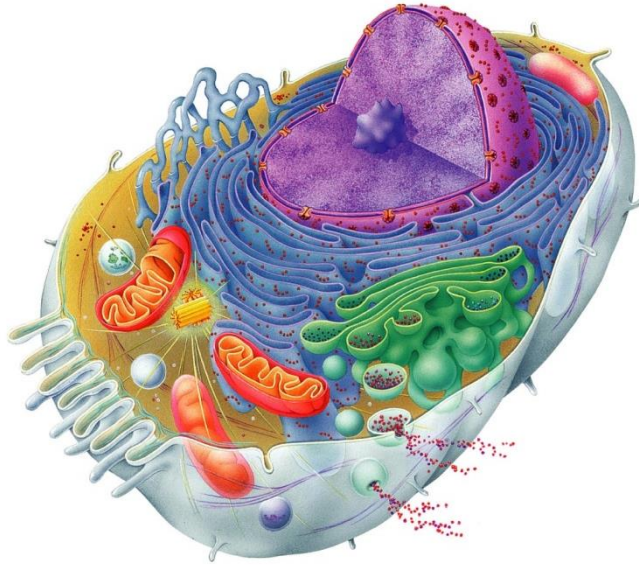


Protists

Viruses are so simple that they are not classified as alive. Prokaryotes are more complex than viruses, but they are still the simplest known forms of living organisms. They are essentially microscopic membrane bags that make proteins according to their genetic instructions. The last major group of cells are known as eukaryotic cells and there is a significant jump in their complexity when compared to their prokaryotic cousins. The key distinction between prokaryotes and eukaryotes is that the eukaryotes have separated, membrane bound compartments to hold different materials and to perform different tasks. These compartments are called organelles. The first kinds of eukaryotic cells were single celled organisms in the Kingdom Protista.

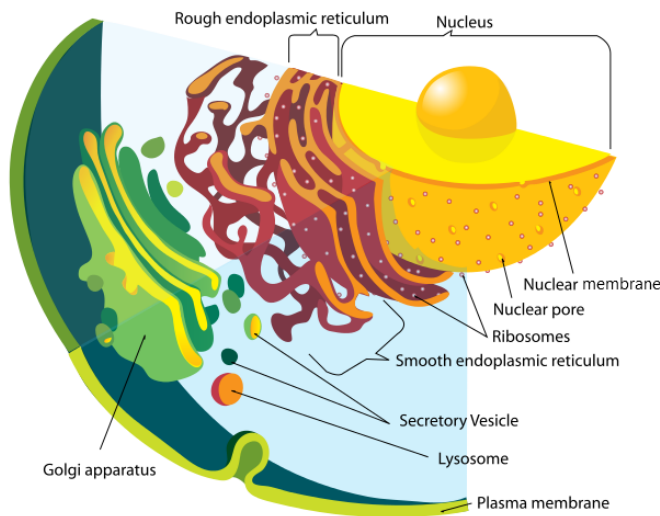
Let us start our examination of the protists by re-familiarizing ourselves with the basic anatomy of eukaryotic cells.

Typical Animal Cell



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	Organelle	Main Function
Endomembrane system	Nucleus	
	Endoplasmic Reticulum	
	Golgi Apparatus	
	Vacuoles / vesicles	
	Cell membrane	
	Ribosomes	
	Nucleolus	
	Mitochondria	
Not in animal cells	Chloroplasts	
	Cell wall	
	Cilia / Flagella	



The Endomembrane System

In a prokaryotic cell, all chemical reactions happen side by side within the cytoplasm. In eukaryotes, having an internal system of membranes allows cells to efficiently organize their materials and processes in separate compartments and perform processes in sequence from one compartment to the next. This internal system of membranes that can share and exchange materials is called the endomembrane system. It is unique to the eukaryotes. Scientists speculate that it likely originated from the inward folding of the cell membrane to increase the cell surface area.

Why No Giant Amoebas?

Eukaryotic cells are likely as large as cell can be. If they got any larger their surface area to volume ratio would be too small. In other words, they would not have enough surface area to support the exchange of resources needed with the environment to support their size.

Using simple diagrams show what happens to the cell surface area to volume ratio when they divide into two smaller cells.

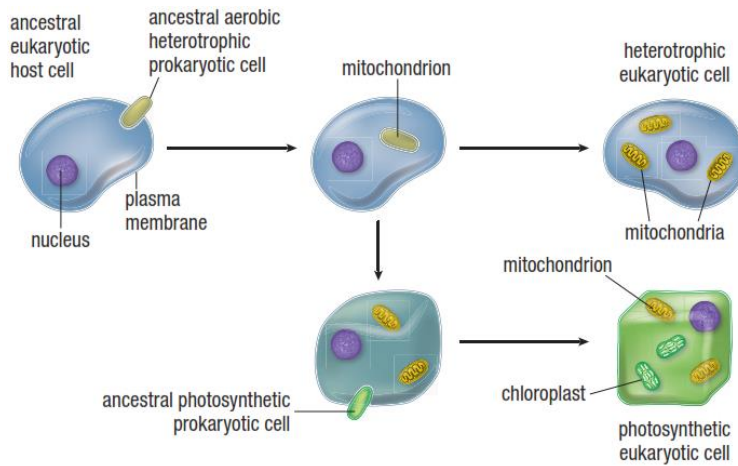
Endosymbiosis – The origins of mitochondria and chloroplasts

The chemical reactions needed for a cell to survive occur within the cytoplasm and organelles. There is good evidence that the most primitive eukaryotic cells eventually recruited help from their prokaryotic cousins. It is widely believed that mitochondria and chloroplasts were at some point in evolutionary history separate species of prokaryotic cells. It is believed that primitive eukaryotic cells developed a symbiotic relationship with these prokaryotes by allowing them to live protected inside of their cells in exchange for services.

