**Single-celled Organisms - - - - Student Reading**

**Amoeba**

The amoeba is a protozoan that belongs to the Kingdom Protista. The name amoeba comes from the Greek word "amoibe", which means change. Amoeba is also spelled ameba. Protists are microscopic unicellular organisms that don't fit into the other kingdoms. Some protists are considered plant-like while others are considered animal-like. The animal-like protists are known as protozoans. The amoeba is considered an animal-like protist because it moves and consumes its food. Protists are classified by how they move. Some have cilia or flagella, but the amoeba has an unusual way of creeping along by stretching its cytoplasm into fingerlike extensions called pseudopodia. The word "pseudopodia" means "false foot". ***Color and label* the pseudopodia yellow**. When looking at amoeba under a microscope, an observer will note that no one amoeba looks the same as any other. The cell membrane is very flexible and allows for the amoeba to change shape. ***Color and label* the cell membrane red**. Amoebas live in ponds or puddles, and can even live inside people.

There are two types of cytoplasm in the amoeba, the darker cytoplasm toward the interior of the protozoan is called endoplasm, and the clearer cytoplasm that is found near the cell membrane is called ectoplasm. By pushing the endoplasm toward the cell membrane, the amoeba causes its body to extend and creep along. The amoeba also uses this method to consume its food, little plants and animals. The pseudopodia extend out and wrap around the food particle in a process called phagocytosis. The food is then engulfed into the amoeba and digested by the enzymes contained in the amoeba's lysosomes. As the food is digested it exists in a structure called a food vacuole. ***Color and label* the food vacuole green**.

Also visible in the amoeba is the nucleus, which contains the amoeba's DNA. ***Color and label* the nucleus purple**. In order to reproduce the amoeba goes through mitotic division, where the nucleus duplicates its genetic material and the cytoplasm splits into two new daughter cells, each identical to the original parent. This method of reproduction is called binary fission. Another structure easily seen in the amoeba is the contractile vacuole. This organelle pumps out excess water so that the amoeba does not burst. ***Color and label* the contractile vacuole orange**.

During unfavorable conditions, the amoeba can create a cyst; this hard walled body can exist for a long period of time until conditions become favorable again. At this point it opens up and the amoeba emerges. Often cysts are created during cold or dry periods where the amoeba could not survive in its normal condition. Amoebas can cause disease. A common disease caused by the amoeba is called Amoebic Dysentery. A person becomes infected by drinking contaminated water. The amoeba then upsets the person's digestive system and causes cramps and diarrhea. A person is most likely to be infected in countries where the water is not filtered or purified.

**Euglena**

Euglenas are unicellular organisms classified into the Kingdom Protista, and the Phylum Euglenophyta. All Euglena have chloroplasts and can make their own food by photosynthesis. They are not completely autotrophic though, Euglena can also consume food (tiny plants and animals) from their environment. Euglenas usually live in quiet ponds or puddles. Euglena move by a flagellum (plural ‚ flagella), which is a long whip-like structure that acts like a little motor. The flagellum is located on the anterior (front) end, and rotates in such a way as to pull the cell through the water. ***Color and label* the flagellum red**. It is attached at a pocket called the reservoir***. Color and label* the reservoir gray**.

The Euglena is unique in that it is both heterotrophic (must consume food) and autotrophic (can make its own food), so it is both plant-like and animal-like. Chloroplasts within the Euglena trap sunlight that is used for photosynthesis, and can be seen as several rod-like structures though out the cell. ***Color and label* the chloroplasts green**. Euglena also have an eyespot at the anterior end that detects light, it can be seen near the reservoir. This helps the Euglena find bright areas to gather sunlight to make their food. ***Color and label* the eyespot blue.** The Euglena has a stiff pellicle outside the cell membrane that helps it keep its shape. The pellicle is somewhat flexible and some Euglena can be observed scrunching up and moving in an inchworm type fashion. If conditions where the Euglena is located become unfavorable, the pellicle hardens into a protective cyst.

