

Plankton

holoplankton
meroplankton
tycoplankton (pseudo-plankton)

neritic
pelagic

Phytoplankton
Zooplankton
Bacterioplankton

Macro-	5 - 1 mm
Meso-	1mm - 200 μm
Micro-	200 - 20 μm
Nano-	20 - 2 μm
Pico-	2 - 0.2 μm

Species composition and abundance

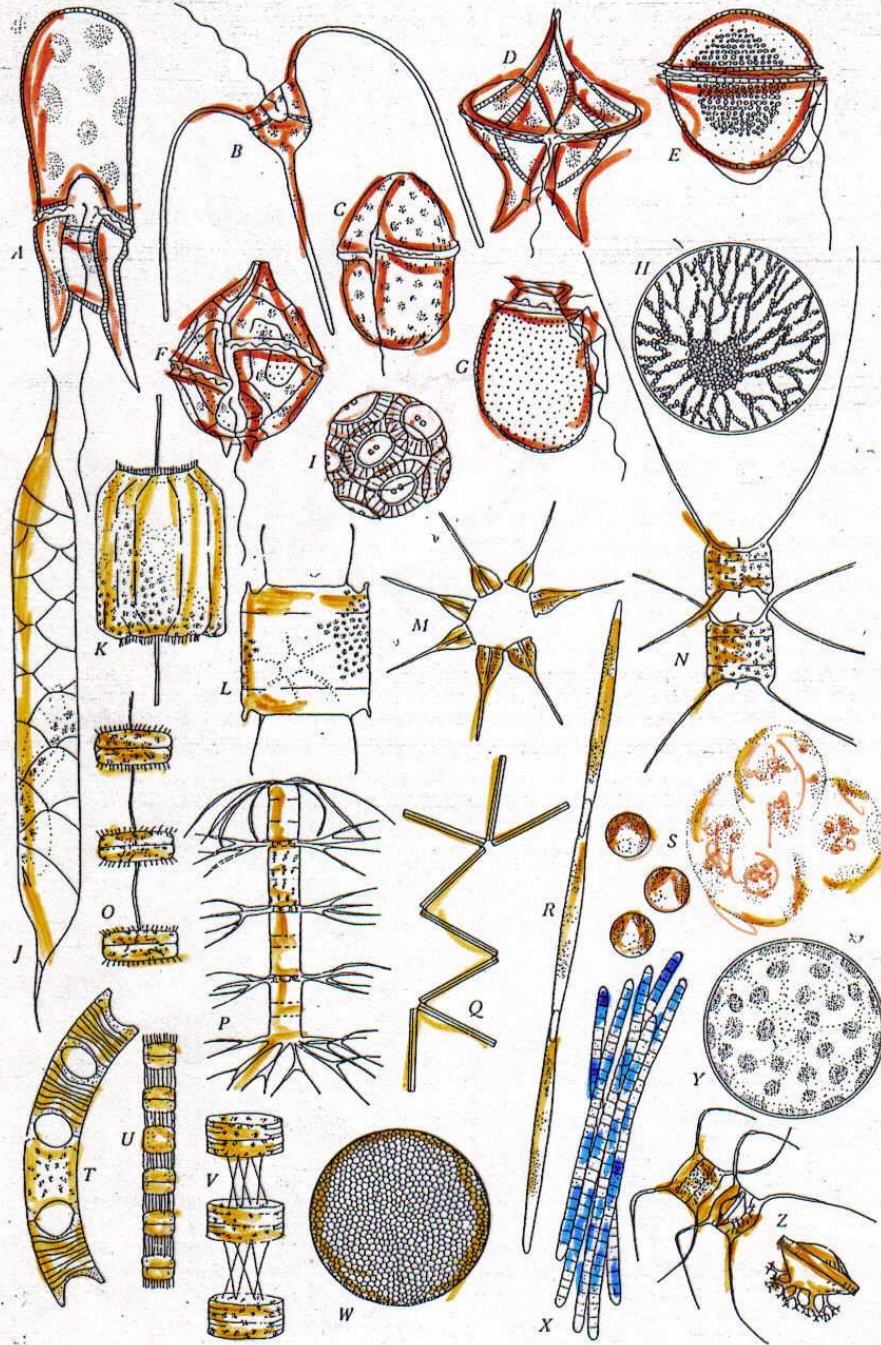
Morphological adaptation
Physiological adaptation

Horizontal and
vertical distribution
Blooms

Periodicity in
polar, temperate
and tropical areas

Fig. 10. Marine phytoplankton – some common microscopic genera. A, B, *Ceratium*; C, *Gymnodinium*; D, *Peridinium*; E, *Phaeocystis*; F, *Gonyaulax*; G, *Dinophysis*; H, *Pyrocystis*; I, *Coccolithus*; J, *Rhizosolenia*; K, *Ditylum*; L, *Biddulphia*; M, *Asterionella*; N, *Chaetoceros*; O,

Thalassiosira; P, *Bacteriastrum*; Q, *Thalassiothrix*; R, *Nitzschia*; S, *Phaeocystis*; T, *Eucampia*; U, *Skeletonema*; V, *Coscinosira*; W, *Coscinodiscus*; X, *Trichodesmium*; Y, *Halosphaera*; Z, *Chaetoceros* (filament with spore in one cell and spore isolated).



Marine Phytoplankton

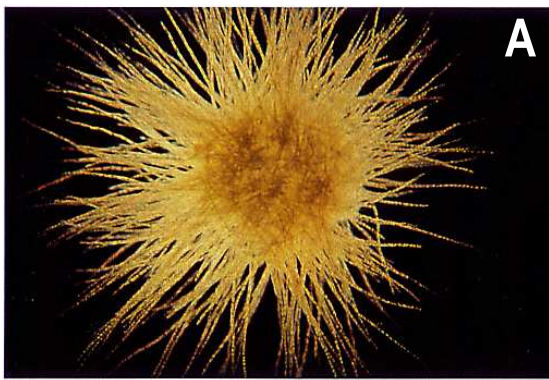
~50% of global CO₂ fixation



Cyanobacteria
Bacillariophyta
Dinophyta
Haptophyta

Prochlorococcus

Synechococcus



a



b

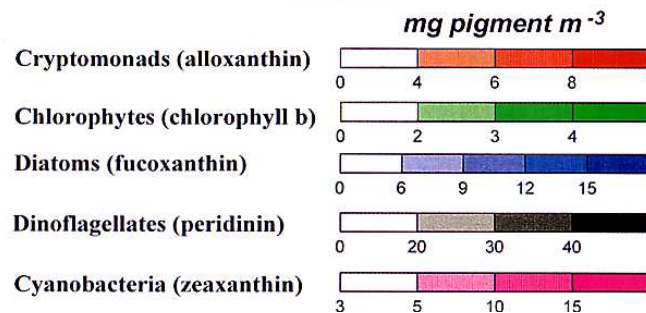
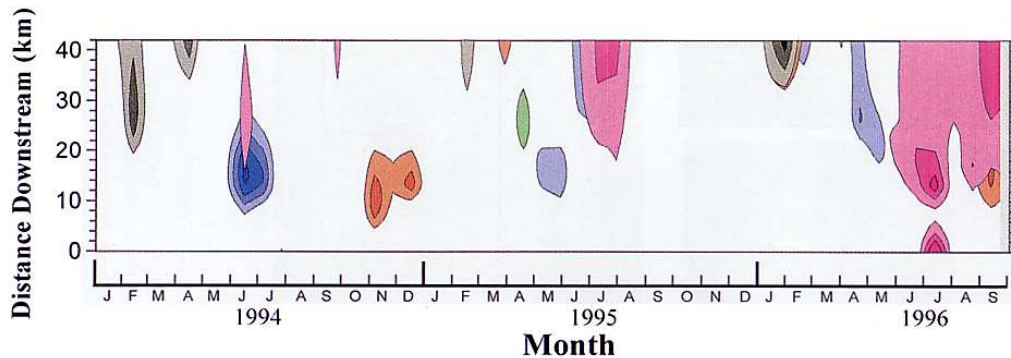
Marine cyanobacteria:

Synechococcus (C)

Prochlorococcus (D)

Trichodesmium (A, B)

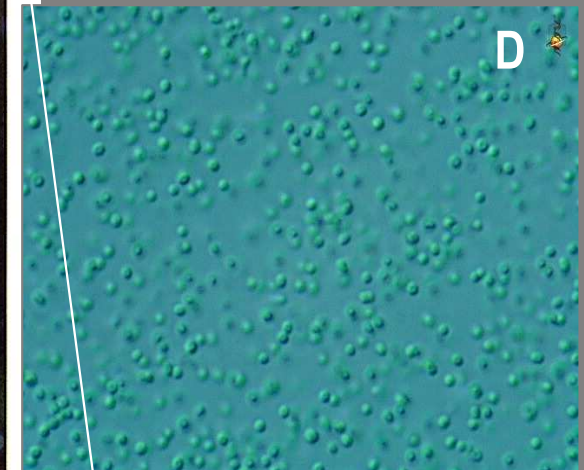
Richelia in Diatoms (E)



c



d



D



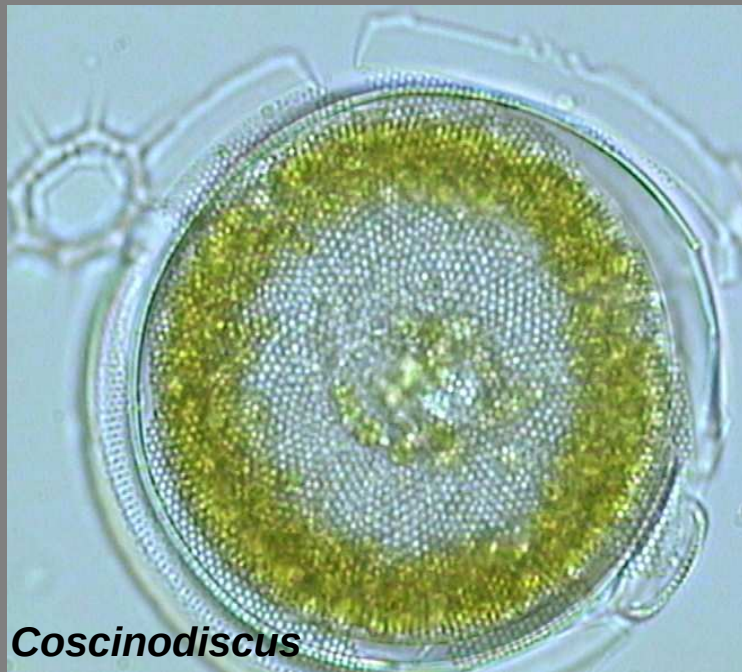
E

10 Cyanobacteria in the sea. a, b *Trichodesmium thiebautii* from blooms in the western Atlantic Ocean: a radial 'puff' aggregate; b fusiform tuft aggregates from site 26 km off coast of North Carolina. c Contour plot of spatio-temporal distribution of plankton blooms along freshwater (0 km) to estuarine (41 km) salinity gradient in Neuse River Estuary, N. Carolina. Data based on biweekly sampling at 8 stations; carotenoid pigments quantified by HPLC.

d Marine *Synechococcus* tagged with fluorescently labelled viruses. *Synechococcus* strain BBC1 has been added to a natural marine microbial community and tagged with cyanophages labelled with the blue fluorescent strain POPO-1. They appear pink, surrounded by a blue halo. Untagged *Synechococcus* spp. fluoresce red or yellow, while a heterotrophic bacterium has been tagged with a virus that has been labelled with a green fluorescent stain

(A, B, E: N_2 fixation)