The mitochondria-like prokaryotes were likely much more efficient at deriving cellular energy molecules from sugars than their eukaryotic hosts. In exchange for protection and better access to food inside the eukaryotic cells, the mitochondrial ancestors shared their abundant cellular energy molecules.

Similarly, chloroplast-like prokaryotes would have shared the food they made (sugars) with their eukaryotic hosts in exchange for protection and supply of CO₂.

Even today, there are few species of protists that do not have either mitochondria or chloroplasts. These include *Giardia lamblia*, *Entamoeba histolytica*, *Trichomonas vaginalis* and species of the genus *Microsporidia*.



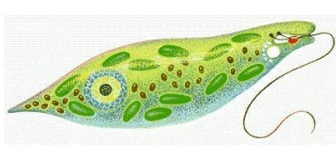

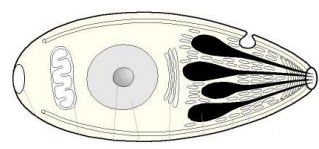
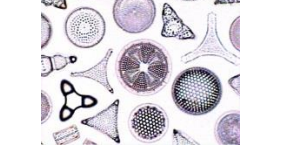
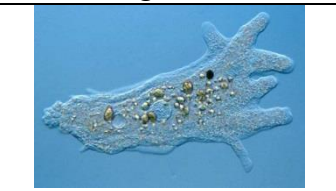
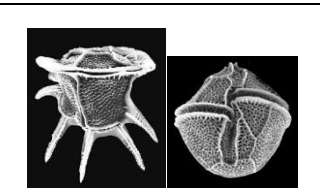
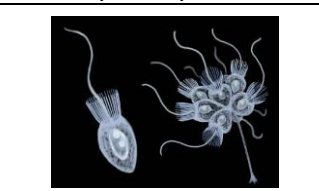
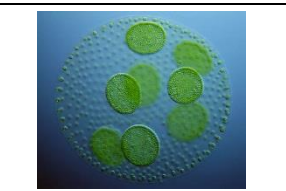
Copy the main evidence that mitochondria and chloroplasts are derived by endosymbiosis

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What are Protists?

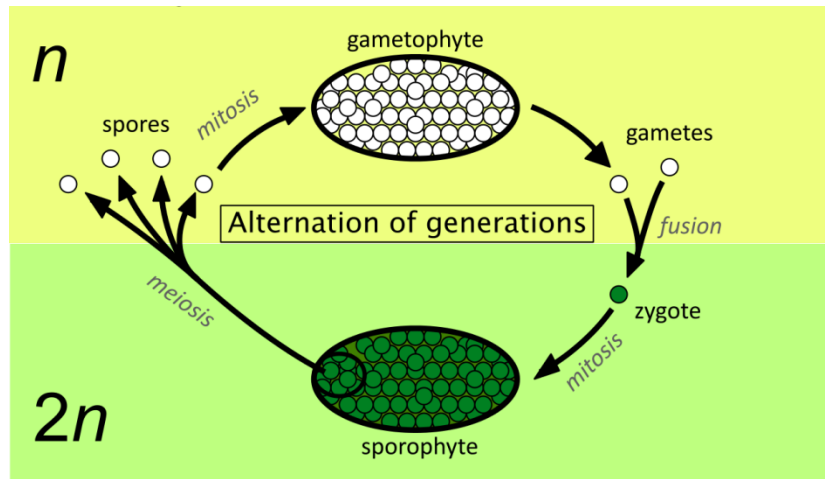
The Kingdom Protista is the least uniform and most diverse kingdom of eukaryotic cells. Rather than being a group of closely related, or morphologically similar organisms, the Kingdom Protista is more of a “catch-all” grouping for species that do not fit well into the other kingdoms. Most are single celled, some are multicellular and they represent a broad range of life strategies. There are more than 200 000 species that have been placed in this group.

Some examples of protists

 euglenoid	 ciliates	 apicomplexa	 diatoms
 amoebas	 dinoflagellates	 choanoflagellates	 green algae

Reproduction

It is not surprising that this diverse group of organisms displays a wide range of reproductive strategies. It is noteworthy, however, that groups within the Kingdom Protista are the simplest organisms that are able to truly use sexual reproduction and undergo meiosis. Many protists are able to reproduce both asexually and sexually and still others *require* phases in their life cycle of both sexual and asexual reproduction. This life cycle requiring two distinct sexual phases is called alternation of generations.



Investigate figure 13 on pg 65 for a specific example

Still other protists have very different and complex life cycles like that of *Plasmodium*, the protists that causes one of the world most prevalent diseases known as malaria.

