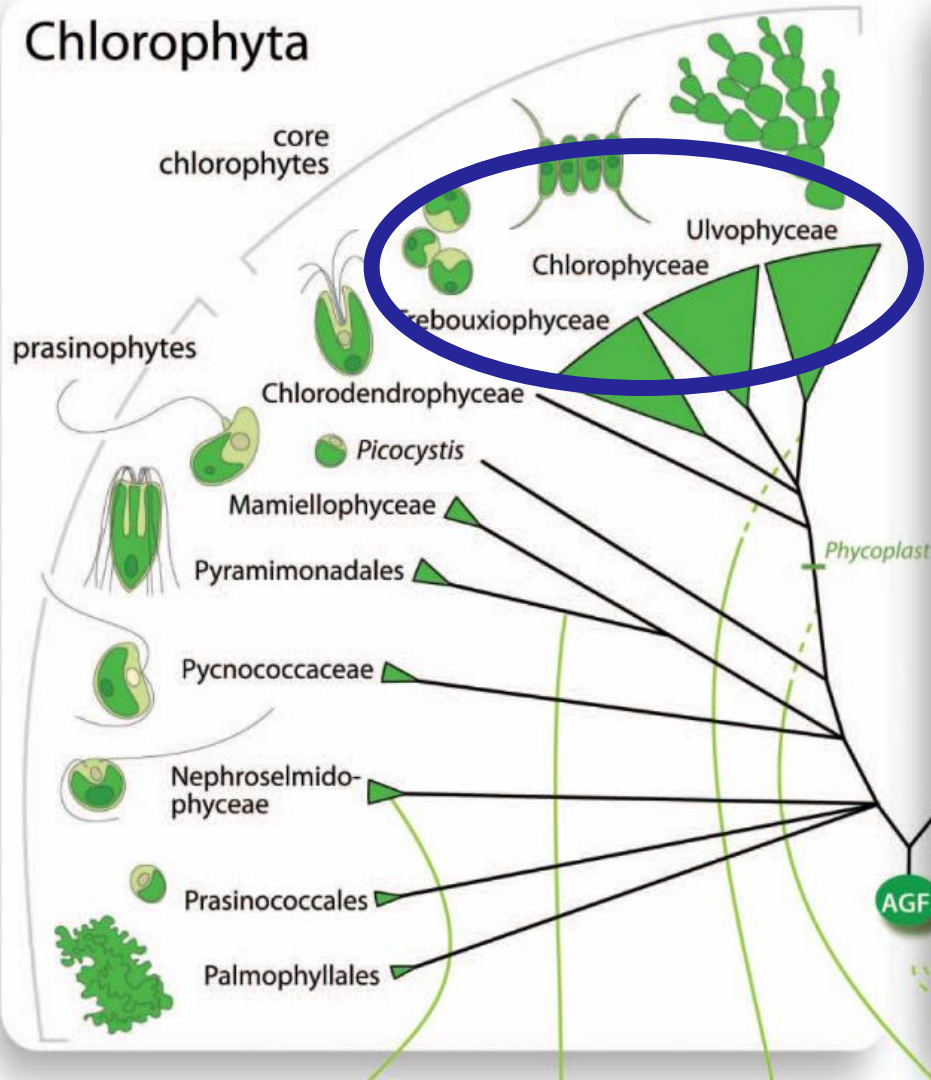


Radiolaria

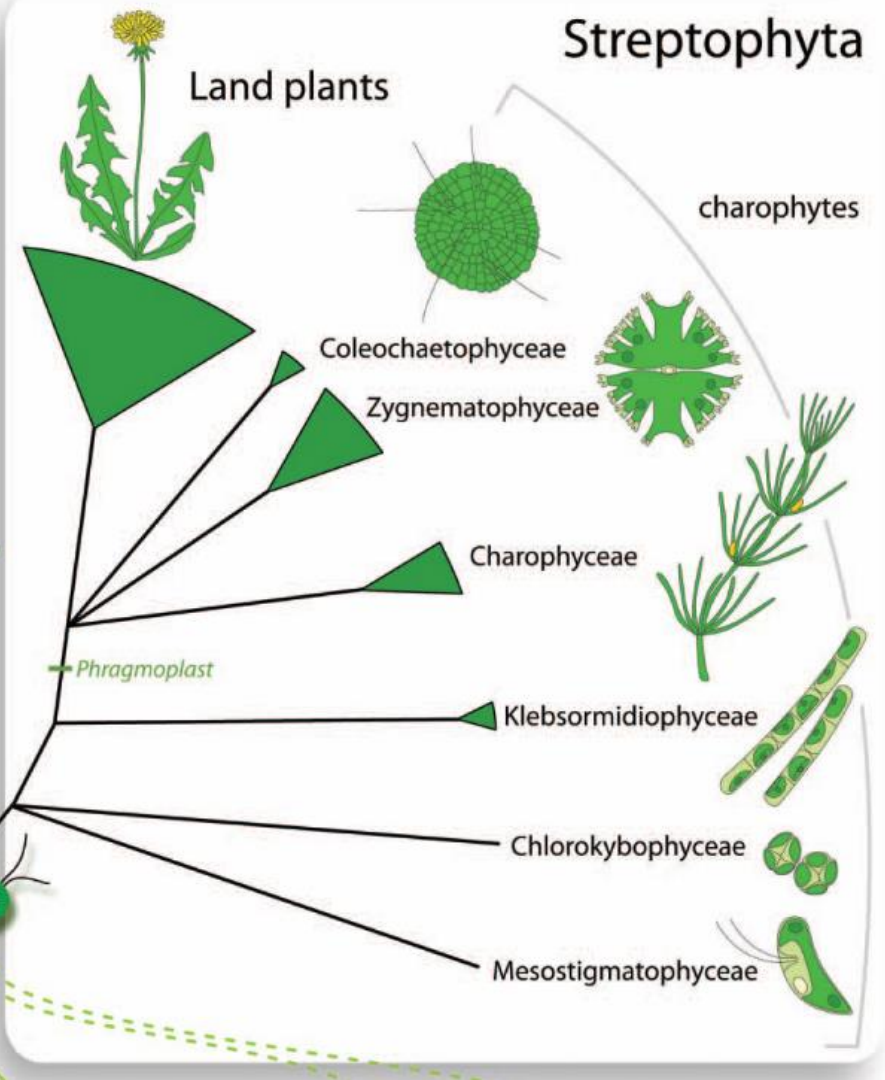


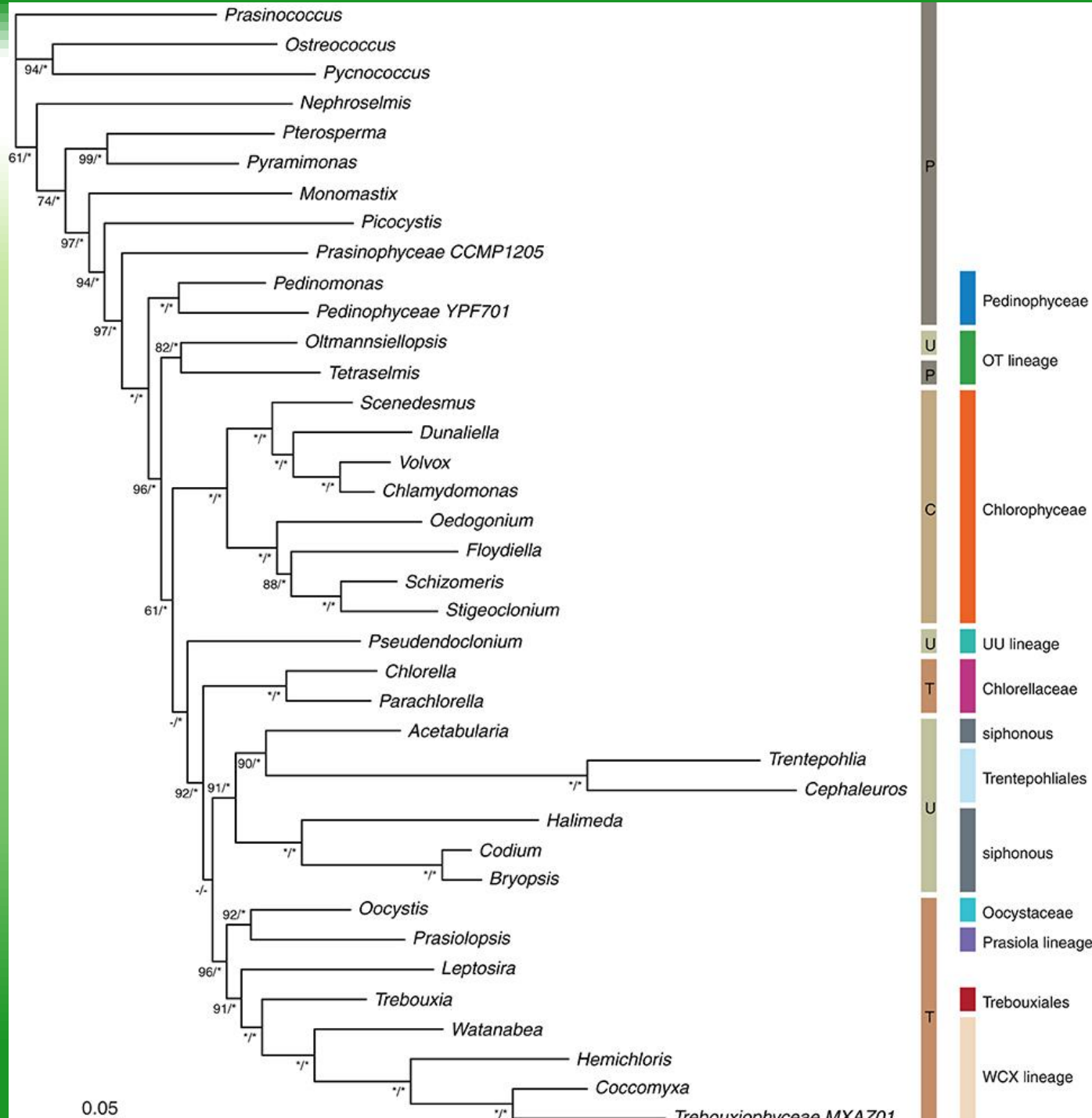
Noctiluca

Chlorophyta



Streptophyta





„UTC group“

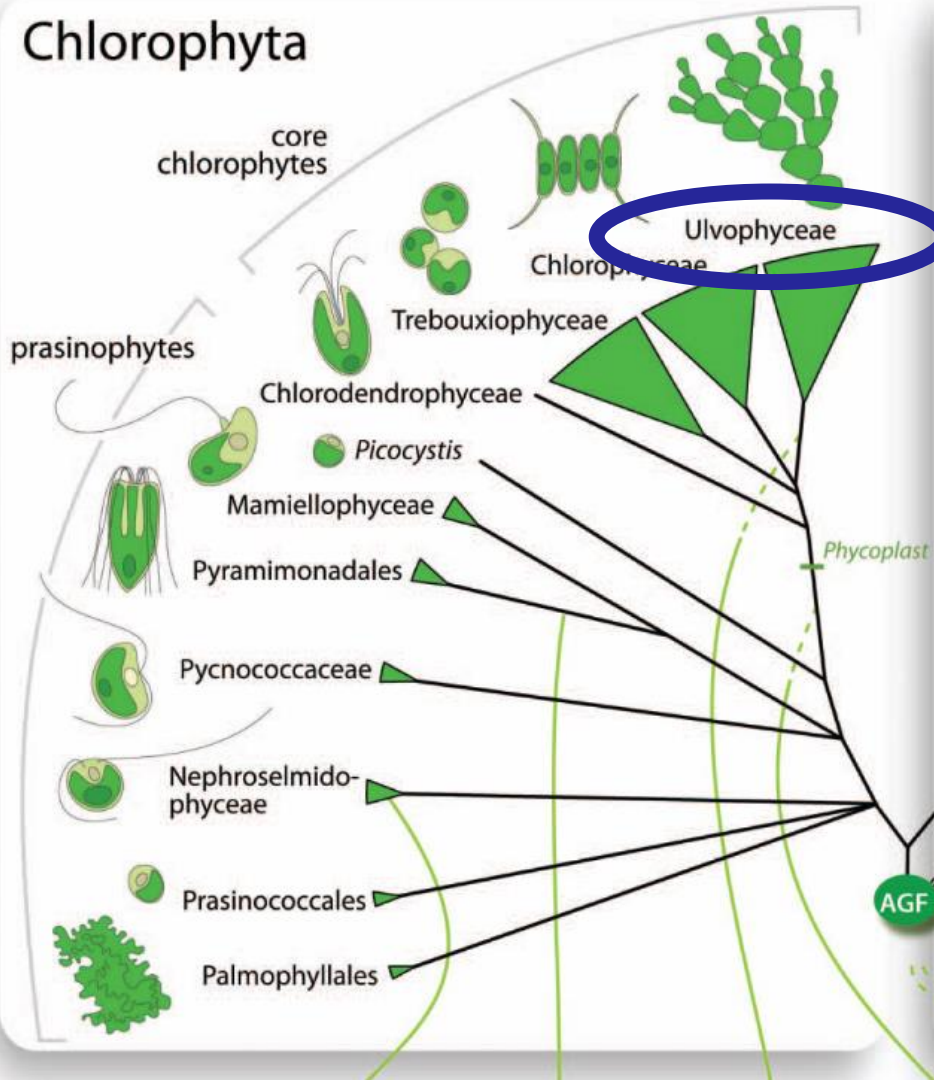
(unresolved relationships among traditional classes and orders)