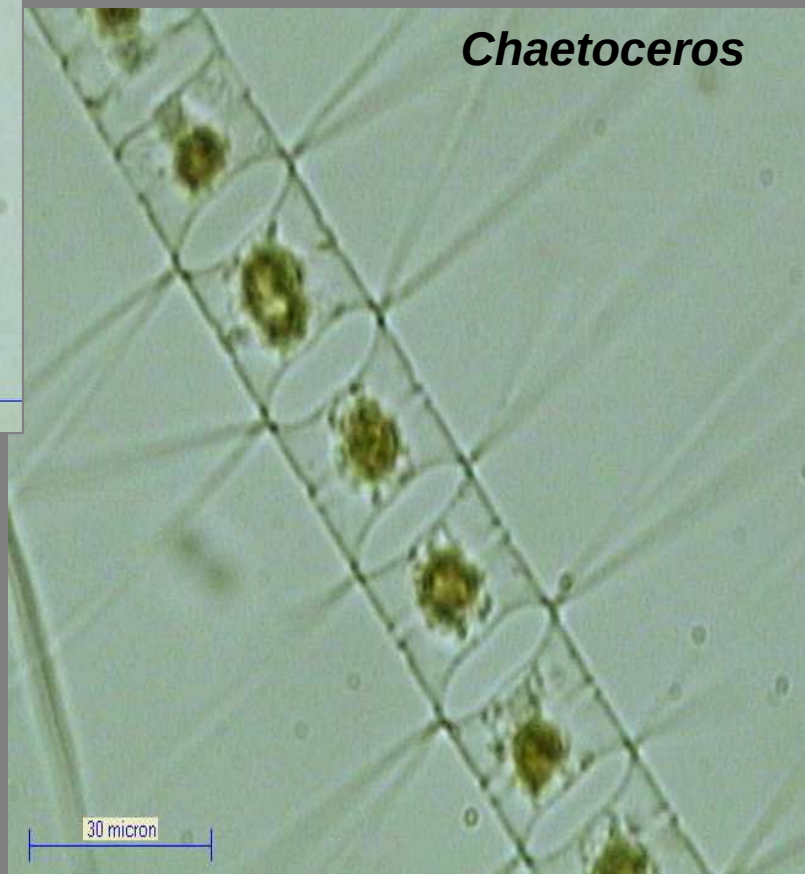
Planktic diatoms



Coscinodiscus



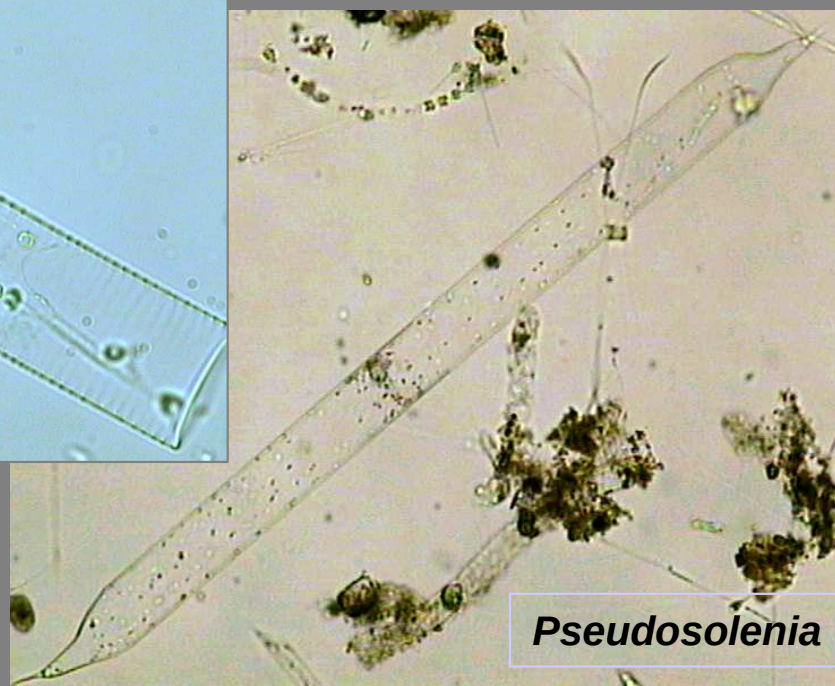
Thalassiosira



Chaetoceros



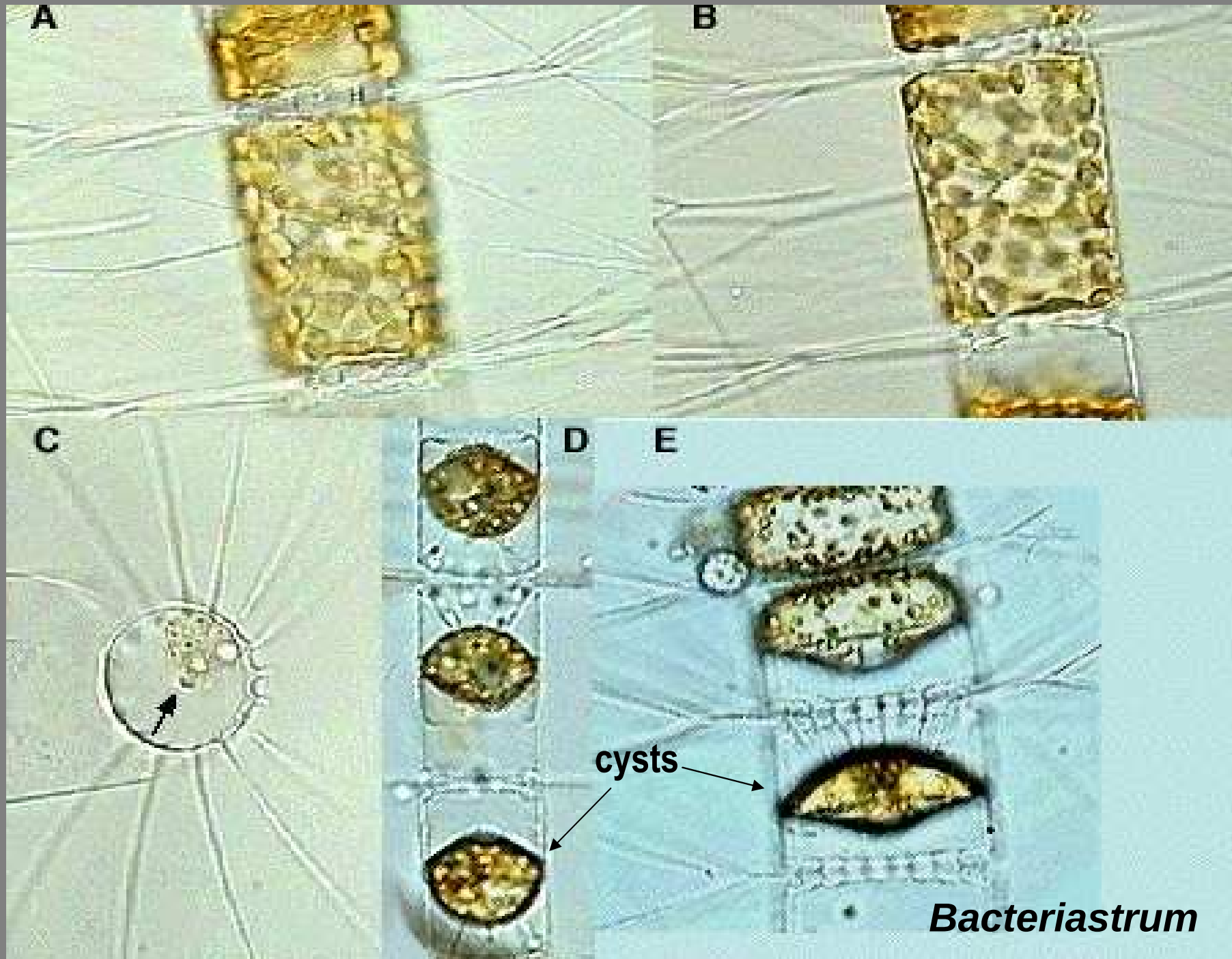
Dactyliosolen



Pseudosolenia

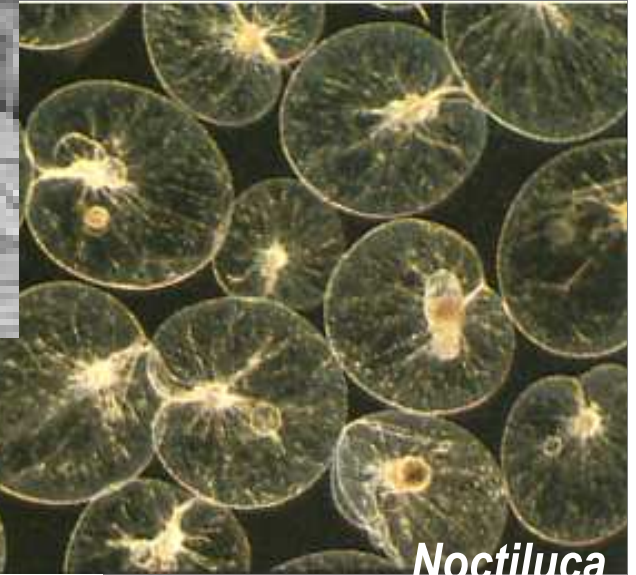
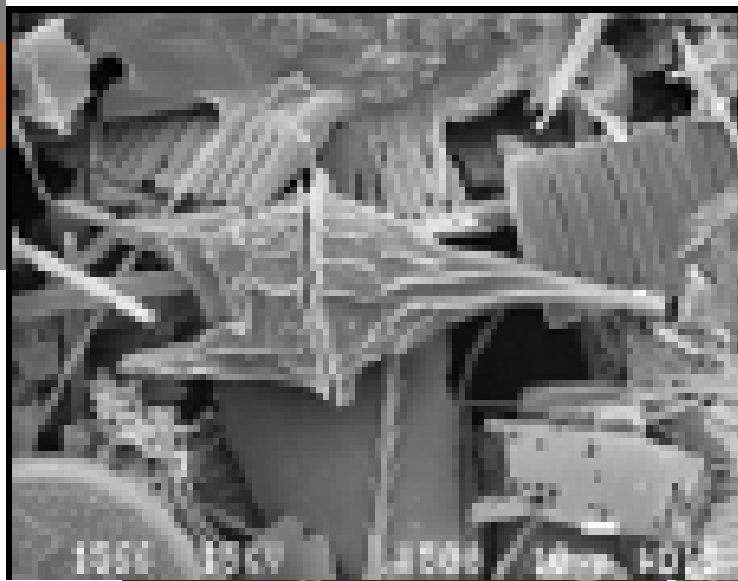


Planktic diatoms

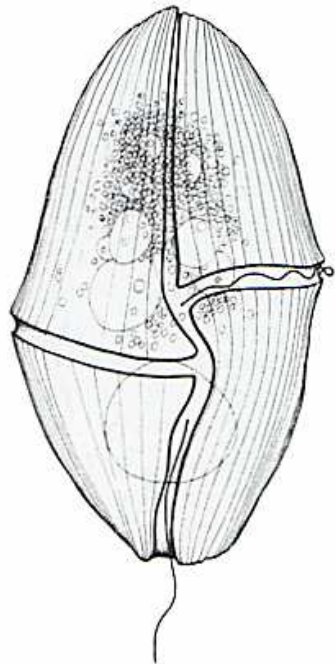


Dinophyta

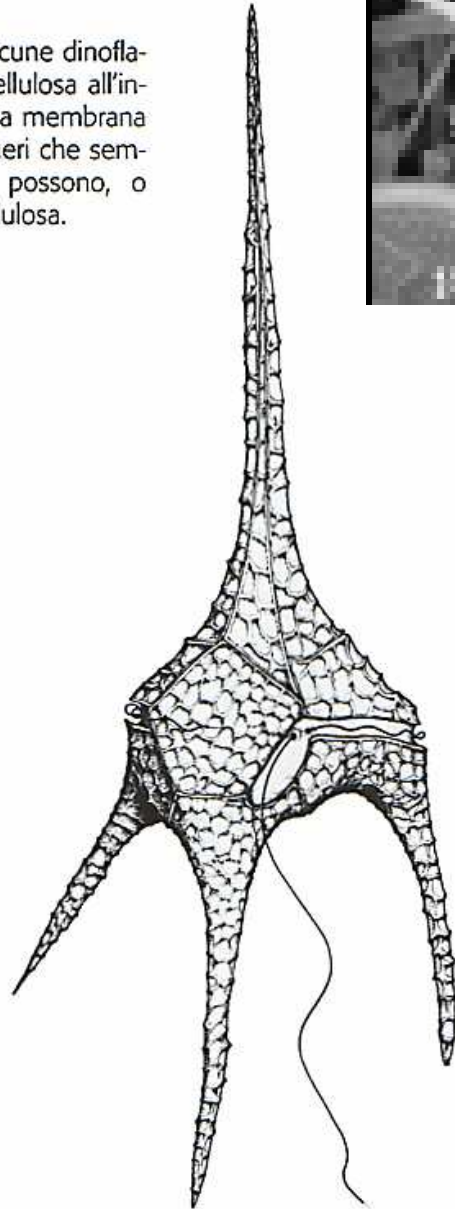
Figura 16.19 La «corazza» di alcune dinoflagellate consiste di placche di cellulosa all'interno di vescicole situate sotto la membrana plasmatica. Le vescicole dei generi che sembrano «nudi» (privi di teca) possono, o meno, contenere placche di cellulosa.



