Cyanophyta (Cyanobacteria; blue-green algae).

A. Difference between bacteria (Monera) and other algae (Eukaryotes).
-normal stuff: circular v. linear DNA; organelles or not; nucleus or not.

B. Differences between cyanobacteria and other photosynthetic bacteria.
1. Cyanos have chlorophyll a.
2. Cyanos produce oxygen from photosynthesis.
3. Cyanos use water as an electron donor in photosynthesis.

C. Thus, functionally, cyanos are more like true algae than they are like other bacteria, especially from a limnological perspective.

D. General distribution.
1. Occur everywhere except very acidic waters.
2. Very common in the oceans; up to 10,000 cells per millilitre.
3. Thermal pools and geysers in Yellowstone National Park.
4. Small pools of water next to plants in tropics.
5. First to colonize bare lava after an eruption.

Cyanophyta (Cyanobacteria; blue-green algae).

E. Basic structures.

1. Vary from independent cells to colonies.
2. Colonies can be amorphous or filamentous.
3. Usually covered by a secretion of mucilage sheath.
4. Two general cell types.

a-Somatic cells: photosynthetic.

b-Heterocysts: nitrogen-fixation.

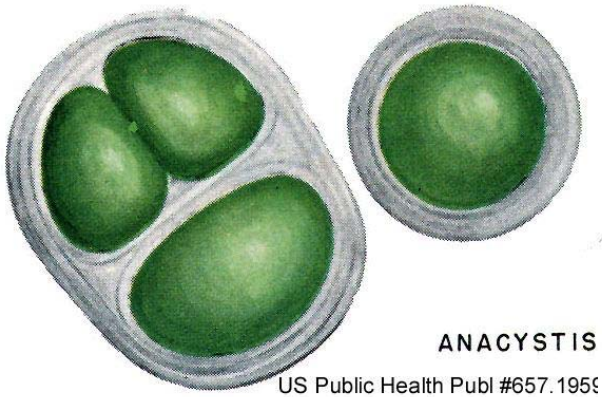
-pores at each pole of heterocyst.

-allows sugars in; NH_4^+ pumped out.

-rest of cell covered by thick waxy layer.

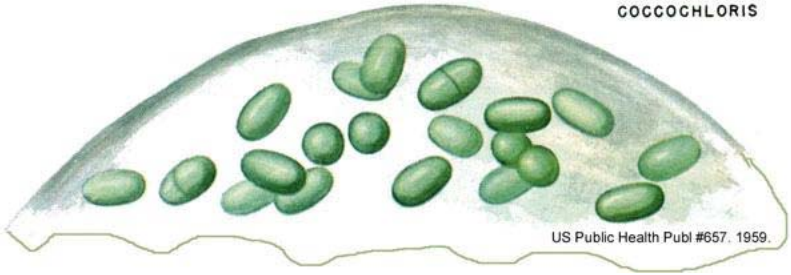
-environment inside is highly reducing (anoxic).

See next slide for examples. Somatic cells are green; heterocysts are pearly; note the mucilaginous sheaths, the highly variable colony forms, and the absence of heterocysts in some forms.



