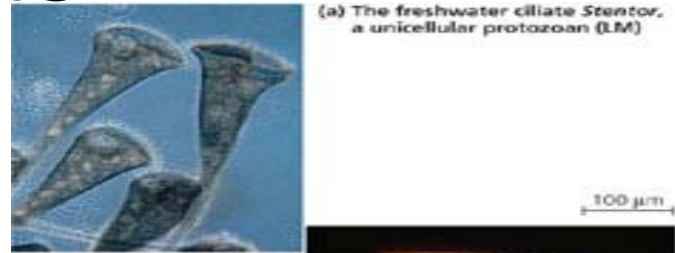


Protists

- What are protists?
- Survey of different groups



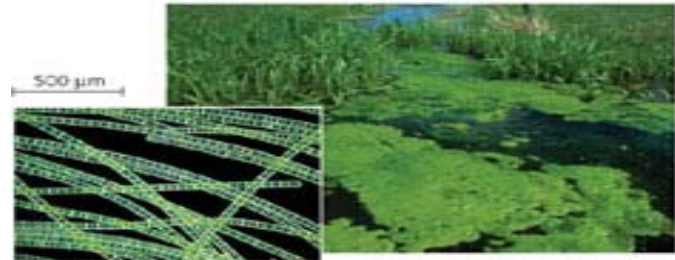
(a) The freshwater ciliate *Stentor*, a unicellular protozoan (LM)



(b) *Ceratium tripos*, a unicellular marine dinoflagellate (LM)



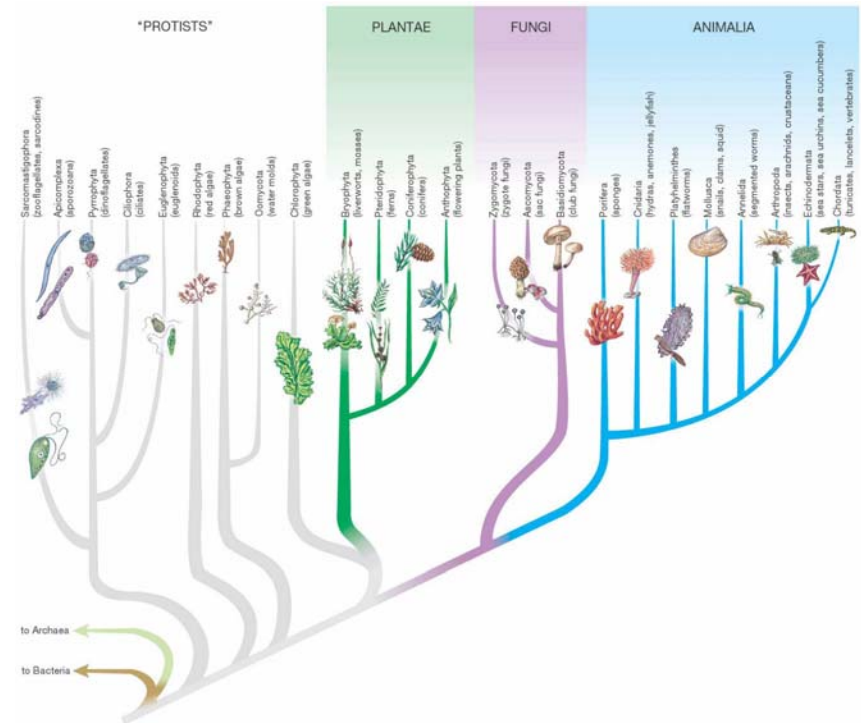
(c) *Desmarestia sanguinea*, a multicellular marine red alga



(d) *Spirogyra*, a filamentous freshwater green alga (inset LM)

Phylogenetic tree

- Diverse collection of organisms in the domain Eukarya
- Not plant, animal or fungus
- ~60,000 species
- Used to be defined by mobility



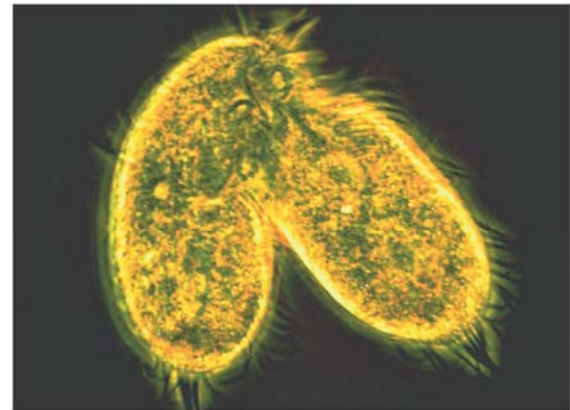
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Table 19-1 The Major Groups of Protists