Noctiluca



Gymnodinium costatum



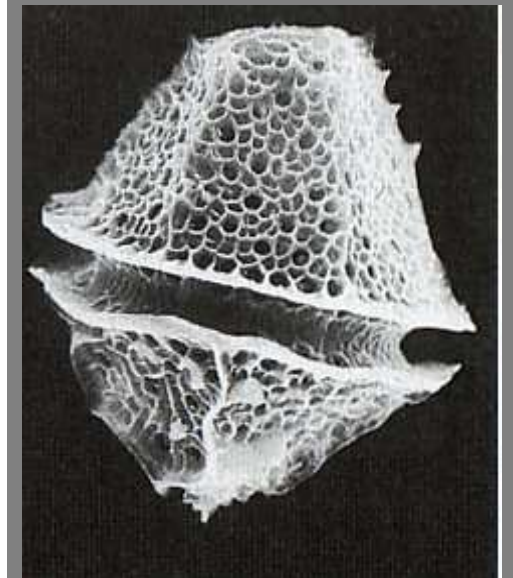
Ceratium



Exuviaella

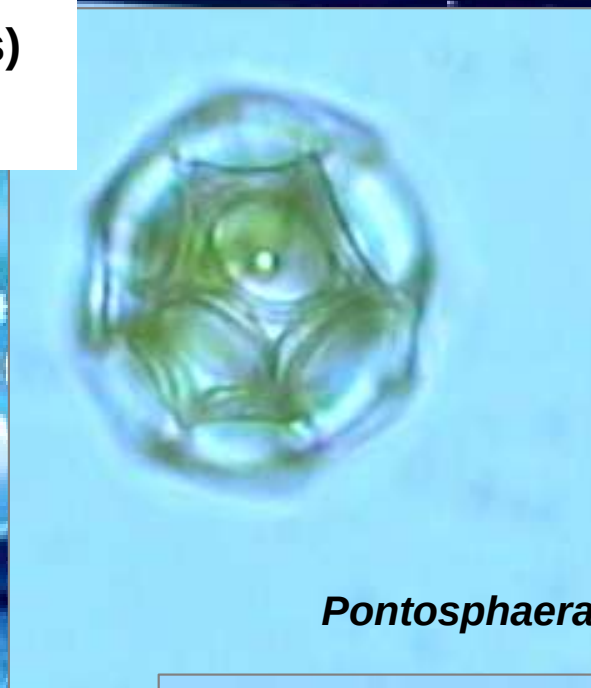


Gymnodinium neglectum

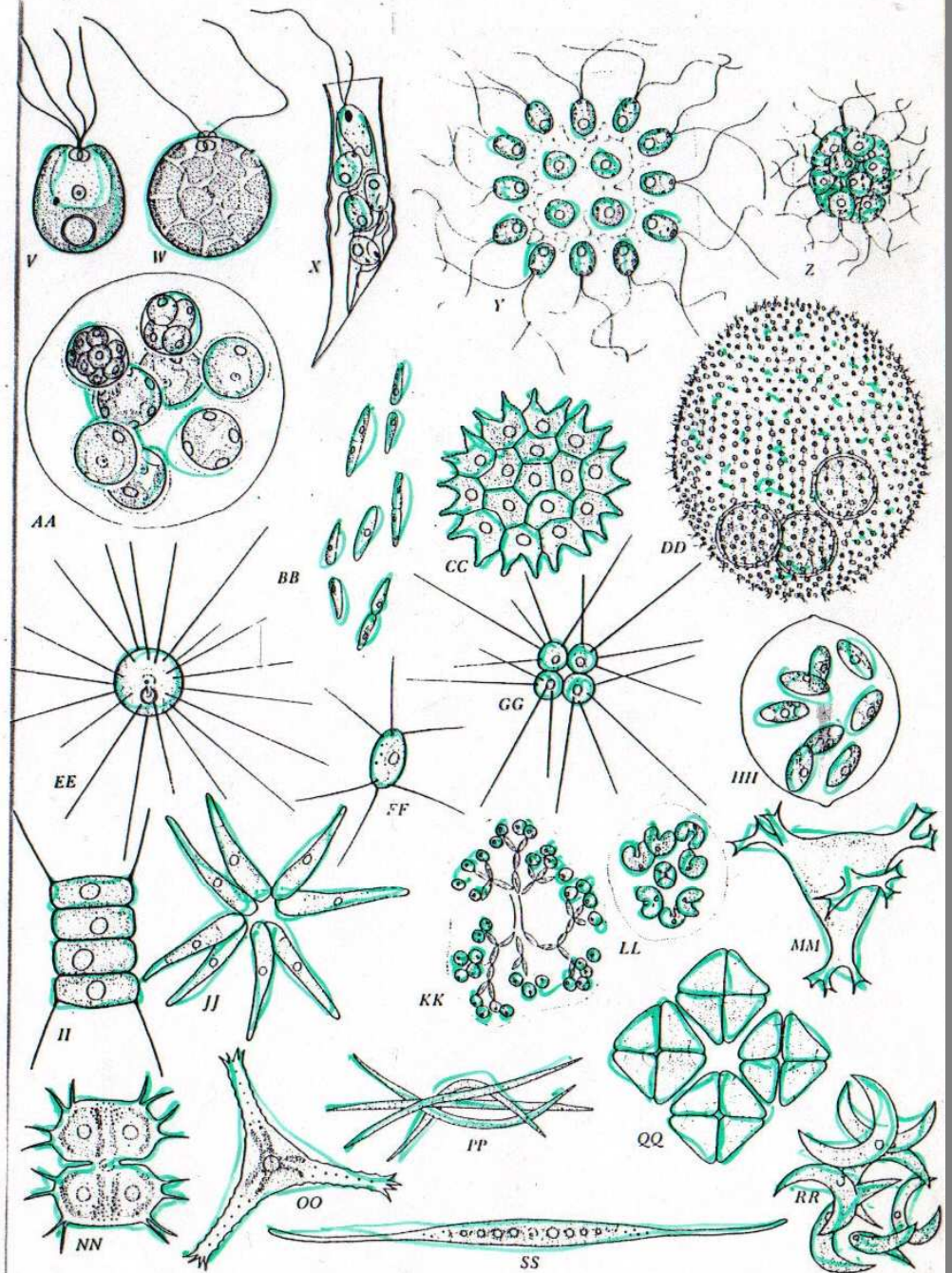
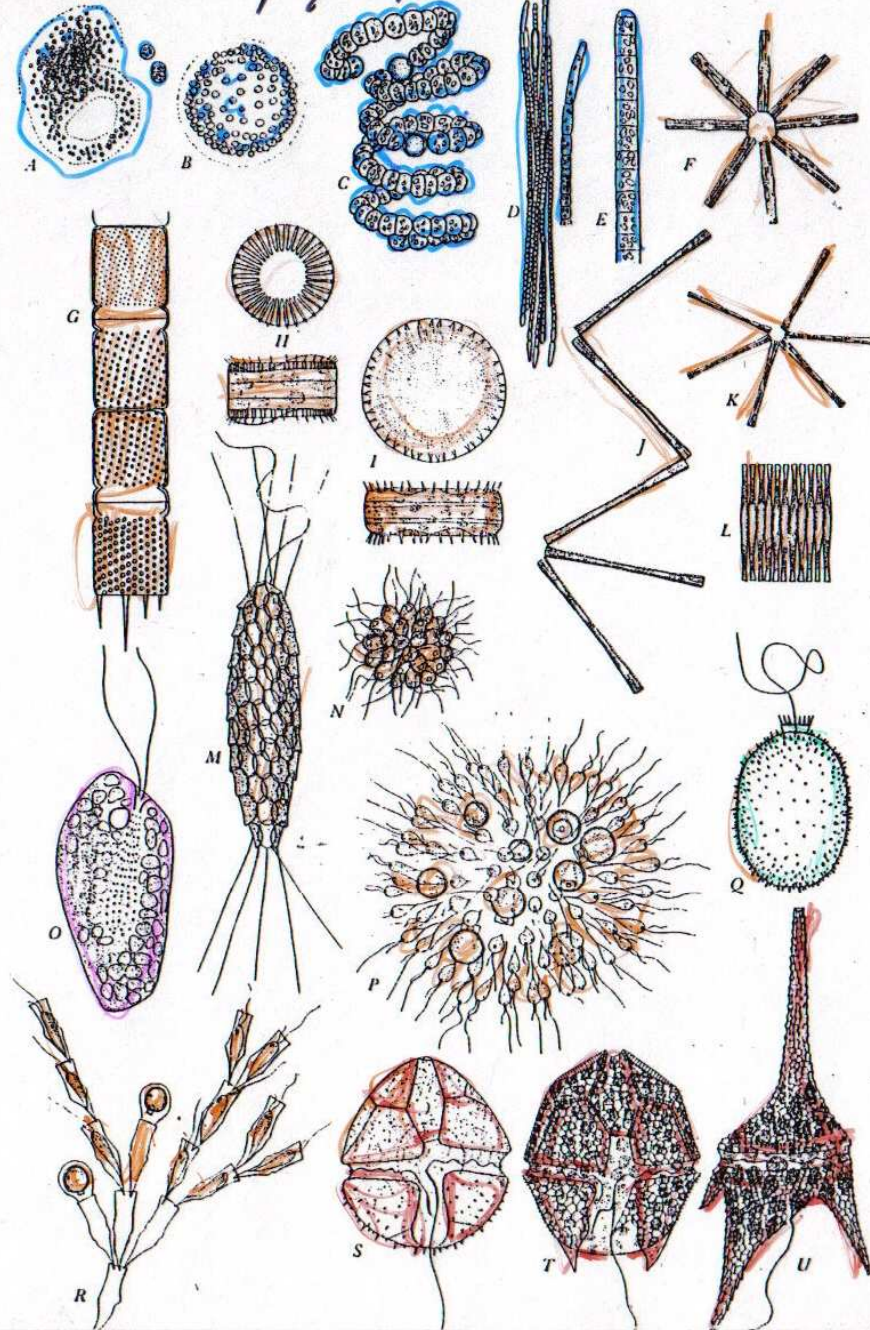