Traditional orders:

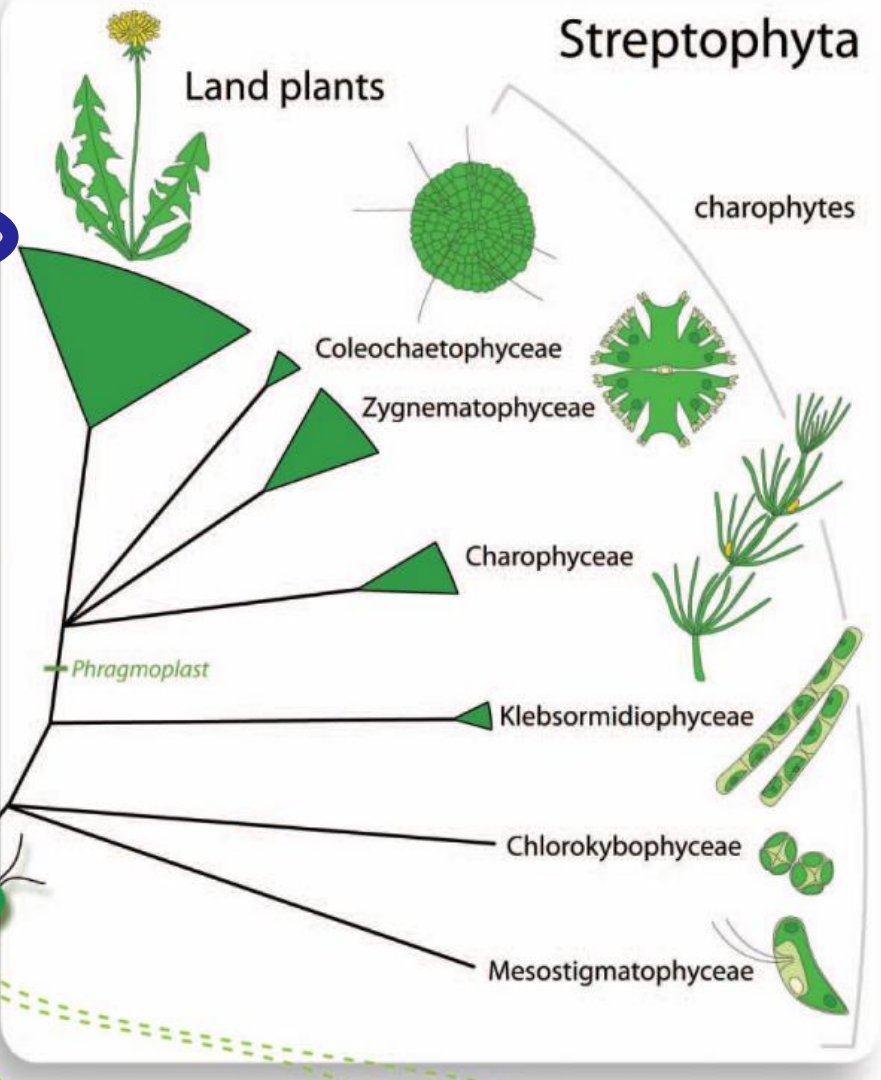
- Ulvales
- Ulotrichales
- Trentepohliales
- Cladophorales
- Siphonocladales
- Bryopsidales
- Dasycladales

Fučíková et al.
(2014)

Chlorophyta

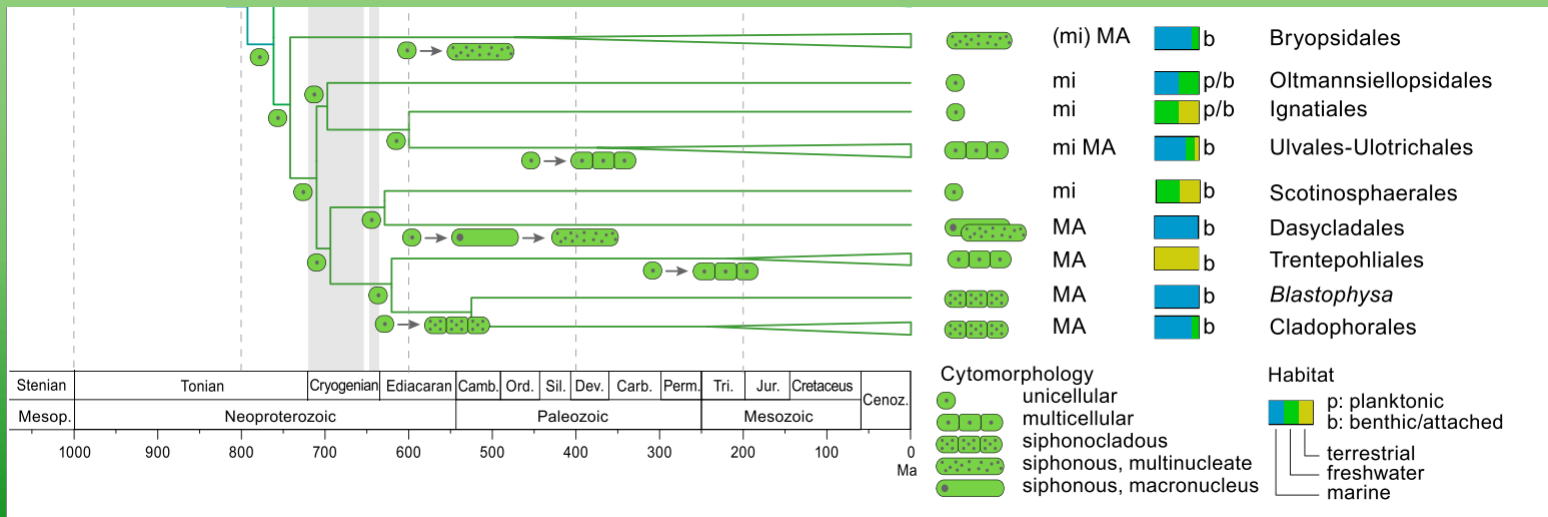
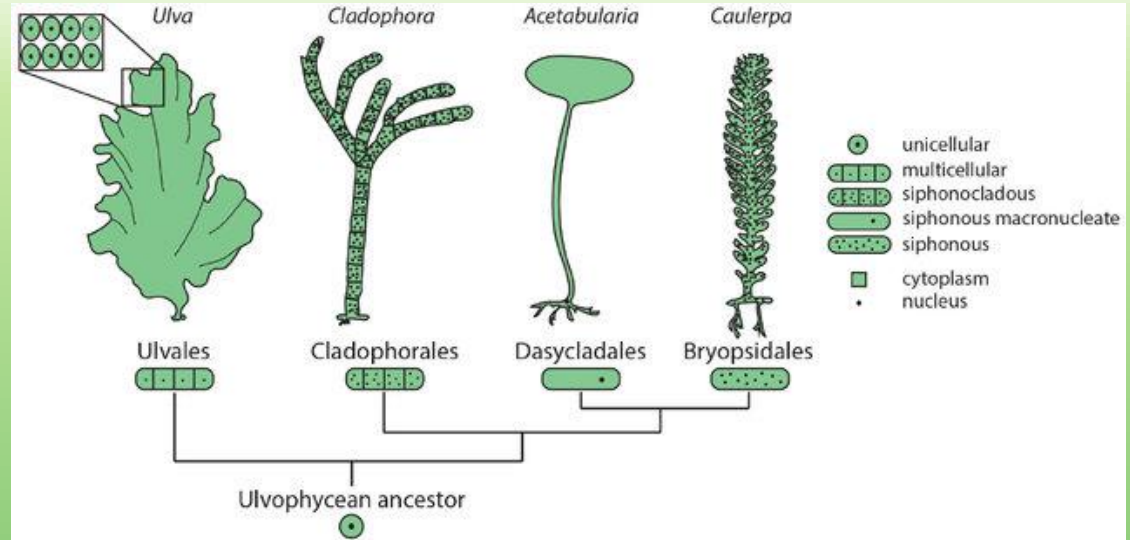