ANACYSTIS

US Public Health Publ #657.1959



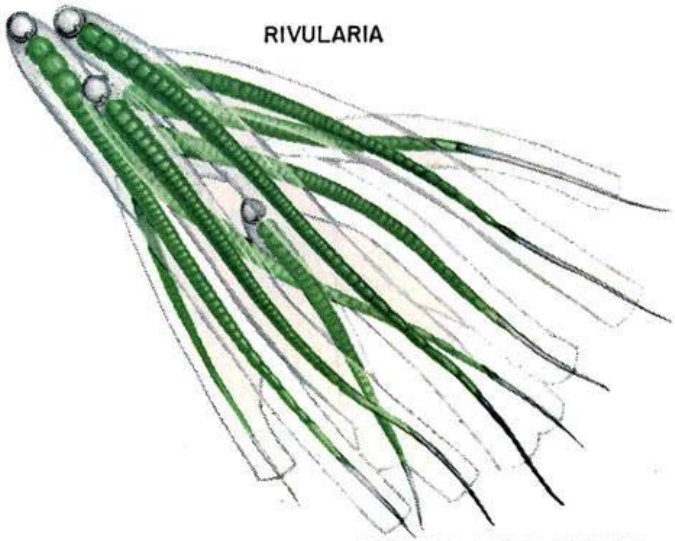
COCCOCHLORIS

US Public Health Publ #657. 1959.

US Public Health Publ #657. 1959.

ANABAENA

CALOTHRIX



RIVULARIA

US Public Health Publ. #657. 1959.

Cyanophyta (Cyanobacteria; blue-green algae).

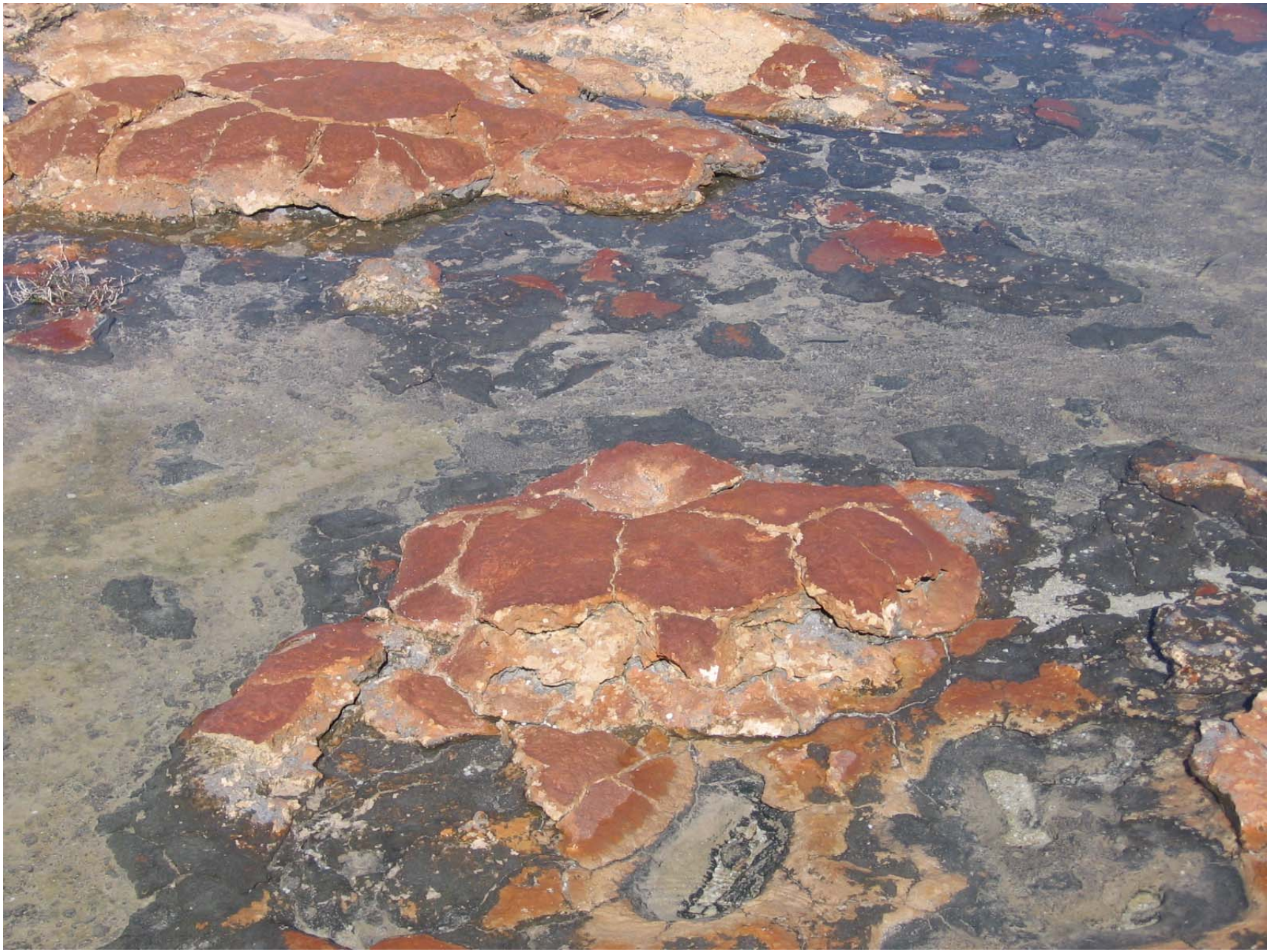
F. Basic life history.