Gonyaulax

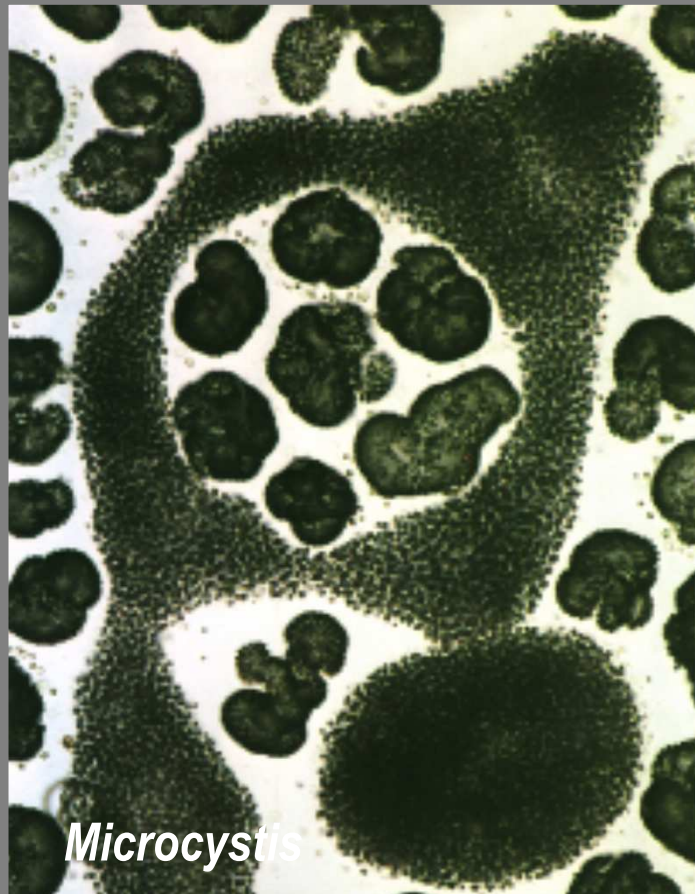
Haptophyta (Coccolithophorides) as carbon sinks



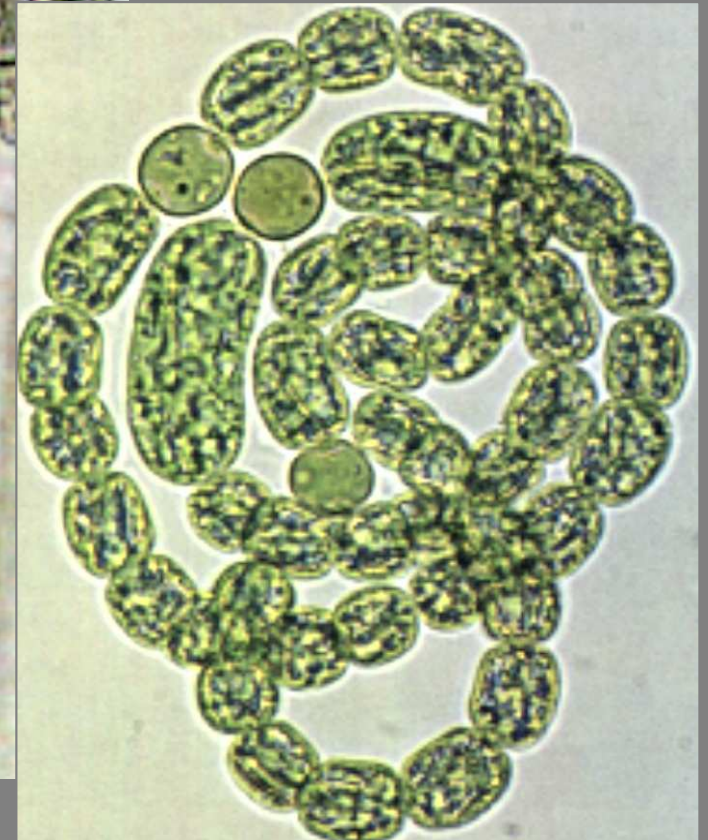
Freshwater phytoplankton



Planktic cyanobacteria



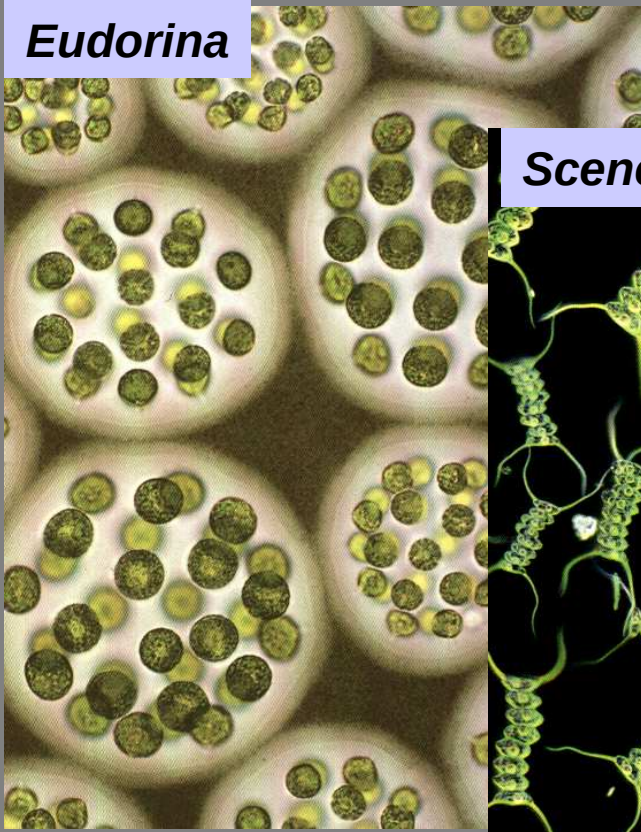
Oscillatoria



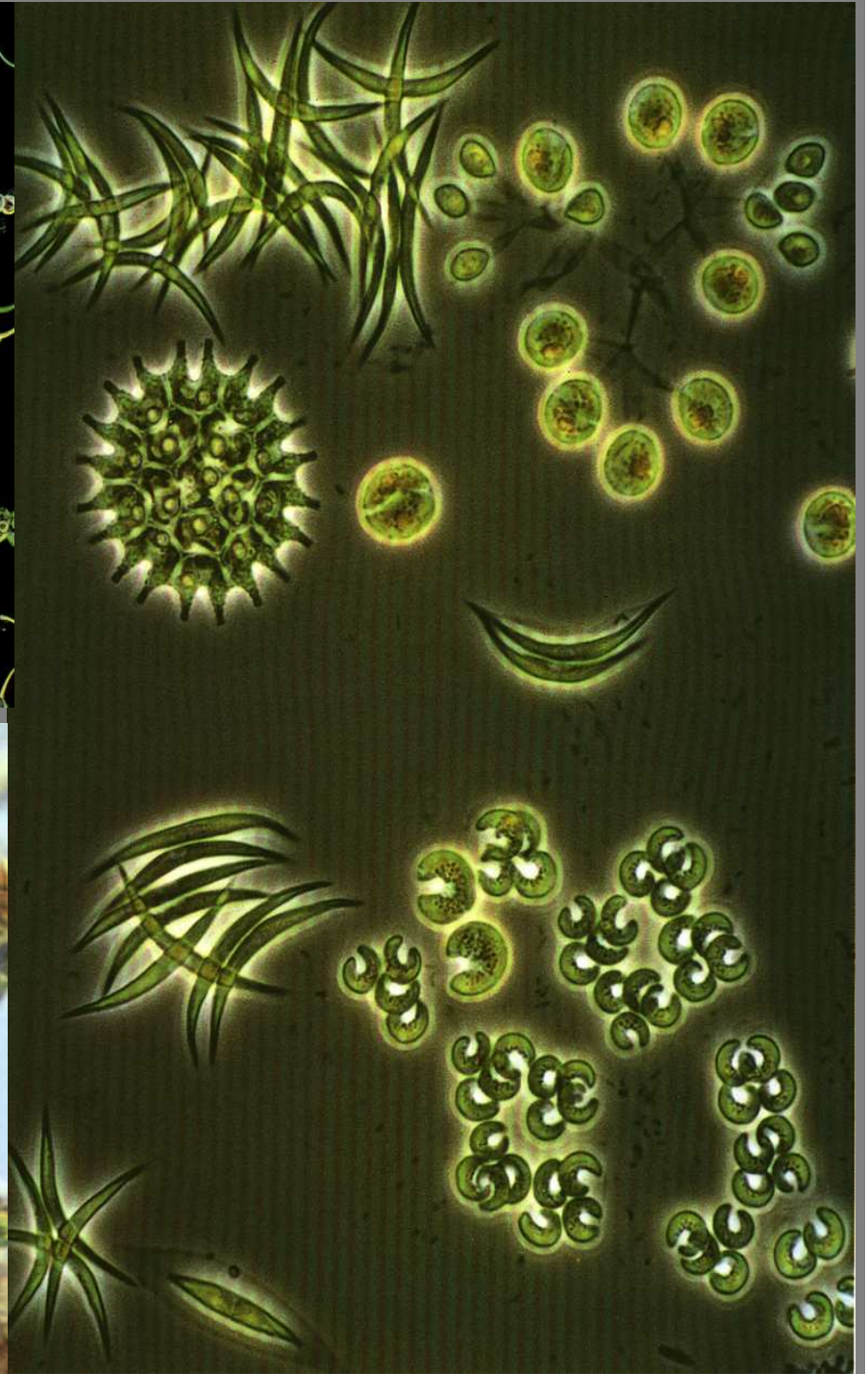
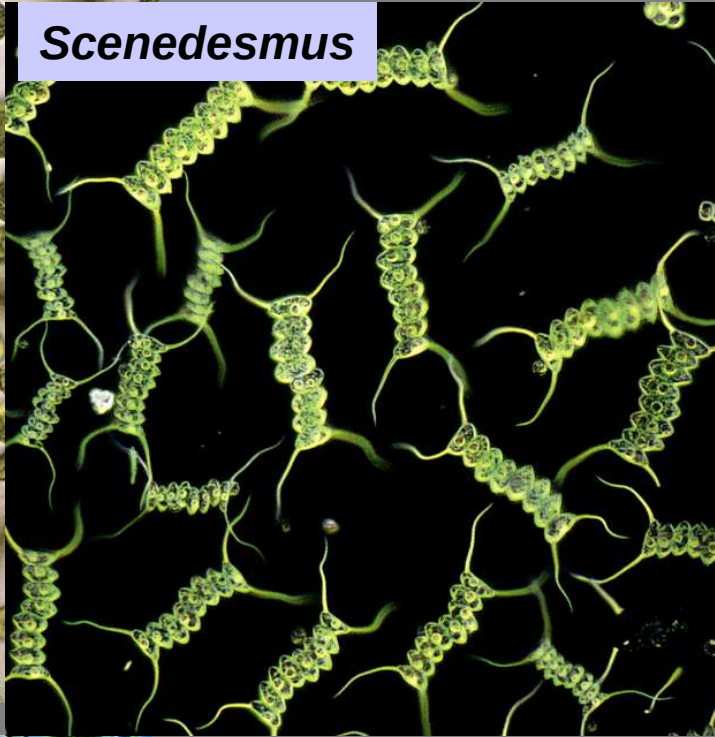
Anabaena