Streptophyta



Ulvophyceae

Evolution of complex, macroscopic thallus and multicellularity:

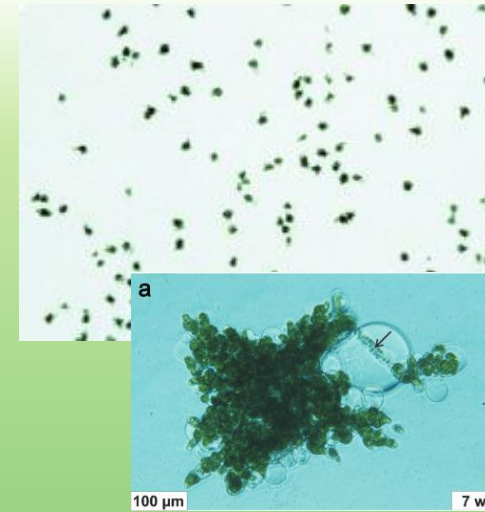


Cortona et al. (2020)

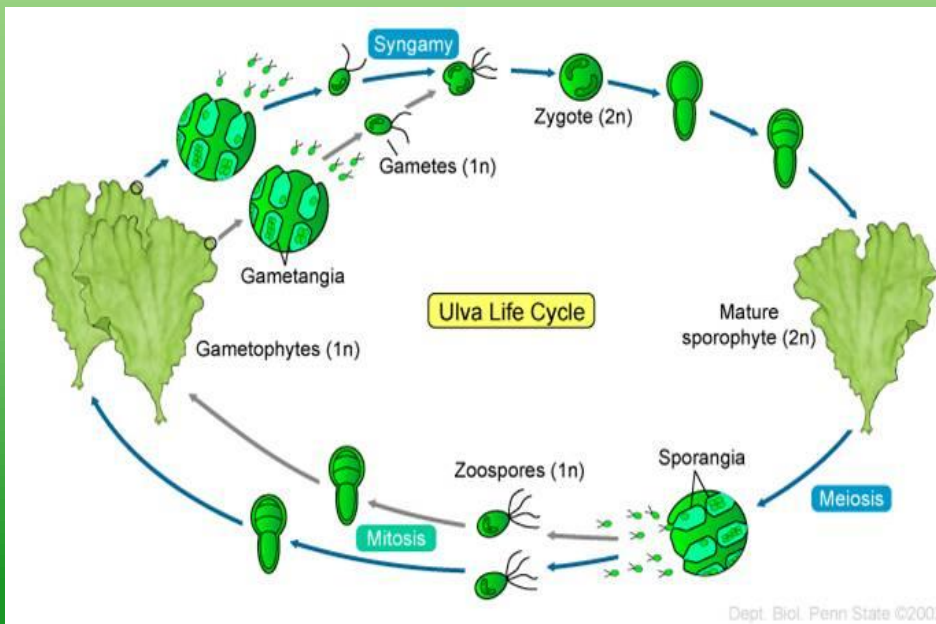
Ulvophyceae: order Ulvales



© Peter Dyrinda



Ulva = *Enteromorpha*



Axenic growth
(Spoerner et al. 2012)

Ulvophyceae: order Ulvales



U. prolifera



U. clathrata
aquacultures



Ulvophyceae: order Cladophorales

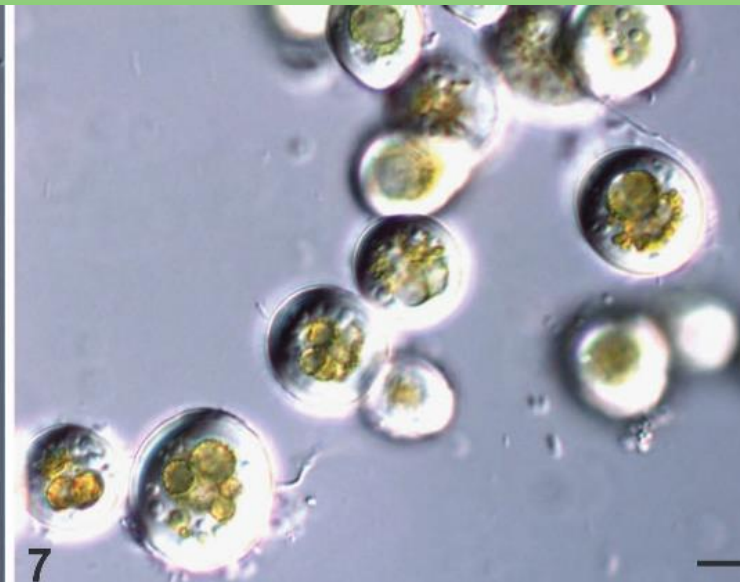


Cladophora



Ulvophyceae: order Cladophorales

Spongiochrysis hawaiiensis



Rindi et al. (2006)
Johnston et al. (2018)

Ulvophyceae: order Siphonocladales

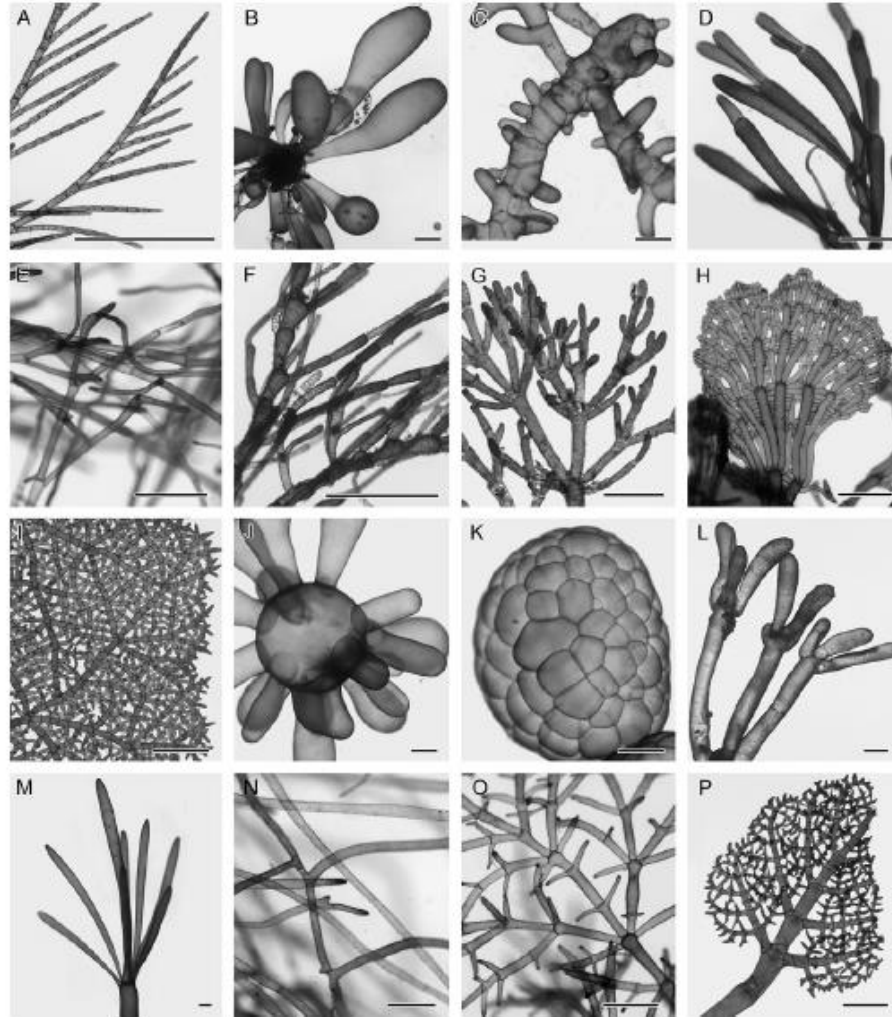


Fig. 1. Morphological variety in the Siphonocladales (A) *Cladophora sericea* (Cladophorales: outgroup), (B) *Boergesenia forbesii* (F252: clade 1), (C) *Siphonocladus pusillus* (F306: clade 1), (D) *Cladophora prolifera* (F280: grade 2), (E) *Cladophora coelothrix* (F275: grade 2), (F) *Cladophora* sp. 1 (F224: "clade" 3), (G) *Cladophora sibogae* (F61: clade 4), (H) *Anadyomene stellata* (F268, clade 5), (I) *Microdictyon kraussii* (F2: clade 5), (J) *Valoni utricularis* (F242: clade 6), (K) *Dictyosphaeria cavemosa* (F283: clade 7), (L) *Valoniopsis pachynema* (F24: clade 8), (M) *Apjohnia laetevirens* (F273: clade 9), (N) *Cladophoropsis membranacea* (F295: clade 9), (O) *Phyllodictyon orientale* (F414: clade 9), (P) *Phyllodictyon anastomosans* (F36: clade 9). Scale bars, 1 mm.