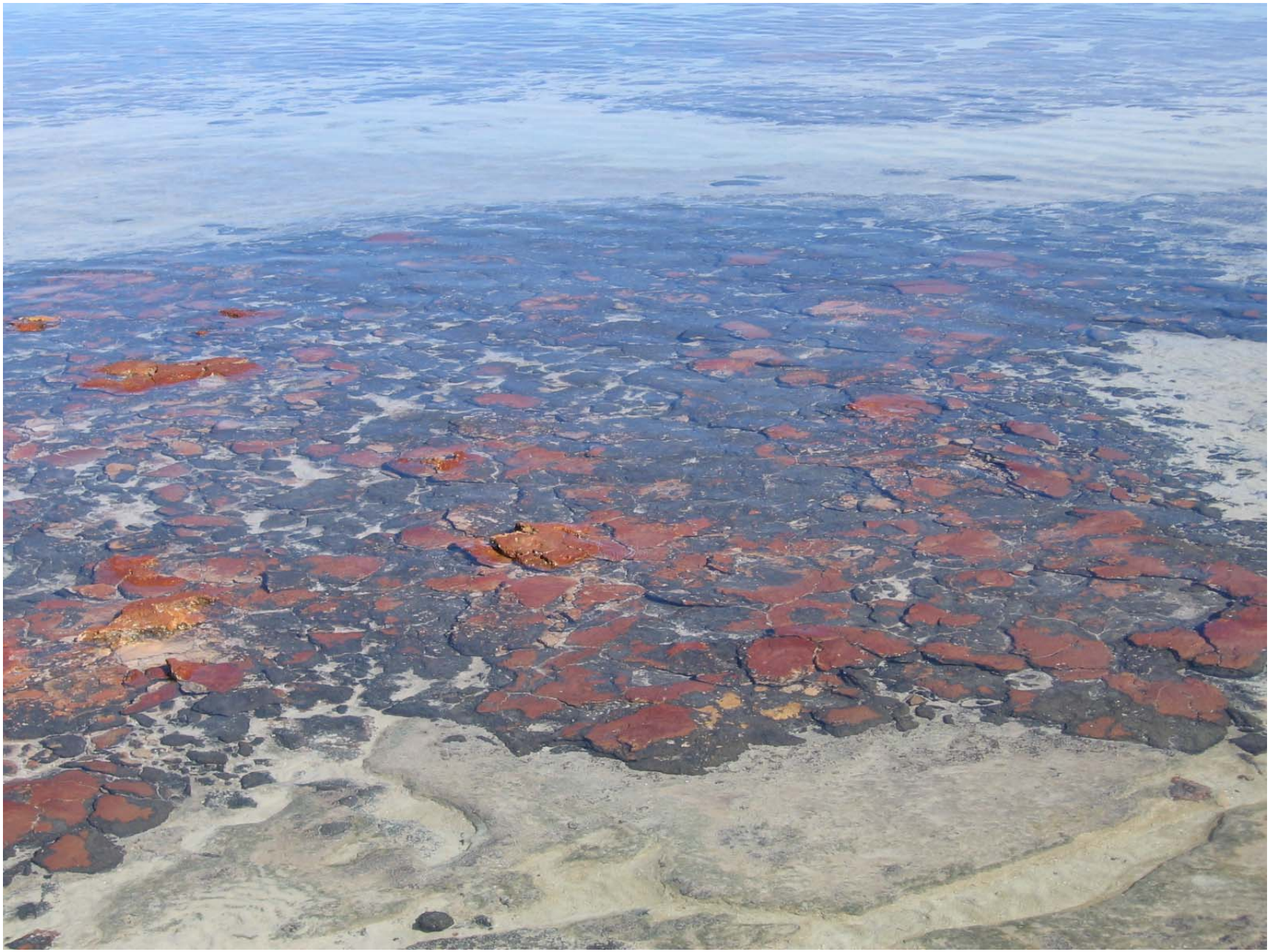
1. New cells in a colony are produced by simple binary fission.
2. New colonies produced in 2 ways.
    a-Fragmentation.
    b-Akinetes.
        i-Thick-walled.
        ii-Resistant to freezing and desiccation.

