

Characteristics of the Kingdom Protista

Introduction:

We have covered two of the six kingdoms, Eubacteria and Archaeobacteria. Both of these are bacteria and are prokaryotic life, that is very simple unorganized life. Now we journey into eukaryotic life, life that is more complex and highly organized with organelles.

Protists:

Protists are eukaryotes organisms that cannot be classified as animal, plants or fungi. They are not prokaryotes and they do not have the specialized features that characterize the other three eukaryotic kingdoms.

Basically, they are single celled or very simple multi-cellular creatures with specialized internal structures and they only function as individuals. They only act alone, even if they live in very large colonies. They do not help other similar cells of share any of life's needs with each other.

A couple of eukaryotic features that evolved in protists.

- Sexual reproduction
- Meiosis
- Mitosis
- Multicellularity
- Flagella and cilia with "9 + 2" structure

Protists Environments

Protists are found most everywhere there is moisture. Many live in water, lakes rivers and oceans but even in damp soil.

Some will hunt down their own food, heterotrophs, some will make their own food, autotrophs, and some are parasites that live in animals and plants. There are even some who can act as both plants and animals.

Protist Reproduction:

Many kinds of protists can only reproduce asexually, giving rise to identical individuals. These end up being simple copies of the generation before and therefore are basically evolutionary dead ends.

Some Protists Can Reproduce Sexually.

To sexually reproduce as single celled life, these organisms must sacrifice the advantages of diploid life and live most of the time of their lives as haploids.

Sexual reproduction many times is triggered by times of environmental stress. The green alga *Chlamydomonas* is a good example of both asexual and sexual reproduction. Normally the alga is actually a haploid cell that reproduces through mitosis, making many identical cells. In times of low nutrients, the cell will under go a mitosis, which produces a different kind of haploid cell. They are either a + cell or a - cell, depending on their outer proteins. A + cell and a - cell will then join and form a zygote, a diploid cell. These fused cells will form a zygospore, a thick walled cell that can with stand long periods of unfavorable conditions. Finally, when conditions are favorable again, meiosis will occur and the "normal" haploid phase of the agla will start up again.

Sexual reproduction occurs in many different ways:

- Conjugation: *Spirogyra*, a green alga reproduces by conjugation. A tube, called a conjugation tube, connects two different cells of *Spirogyra* and the contents of one cell moves over to the other cell and the two nuclei fuse. The resulting zygote then develops a thick wall and falls from the parent filament. When conditions are favorable, the spore undergoes meiosis, which produces new haploid filaments.

- Reproduction with gametes:

Oedogonium, another green alga, has specialized cells for producing and holding gametes. One type of cell produces flagellated sperm type cells, and another type of cell produces egg type cell. When released, the sperm type cell swims to the egg type cell and fuses with it. The resulting zygote is released and forms a thick walled resting spore. This diploid spore undergoes meiosis and the resulting spores settle in to form new *Oedogoniums*.

- Alternation of generations: *Ulva* is a marine green alga. It spends part of its life as a haploid gamete-producing phase called

gametophyte, and a diploid producing phase called the sporophyte. The adult sporophyte phase has reproductive cells called sporangia. The gametophyte and the sporophyte phases both look pretty much the same.

Protists Diversity:

There are 15 major phyla of protists. They cover many different life styles and live in most parts of the world. The following features distinguish the seven main different types of protists:

Distinguishing Features	Phylum	Mode of Nutrition
Move using pseudopodia	Rhizopoda (amoebas)	Heterotrophic
	Foraminifera (forams)	
Have double shells made of silica	Bacillariophyta (diatoms)	Photosynthetic
Photosynthetic protists; can be multicellular	Chlorophyta (green algae)	Photosynthetic
	Rhodophyta (red algae)	
	Phaeophyta (brown algae)	
Move using flagella	Dinoflagellata (dinoflagellates)	Photosynthetic
	Zoomastigina (unicellular flagellates)	Heterotrophic
	Euglenophyta (euglenoids)	Most are heterotrophic; some are photosynthetic
Move using cilia	Ciliophora (ciliates)	Heterotrophic
Funguslike protists	Acrosiromycota (cellular slime molds)	Heterotrophic
	Myxomycota (plasmodial slime molds)	
	Oomycota (oomycetes)	
	Chytridiomycota (chytrids)	
Form resistant spores	Sporozoa (sporozoans)	Heterotrophic