Ulvophyceae: order Bryopsidales

siphonous thallus

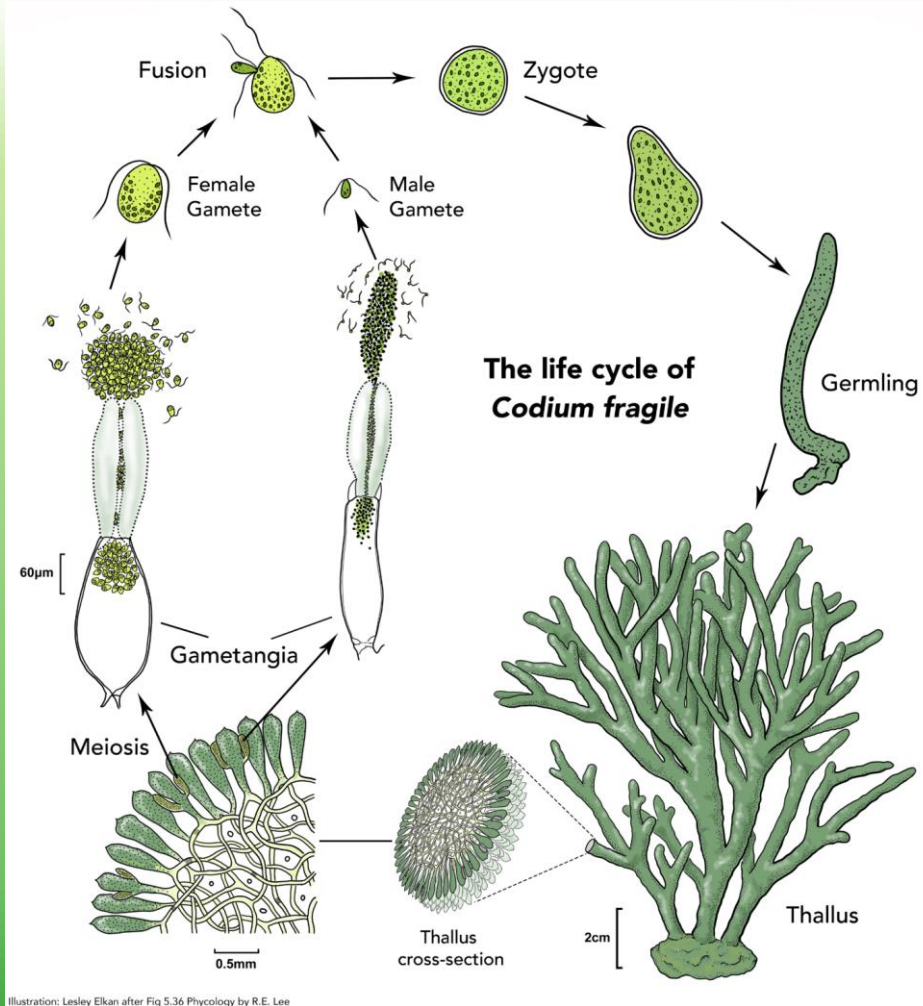


© D. Rostron

Bryopsis



Codium bursa

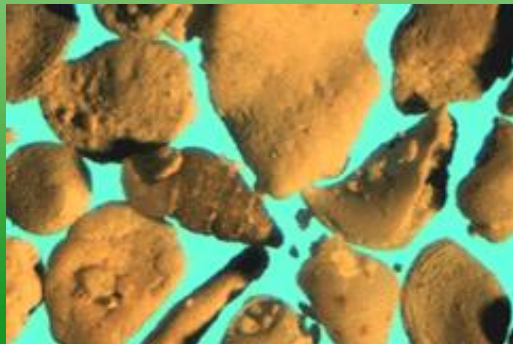
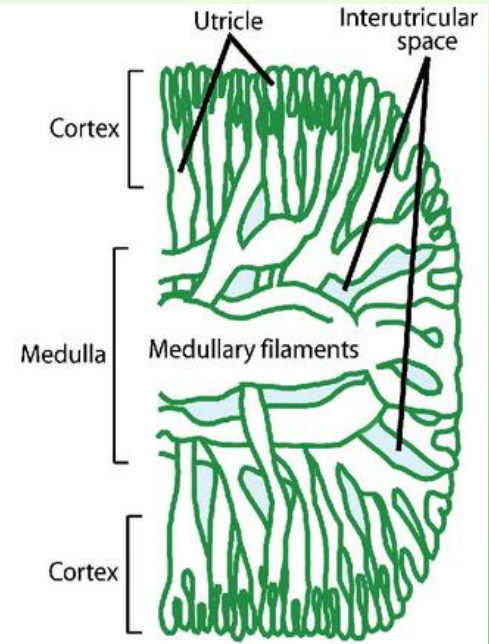


Codium fragile

“Dead man’s fingers”

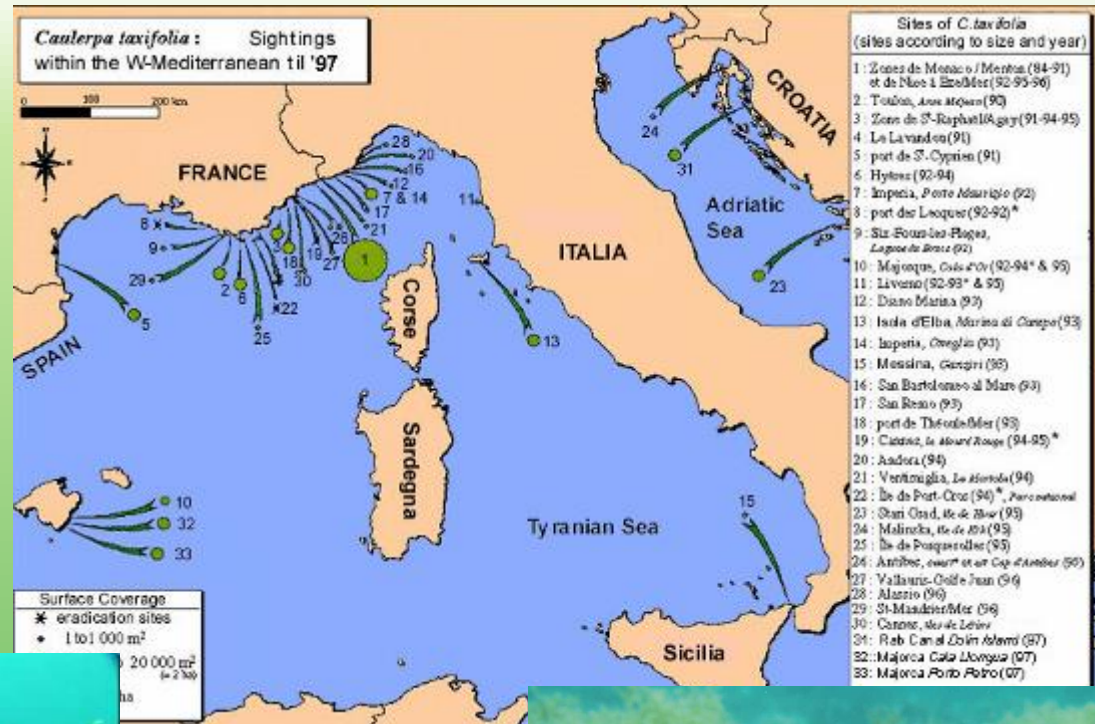
Ulvophyceae: order Bryopsidales

Halimeda



Ulvophyceae: order Bryopsidales

Caulerpa taxifolia “killer alga”

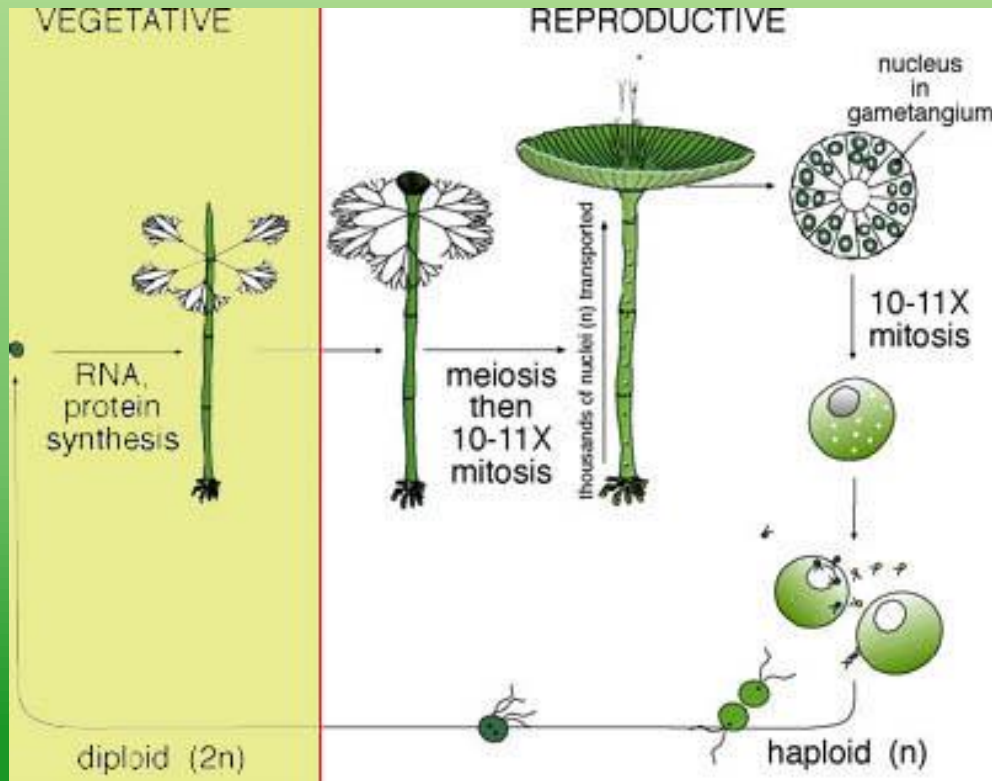
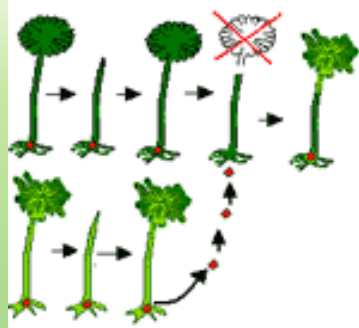


Caulerpa cylindracea “killer alga II”



