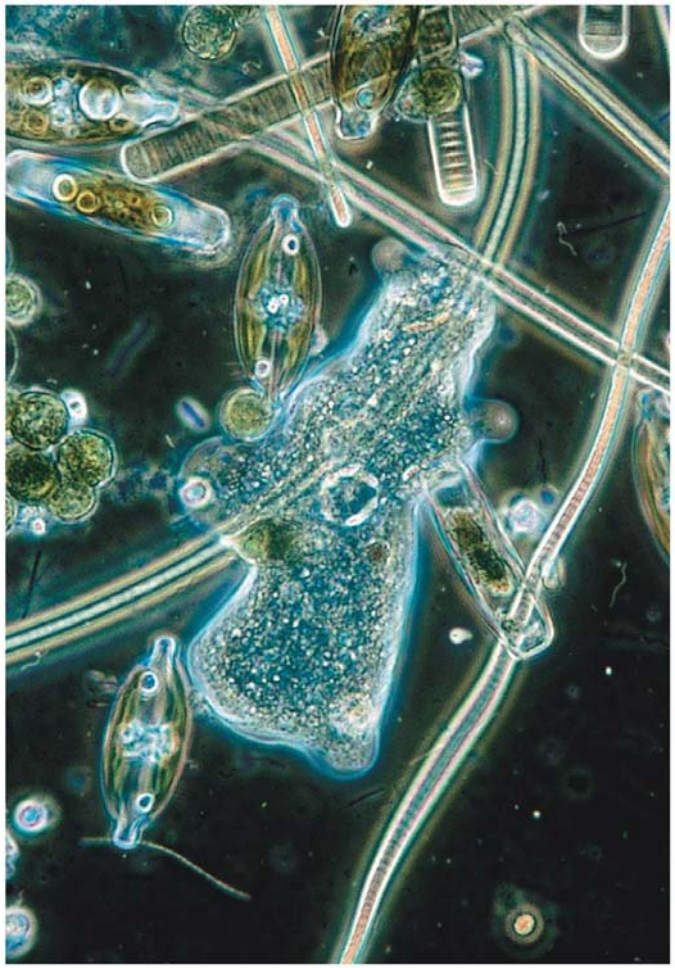
PROTISTS



- Protists constitute several kingdoms within the domain Eukarya
- Protists obtain their nutrition in a variety of ways
  - Algae are autotrophic protists
  - Protozoans are heterotrophic protists
  - Fungus-like protists obtain organic molecules by absorption

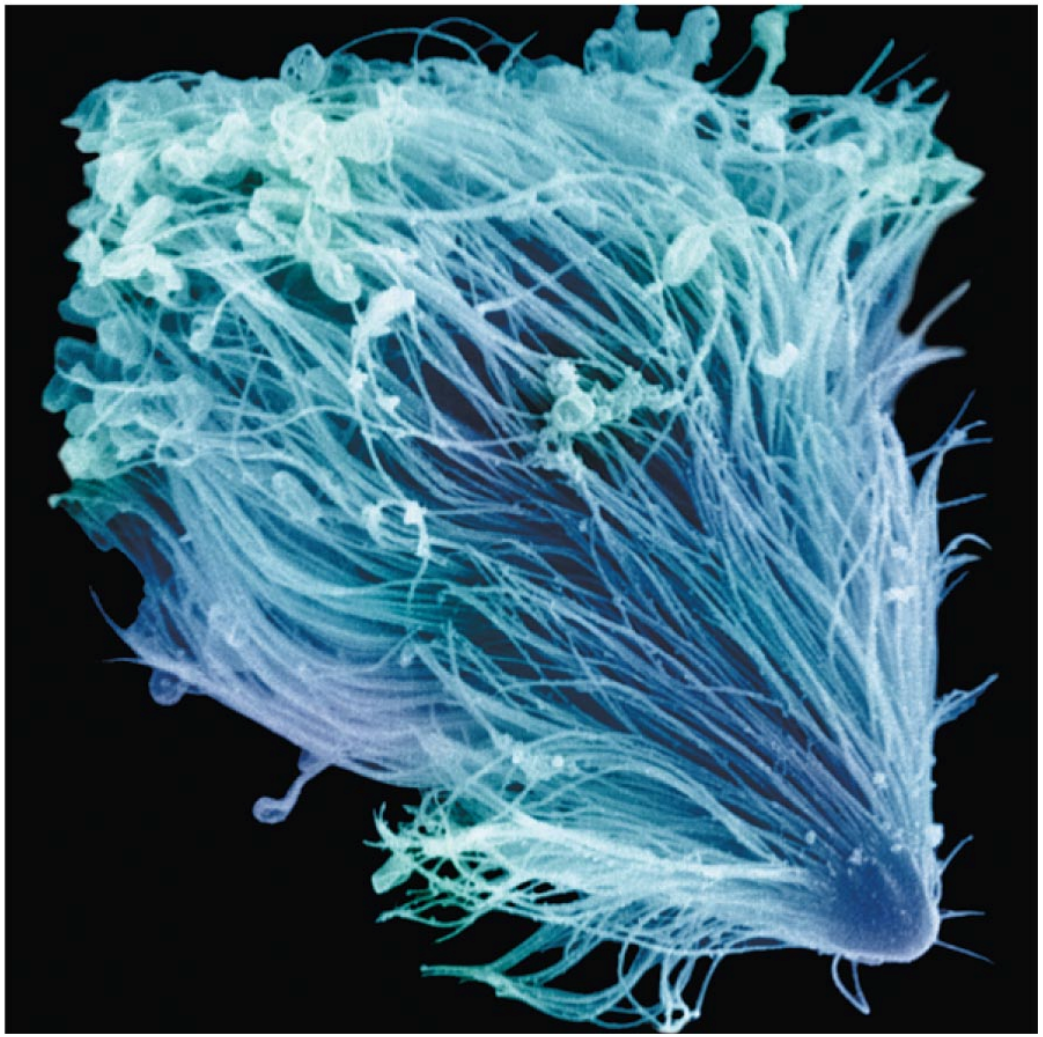
Symbiosis

Symbiosis is a close association between of two or more organisms

*Endo*symbiosis— living *within* another

Symbiosis

- Termite endosymbionts digest cellulose in the wood eaten by the host
- The protists have endosymbiotic prokaryotes that metabolize the cellulose