Cyanophyta (Cyanobacteria; blue-green algae).

G. Other stuff.

1. Most cyanos cannot move, but a few move by twisting.
2. Many cyanos produce toxins that are deadly to other animals.
3. Some can produce antibiotics that kill other strains of the same species.
4. Blooms can be huge.
    a-Generally characterized by scum on the surface.
    b-One bloom around Australia.
        i-Extended 1,000 miles long.
        ii-Covered 20,000 square kilometers.
    -see pic of slimy bloom of cyanos in a pond on next slide.
5. Common genera.
    a-*Anabaena*.
6. Ancient cyanos thought to be first cellular life on Earth.
    -see pics of Stromatolites on next slides, which are stone-like structures resulting from long-term growth of cyanobacteria.
    -the pics are from Shark Bay in Australia, which I visited quite a few years ago.





Chlorophyta (green algae).

A. General distribution.

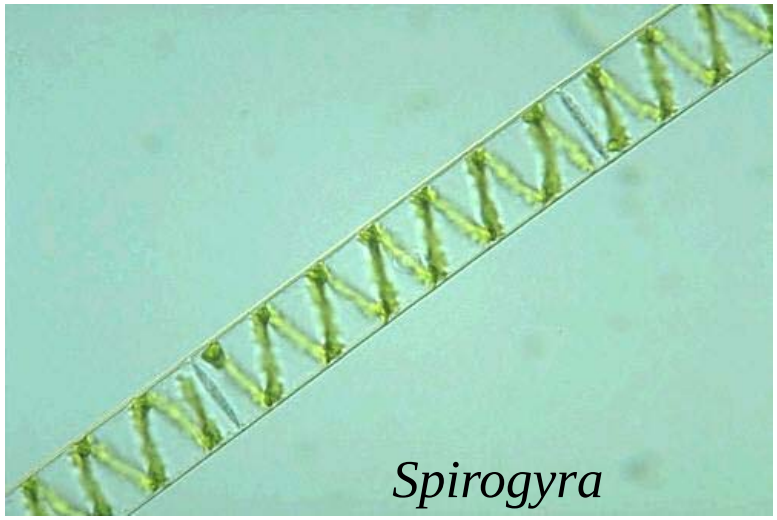
1. Most commonly found in freshwater.
2. Other places.