Ulvophyceae: order Dasycladales

Acetabularia



Ulvophyceae: order Trentepohliales

Trentepohlia



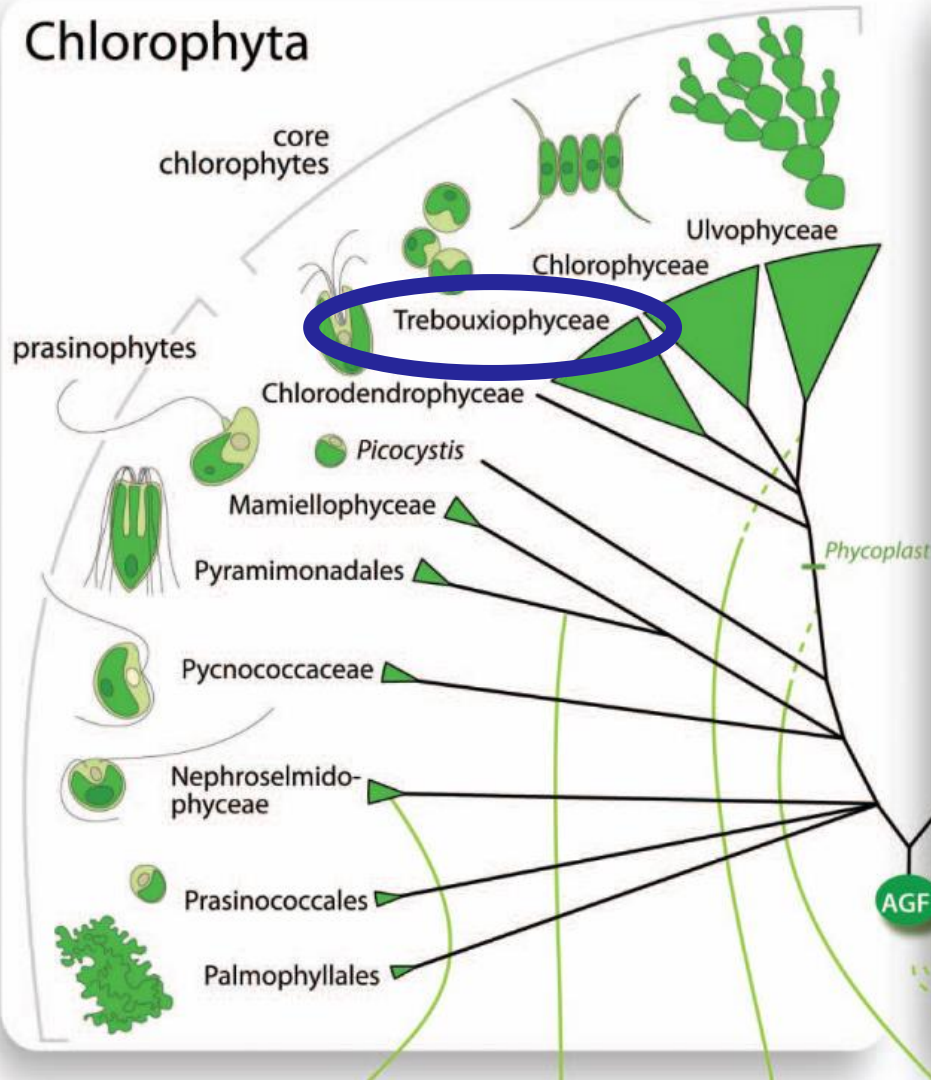
T. umbrina



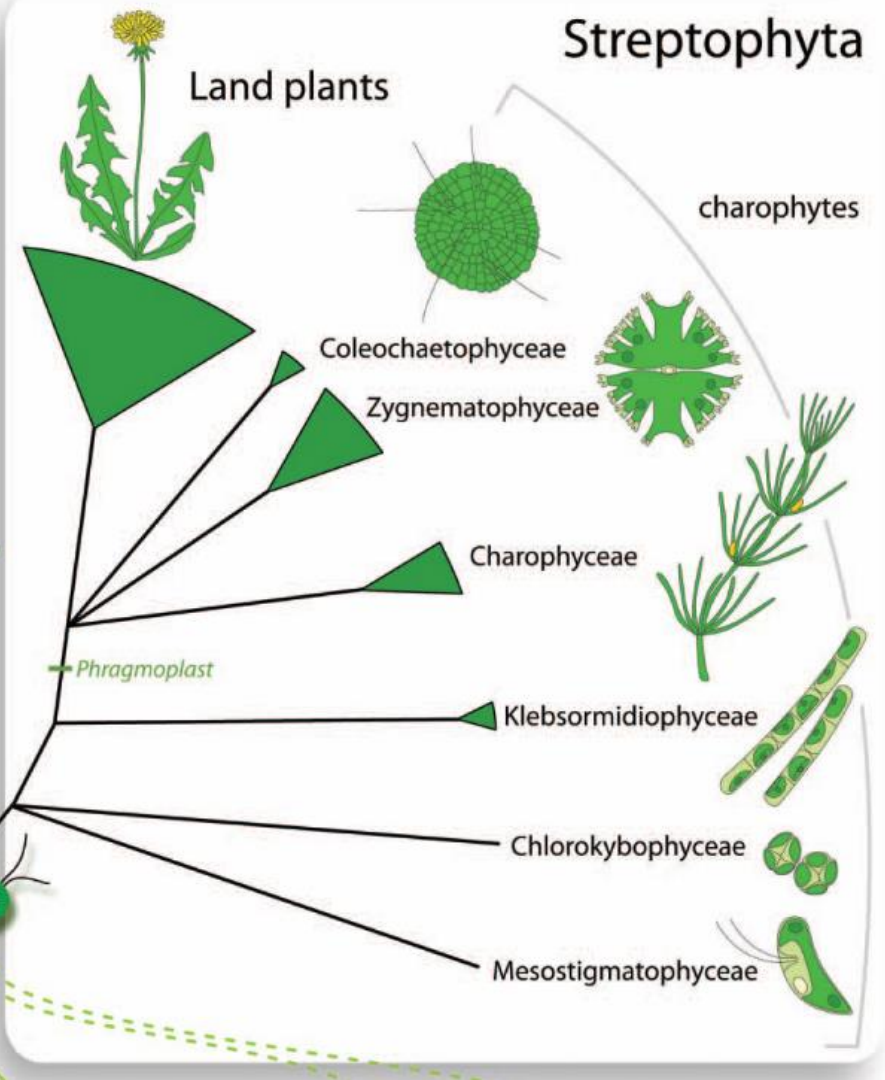
T. jolithus



Chlorophyta

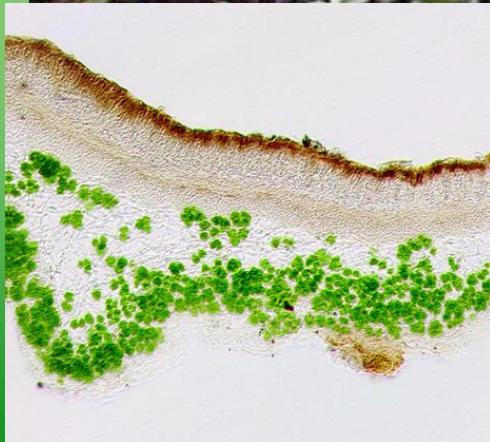


Streptophyta

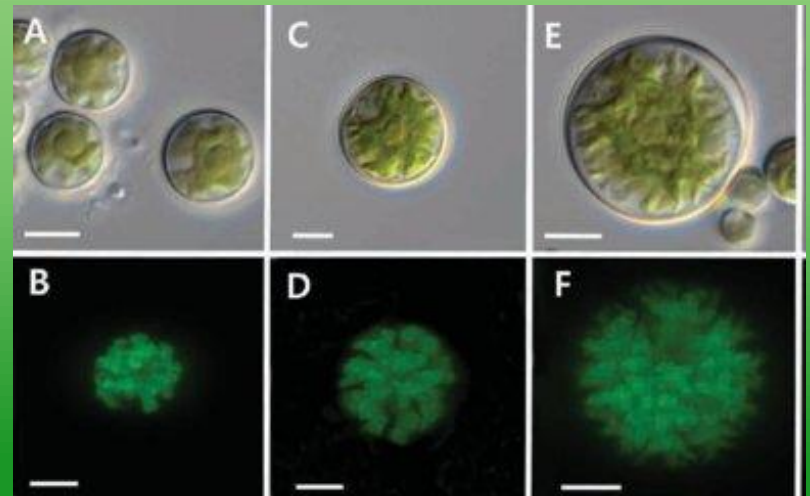


Trebouxiophyceae

Terrestrial, lichen photobionts

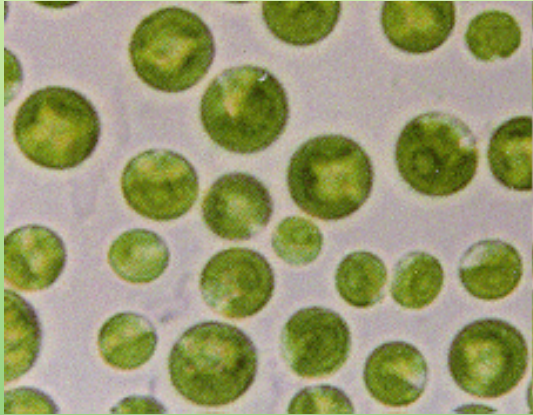