Group	Subgroup	Locomotion	Nutrition	Representative Features	Representative Genus
Chromists	Water molds	Swim with flagella (gametes)	Heterotrophic bodies	Filamentous	<i>Plasmopara</i> (causes downy mildew)
	Diatoms	Glide along surfaces	Autotrophic; photosynthetic	Have silica shells; most marine	<i>Navicula</i> (glides toward light)
	Brown algae	Nonmotile	Autotrophic; photosynthetic	"Seaweeds" of temperate oceans	<i>Macrocystis</i> (forms kelp forests)
Alveolates	Dinoflagellates	Swim with two flagella	Autotrophic; photosynthetic	Many bioluminescent; often have cellulose	<i>Gonyaulax</i> (causes red tide)
	Apicomplexans	Nonmotile	Heterotrophic; all parasitic	Form infectious spores	<i>Plasmodium</i> (causes malaria)
	Ciliates	Swim with cilia	Heterotrophic	Most complex single cells	<i>Paramecium</i> (fast-moving pond-dweller)
Slime molds	Acellular slime molds	Sluglike mass oozes over surfaces	Heterotrophic	Form multinucleate plasmodium	<i>Physarum</i> (forms a large bright orange mass)
	Cellular slime molds	Amoeboid cells extend pseudopods; sluglike mass crawls over surfaces	Heterotrophic	Form pseudoplasmodium with individual amoeboid cells	<i>Dictyostelium</i> (often used in laboratory studies)
Euglenoids		Swim with one flagellum	Autotrophic; photosynthetic	Have an eyespot; all freshwater	<i>Euglena</i> (common pond-dweller)
Red algae		Nonmotile	Autotrophic; photosynthetic	Some deposit calcium carbonate; most marine	<i>Porphyra</i> (used as food in Japan)
Zooflagellates		Swim with flagella	Heterotrophic	Inhabit soil or water or may be parasitic	<i>Trypanosoma</i> (causes African sleeping sickness)
Pseudopod-users	Amoebas	Extend pseudopods	Heterotrophic	Both naked and shelled forms exist	<i>Amoeba</i> (common pond-dweller)
	Foraminifera Radiolarians Heliozoans				
Green algae		Swim with flagella (some species)	Autotrophic; photosynthetic	Closest relatives of land plants	<i>Ulva</i> (sea lettuce)

What are protists?

- Single cell with exceptions
- Some are aggregates
- Multicellular
- Reproduce asexually
- Some sexual reproduction
- Three modes nutrition: photosynthetic, absorb, ingest
- Algae, protozoa



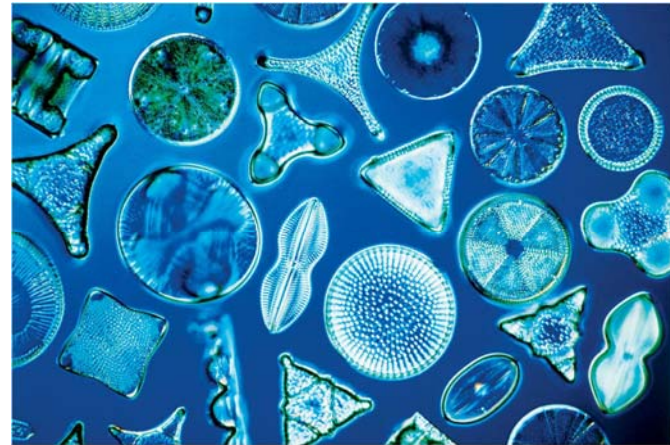
(b)

Chromists

- Water molds
- Brown algae
- Diatoms: silica in cell walls
- Diatomaceous earth
- Used in toothpaste and metal polish



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Brown algae



Multicellular, mostly marine
100m in height



(a)

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Kelp

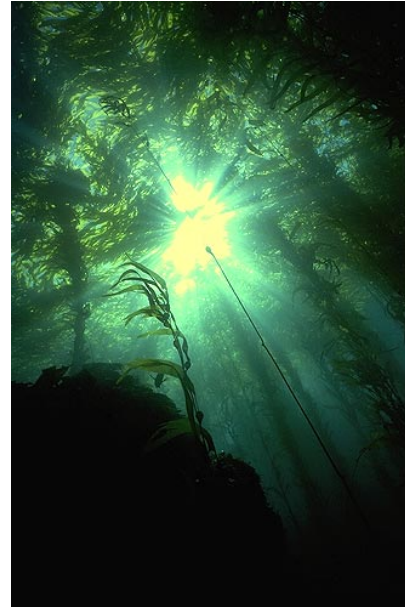


(a) The seaweed is grown on nets in shallow coastal waters.