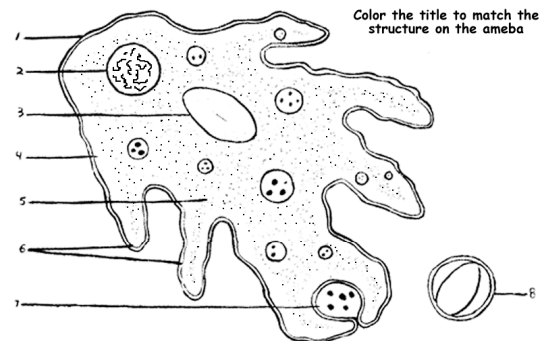
Protist Types

Protists That Move with Cytoplasmic Extensions:

Amoebas move using cytoplasmic extensions. They move by "flowing" their cytoplasm out a little like molasses flows on a cold day. The "arms" of the amoebas that flow out are called pseudopodia; which means false foot. The cytoplasm flow might seem slow but they can capture fast moving food by this method.



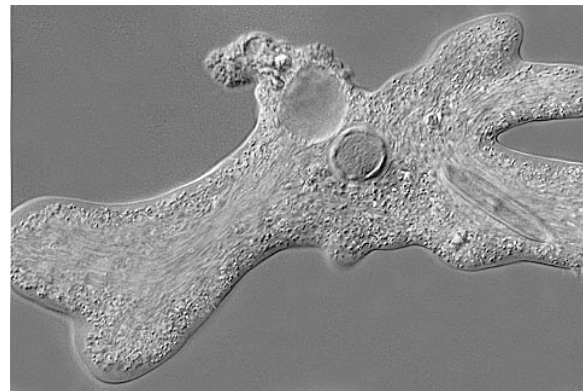
Amoeba



Color the title to match the structure on the amoeba

- CELL MEMBRANE 1
- VACUOLE 3
- PSEUDOPODIA 6
- ENDOPLASM 5
- ECTOPLASM 4
- FOOD VACUOLE 7
- NUCLEUS 2
- CYST 8

Amoeba



Amoeba

Forams:

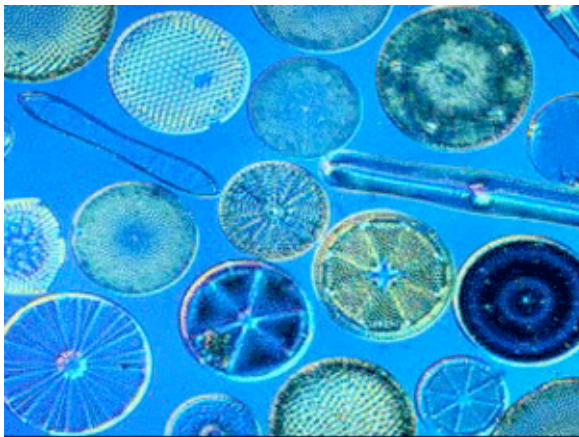
Forams are single celled snail like creatures. They have a shell like covering and are important single cell creatures because they show up in the fossil record. They make up a great portion of the white cliffs of Dover over in jolly old England.



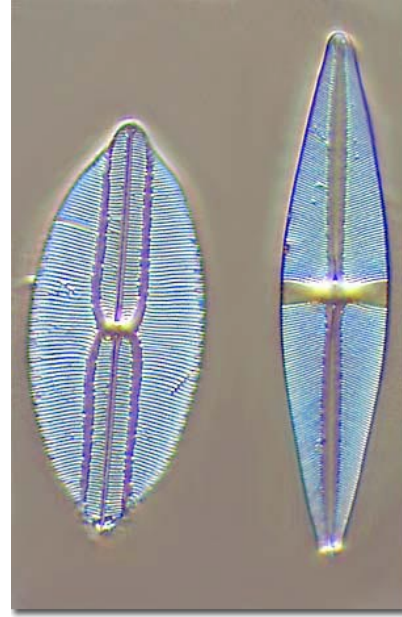
Foram

Diatoms:

Double Shells Diatoms are very important single celled organisms. They are single celled creatures with a unique double shell made of silica. They are important to all living creatures, as they are the start of the food supply in most marine and freshwater food chains. They also produce most of the world's oxygen, as they are photosynthetic. Diatoms reproduce asexually and they are diploid. When one reproduces it will slide out of its shell because it will be too small to fit in a full size shell.



