Chapter 3
Diversity of Aquatic Organisms: The Single-Celled and Colonial Organisms

The purpose of learning this information is to introduce the cast of characters, namely the smaller aquatic organisms.

Quick Review
Modern classification is a rapidly changing science. Furthermore, at present, biologists don't agree on how to classify the protists. Therefore, we will take the traditional approach to considering the protists as a single kingdom.

Classification of Living Things						
DOMAIN	**Bacteria**	**Archaea**	**Eukarya**			
KINGDOM	**Eubacteria**	**Archaebacteria**	**Protista**	**Fungi**	**Plantae**	**Animalia**
CELL TYPE	Prokaryote	Prokaryote	Eukaryote	Eukaryote	Eukaryote	Eukaryote
CELL STRUCTURES	Cell walls with peptidoglycan	Cell walls without peptidoglycan	Cell walls of cellulose in some; some have chloroplasts	Cell walls of chitin	Cell walls of cellulose; chloroplasts	No cell walls or chloroplasts
NUMBER OF CELLS	Unicellular	Unicellular	Most unicellular; some colonial; some multicellular	Most multicellular; some unicellular	Multicellular	Multicellular
MODE OF NUTRITION	Autotroph or heterotroph	Autotroph or heterotroph	Autotroph or heterotroph	Heterotroph	Autotroph	Heterotroph

Resource: *Biology*, Miller & Levine, Prentice Hall, 2008

Key Terms:
taxonomy, diversity, morphology, anatomy, habitat, niche, autotrophic, heterotrophic, diapauses, microbes, peptidoglycan, filaments, colonies, stromatolites, anaerobic, spores, organelles, protozoa, algae, cosmopolitan, symbiosis, plasma membrane, mitochondria, chloroplasts, undulapodium, cilium (cilia), pseudopodia, phagotrophic, gametes, sessile, parasitic, chlorophylls, carotenoids, xanthins, mycology

Key Questions:
1) **Prokaryotes (Bacteria and Archaea)**
Kingdom Eubacteria – more than 10,000 species of bacteria; they are heterotrophs, photosynthetic autotrophs, or chemosynthetic autotrophs; have very strong cell walls containing peptidoglycan, a carbohydrate; inside the cell wall is a cell membrane that surrounds the cytoplasm, some have a second membrane, outside the cell membrane, for damage resistance; less complex genetic makeup than found in archaebacteria or eukaryotes; live in most habitats except extreme one were archaebacteria live; some cause disease such as strep throat and pneumonia; most bacteria are harmless and many are actually helpful
Phylum Cyanophycota – photosynthetic autotrophs; contain the pigment chlorophyll; most are blue-green; some are red or yellow in color; commonly live in ponds, streams, most areas of land; composed of chains of independent cells
Kingdom Archaebacteria – a few hundred species; most live in extreme and/or oxygen-free environments (swamps, deep-ocean hydrothermal vents, sweater evaporating ponds); lipids in cell membranes, composition of cell walls, and sequence of nucleic acids in their ribosomal RNA

differ considerably from those of other prokaryotes; genes have similar structure to those in eukaryotes

a) Why are microbes so significant?
b) What is the common name for prokaryotes?
c) What is the difference between bacteria and archaea?
d) What characteristics distinguish a prokaryotic cell from a eukaryotic cell?
e) How many named species of prokaryotes exist?
f) Become an expert.*
    i) Kingdom Eubacteria
        (1) Phylum Cyanophycota (Cyanobacteria): *Anabaena, Hapalosiphon, Lyngbya, Microcystis, Nodularia, Nostoc, Phormidium, and Spirulina*
g) Describe the economic importance of bacteria.