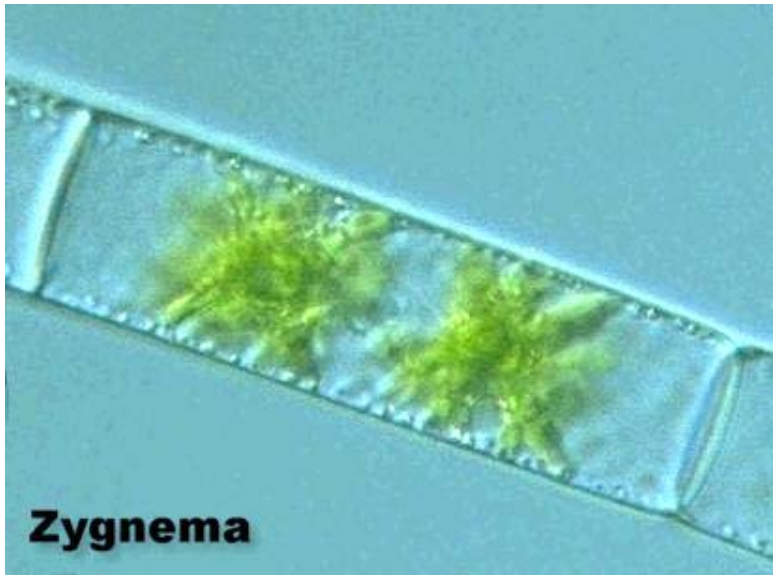
a-Oceans.
b-Tree bark.
c-Fur of sloths and other jungle animals.

B. Basic structures.

1. Morphologically diverse.
2. Flagellated unicellular forms.
3. Filamentous forms.
4. Net-like, tubular forms.

-see pics on next slide of filamentous forms.


Spirogyra


Zygnema


Ulothrix

Chlorophyta (green algae).

C. Basic life history.

1. Asexual reproduction.
    a-Simple binary fission, including colony formation.
    b-Fragmentation, especially in colonial filamentous forms.

2. Sexual reproduction.
    a-Fusion of haploid cells followed by meiosis.
    b-Gametes can also be formed.
    c-Some are monecious and some are diecious.

D. Common genera.
1. *Spirogyra*.
2. *Ulothrix*.
3. *Chlamydomonas*.

Bacillariophyceae (diatoms).

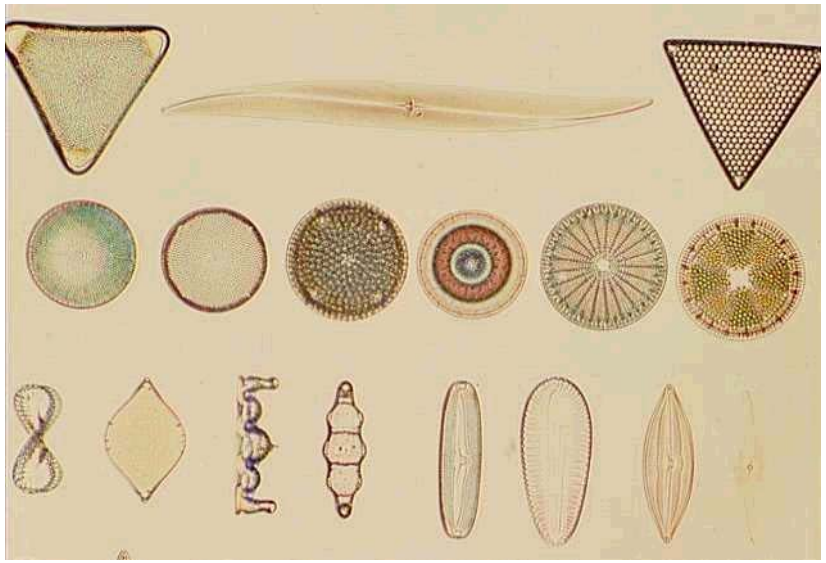
A. General distribution.

1. Common in freshwater habitats and marine systems.
2. Most are associated with littoral substrates, i.e., benthic.

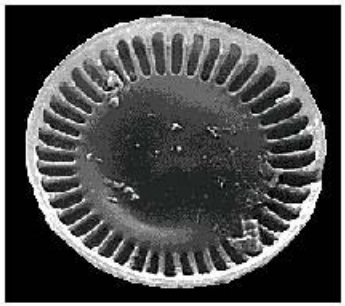
B. Basic structures.