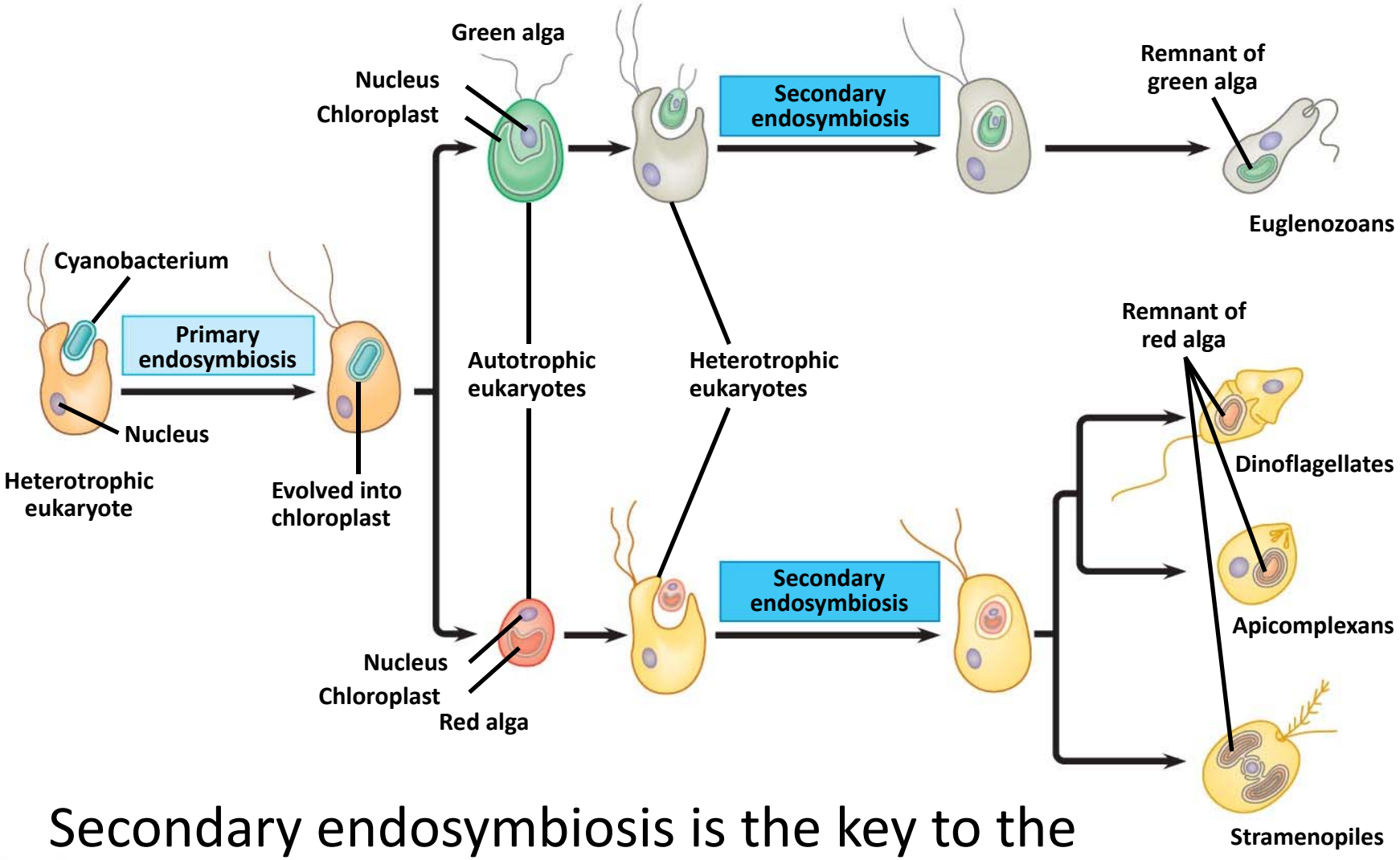


Scanning electron microscope view of the prokaryote that lives in the termite that digests cellulose

Protists are eukaryotes

- Some have a high level of complexity
- They have multiplenmembrane-bound chromosomes
- Their flagella or cilia contain microtubules with a 9 + 2 pattern

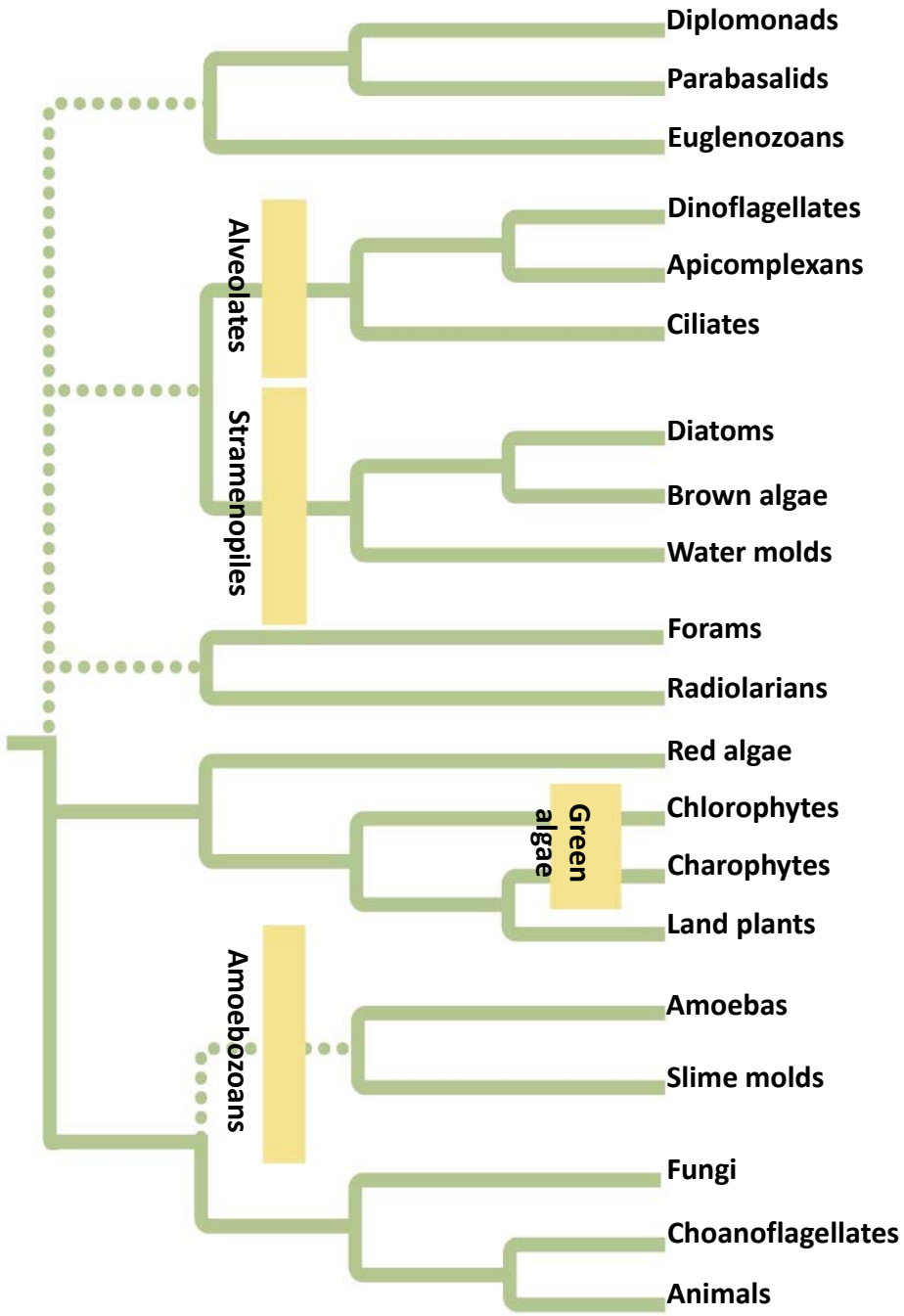
Secondary endosymbiosis



Secondary endosymbiosis is the key to the enormous diversity of protists

Taxonomy

of protists remains a work in progress and includes multiple clades of protists.



DNA studies will keep the names, boundaries, and placement of clades in flix for many ayears to come.