Colonial green algae

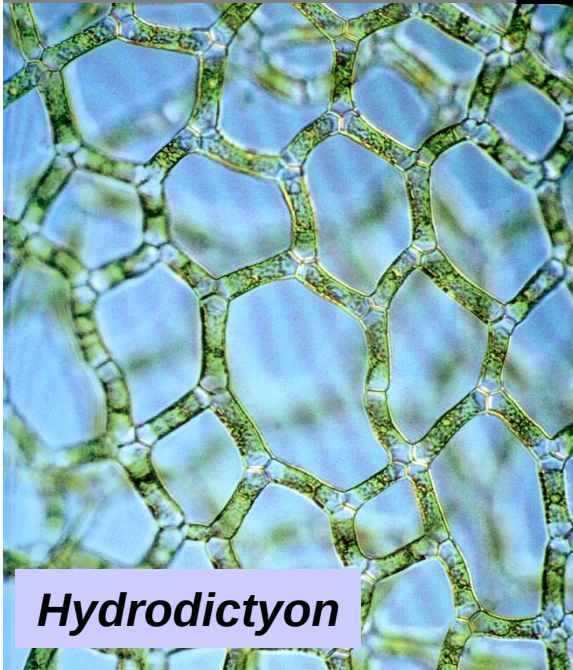
Eudorina



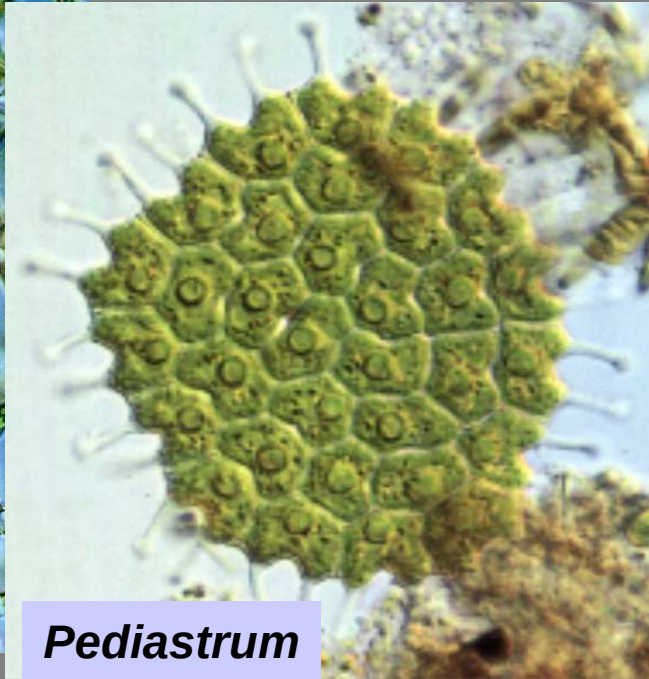
Scenedesmus



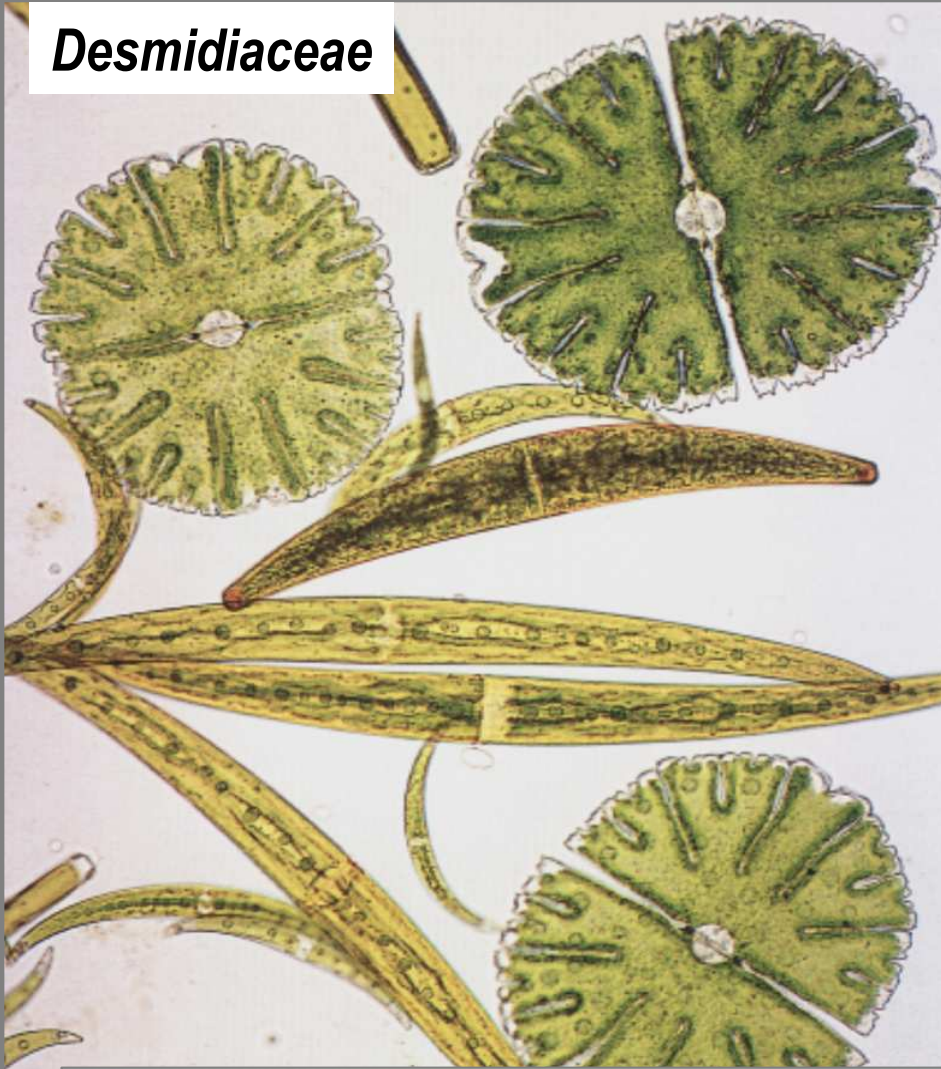
Hydrodictyon



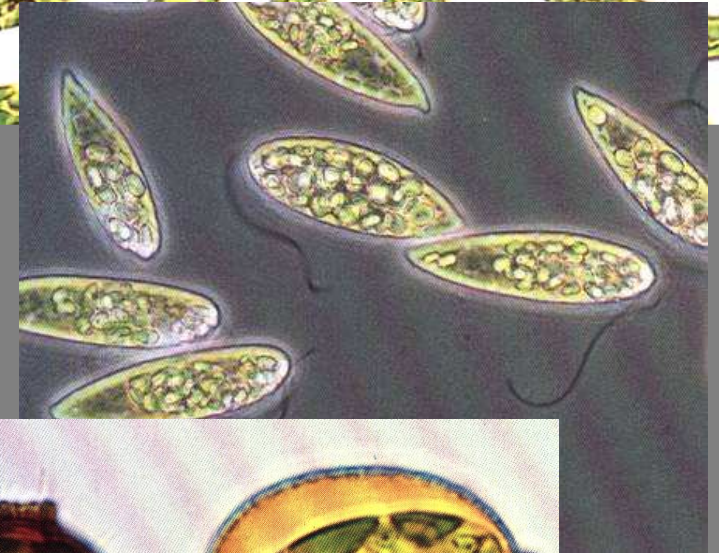
Pediastrum



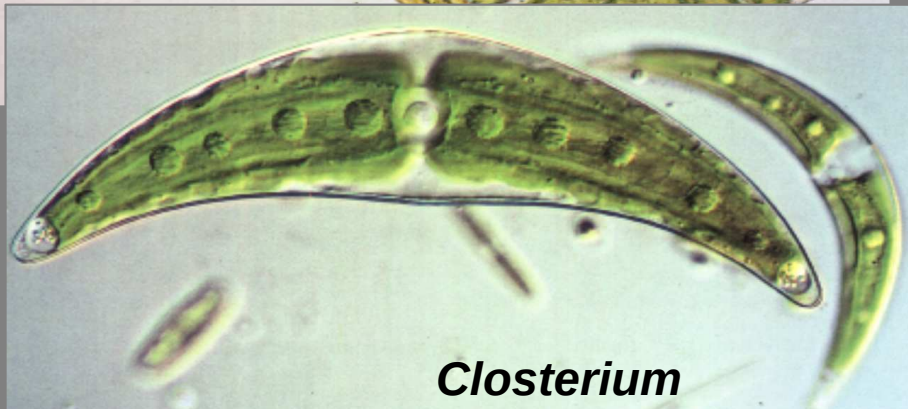
Desmidiaceae



Euglena



Closterium

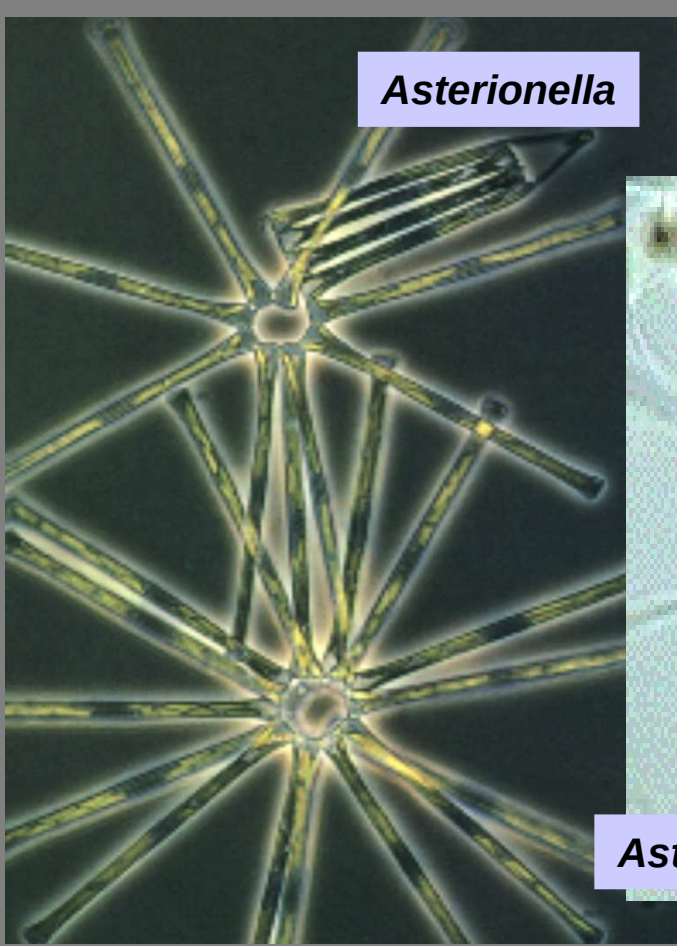


Trachelomonas



Colonial diatoms

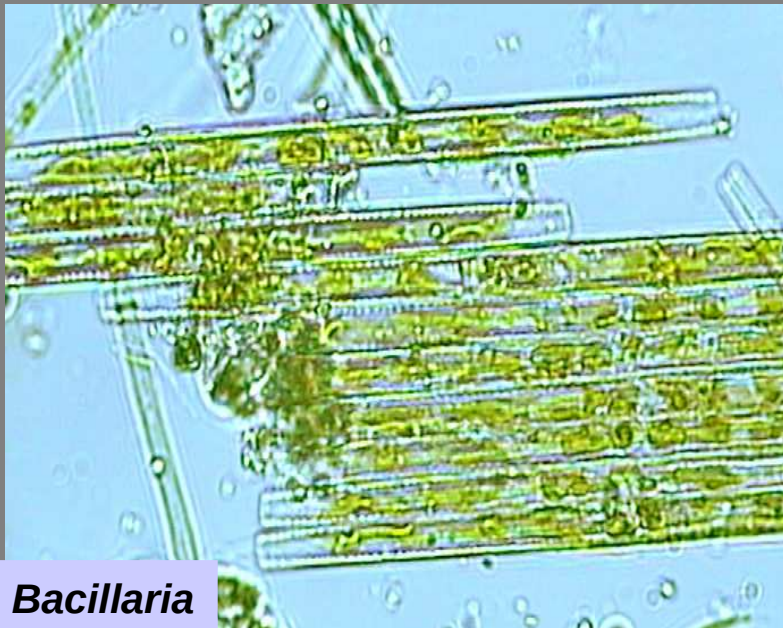
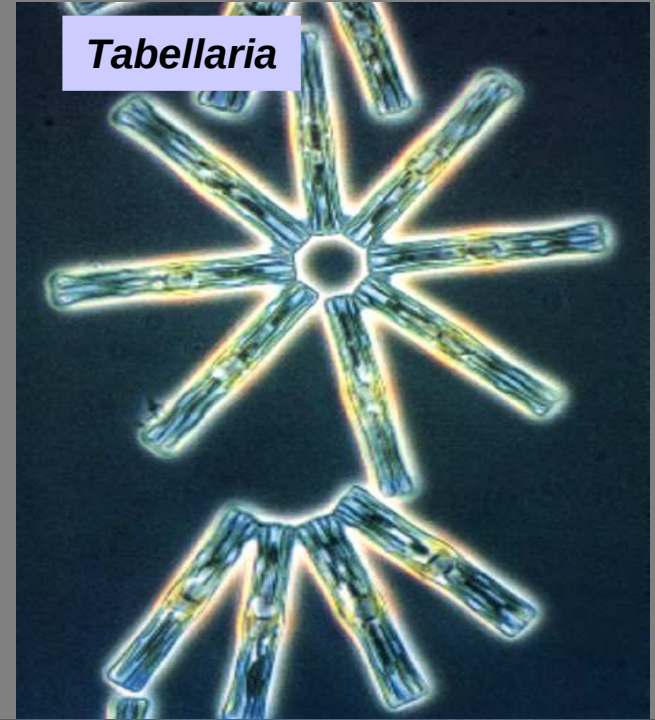
Asterionella