(b) A worker spreads the harvested seaweed on bamboo screens to dry.

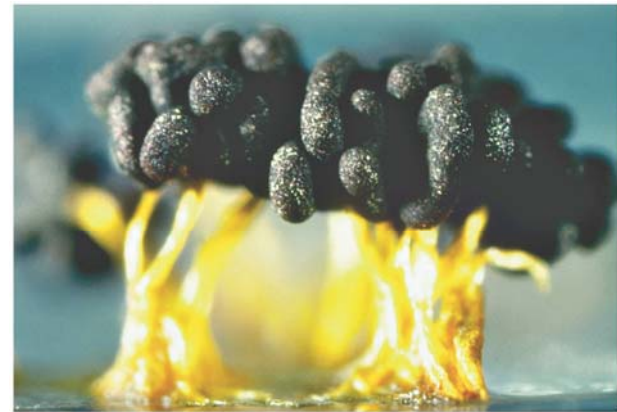
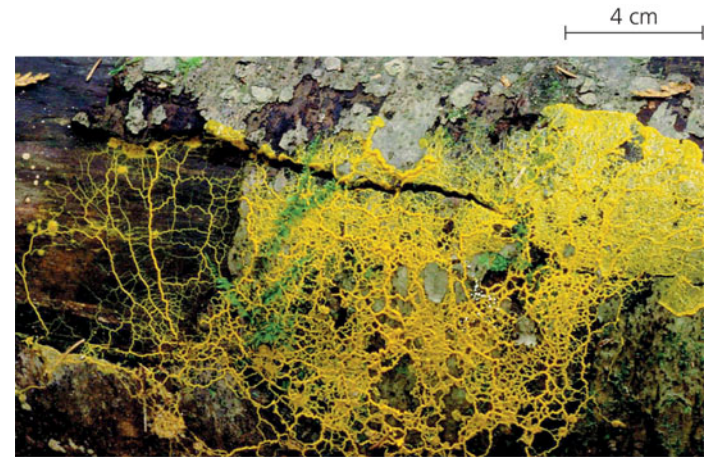


(c) Paper-thin, glossy sheets of nori make a mineral-rich wrap for rice, seafood, and vegetables in sushi.

