

Kingdom Protista: Types of Protists and Their Characteristics

I. Background Information

A. Basic Characteristics

1. Protists may be single-celled or many-celled organisms or can live in colonies.
2. They contain membrane-bound organelles, including an organized nucleus—they are eukaryotic.
3. Most live in water environments, but a few species live in very moist areas on the land.
4. Most protists reproduce asexually with binary fission but some can reproduce sexual by conjugation.
 - a. In **conjugation**, two protists attach to each other and exchange genetic material.
5. Most protists can be broken down into 2 main groups based on their characteristics:
 - a. plantlike protists—contain chlorophyll in chloroplasts and makes their own food (autotrophic).
 - b. animal-like protists—must feed on other organisms (heterotrophic) and can move from place to place.

B. Phylogeny of Protists (their evolutionary history)

1. Scientists believe that protists evolved from the bacteria, but understanding their history is difficult because most lack hard parts (like bones or shells) so there is very little fossil evidence.
 - a. Mutations over time have made the structures of the protists more complex than the bacteria.
 - b. Plantlike protists have evolved from the cyanobacteria and are the ancestors of today's plants.
 - c. Animal-like protists have evolved from heterotrophic bacteria and are the ancestors of modern animals.

II. Types of Protists

A. Plantlike Protists

1. **algae** = single-celled and many-celled plantlike protists.
 - a. All algae contain chlorophyll in chloroplasts and make their own food (they are producers).
 - b. The algae may also contain other pigments (colors) in addition to chlorophyll, giving them a color other than green. (The chlorophyll is there, it is just “overpowered” by the other color.)
2. Almost all algae live in water.
 - a. The many-celled algae are seaweed while the single-cell algae are called phytoplankton.
 1. **phytoplankton** = single-celled algae that float near the surface of the water; they are an important part of the food chain and produce a lot of oxygen which is released into the atmosphere.
3. Algae are grouped into 6 different phyla based on their color.
4. **Golden Algae—Phylum Chrysophyta**
 - a. Diatoms are a marine (saltwater) species of golden brown that make up a large part of phytoplankton.
 - b. Diatoms form a hard, box-like shell around their cells.
 1. When diatoms die, their shells do not decompose but sink to the ocean floor and collect in layers, forming deposits called diatomaceous earth.
 2. Diatom shells have been mined and used in a number of ways:
 - a. as the grit in toothpaste
 - b. as the grit in scouring powders
 - c. in insulation and water filters
 - d. in cosmetics
 - e. in highway paints (the shells reflect light very well)
5. **Fire Algae—Phylum Pyrrophyta**
 - a. Dinoflagellates are single-celled marine organisms that have a red pigment.
 - c. They usually have 2 flagella that work together to produce a spinning motion.
 - d. Some species of dinoflagellates have the ability to produce light, giving them a “glow”.
 1. This is called **bioluminescence** (meaning “having living light”).
 2. Sailors often see a strange glow at night in the water behind their ships.
 - e. One species of dinoflagellates is responsible for red tides.
 1. This dinoflagellate produces a toxin (poison). When it has a population explosion in one particular area of the ocean, it can kill other marine organisms and contaminate the fish and shellfish we eat.
6. **Green Algae—Phylum Chlorophyta**
 - a. This type of algae can be single or many-celled or may live in colonies (example: Volvox).
 - b. They live mainly in water environments, but can also live in soil and on trunks of trees (if the area is moist).

7. **Red Algae—Phylum Rhodophyta**

- a. Most are many-celled and live in marine environments (ex. some types of seaweed).
- b. They often live deep in the ocean where only certain colors of light can penetrate, mostly in the blue range.
- c. Carbohydrates from red algae form a substance called carrageenan, which is used as an emulsifier.
 1. An emulsifier helps keep substances mixed together that would normally separate which helps make foods like ice cream and pudding creamy.

8. **Brown Algae—Phylum Phaeophyta**

- a. These are many-celled organisms that live in marine environments.
- b. Many forms of seaweed are species of brown algae (ex. kelp).
- c. Brown algae are important sources of food and shelter for marine animals.
- d. Algin is a substance produced from brown algae that is used to thicken certain foods like ice cream and marshmallows.

9. **Euglena—Phylum Euglenophyta**

- a. *Euglena* are single-celled organisms that have characteristics of both plant and animals.
- b. They contain chlorophyll in chloroplasts, so when light is present, they can make their own food.
- c. When light is not available, they can capture and use other organisms as food sources.
- d. Like animals, they have a means of movement (a flagellum) and a way of sensing their environment (they have an eyespot that is used to detect light).
 1. Organisms with flagella will appear to move in a “zig zag” pattern.

B. Animal-like Protists

1. **protozoa** (singular: protozoan) = single-celled, animal-like protists.

2. Protozoa can live in water environments and in soil.

3. They are heterotrophs and can eat by capturing living organisms, feeding on dead things (saprophytes), or as a parasite in another living organism (in a host).

4. **Sarcodines—Phylum Sarcodina**

- a. Sarcodines are found mostly in fresh and saltwater environments, but can live in hosts as parasites.
- b. Sarcodines move by using pseudopods (ex. amoeba are typical sarcodines).
 1. **pseudopods** = an extension of the cell membrane and cytoplasm; means “false foot”.
 - a. Organisms that move with pseudopods appear to flow when they move.
 2. Pseudopods are not only used for movement, but are also used to engulf food (endocytosis).
 - a. A vacuole forms around the food and then enzymes are used to digest the food so it can diffuse into the organism.

5. **Flagellates—Phylum Mastigophora**

- a. Most flagellates live in fresh water but can be parasites, causing disease (ex. African sleeping sickness and *Giardia* which affects the intestines)
- b. They all have one or more flagella that whip back and forth to help them swim in the water.

6. **Ciliates—Phylum Ciliophora**

- a. Most ciliates live in water environments.
- b. All ciliates use cilia to move (the cilia may cover all or part of the ciliate’s cell).
 1. **cilia** = short, hair-like structures that wave gently to move the organism.
 - a. Organisms that use cilia for movement appear to move in smooth, straight lines.
- c. A *Paramecium* is a typical ciliate.
 1. A *Paramecium* is covered with cilia that it uses for movement but the cilia are also used to sweep food (usually bacteria or smaller protists) into the organism’s oral groove—an opening into the *Paramecium* that will form a food vacuole at the end. Wastes are removed through the anal pore.
 2. A *Paramecium* also has 2 nuclei: the macronucleus controls everyday activities and the micronucleus controls reproduction.
 3. A contractile vacuole contracts to force out excess water from the *Paramecium*.

7. **Sporozoans—Phylum Sporozoa**

- a. Sporozoans live only as parasites—they live in and feed on the blood of their hosts.
 1. *Plasmodium* is the sporozoan that causes malaria. It is spread by one species of mosquito.