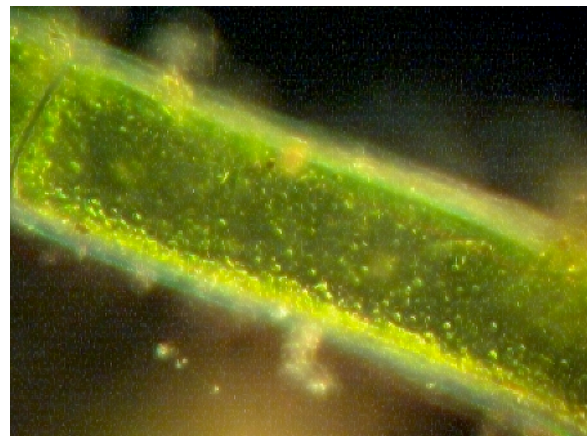
Diatoms



Diatoms

Algae:

Algae are multi-cellular colonies of organisms. The green, red and brown algae are some of the fastest growing and most photosynthetic members of the kingdom protista. Most of the green algae live in freshwater but there are some large multi-cellular marine organisms that are green algae too. Red algae are found in warm oceans and can grow in fairly deep water. They are good at photosynthesis, using the light that penetrates through to greater depths. Brown algae are all multi-cellular and live almost exclusively in marine waters in temperate oceans. The great kelp beds found off the west coast are all members of brown algae.



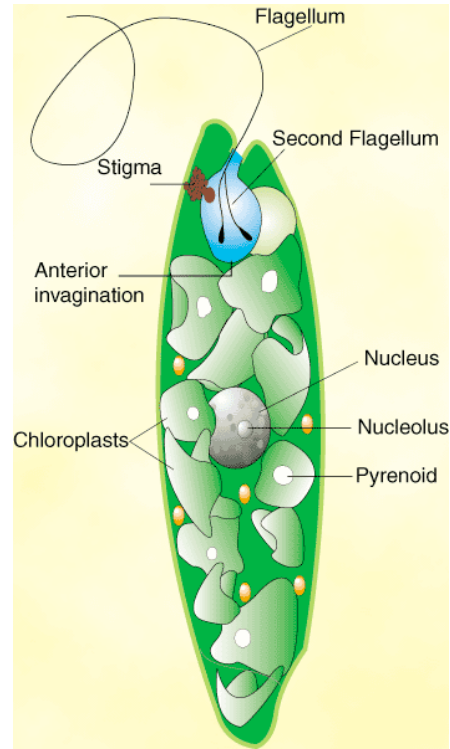
Alga



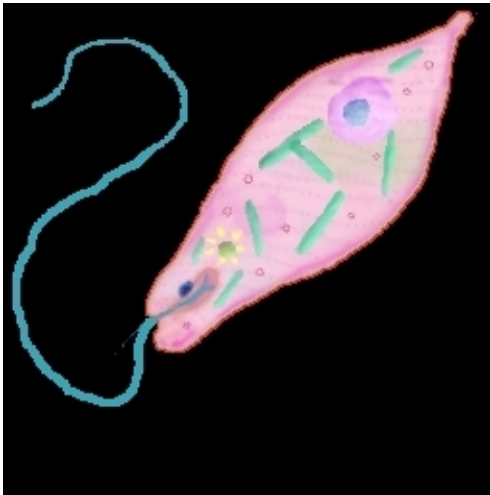
Algae Colony

Protists with Flagella:

Flagellates are protists that move about by beating the water with a whip like tail. Some are fresh water like the dinoflagellates and the euglena but most are marine. Some, like trichonympha, live in the guts of others animals like termites. Some flagellates are heterotrophs and some are autotrophs while others, like the euglena, can act like both.