Asterochloris



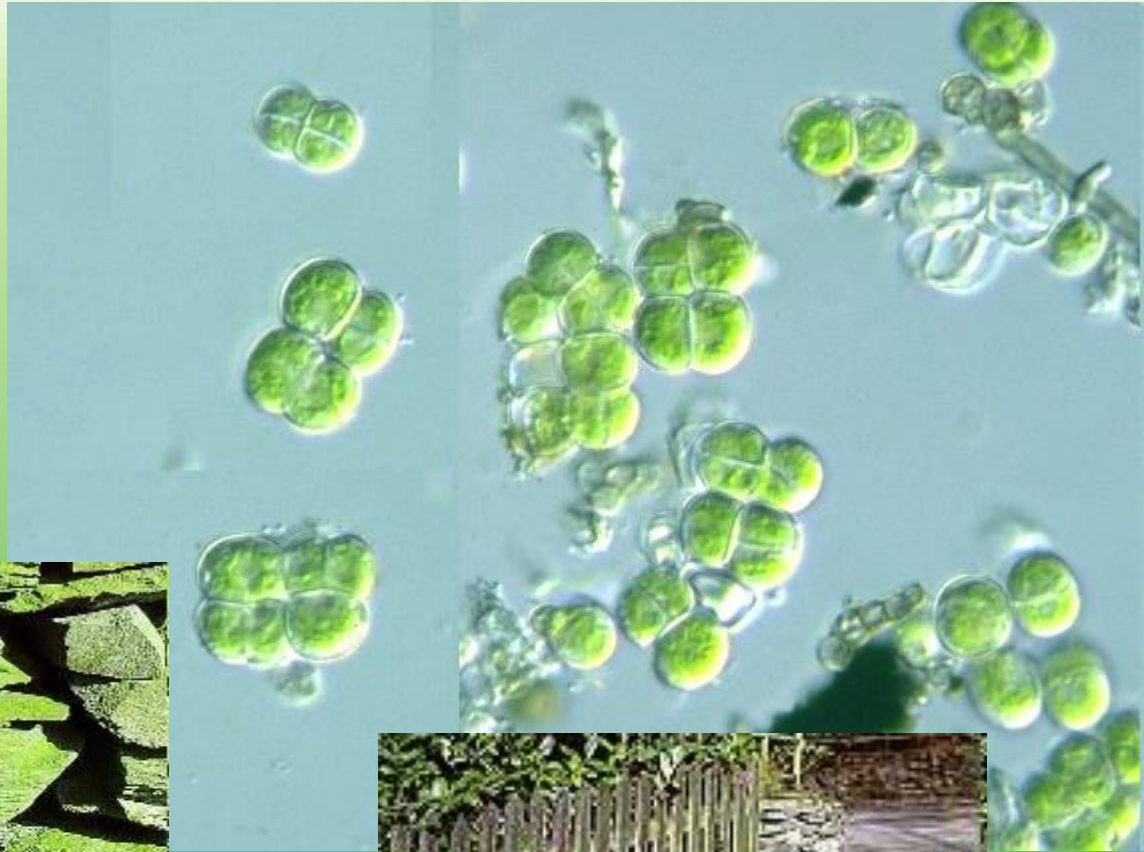
Trebouxiophyceae

Chlorella



Trebouxiophyceae

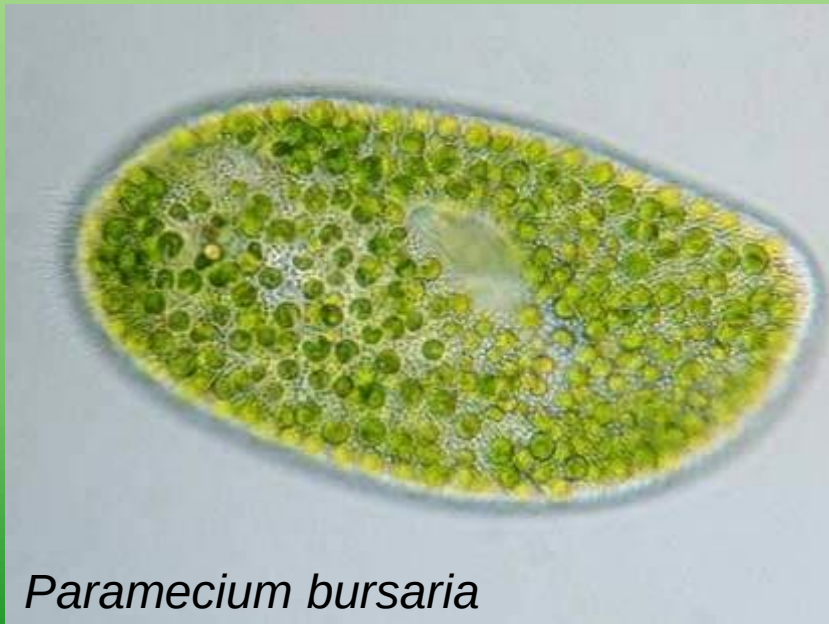
Apatococcus



Trebouxiophyceae

Endosymbiotic *Chlorella*

- polyps (*Chlorohydra*)
- freshwater sponges
- protista (*Paramecium*)



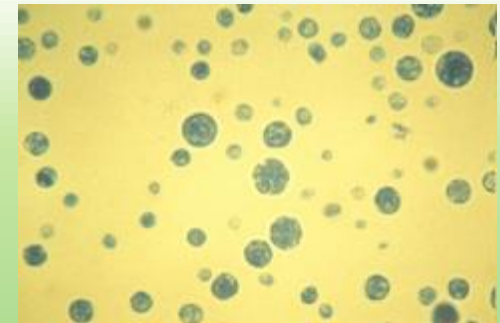
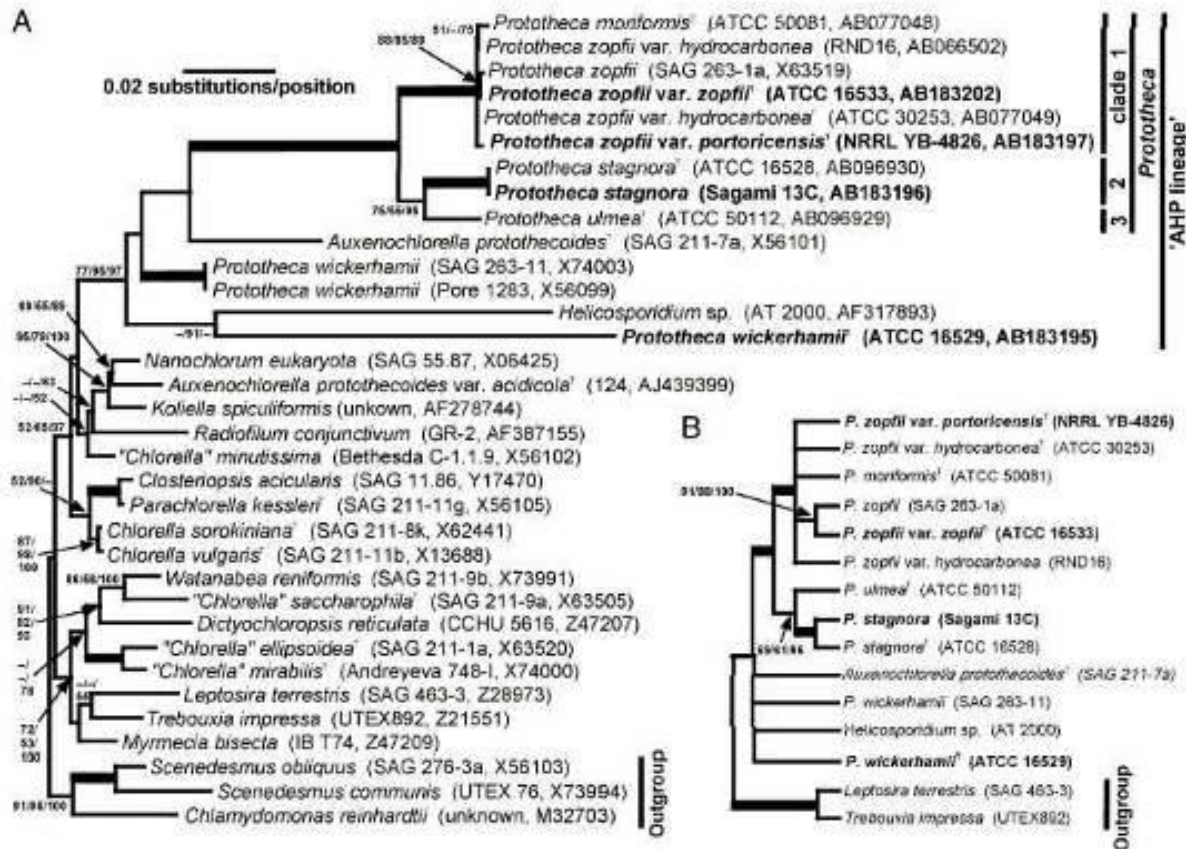
Paramecium bursaria