Diplomonads and Parabasalids

- **Diplomonads** may be the most ancient surviving lineage of eukaryotes
  - They have modified mitochondria without DNA or electron transport chains
  - Most are anaerobic

– **Parabasalids** are heterotrophic protists with modified mitochondria that generate some energy anaerobically

STD

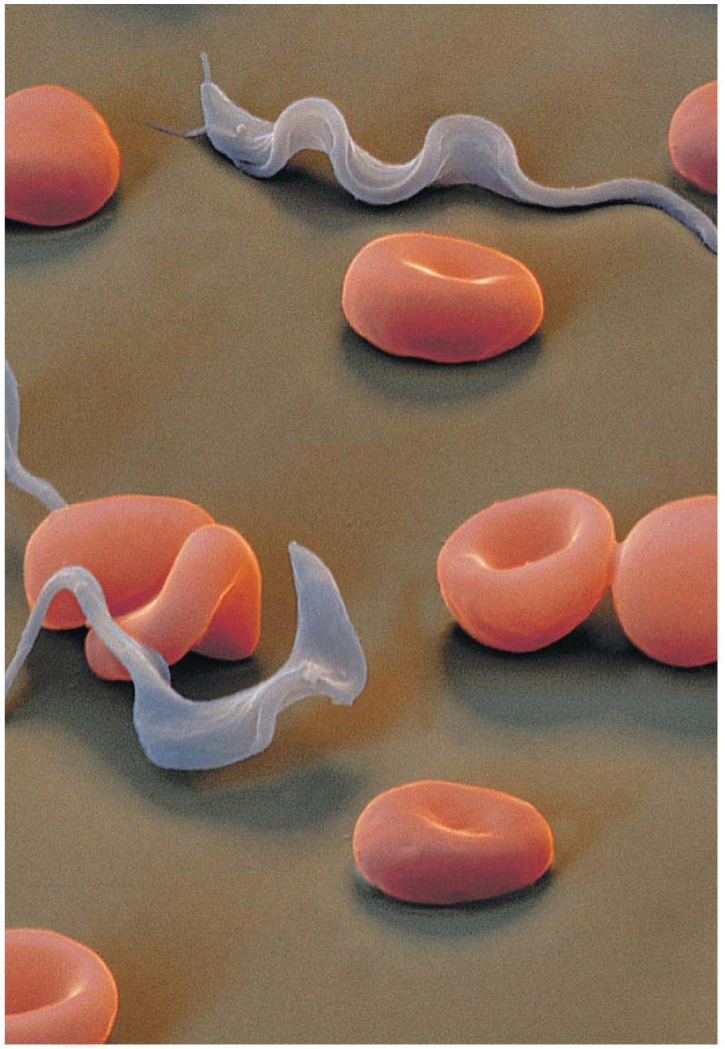
anyone?

The parasite *Trichomonas vaginalis* is sexually transmitted, feeding on white blood cells and bacteria living in the cells lining the vagina

Euglenozoans

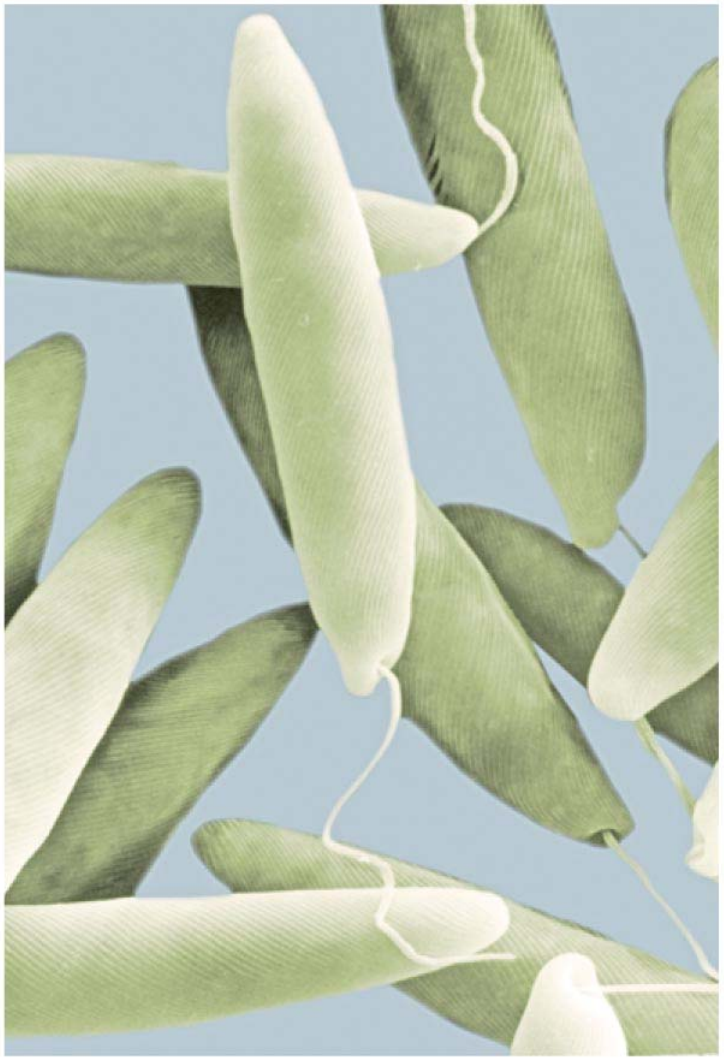
– are a diverse clade of protists

  – Their common feature is a crystalline rod of unknown function inside their flagella



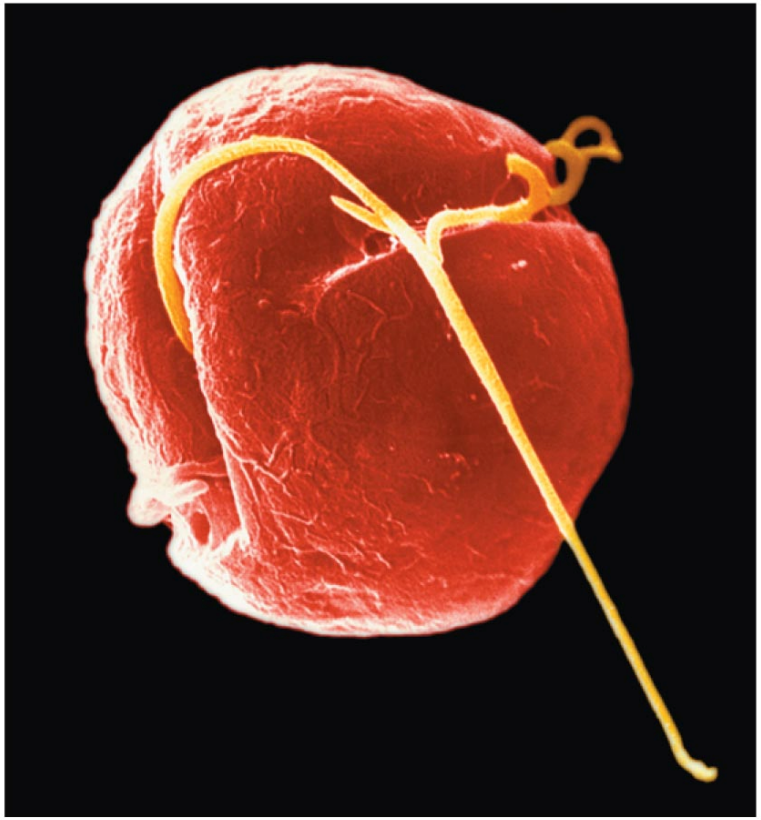
Trypanosome with RBCs this causes African sleeping sickness

– Euglenozoans include heterotrophs, photosynthetic autotrophs, and pathogenic parasites