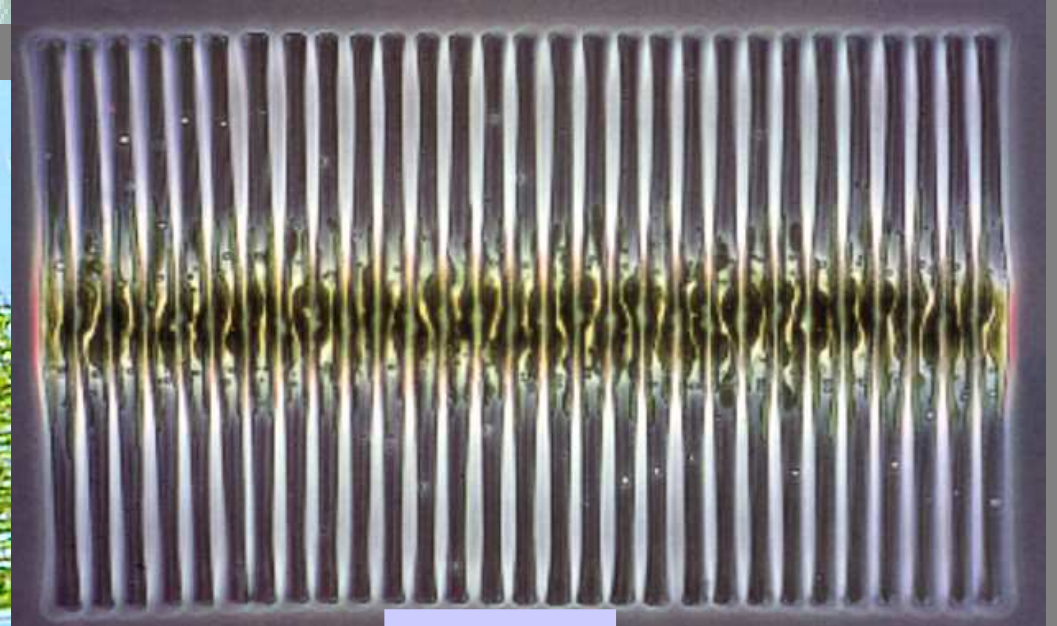
Asterionellopsis



Tabellaria



Bacillaria



Fragilaria

Cryptophyta

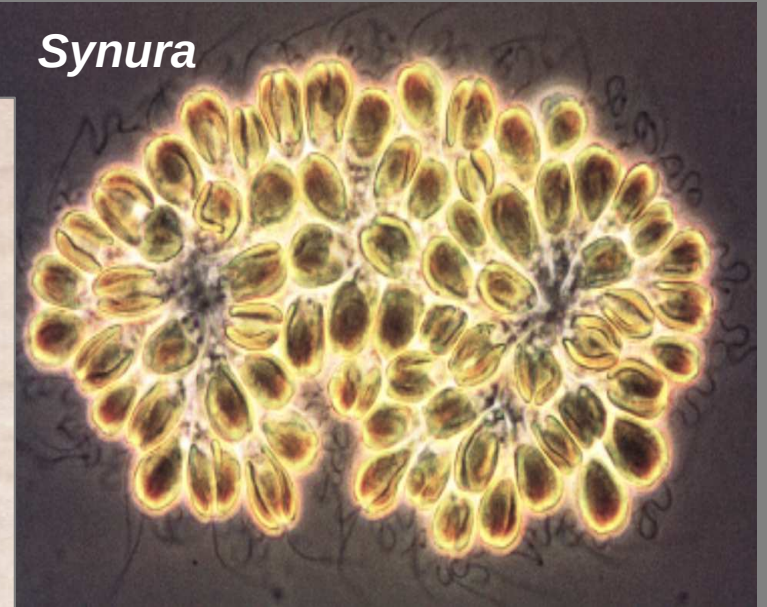


Synurophyceae



Mallomonas

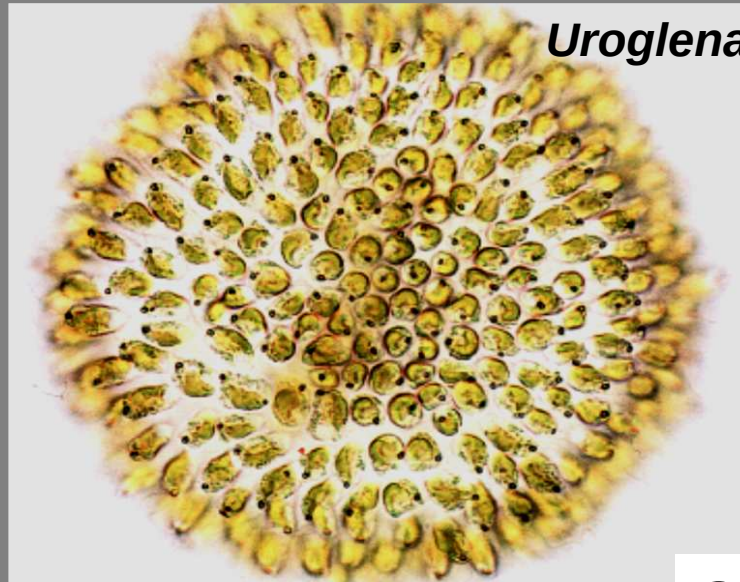
Synura



Dinobryon



Uroglena



Cryptomonas



Chrysophyceae

Phytoplankton morphological and physiological adaptations

- against sinking:
 - higher surface (colonial forms, cell aggregates, cell wall extensions)
 - mobility (buoyancy by gas vacuoles, swimming by flagella)
 - reduced density (oil droplets, less ions)
- S/V ratios (nutrient uptake, growth rate)
- grazing
- competition

Physical environment

Water { solvent
max density at 4°C
viscosity (neuston)

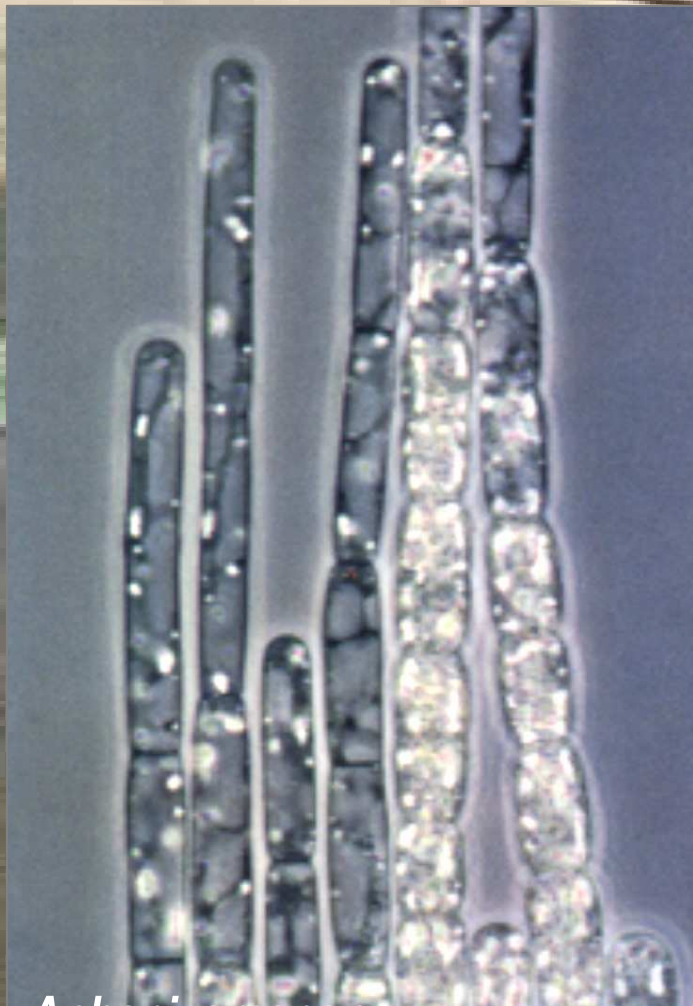
Light { irradiance
wavelength

Temperature → thermocline

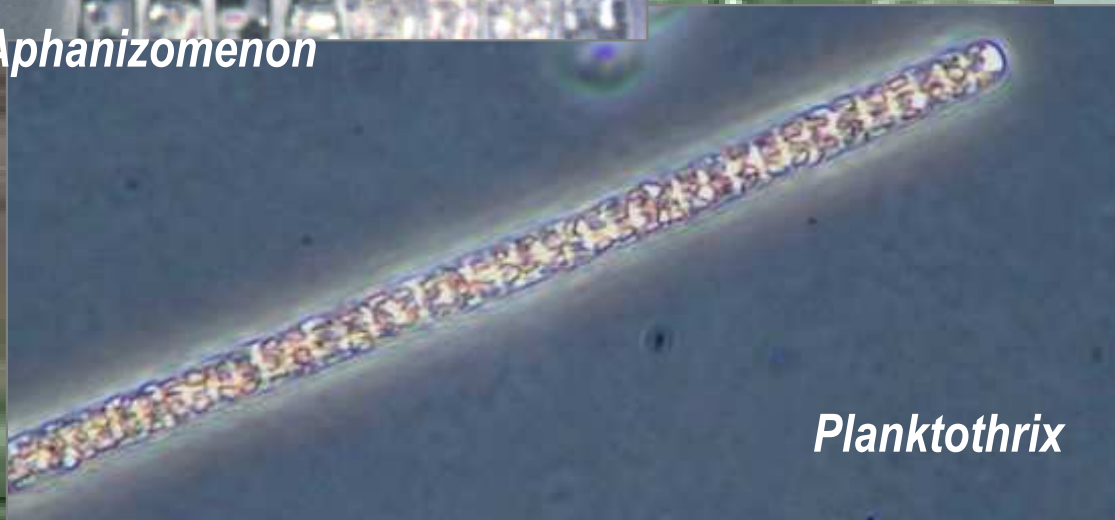
Turbulence → Wind-driven circulation, waves, currents

Gas vesicles in planktic cyanobacteria

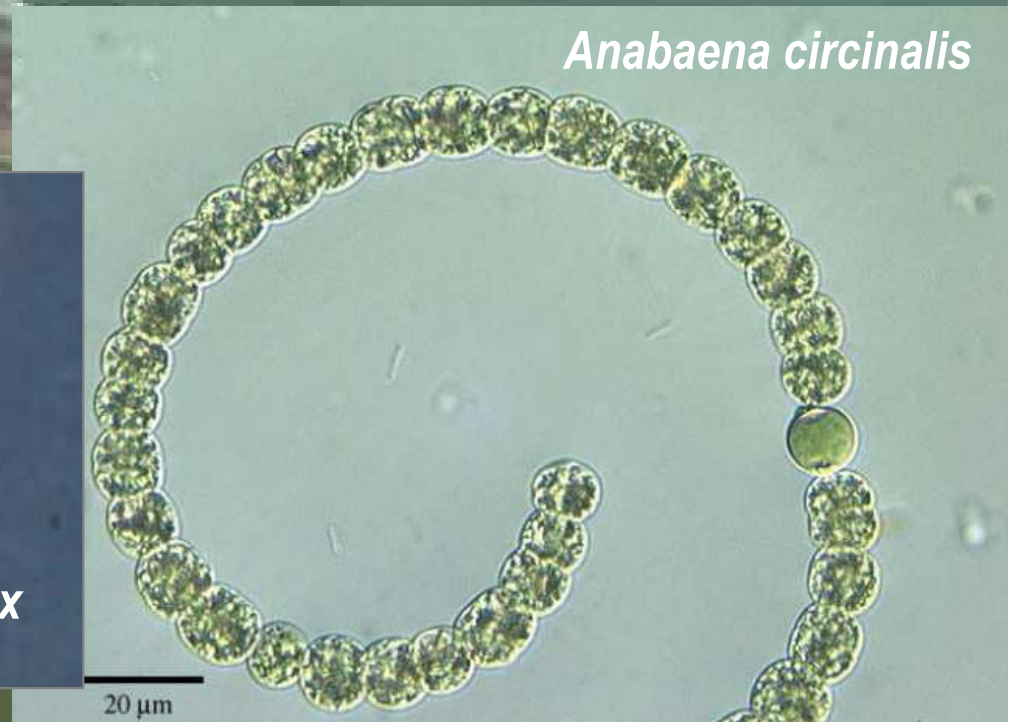
hollow proteic structures that allow buoyancy
(vertical migration throughout the water column)