In the center of the cell is the nucleus, which contains the cell's DNA and controls the cell's activities. ***Color and label* the nucleus purple**. The nucleolus can be seen within the nucleus. Euglena reproduce through Binary Fission, just like amoebas. The interior of the cell contains a jelly-like fluid substance called cytoplasm. ***Color and label* the cytoplasm light yellow**. Toward the posterior of the cell is a star-like structure, the contractile vacuole. This organelle helps the cell remove excess water, and without it, the Euglena could take on so much water due to osmosis that the cell would explode.

**Paramecium**

The Genus Paramecium is commonly found throughout the world, in fresh and marine water containing bacteria and decaying organic matter. Paramecium is a small unicellular, animal-like organism. It is elongated and ranges in size from 120 to 300 microns. The outside of the cell is covered with a tough pellicle. The posterior half is slightly wider than the anterior half and is bluntly pointed, while the anterior end is rounded. The outer surface of the organism is covered with many hundreds of minute hair-like projections called cilia which it beats rhythmically to move*.* ***Label and color* the cilia black**. On its underside there is a large, long groove running about half the length of its body. This oral groove leads inward to the gullet and eventually the mouth. ***Color and label* the oral groove red**. Paramecia have two nuclei -- a larger macronucleus and a smaller micronucleus. The macronucleus, which is relatively large and located near the center of the organism, controls most of the metabolic functions of the cell. It controls respiration, protein synthesis and digestion. The micronucleus, which lies partly within a depression on the oral side of the macronucleus, is involved primarily in reproductive and hereditary functions. ***Color and label* the nucleus blue**. Paramecia reproduce primarily by Binary Fission, but will have occasional conjugation.

Because paramecia live in water, they require an organelle to pump out excess water so they do not lyse (burst). These organelles are the contractile vacuoles, usually one at each end, each surrounded by several radiating canals which collect water from the surrounding cytoplasm. ***Color and label* the contractile vacuole purple**. The contractile vacuoles serve the critical function of osmoregulation, as water tends to accumulate inside the cytoplasm due to osmotic pressure. These structures are absent in marine Paramecium. It is easy to identify the contractile vacuole due to its star shape.

Food enters the paramecium through the oral groove and goes to the gullet. Food vacuoles, which are round in shape, contain enzymes to digest the smaller protozoans that the paramecium feeds on. ***Label and color* the food vacuoles yellow**. These vacuoles can be seen at the mouth where the food is loaded into them for digestion. Undigested food particles are eliminated through the anal pore.

Paramecium can respond to changes in temperature, food, oxygen and toxins with a very simple defense mechanism. Just inside the pellicle are threadlike organelles called trichocysts. The paramecium can shoot tiny threads out to entangle a predator or to make themselves appear bigger. Paramecia are also known to exhibit avoidance behavior. This is where the paramecium will move away from a negative or unpleasant stimulus. There are 2 kinds of cytoplasm in the paramecium. The cytoplasm around the edges is clear and is called ectoplasm. The rest of the cytoplasm is more dense and is called the endoplasm.

**Volvox**

**Volvox** is one of the best known types of plant-like protists and is commonly called algae. Although volvox are single celled organisms, each volvox does not live as just one cell, rather it lives in a spherical (round) colony composed of 500-60,000 biflagellate cells. In order to move the colony, each volvox uses their two flagella to spin/roll through the water. The flagella are whip like hairs that each volvox has. ***Color and label* the flagella on the individual cells green**. Volvox diffuses carbon dioxide and oxygen through its outer membrane. The volvox has a red eyespot that is used to locate the most light possible in the dark water. It is important that the volvox have these eye spots because it relies on light for the process of photosynthesis. Volvox reproduce asexually when reproductive cells in the colony break off and form daughter colonies, the circular spheres found within a volvox. ***Color and label* the daughter colony yellow.** The non-reproductive cells become larger, greener and structurally different as the colony matures. The daughter colonies remain inside the volvox until the mother colony breaks apart.

Volvox are found in ponds and ditches and even in shallow puddles. They prefer clean, nutrient rich, warm water. If you gather some pond water, volvox will be near the top, close to the sunlight.