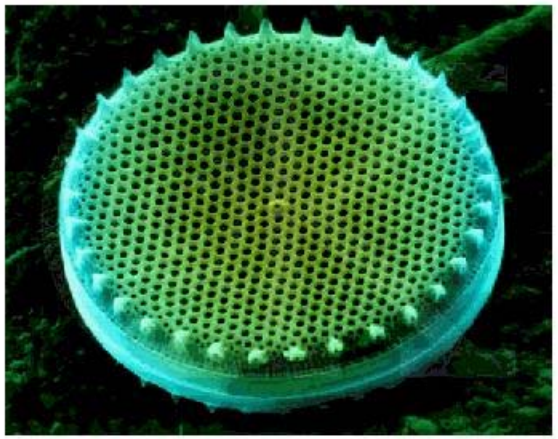
1. Most conspicuous feature is a silicon-based cell wall.
2. Two basic forms.
    a-Centrales-forms: radially-symmetrical.
    b-Pennales-forms: usually longer and bilaterally-symmetrical.
3. Both unicellular colonial forms exist—most are unicellular.

-see pics on next slide.

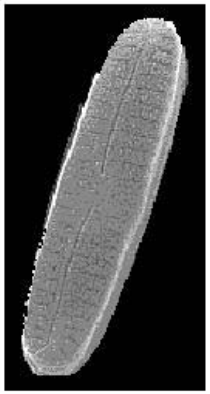


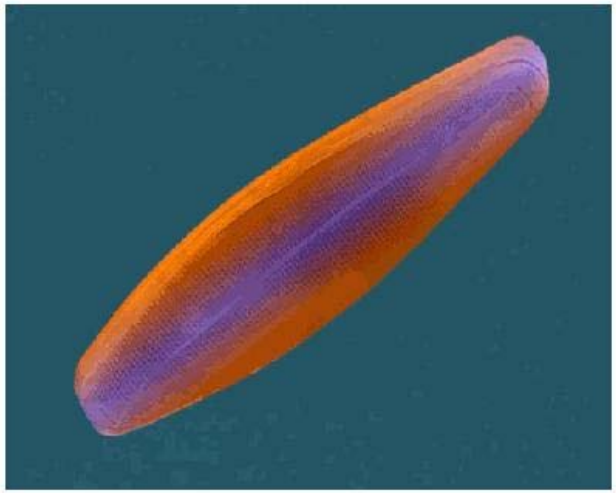
Centric Diatoms





Pennate Diatoms





Bacillariophyceae (diatoms).

C. Basic life history.

1. Asexual reproduction most common; simple binary fission.
2. Sexual reproduction.

a-Binary fission occurs.

b-A few cells grow back to original size.

c-Most cells remain small.

i-Small cells undergo binary fission.

ii-Same process occurs.

d-When cells get small enough, they undergo meiosis, producing 4 gametes.

e-Gametes disperse and fuse with other gametes, restoring original cell size.

Euglenophyceae (Euglenoids).

A. General distribution.

1. Most are not planktonic, but some are and can become important.

B. Basic structures.

1. Always flagellated.
2. Usually unicellular.
3. Some photosynthetic; some heterotrophic.

-see pics on next slide.

C. Basic life history.

1. Asexual reproduction is the only form known to exist.
2. Simple binary fission.

D. Common genera.

1. *Euglena*.


