Animal – Like Protista (Protozoa)

Introduction

Several groups of small, eukaryotic organisms **formerly called protozoa,** have traditionally been thought to be related to animals and regularly studied in zoology classes. These organisms include several forms that are commonly found in ponds, lakes, and streams. Among them are many forms that are important pathogens and parasites, forms that are believed to be of significance in evolution of animals, and forms that play an important role in natural ecosystems.

During the past few years, however, new information about their chemistry, structure, and genomes has made it increasingly clear that these animal-like single celled protistans, are not really closely related to multicellular animals. This new evidence has stimulated active debate among scientists about the classification of groups included in the former protozoa. Numerous scientists now believe that many of the organisms formerly included in the Phylum Protozoa are not closely related and should be placed in different taxonomic groups.

No general agreement has yet been reached among scientists about the correct classification of these organisms, and their phylogenetic relationships remain enigmatic. We have chosen, however, to include several representatives of these animal-like protists in. this book because of their obvious similarities to animals, and because they have been studied by students in Zoology classes for many years.

The animal-like protista are eukaryotic unicellular organisms, generally microscopic in size, that live as single individuals or in simple colonies. They are sometimes called a cellular since their bodies are not divided into cells; rather, they represent very complex cells that carry on many of the metabolic functions of multicellular animals within a single cell membrane. These tiny organisms exhibit great intracellular complexity with many internal organelles that are analogous, and perhaps homologous, some of with the organs and organ systems of animals.

We include in this chapter some representatives of some common and well-differentiated groups of these animal-like protistans now considered to represent different phyla.We will study representatives of the Mastigophora (flagellates), the

Sarcodina (amoebas), the Euglcnozoa (euglenas), the Ciliaphora (ciliates), and the Apicomplcxa (sporozoans).

An *Amoeba*: *Amoeba proteus*

Phylum Sarcodina

Amoeba proteus is a protistan found in ponds and streams. It often occurs on the undersides of plant leaves and among diatoms and desmids. The transparent amoeba constantly changes shape by extending pseudopodia, foot-like extensions of the cytoplasm, which serve for locomotion and in food capture. *Amoeba proteus* feeds on bacteria, small algae, and small protistans.

In feeding, an advancing pseudopodium flows over one or more food organisms to trap the food in a water-filled cup. The opening of the food cup then narrows until the food is completely enclosed in a food vacuole.

Amoeboid Movement

An amoeba moves about by extending pseudopodia into which some of the innermost cell contents flow. Various kinds of amoebae form pseudopodia of different size and form. Pseudopodia are important in feeding, support, and locomotion. The mechanism of amoeboid movement has been studied by many scientists because of its intriguing nature and because similar movements occur in many other kinds , of cells, including human leucocytes. Also, scientists believe that amoeboid movement may be closely related to the phenomenon of cytoplasmic streaming, movement of cell contents that occur in virtually all kinds of living cells.

The movement of an amoeba is accomplished by the forward flow of the relatively liquid plasmasol from the center of the amoeba toward and into an expanding pseudopodium. Around the periphery of the pseudopodium, the plasmasol changes into a stiff plasmagel. Thus, the plasmasol moves the pseudopodium forward, and the plasmagel serves to fix it in position.

Biochemical and biophysical studies have demonstrated that the mechanism of amoeboid movement is similar to that in muscle contraction. Contractile proteins similar to the actin and myosin found in vertebrate muscles are present in the

cytoplasm of an amoeba. We now know that amoeboid movement results from folding, unfolding, polymerization, and deploy-merization of these proteins.

Reproduction

The reproduction of *Amoeba proteus* occurs only through the asexual process of binary fission. The nucleus and cytoplasm of a parent cell divide to form two daughter cells approximately equal in size. Thus, each of the daughter cells is genetically identical to the parent cell, excluding the rare occurrence of a mutation in one of the daughter cells.

Other Sarcodina

Many amoeboid protozoa are more specialized than *Amoeba*. *Pelamyxa carolinensis* is a large multinucleate amoeba often studied in zoology classes. Numerous species of amoebae live in shells or tests, which they secrete, or which they form from sand grains or other materials. *Difflugia* and *Arcella* are two common testate amoebae found in freshwater ponds and streams. Other species of amoebae are parasites or symbionts in the digestive tracts of various animals. *Entamoeba histolytica*, an important intestinal parasite of humans, is the cause of amoebic dysentery, a disease often spread by drinking water or by eating raw vegetables contaminated by human wastes in parts of the world with poor sanitary facilities.

Some freshwater members of the Subphylum Sarcodina have many long, thin pseudopodia supported by axial rods of microtubules *Actinosphaerium* is a common