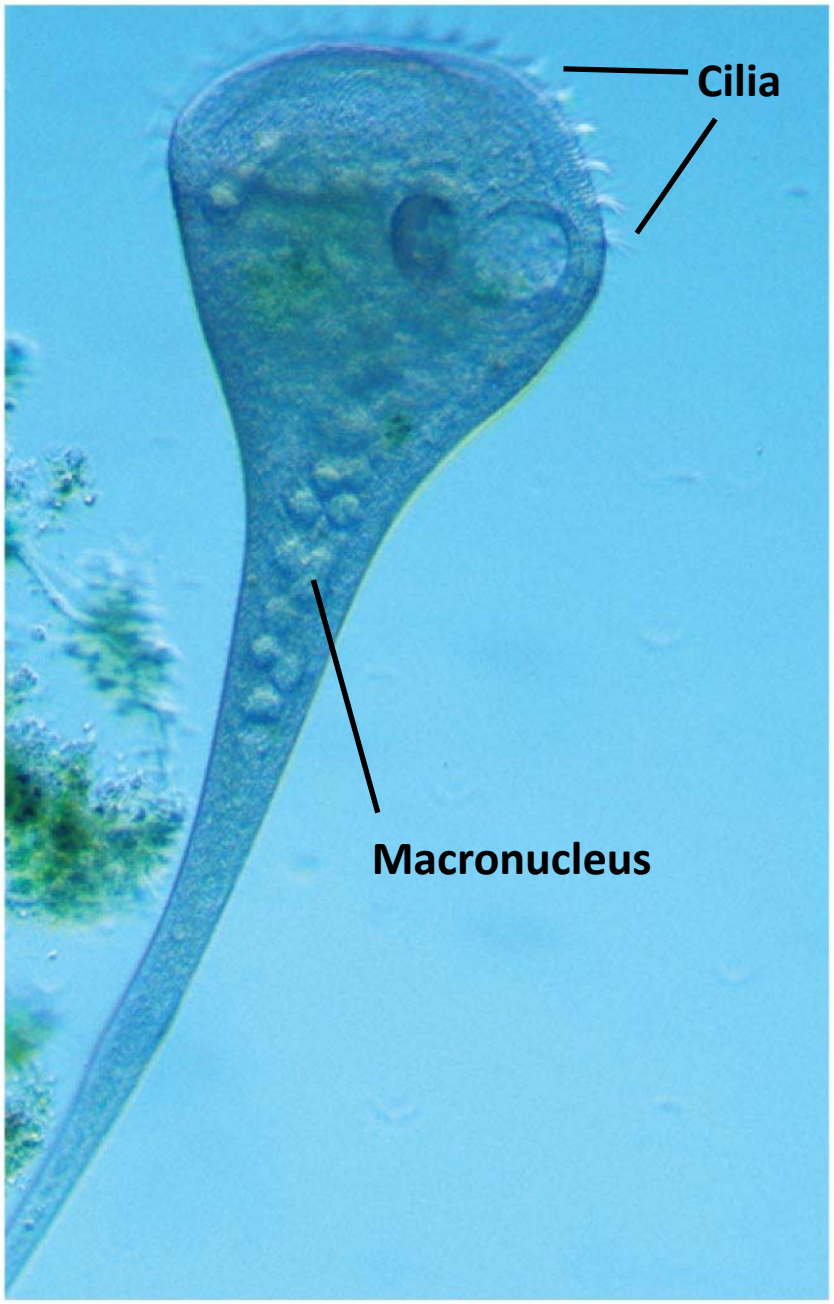


Euglena

- **Alveolates** have membrane-enclosed sacs or alveoli beneath the plasma membrane
- **Dinoflagellates** are important members of marine and freshwater phytoplankton
  - Some live within coral animals, feeding coral reef communities
  - Dinoflagellate blooms cause red tides



– **Ciliates** use cilia to move and feed.
– **Apicomplexans** are animal parasites such as *Plasmodium*, which causes malaria

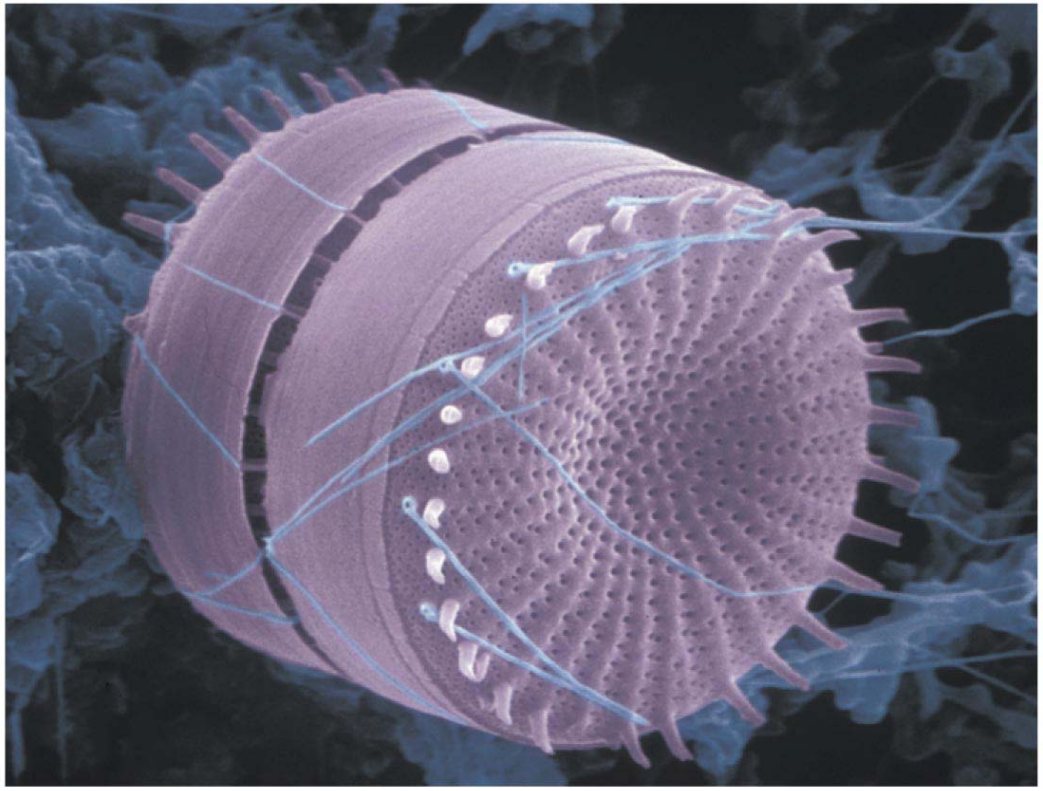


Stramenopiles have “hairy” and smooth flagella

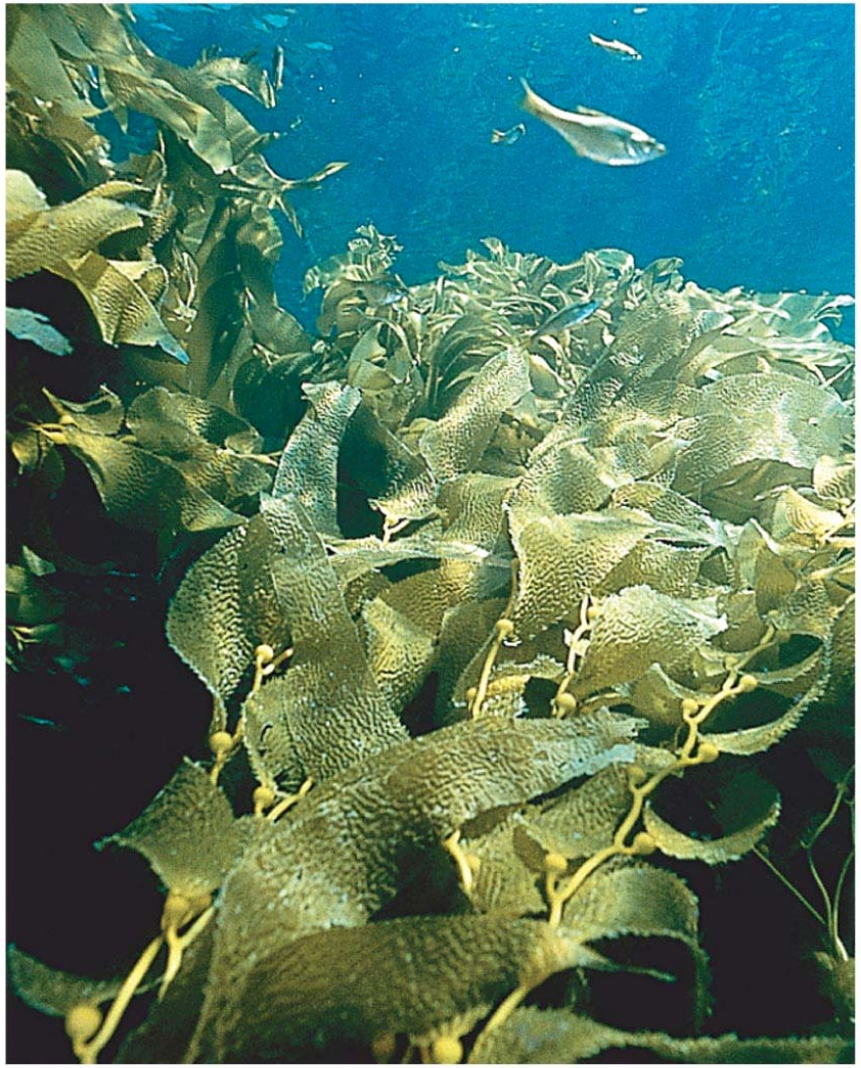
– **Stramenopiles** are named for their “hairy” flagellum, usually paired with a “smooth” flagellum