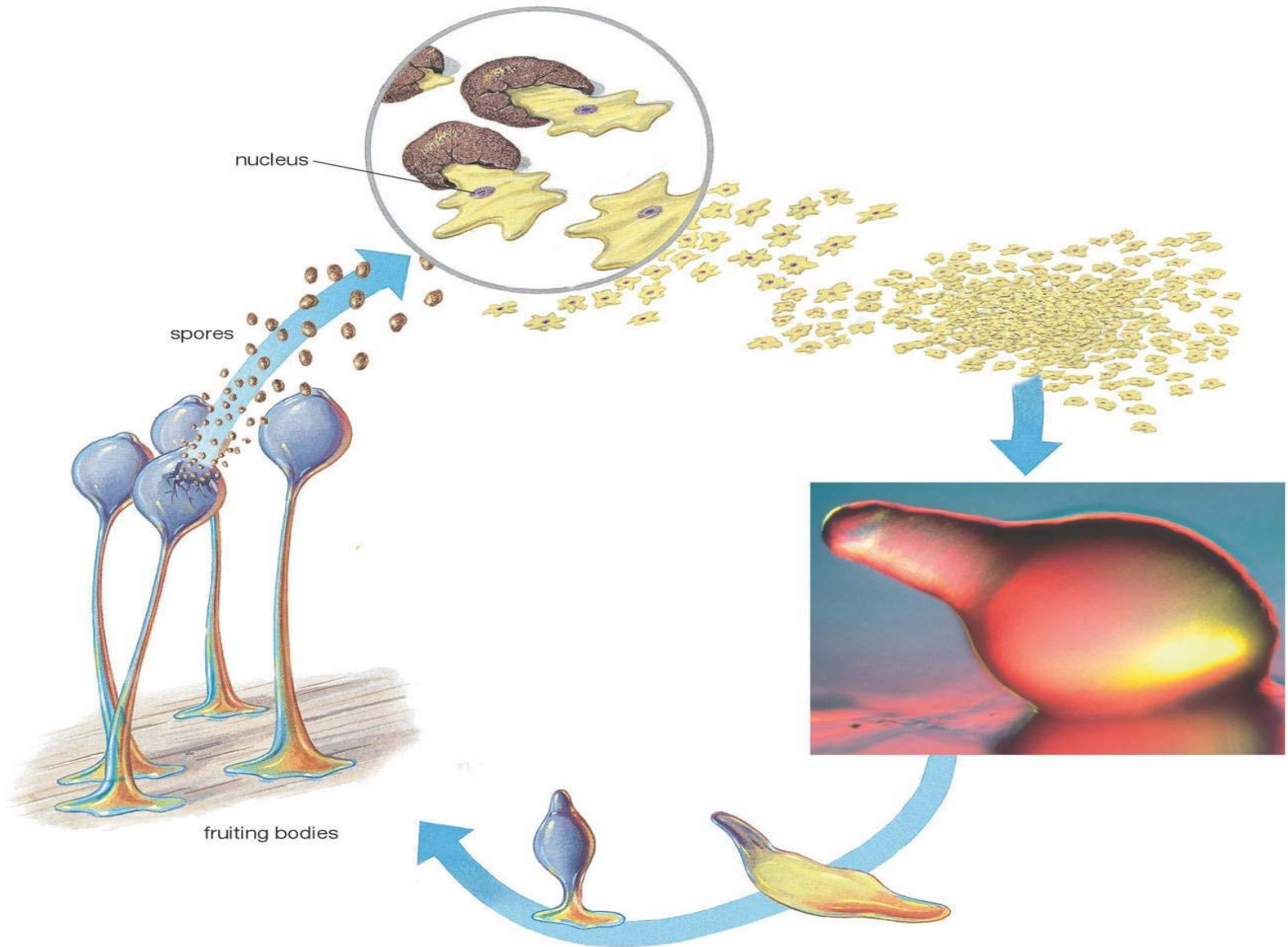


Alveolates

- Slime mold
- Dinoflagellates
- Ciliates
- Apicomplexans (no locomotion)

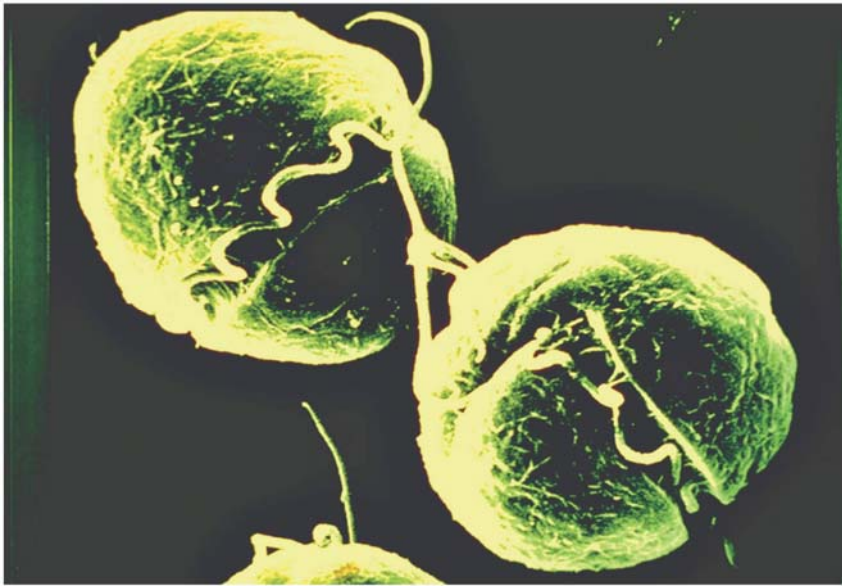


(b)