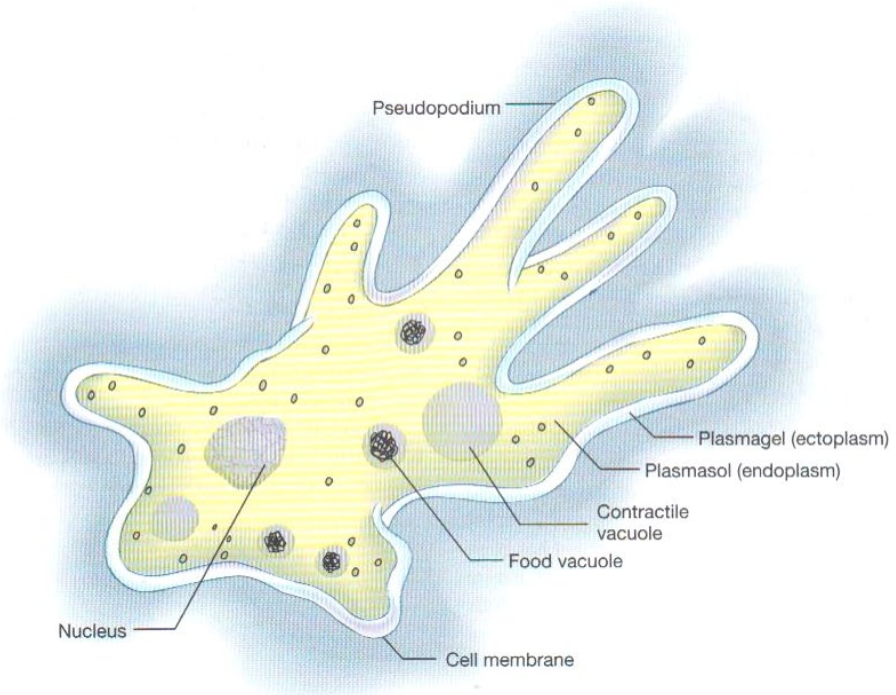

FIGURE ***Amoeba proteus.***

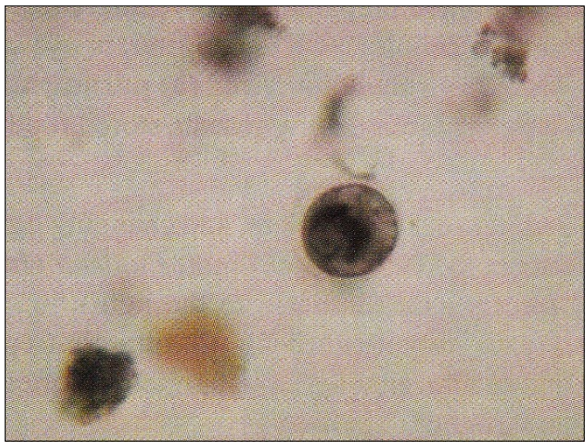

FIGURE Entamoeba histolytica.

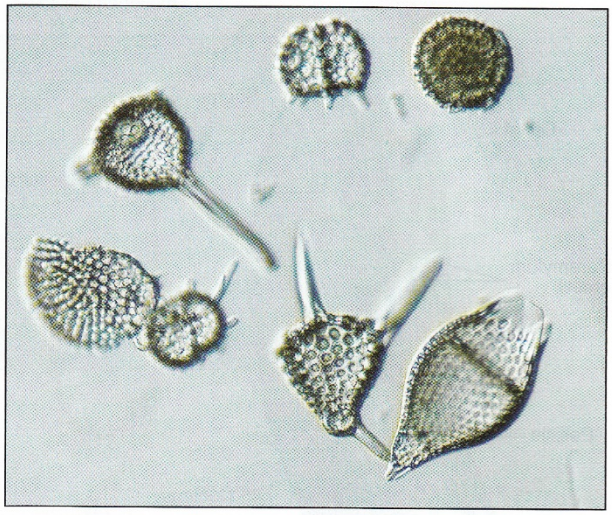

FIGURE Radiolarian test.

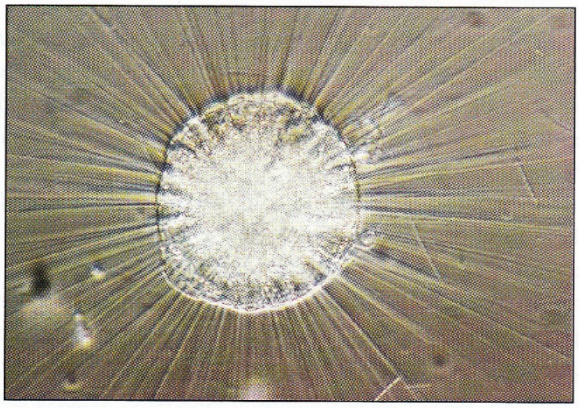

FIGURE Actinosphaerium.

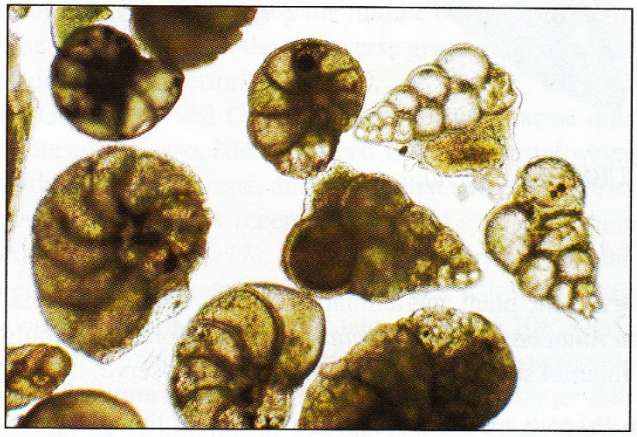

FIGURE Foraminiferan tests.

freshwater example of a group called heliozoans because of the resem-blance to the sun and its rays of sunlight.

Members of three marine classes of this subphylum, called radiolarians, form skeletons or tests of silicon and/or strontium compounds and exhibit many beautiful shapes. The radiolarians are among the oldest known protozoa, and their tests are abundant in marine sediments in many parts of the world.

The foraminiferans, representing another class of sarcodines, are an ancient and important group of marine sarcodines that form tests of calcium carbonate or other materials. The shells of foraminiferans accumulate on the sea bottom and contribute to the formation of chalk and lime-stone. England's White Cliffs of Dover are made up largely of foraminiferan tests, as is much of the Bedford limestone found in Indiana and Illinois, and some of the limestone that was used to build the Egyptian pyramids.

The distribution of certain other species of foraminifera in rock samples is very important to petroleum geologists as indicators of ancient environmental conditions that may have been favorable for the formation of petroleum and thus provide important clues to the possible location of petroleum pools.

A Solitary Flagellate: *Euglena*