Water molds are fungus-like and decompose dead organisms in freshwater habitats

Diatoms are unicellular,
with silicate cell walls

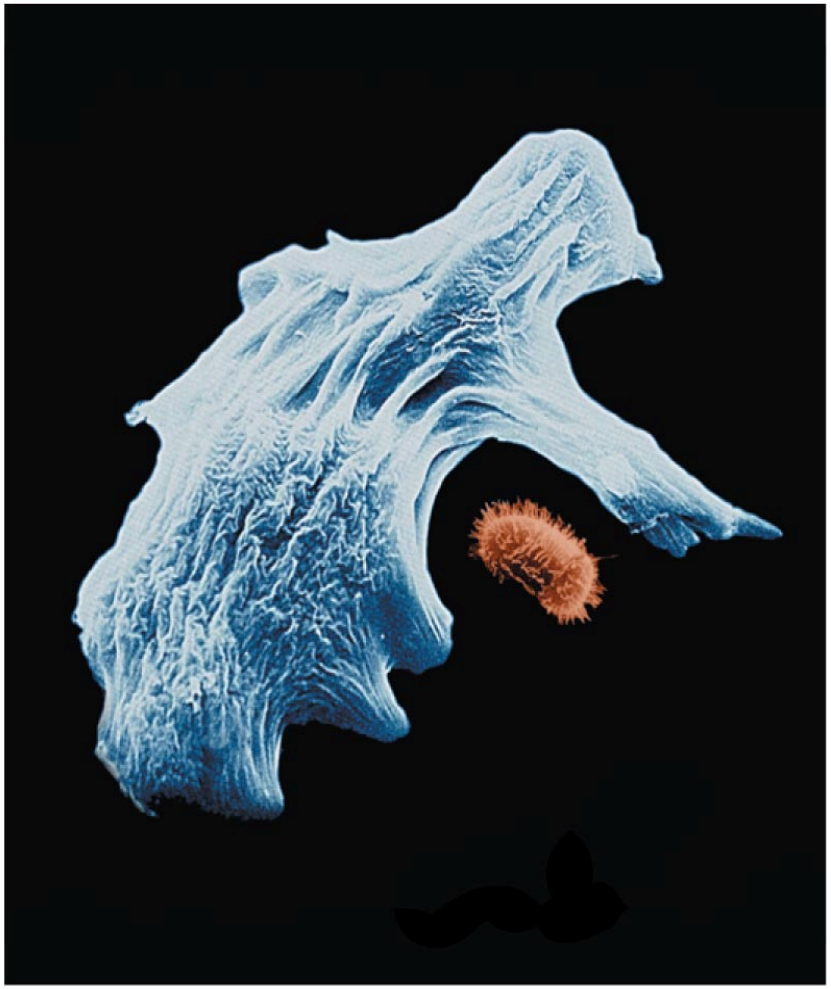


Brown algae are large, complex algae called *seaweeds*; all are multicellular and most are marine



Amoebozoans have Pseudopodia

- Amoebas move and feed by means of **pseudopodia**
- Members of the clade **amoebozoans** include many free-living amoebas, some parasitic amoebas, and slime molds



Amoebozoans have Pseudopodia

A **plasmodial slime mold** is an amoebozoan that forms a **plasmodium**, a multinucleate mass of cytoplasm

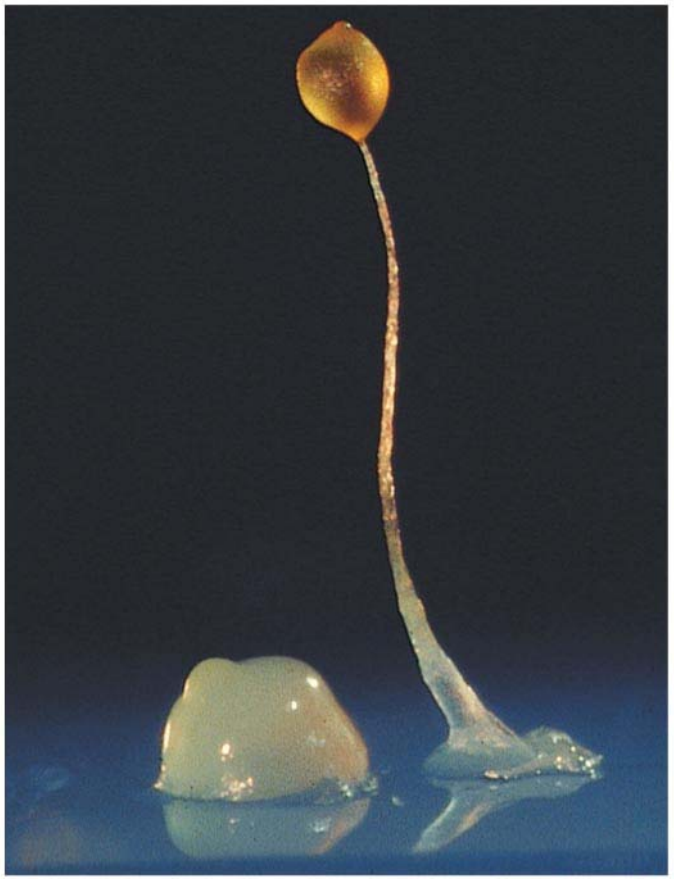
The plasmodium extends pseudopodia through soil and rotting logs, engulfing food by phagocytosis as it grows

Under adverse conditions, the plasmodium forms reproductive structures that produce spores

Amoebozoans have Pseudopodia

Cellular slime molds live as solitary amoeboid cells

When food is scarce, the amoeboid cells swarm together, forming a slug-like aggregate that migrates, before forming a fruiting body borne on a stalk