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Dinoflagellates

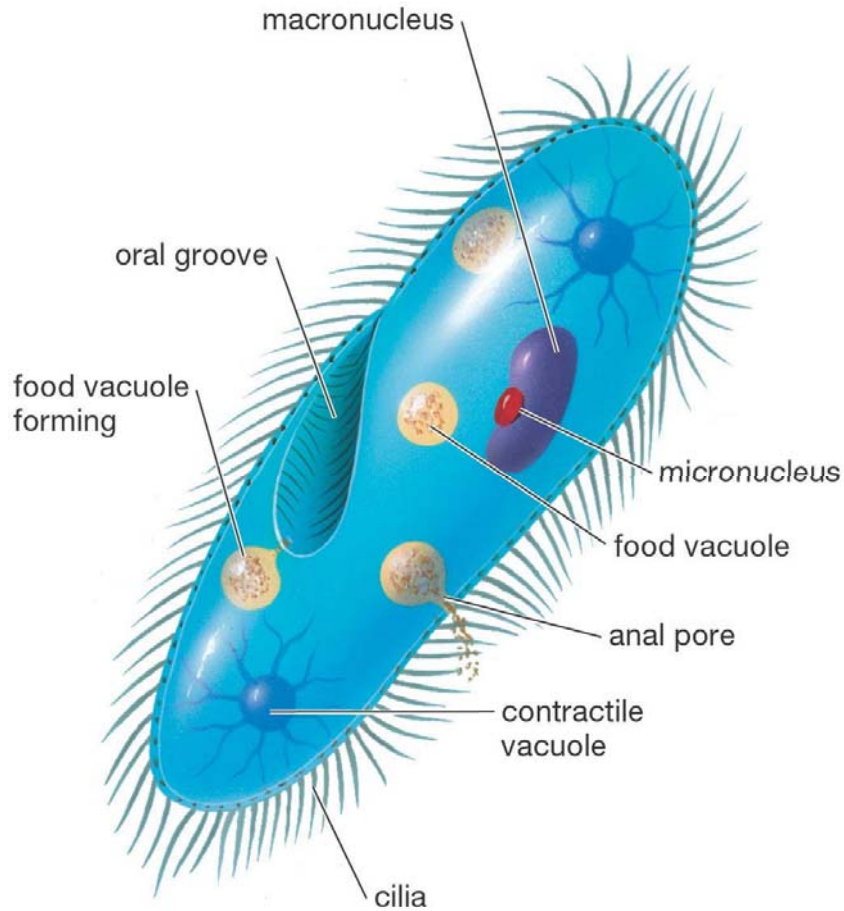


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Ciliates



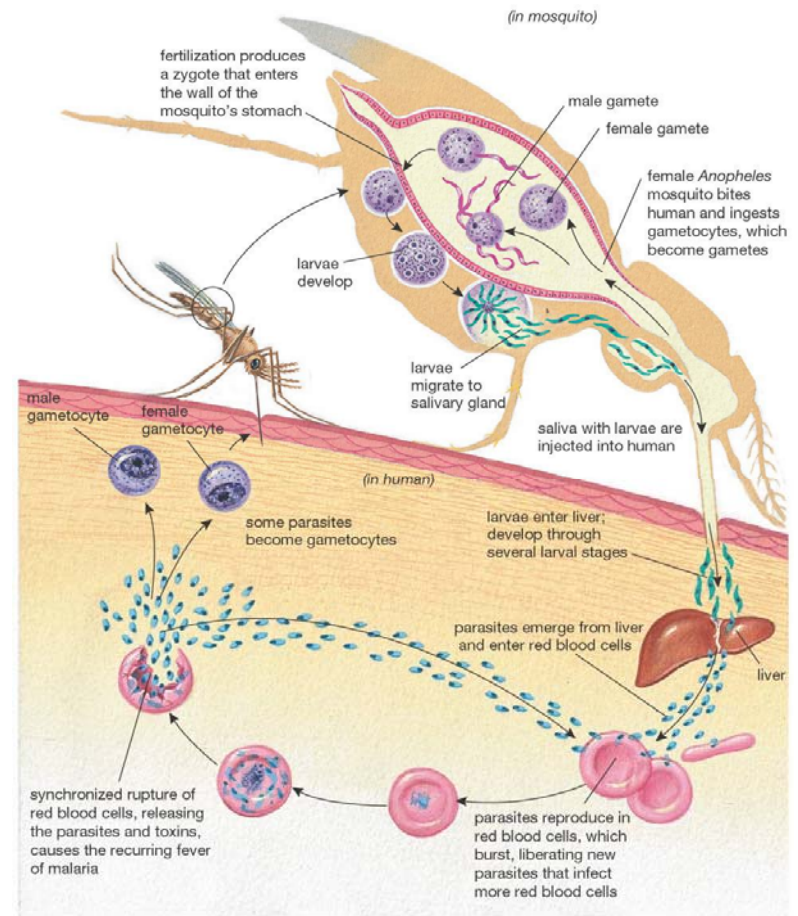
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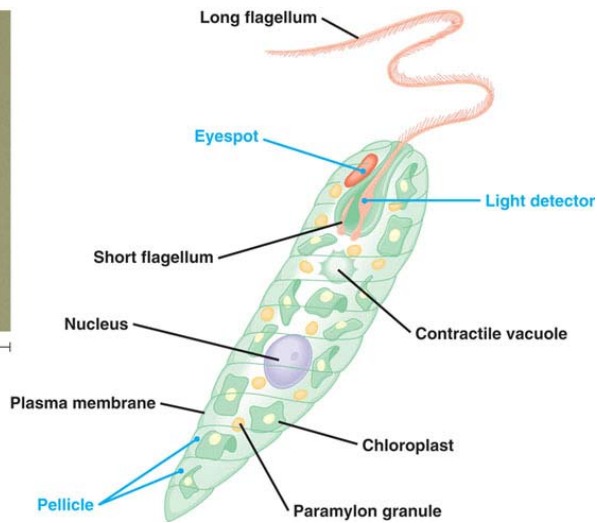
Apicomplexans