2) **Protista**

Records indicated that protests existed on Earth up to two billion years ago; some are unicellular and others are multicellular; some are plantlike autotrophs, some are animal-like heterotrophs, and others are fungus like heterotrophs that produce reproductive structures like that of fungi

Phylum Zoomastignina – some live in lakes and streams and absorb nutrients from decaying organic material; others live in bodies of other organisms

Phylum Sarcodina – move and feed via temporary cytoplasmic projections known as pseudopods; best known sarcodines are amoebas

Phylum Ciliophora – have short hair like projections similar to flagella used for feeding and movement; found in both fresh and salt water; they are free living; best know ciliates are *Paramecium*

Phylum Sporozoa – some are parasites of a variety of organisms including worms, fish, birds, and humans; many are free living

Phylum Euglenophyta – unicellular; aquatic protests that have both plant and animal characteristics; lack cell wall made of cellulose; have a flexible pellicle made of protein that surrounds the cell membrane; have chlorophyll and photosynthesize; can be heterotrophs; have one or more flagella to move toward light or food

Phylum Chrysophyta – yellow-green algae and golden-brown algae; cell walls of some contain the carbohydrate pectin rather than cellulose and others contain pectin and cellulose; generally store food in the form of oil rather than starch (see next phylum Bacillariophyta for advantages of oil); reproduce both asexually and sexually; most are solitary, but some form threadlike colonies

Phylum Bacillariophyta – unicellular photosynthetic organisms with shells composed of silica; abundant in both marine and freshwater ecosystems; are a large component of phytoplankton; contain pigments such as chlorophyll and carotenoids that usually give a golden-yellow color; food is stored in oil rather than starch giving fish that feed on them an oily taste; oils give buoyancy

Phylum Pyrrophyta – cell walls composed of thick cellulose plates; come in a variety of shapes and styles; contain chlorophyll, carotenoids, and red pigments; have two flagella located in grooves at right angles to each other; cell spins as flagella beat; few species live in freshwater; most species are marine; are a large component of phytoplankton; many species live symbiotically with jellyfish, mollusks, and corals; some free-living species are bioluminescent; Pyrrophyta means “fire plants”; several species produce toxins; organisms may become numerous causing red tide (40-60 million dinoflagellates per liter of seawater) and toxins produced during red tide may kill humans; most reproduce asexually by binary fission

Phylum Rhodophyta – Rhodophyta means "red plants"; able to live a great depths due to their efficiency in harvesting light energy; contain chlorophyll and reddish accessory pigments called phycobilins which are especially good at absorbing blue light; many red algae are actually green, purple, or reddish black; most are multicellular, lack flagella and centrioles; play an important role in the formation of coral reefs (help maintain the equilibrium of the coral ecosystem, provided nutrients for photosynthesis that nourish coral animals, provide much of the calcium carbonate that helps to stabilize the growing coral reef)

Phylum Phaeophyta – Phaeophyta means "dusty plants"; contain chlorophyll and the brown accessory pigment fucoxanthin; most are a dark, yellow-brown color; largest and most complex algae, all are multicelluar; most are marine, commonly found in cool, shallow coastal water of temperate or arctic areas

Phylum Chlorophyta – Chlorophyta means "green plants"; have cellulose in their cell walls, contain chlorophyll; store food in the form of starch; found in fresh and salt water, and even moist areas on land; many species live most of their lives as single cells; some form colonies

a) How many named species of protists exist?
b) Become an expert.*
    i) Kingdom Protista
        (1) Animal-like Protists (Protozoans)
            (a) Phylum Zoomastigina (Zooflagellates)
            (b) Phylum Sarcodina (Pseudopods): *Amoeba*
            (c) Phylum Ciliophora (Ciliates): *Paramecium*
            (d) Phylum Sporozoa (Sporozoans)
        (2) Plant-like Protists (Algae)
            (a) Phylum Euglenophyta (Euglenophytes): *Euglena*
            (b) Phylum Chrysophyta (Chrysophytes)
            (c) Phylum Bacillariophyta (Diatoms)
            (d) Phylum Pyrrophyta (Dinoflagellates)
            (e) Phylum Rhodophyta (Red Algae)
            (f) Phylum Phaeophyta (Brown Algae)
            (g) Phylum Chlorophyta (Green Alage)
c) Describe the economic importance of protists.

3) Fungi
    a) How many named species of fungi exist?
    b) Describe the economic importance of fungi.

*Note: "Become an expert" means the following. In your lab experience you: identified and named organisms, classified organisms, described their relationships and diversity, described and drew their morphology (also note size) and if possible anatomy, identified where they are most often found, as well as described their movement (swimming and escape behavior), feeding, and life history.