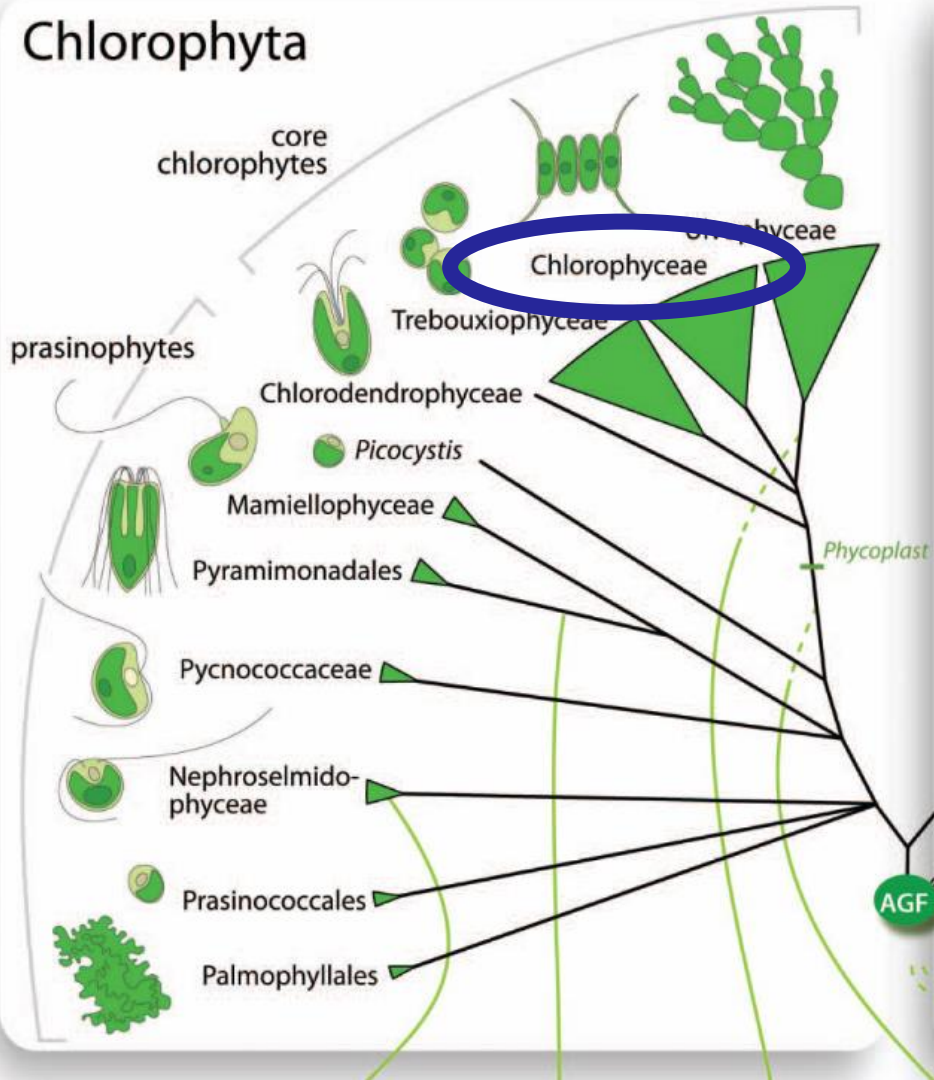
Chlorohydra viridissima

Trebouxiophyceae

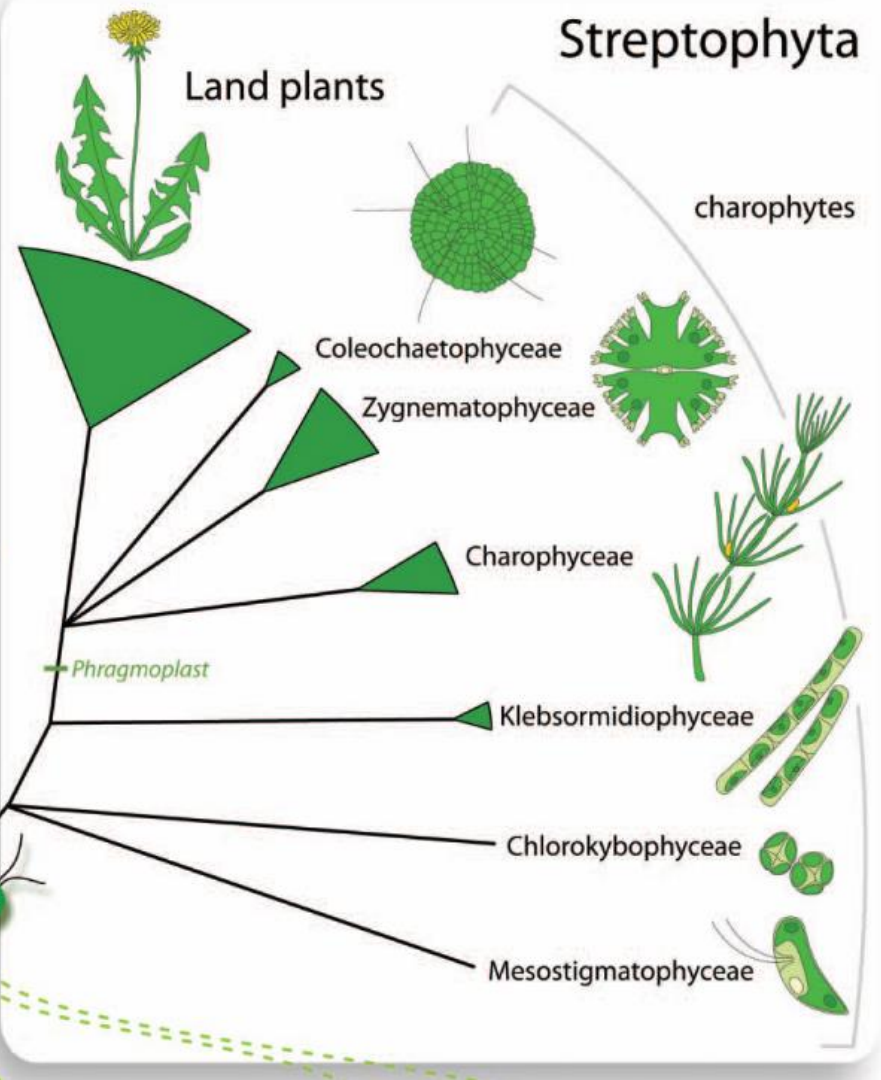
Prototheca – pathogenous



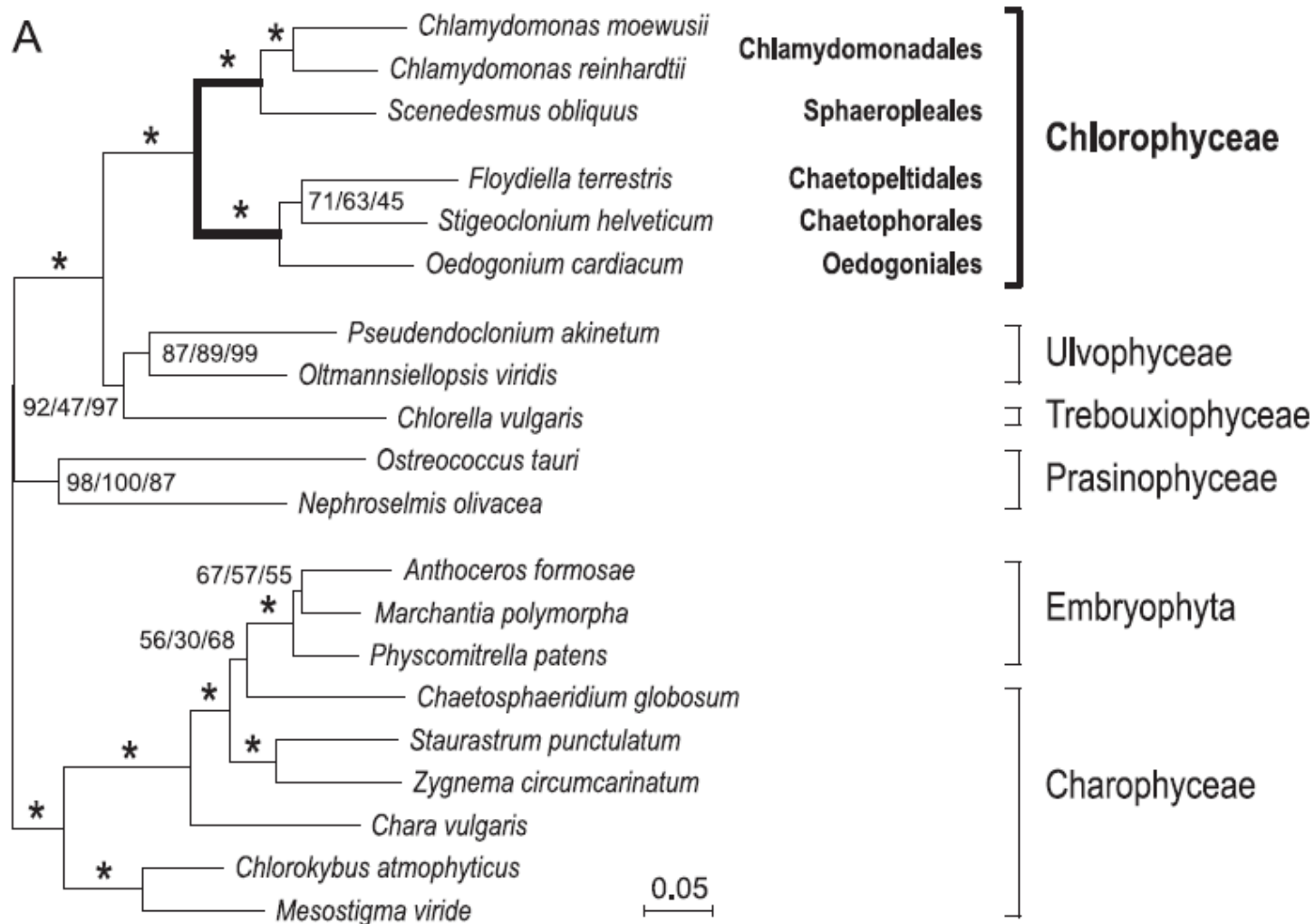
Chlorophyta



Streptophyta

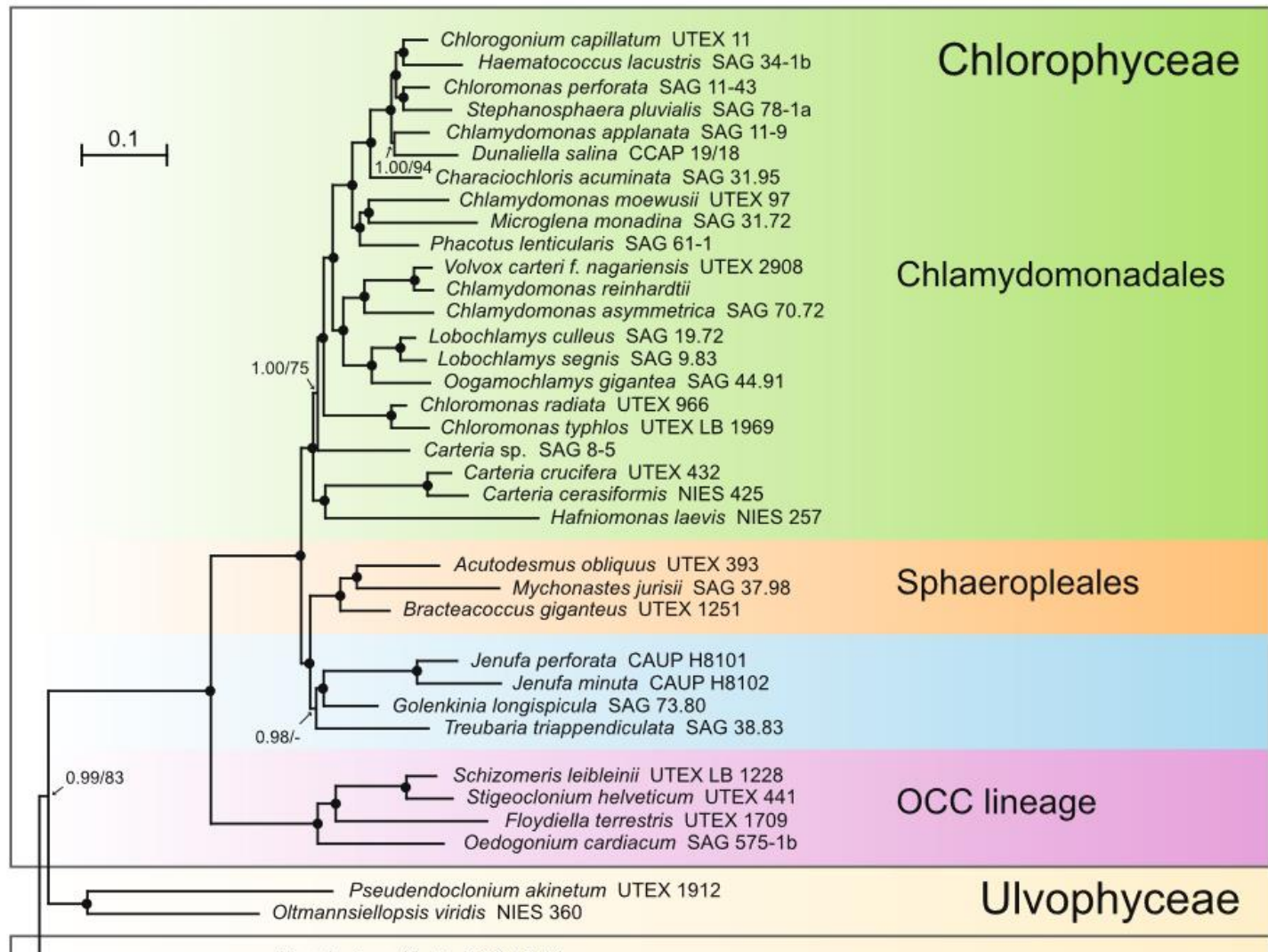


Chlorophyceae



Relationships among the five monophyletic groups of the Chlorophyceae as inferred from 44 chloroplast protein-coding genes of 11 chlorophytes and nine streptophytes. (A) Best maximum-likelihood (Turmel et al. 2008)

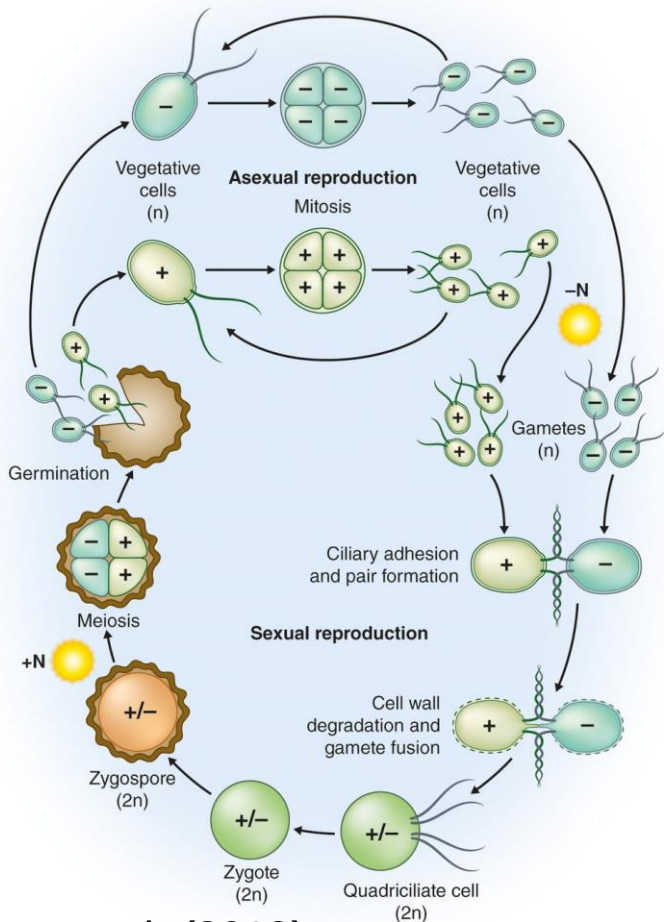
Chlorophyceae



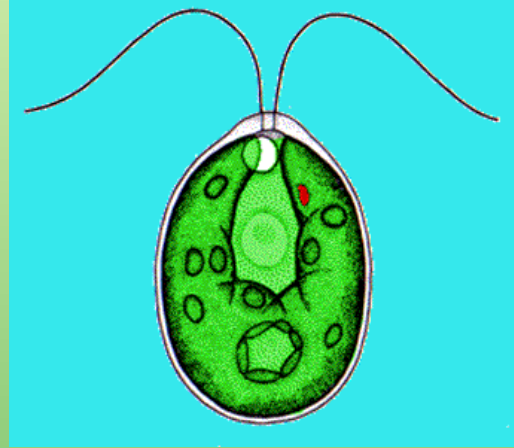
Lemieux et al. (2015)