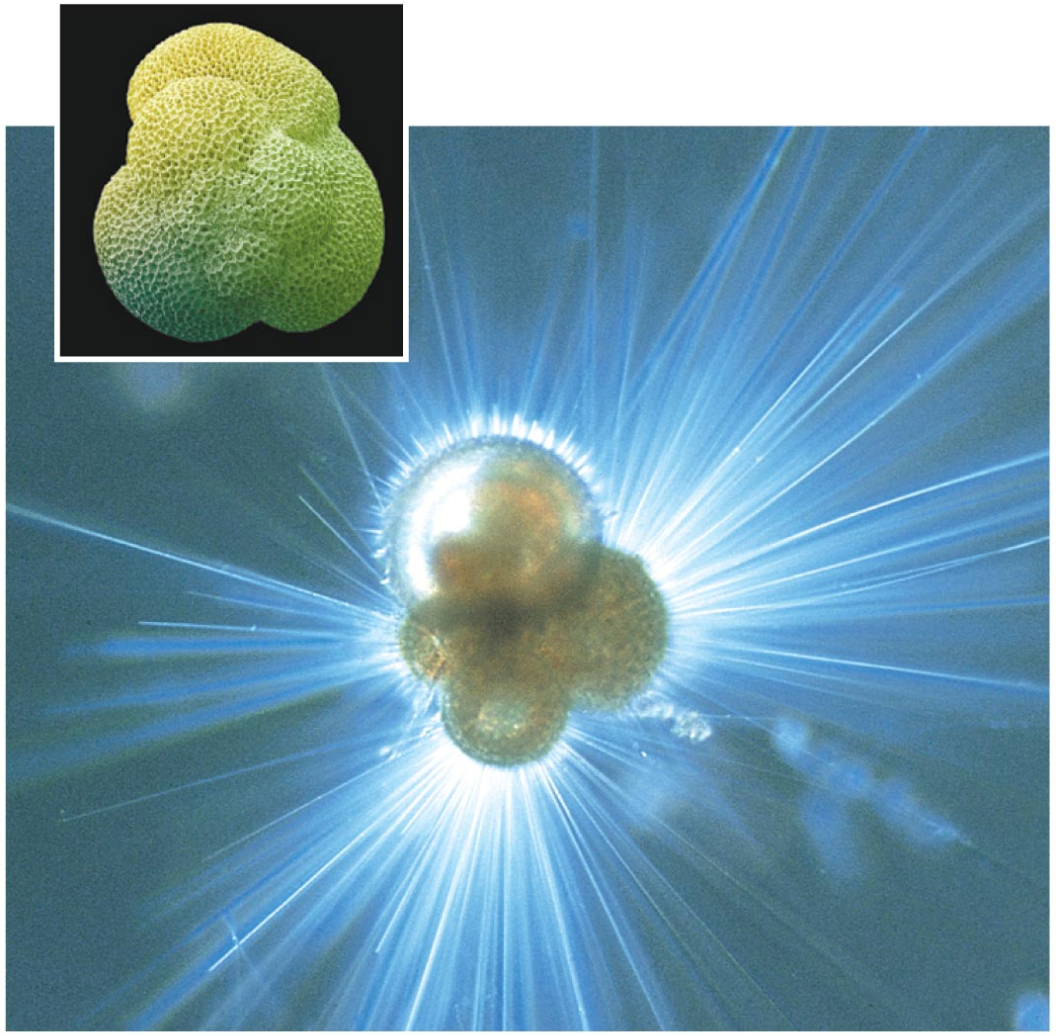


Foraminiferans have threadlike pseudopodia

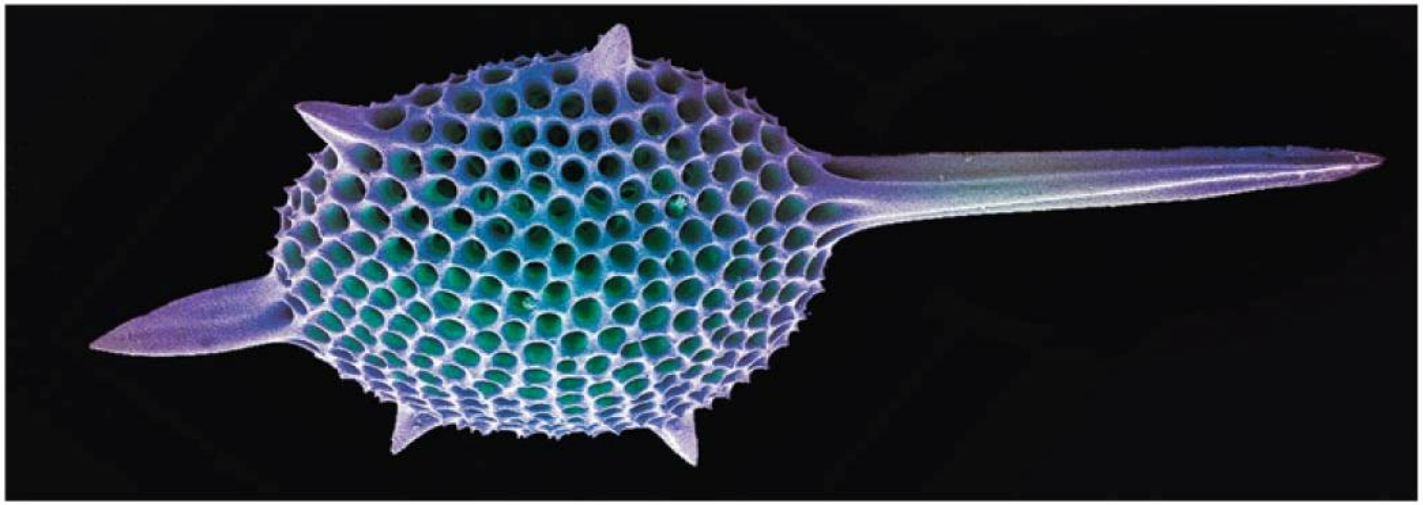
Foraminiferans and radiolarians move and feed by means of threadlike pseudopodia

Foraminiferans live in marine and freshwater

They have porous tests composed of calcium carbonate, with small pores through which pseudopodia extend



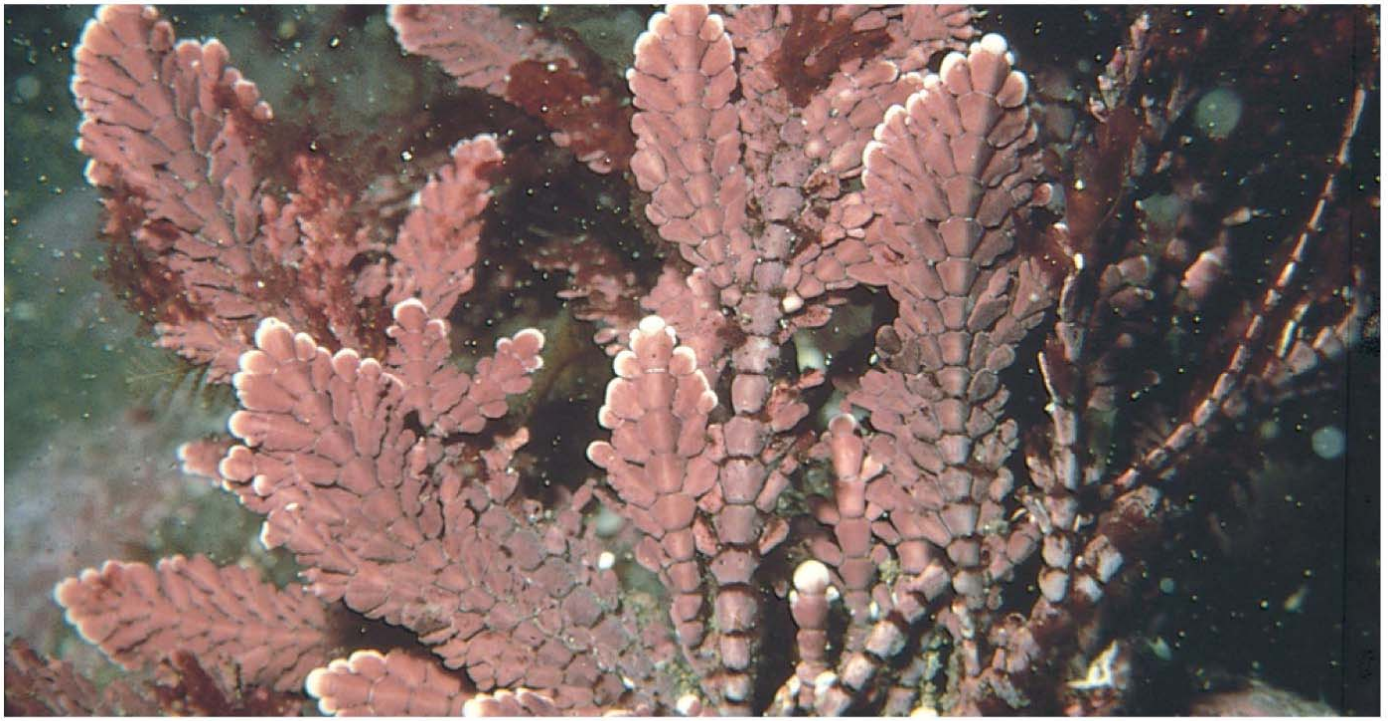
Radiolarians have threadlike pseudopodia