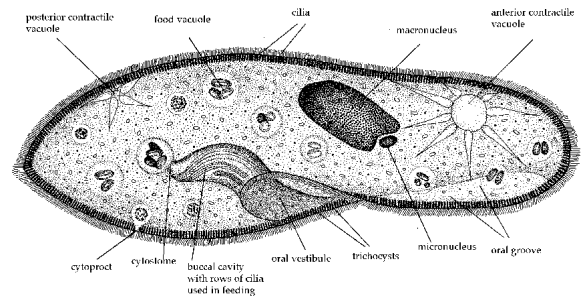
Euglena



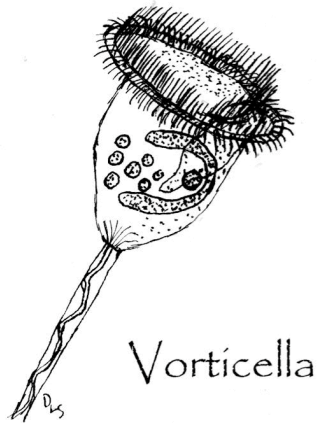
Euglena

Protists That Use Cilia to Swim.

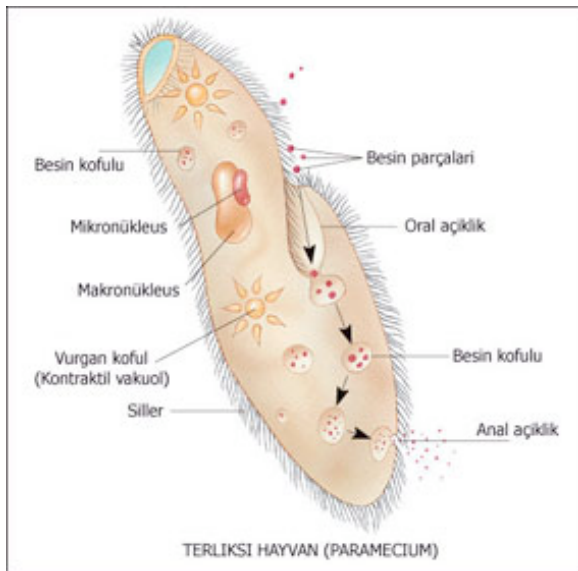
The protists that move about using thousands of cilia to propel them and control their movements are all members of the phylum Ciliophora. They are heterotrophs, normally diploid and reproduce asexually by mitosis. Some members do a form of sexual reproduction called conjugation by lining up side by side and exchanging genetic material. The Paramecium is a classic example of this phylum.



Paramecium



Vorticella



Paramecium

Protists Molds:

The protists molds are not really fungi. They are single celled organisms that resemble the fungi kindom, but are actually protists. The slime molds are heterotrophs that live in soil and are like amoebas, and eat bacteria. During times of environmental stress the slime mold changes and forms a stalk that fills with spores, which will be released, and each spore can develop into a new individual.

The plasmodium slime molds acts like a mass of cytoplasm. They can move this way through many things as they stream along as a plasmodium, this mass of cytoplasm. Again under times of environmental stress, they form a number of haploid spores, which will fuse, and form a diploid that will form a new plasmodium slime mold.

Oomycetes are members of they phylum Oomycota which are water slime molds. These are heterotrophs that break down dead fresh water things.

Protists That Form Resistant Spores:

Sporozoans are non-moving spore forming single celled organisms. They infect individuals by getting passed from one host to another. They reproduce both sexually and asexually. When the large female gamete is fused with a smaller male gamete, they form a diploid thick walled cyst called a oocyte, which is highly resistant to drought and other unfavorable conditions. They then can be passed on to other hosts and stay dormant until conditions are again favorable. The most famous is the Plasmodium, which causes malaria.

Protists and Human Health:

The Plasmodium is a major human health problem. The mosquito picks up the spores from one host when it sucks up blood for reproduction from an infected host. The mosquito takes in gametocytes, haploid cells, and then they fuse in the adult mosquito, move to the salivary glands where they can be injected into a new uninfected host the next time the mosquito seeks out blood.

There are a number of protists besides the Plasmodium that can infect humans. Amoebic dysentery, Giardiasis, Leishmaniasis, Chagas' disease, Toxoplasmosis, and others can be a concern to humans.

Disease	Host	Organism
Amoebic dysentery	Humans	Entamoeba
Malaria	Humans	Plasmodium
Toxoplasmosis	Humans, cats	Toxoplasma
Giardiasis	Humans	Giardia
Sleeping sickness	Humans, tsetse flies	Trypanosoma
Leishmaniasis	Humans, sand flies	Leishmania
Late blight	Potatoes	Phytophthora