- Plasmodium
- Malaria
- Transmitted by mosquito bite
- Cycles of 24-48h



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Euglenoids and Red Algae



(a) *Bonnemaisonia hamifera*. This red alga has a filamentous form.



(b) Dulse (*Palmaria palmata*). This edible species has a "leafy" form.

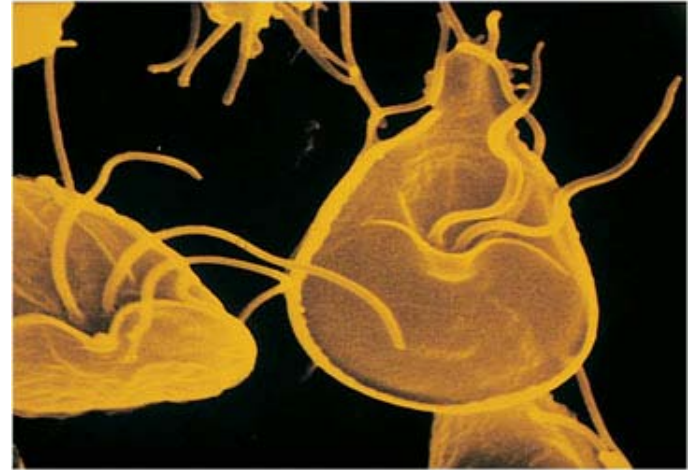


(c) A coralline alga. The cell walls of coralline algae are hardened by calcium carbonate. Some coralline algae are members of the biological communities around coral reefs.



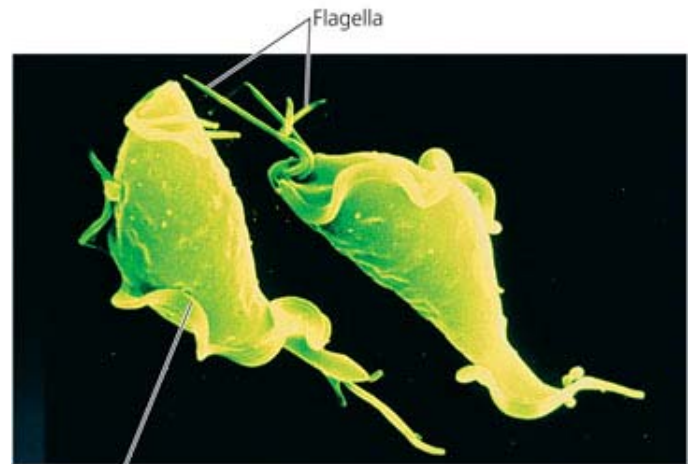
Zooflagellates

- Possess at least one flagella
- Free-living
- Symbiotic:
- Mutualism: termite gut
- Parasites



(a) *Giardia intestinalis*, a diplomonad (colorized SEM)

5 μ m



Undulating membrane

Flagella

5 μ m

(b) *Trichomonas vaginalis*, a parabasalid (colorized SEM)