Radiolarians produce an internal silicate skeleton

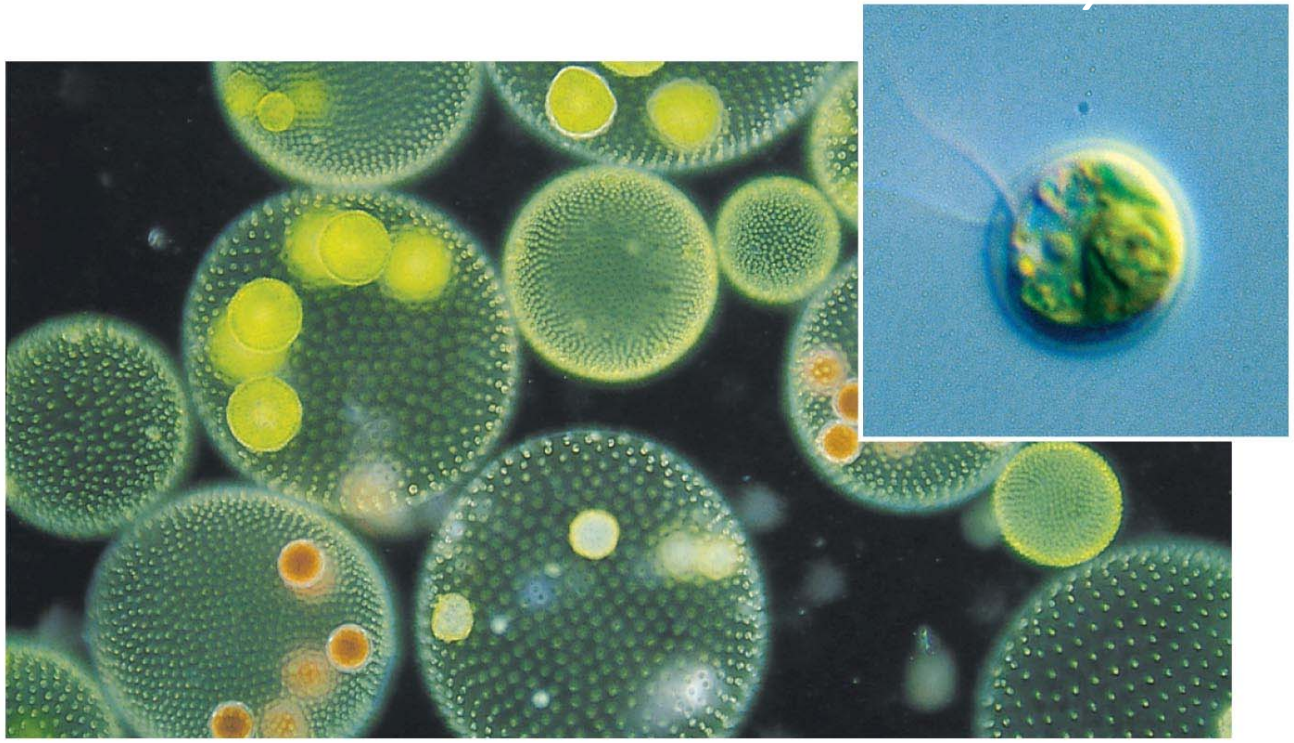
The test is composed of organic materials

Algae is the closest relative of land plants



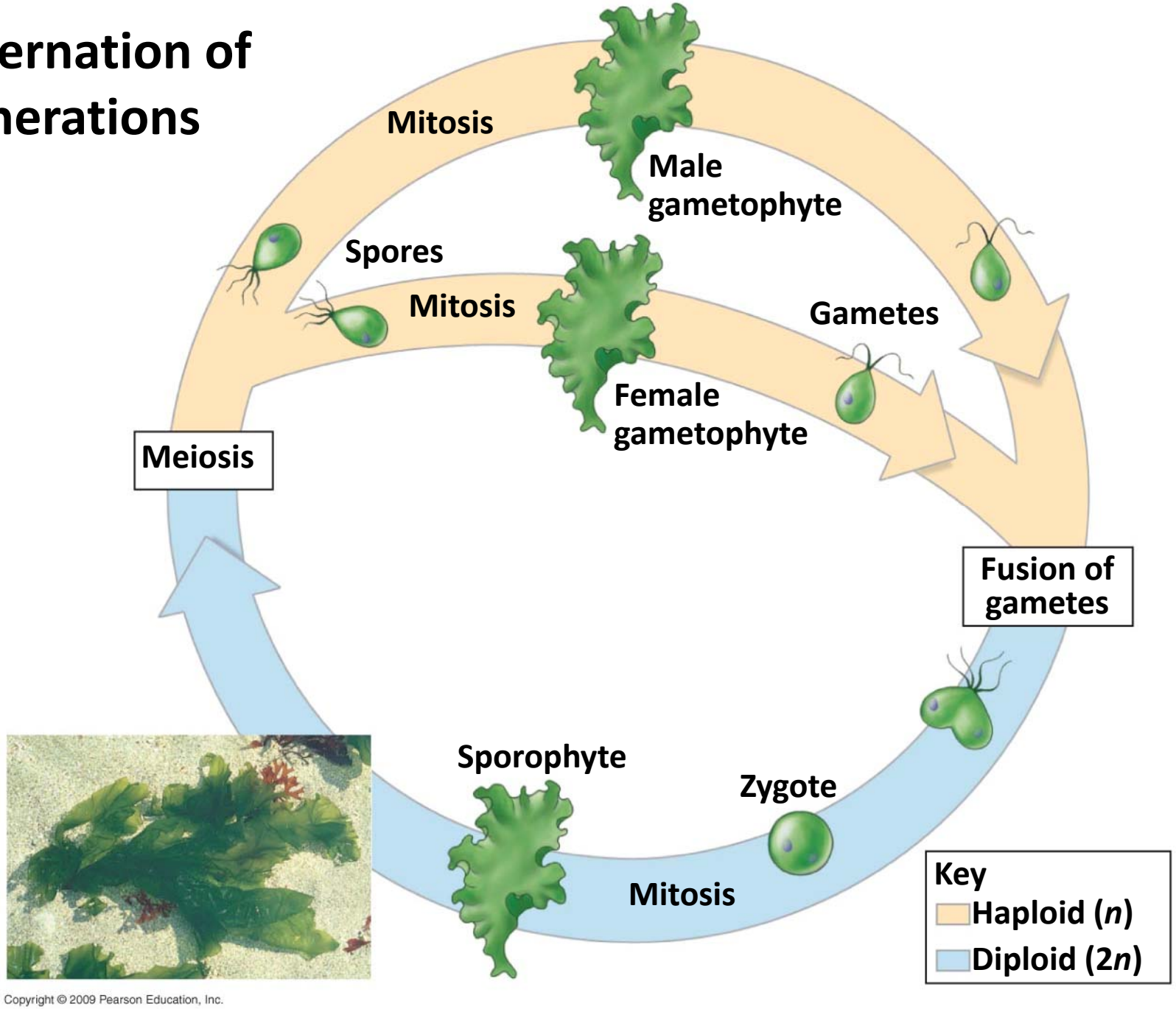
Red algae are typically soft-bodied, but some have cell walls encrusted with hard, chalky deposits