Petalomonas


Entosiphon

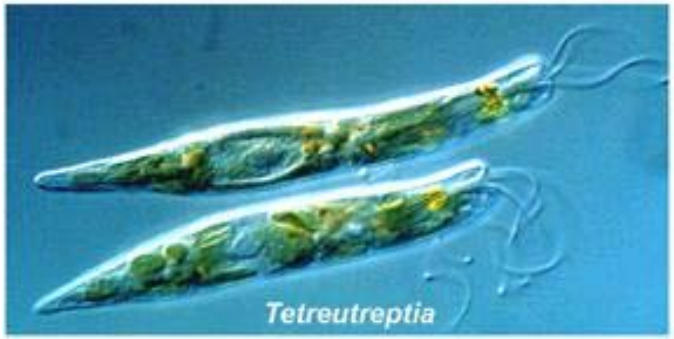

Distigma


Peranema


Phacus


Euglena


Euglena


Tetreutreptia


Trachelomonas

Dinophyta (Dinoflagellates).

A. General distribution.

1. Mostly marine; some freshwater.
2. Red tides→huge blooms, sometimes with fish kills and the like due to production of toxins.

B. Basic structures.

1. Two forms.
   a-Naked.
   b-Armored: cell wall sculpted into grooves, dimples and extensions.
2. Unicellular.
3. Two flagella.

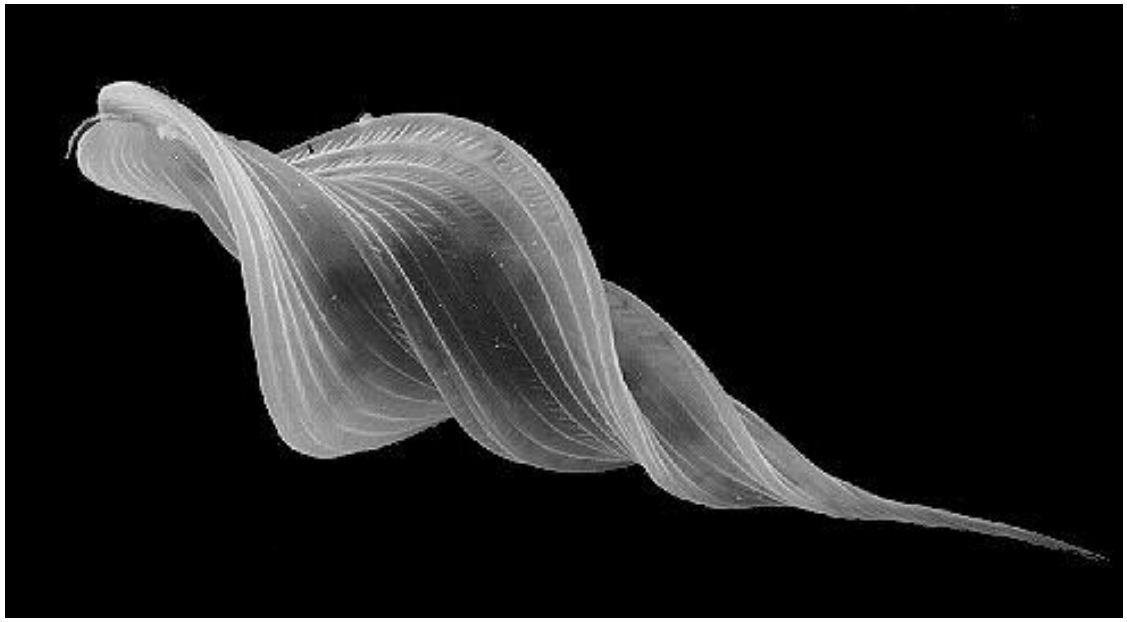
-see pics on next slide.

C. Basic life history.

1. Almost entirely asexual by binary fission.
2. Usually results in a non-motile cyst; cyst resistant and dormant.

D. Common genera.

1. *Ceratium*—pic on next slide (lower pic; left-hand side).




Copyright © Michael R. Martin 2002

Other groups→far less common in freshwaters; as always in biology, in some circumstances, species in these groups can become important components of freshwater systems, but usually, they are minor players.

A. Yellow-green algae.

B. Golden-brown algae.

C. Brown algae.

D. Red algae.