Giardia & Trypanosoma



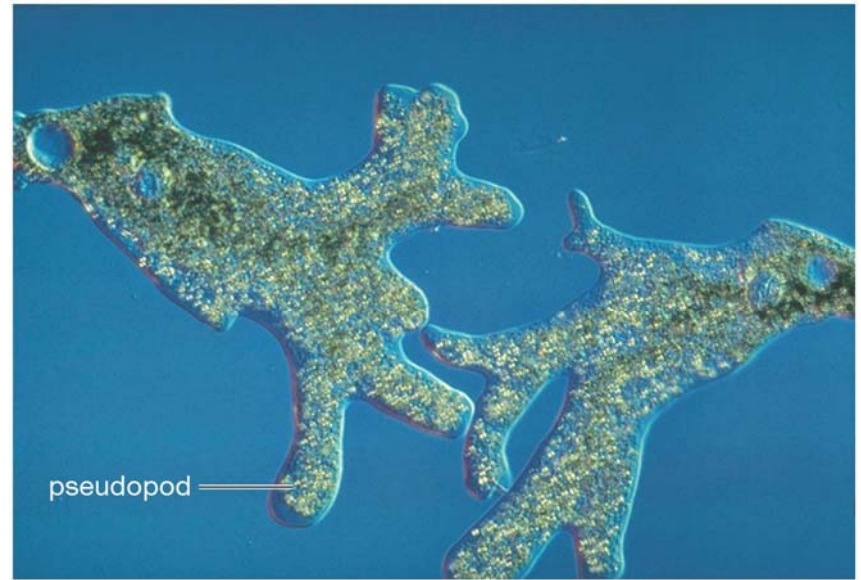
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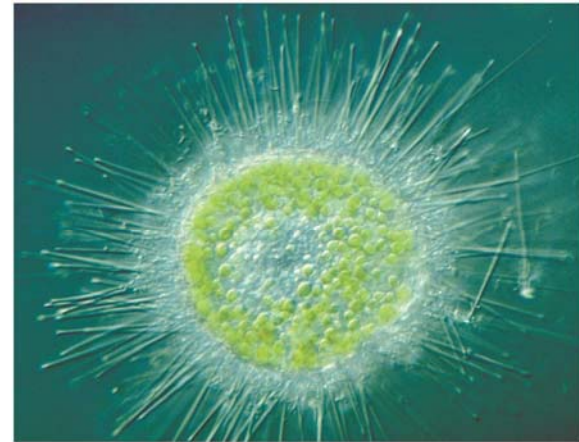
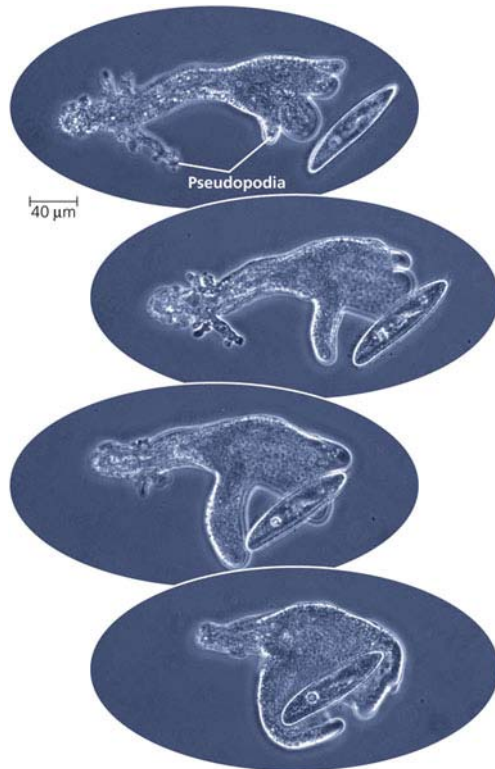
Pseudopods

- Amoebas
- Helizoans
- Foraminiferans & Radiolarins

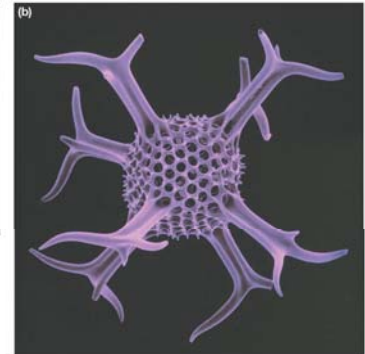
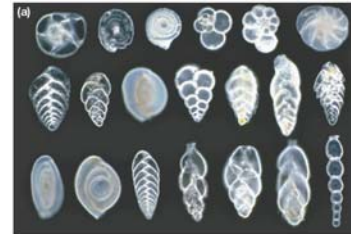


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Foraminiferans & Radiolarins



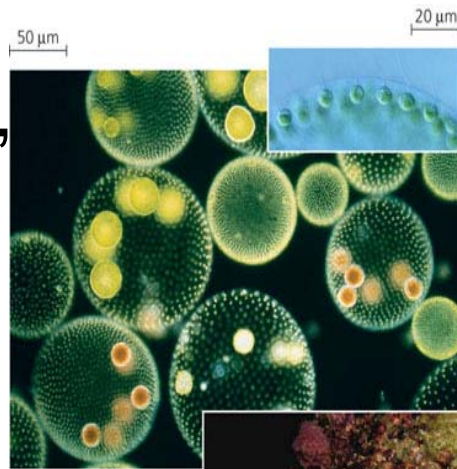
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Chlorophyta

- Green Alga
- Unicellular, colonial, and multicellular
- Mostly freshwater
- Gave rise to land plants



(a) *Volvox*, a colonial freshwater chlorophyte. The colony is a hollow ball whose wall is composed of hundreds or thousands of biflagellated cells (see inset LM) embedded in a gelatinous matrix. The cells are usually connected by strands of cytoplasm; if isolated, these cells cannot reproduce. The large colonies seen here will eventually release the small "daughter" colonies within them (LM).