Aphanizomenon



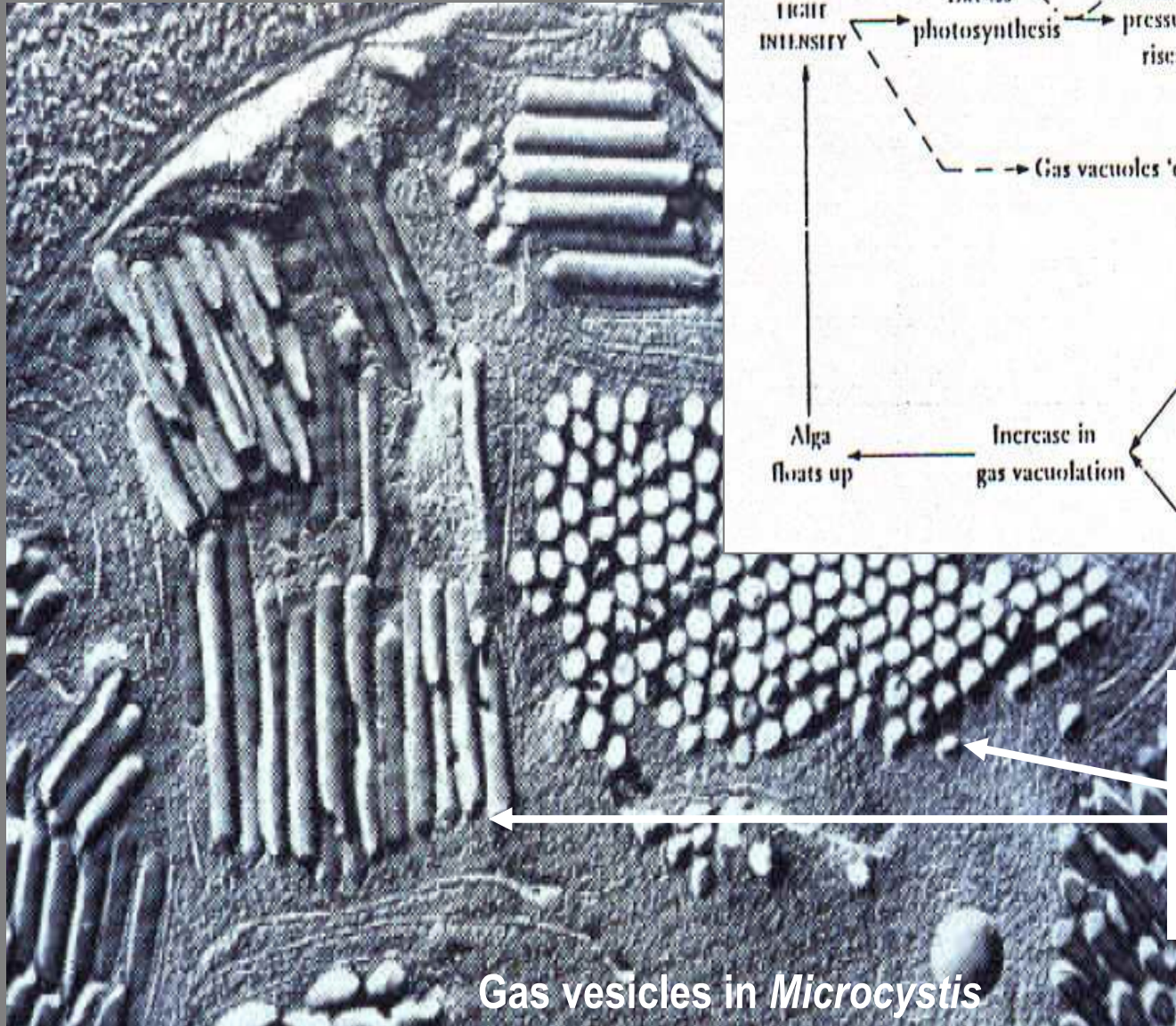
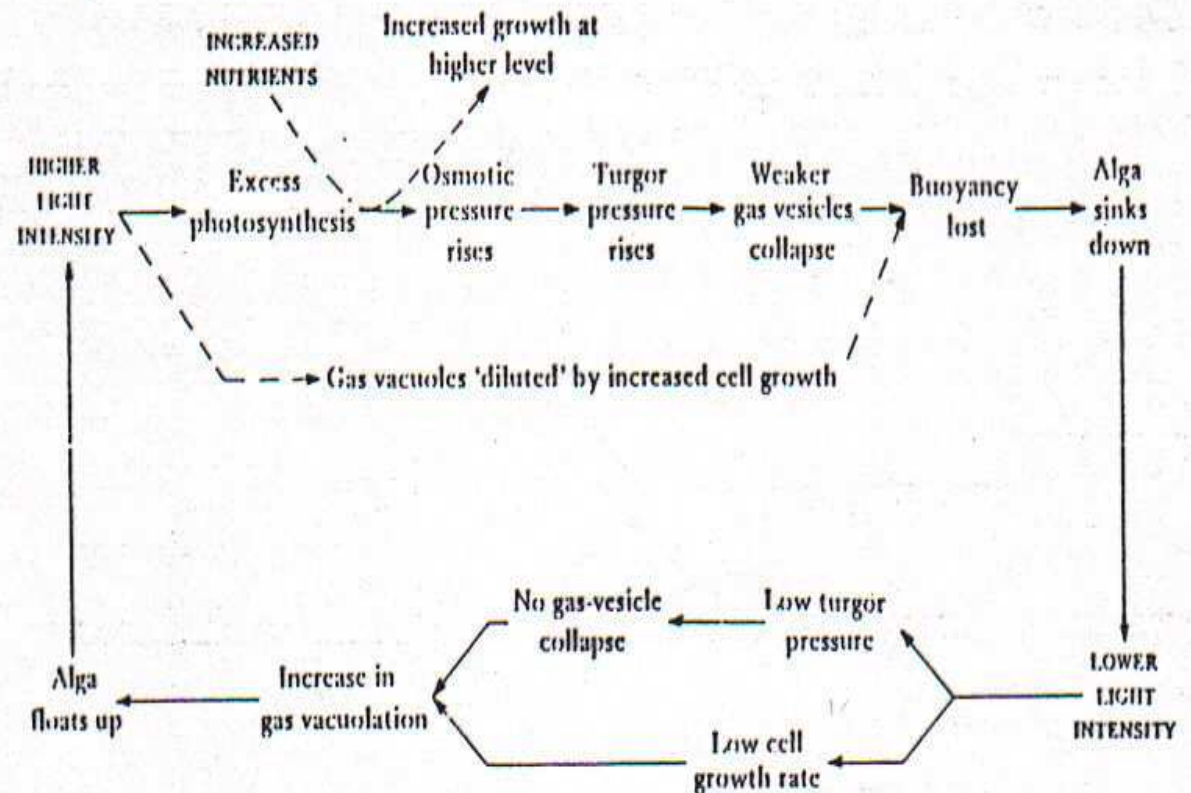
Planktothrix



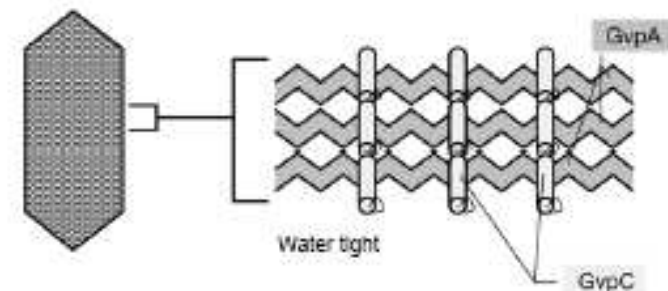
Anabaena circinalis

Double protein layer (GvpA, GvpC)
rigid and permeable to gases
varying in length and diameter
(300-1000 nm x 45-120 nm)

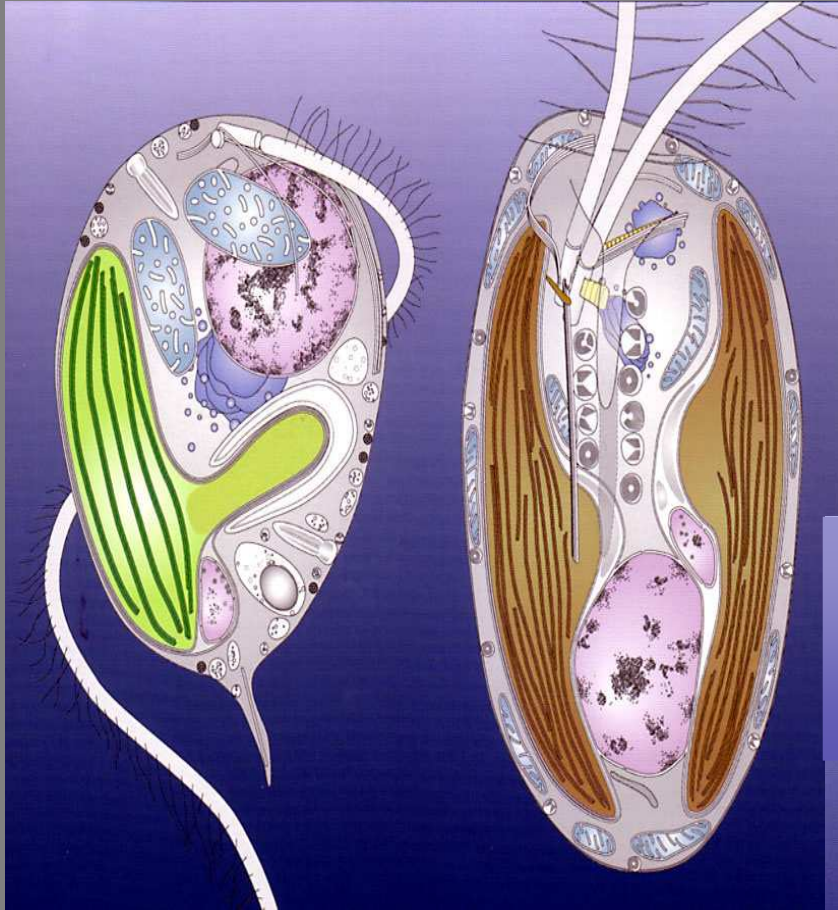
Fig. 19. A possible sequence of events in buoyancy regulation by planktonic Cyanophyta.