Algae is the closest relative of land plants



- **Green algae** split into two groups, the chlorophytes and the charophytes
  - The charophytes are the closest living relatives of land plants

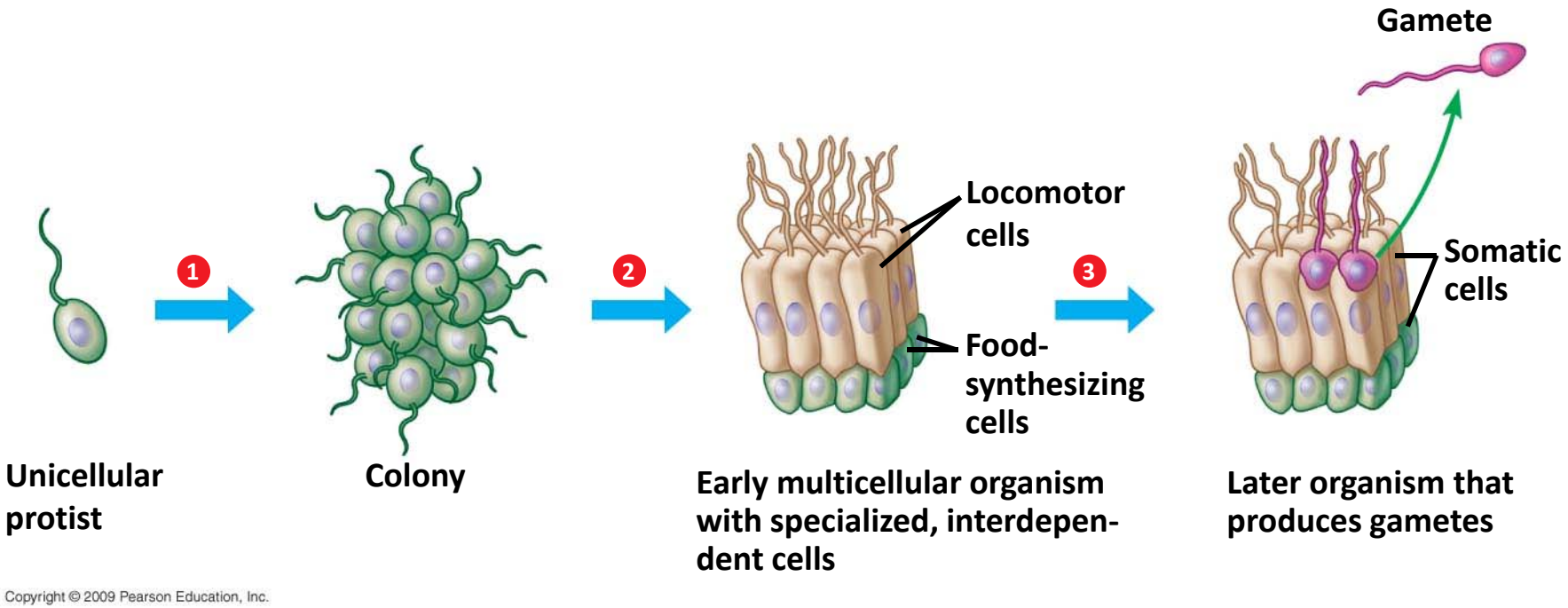
Alternation of generations



Multicellularity
Evolved several times in eukaryotes

- Multicellular life arose over a billion years ago.
- By 543 million years ago, diverse animals and multicellular algae lived in aquatic environments; plants and fungi colonized land 500 million years ago

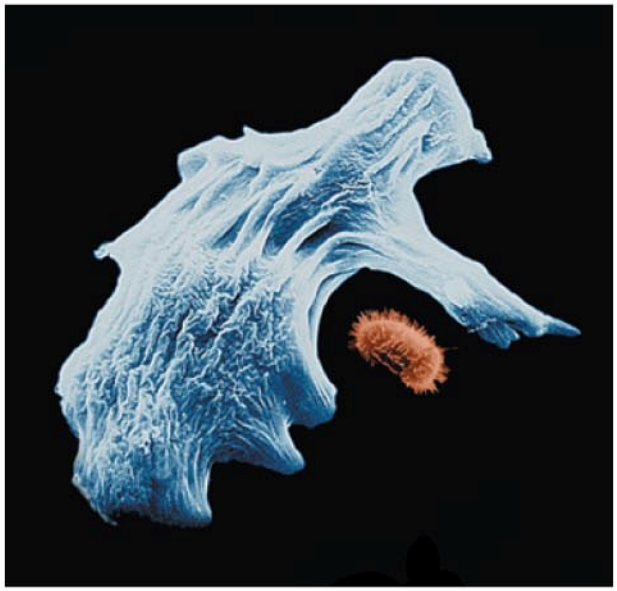
Multicellularity
Evolved several times in eukaryotes



Probably by specialization of the cells of colonial protists.

Nutritional Mode	Energy Source	Carbon Source
Photoautotroph	Sunlight	CO_2
Chemoautotroph	Inorganic chemicals	
Photoheterotroph	Sunlight	Organic compounds
Chemoheterotroph	Organic compounds	

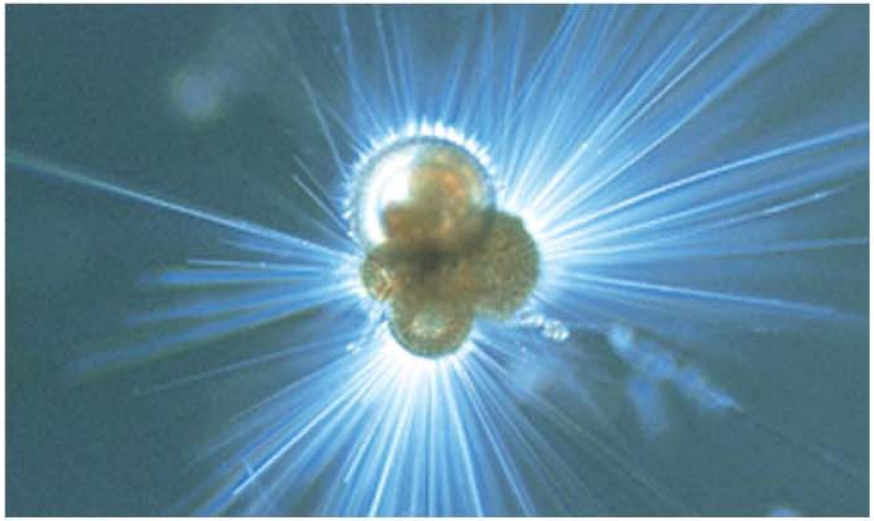
(a)



(b)

(c)

(d)



You should now be able to

1. Compare the characteristics of the three domains of life; explain why biologists consider Archaea to be more closely related to Eukarya than to Bacteria
2. Describe the structures and functions of the diverse features of prokaryotes; explain how these features have contributed to their success
3. Describe the nutritional diversity of prokaryotes; explain the significance of biofilms
4. Describe the diverse types of Archaea living in extreme and moderate environments

You should now be able to

5. Distinguish between the subgroups of the domain Bacteria, noting the particular structure, special features, and habitats of each group
6. Distinguish between bacterial exotoxins and endotoxins, noting examples of each
7. Describe the positive natural roles of prokaryotes
8. Describe the basic types of protists; explain why biologists currently think that they represent many clades

You should now be able to

9. Explain how primary endosymbiosis and secondary endosymbiosis led to further cellular diversity
10. Describe the major protist clades noting characteristics and examples of each
11. Describe the life cycle of *Ulva,* noting each form in the alternation of generations and how each is produced
12. Explain how multicellular life may have evolved in eukaryotes