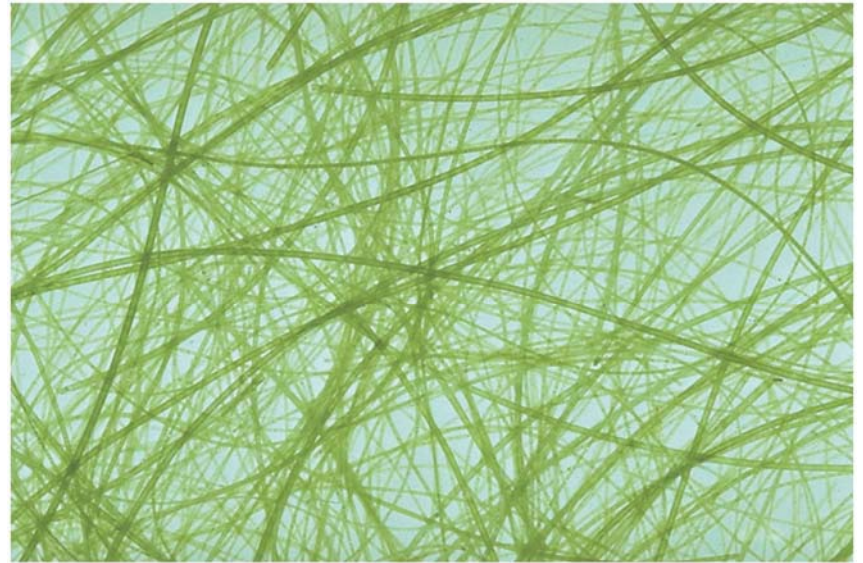
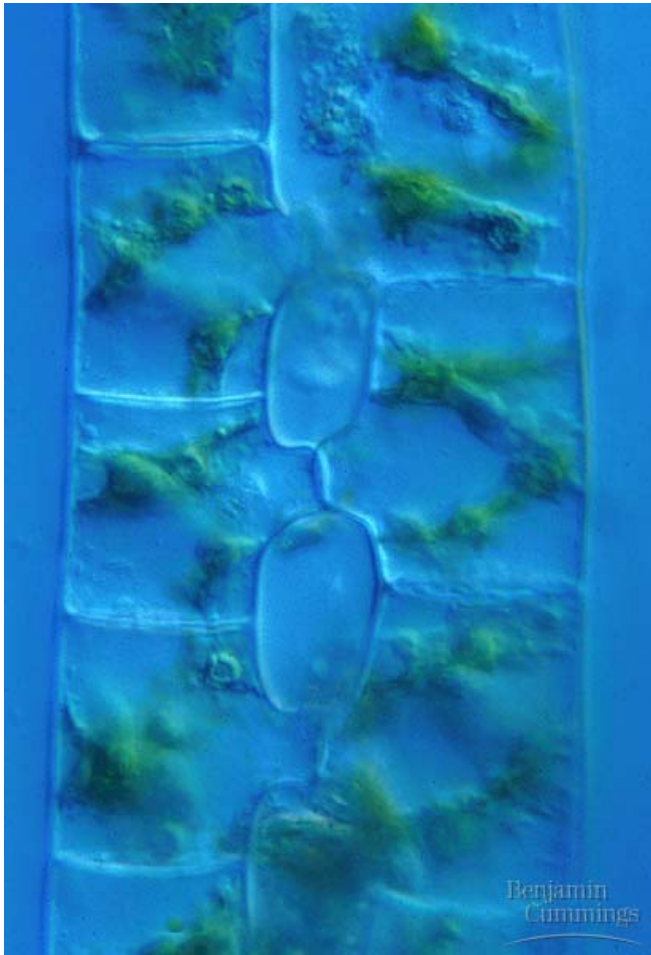
(b) *Caulerpa*, an intertidal chlorophyte. The branched filaments lack cross-walls and thus are multinucleate. In effect, the thallus is one huge "supercell."



(c) *Ulva*, or sea lettuce. This edible seaweed has a multicellular thallus differentiated into leaflike blades and a rootlike holdfast that anchors the alga against turbulent waves and tides.



Spirogyra



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