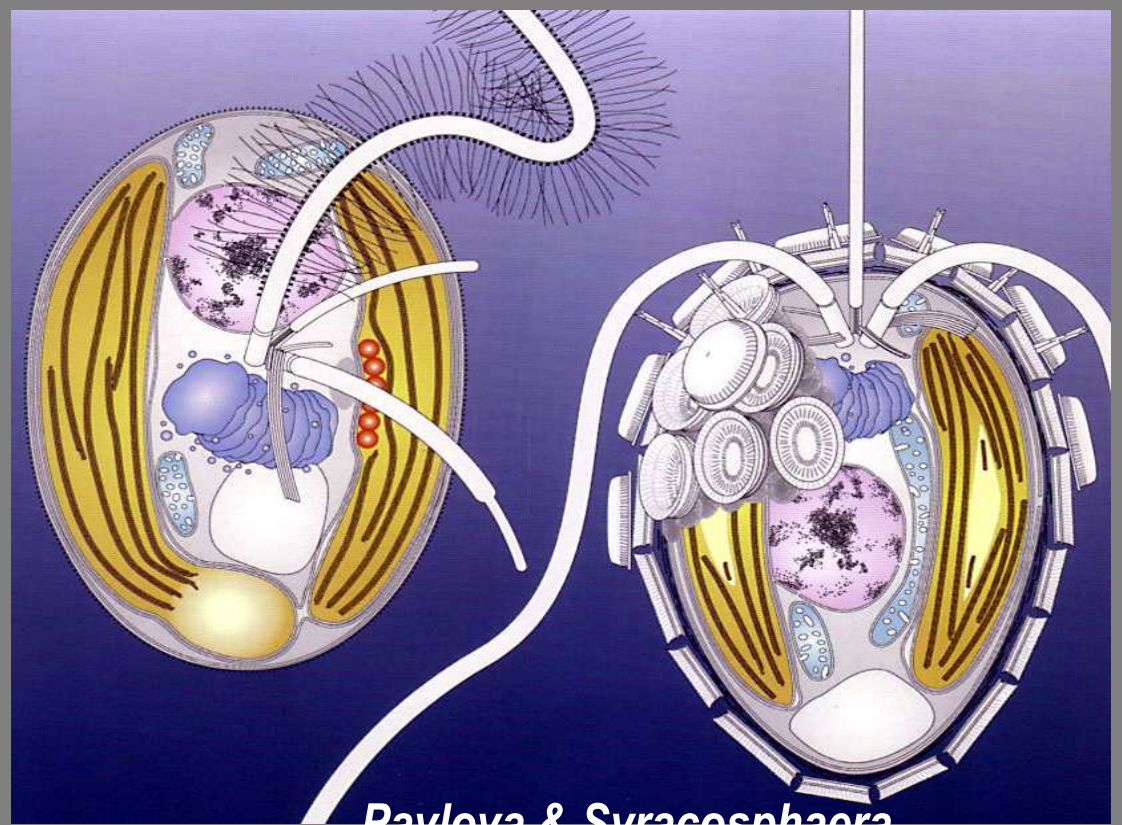
Gas vesicles in *Microcystis*



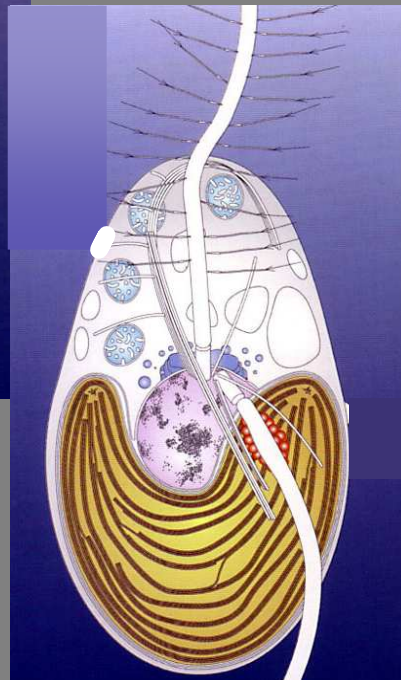
Phytoflagellates: swimming and phototaxis



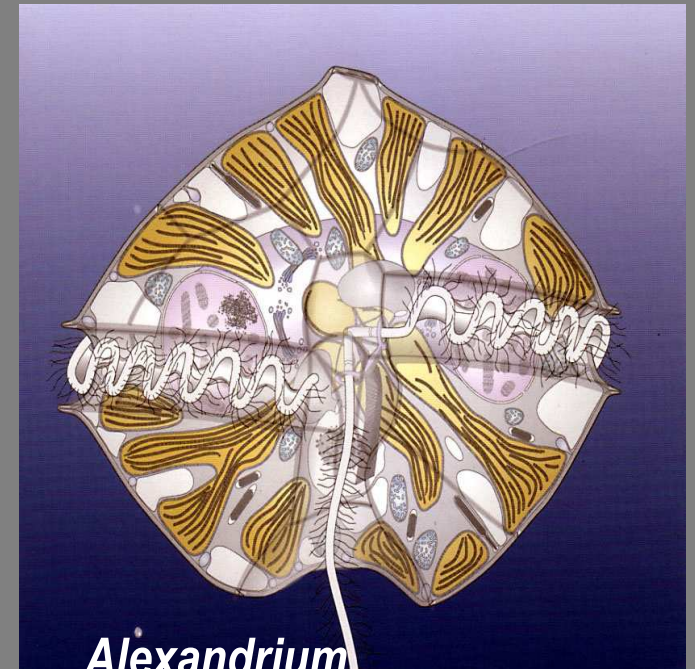
Chlorarachniophyta & Cryptophyta



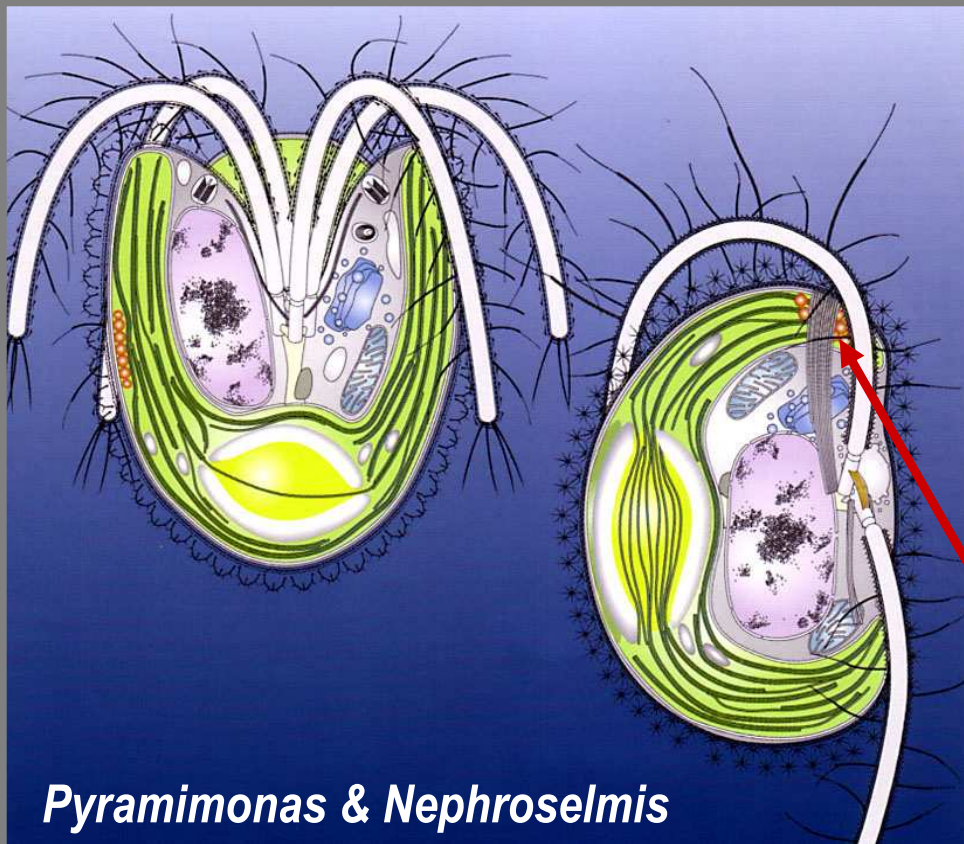
Pavlova & Syracosphaera



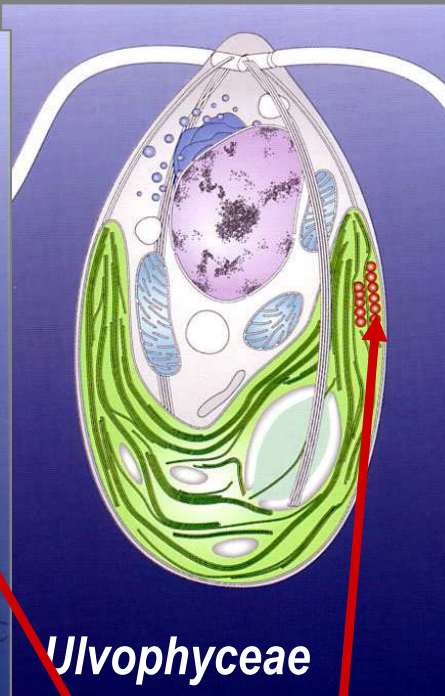
Phaeo- flagellate cells



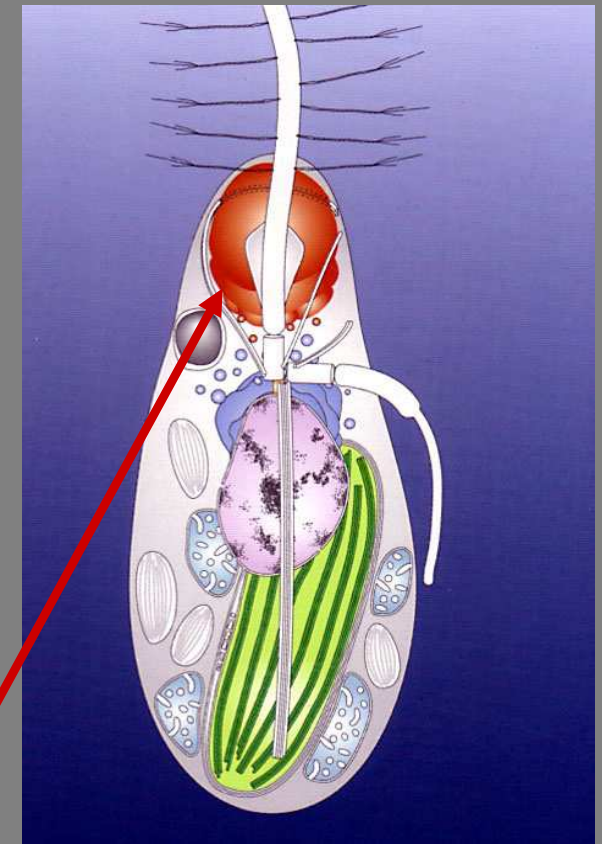
Alexandrium



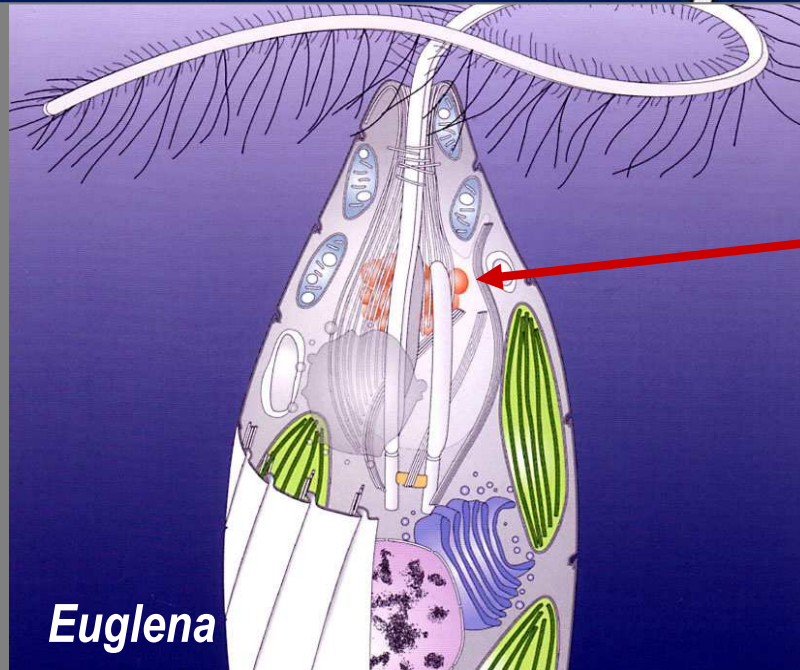
Pyramimonas & *Nephroselmis*



Ulvophyceae
flagellate cells



Pseudocharaciopsis
(Eustigmatophyte)



Euglena

**Eye-spot (or stigma) +
rhodopsin-like photoreceptors**