Chlorophyceae: order Chlamydomonadales

Chlamydomonas reinhardtii



Sasso et al. (2018)

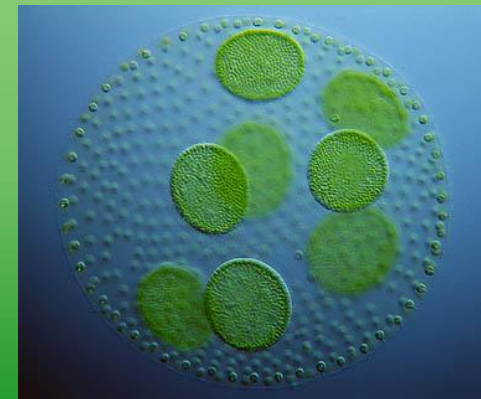
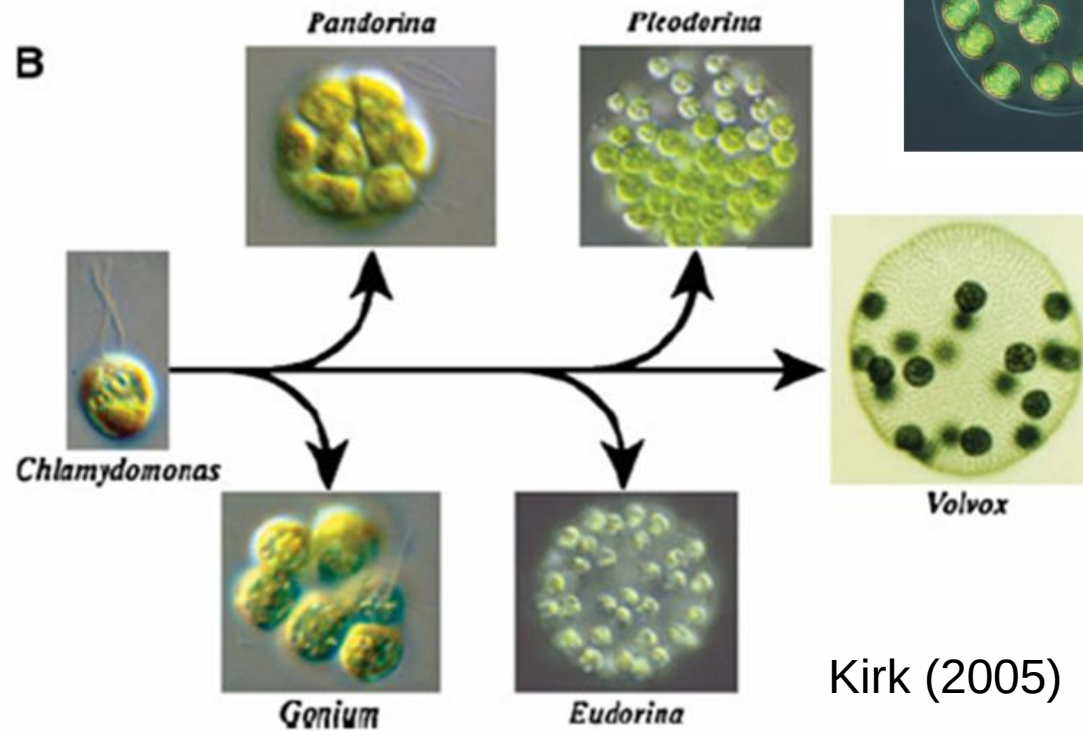
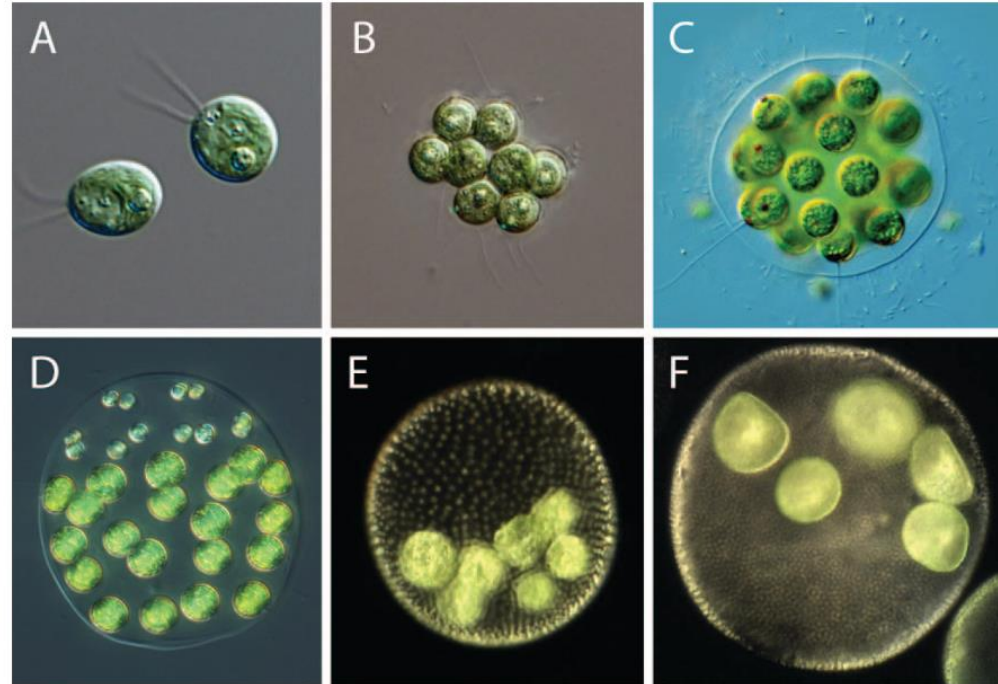


*Chlamydomonas
nivalis*



Chlorophyceae: order Chlamydomonadales

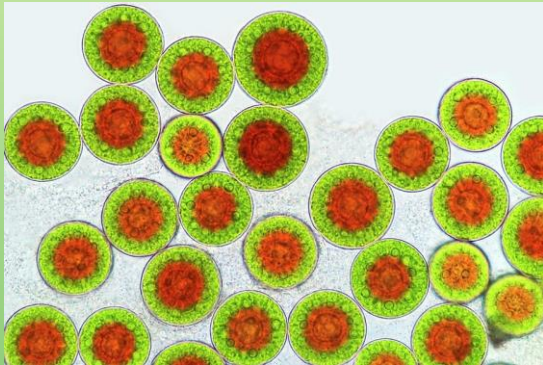
Evolution of multicellularity



Volvox globator

Chlorophyceae: order Chlamydomonadales

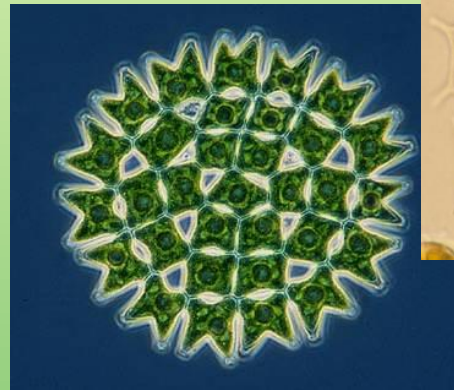
Haematococcus



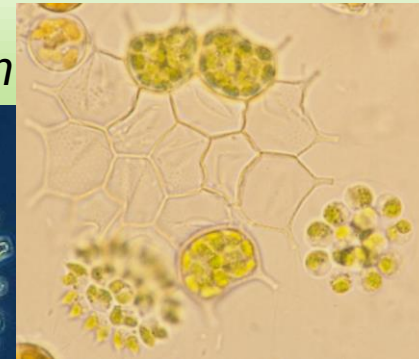
Dunaliella



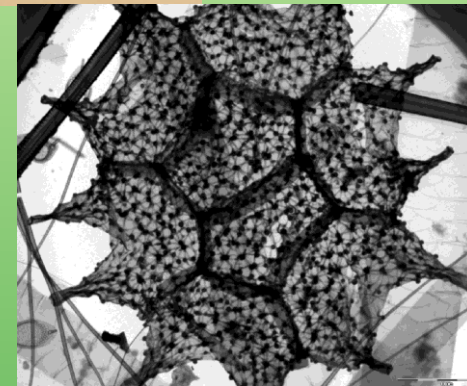
Chlorophyceae: order Sphaeropleales



Pediatrum



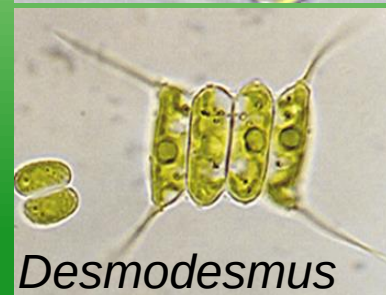
coenobium



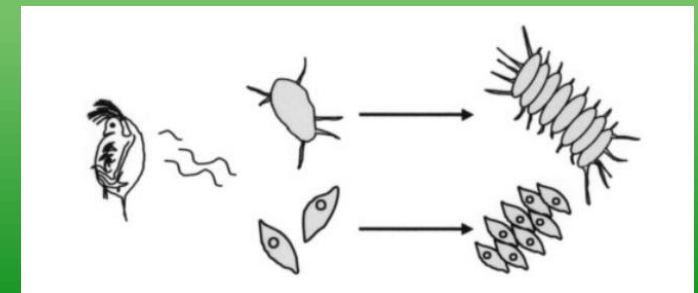
algaenan



Scenedesmus



Desmodesmus



Lüring (2003)

