**Groups of microbiology**

**Archaea**

Archaea were once thought to be a type of bacteria. After extensive research of their DNA and membrane structure, some scientists decided to put them into a separate group - Archaea. Another group of scientists is still not convinced and refers to them as Archaeabacteria.

Archaea are unicellular prokaryotes which make them bacteria-like organisms. Their DNA structure resembles the DNA of eukaryotic cells. Also, the cell walls of Archaebacteria are structurally different from the bacterial ones. Archaea live in environments that would not be suitable for most life forms. They can be found around hot geysers, very salty lakes and on the ocean floor. Because Archaea thrive in such extreme conditions, they are sometimes called 'organism - extremists' or 'extremophiles. Archaeans can survive these extreme conditions due to their physiology. They synthesis different enzymes that keep their cells from being destroyed by high temperatures, salty or acidic water.

Because of their 'fondness' for extreme environmental conditions, Archaeans are believed to be the first living forms that appeared on Earth when it was still waterless, airless and a scorching hot planet.

Archaeans use different energy sources like hydrogen gas, carbon dioxide and sulphur. Some of them use sunlight to make energy, but not the same way as plants do.

Compared with bacteria, Archaebacterial cell walls are composed of different polysaccharides and proteins, with no peptidoglycan.

**Bacteria**

All bacteria are unicellular prokaryotes, meaning they do not have a defined cellular nucleus. Their genetic information is in their nucleoid, - single, circular tightly- packed DNA molecule. According to their shape, all bacteria are divided into three groups:

* spirilla (with a spiral body shape);
* cocci (with a spherical body shape);
* bacillus ( with a rod (stick) shaped body).

Some types of bacteria live on their own and others form colonies. Some bacteria are quite mobile and others 'stay put' for their whole life. Bacteria move using their cytoplasmic tail - flagella, or by secreting slimy substances that allow them to slide along surfaces.

The cell walls of most bacteria contain a polysaccharide called peptidoglycan. Differences in their cell wall structure is a major feature used in classifying these organisms. The staining abilities of bacteria are also based on their cell wall structure. According to the way they stain, bacteria can be classified as either Gram - positive or Gram - negative.

Based on their response to gaseous oxygen, all bacteria can be divided into the following groups:

1-Aerobic-living in the presence of oxygen;
2-Anaerobic - living without oxygen;
3-Facultative anaerobes - can live in both environments.

According to the way they obtain energy, bacteria are classified as heterotrophs or autotrophs. Autotrophs make their own food by using the energy of sunlight or chemical reactions, in which case they are called chemoautotrophs. Heterotrophs obtain their energy by consuming other organisms. Bacteria that use decaying life forms as a source of energy are called saprophytes.

Flagella are organelles defined by function rather than structure. There are large differences between different types of flagella; the prokaryotic and eukaryotic flagella differ greatly in protein composition, structure, and mechanism of propulsion. However, both can be used for swimming.

An example of a flagellate [bacterium](https://en.wikipedia.org/wiki/Bacterium) is the ulcer-causing [*Helicobacter pylori*](https://en.wikipedia.org/wiki/Helicobacter_pylori), which uses multiple flagella to propel itself through the mucus lining to reach the stomach [epithelium](https://en.wikipedia.org/wiki/Epithelium).  An example of a eukaryotic flagellate cell is the mammalian [sperm](https://en.wikipedia.org/wiki/Spermatozoon) cell, which uses its flagellum to propel itself through the female reproductive tract.[[6]](https://en.wikipedia.org/wiki/Flagellum#cite_note-pmid17148374-6)Eukaryotic flagella are structurally identical to eukaryotic [cilia](https://en.wikipedia.org/wiki/Cilia), although distinctions are sometimes made according to function and/or length.

**Flagellar arrangement schemes**



Examples of bacterial flagella arrangement schemes. A-Monotrichous; B-Lophotrichous; C-Amphitrichous; D-Peritrichous.

Different species of bacteria have different numbers and arrangements of flagella.

* Monotrichous bacteria have a single flagellum (e.g., [*Vibrio cholerae*](https://en.wikipedia.org/wiki/Vibrio_cholerae)).
* Lophotrichous bacteria have multiple flagella located at the same spot on the bacteria's surfaces which act in concert to drive the bacteria in a single direction. In many cases, the bases of multiple flagella are surrounded by a specialized region of the cell membrane, the so-called [*polar organelle*](https://en.wikipedia.org/wiki/Polar_organelle).[[*citation needed*](https://en.wikipedia.org/wiki/Wikipedia%3ACitation_needed)]
* Amphitrichous bacteria have a single flagellum on each of two opposite ends (only one flagellum operates at a time, allowing the bacteria to reverse course rapidly by switching which flagellum is active).
* Peritrichous bacteria have flagella projecting in all directions (e.g., *E. coli*).

 Other bacteria, such as most [Spirochetes](https://en.wikipedia.org/wiki/Spirochete), have two or more specialized flagella (endoflagella) arising from opposite poles of the cell, which together constitute the so-called "axial filament" that is located within the [periplasmic space](https://en.wikipedia.org/wiki/Periplasmic_space) between the flexible cell wall and an outer sheath. The rotation of the axial filament relative to the cell body causes the entire bacterium to move forward in a corkscrew-like motion, even through material viscous enough to prevent the passage of normally flagellated bacteria.

Counterclockwise rotation of a monotrichous polar flagellum pushes the cell forward with the flagellum trailing behind, much like a corkscrew moving inside cork. Indeed, water on the microscopic scale is highly [viscous](https://en.wikipedia.org/wiki/Viscous), very different from our daily experience of water.



Prokaryotic flagella run in a rotary movement, while eukaryotic flagella run in a bending movement. The prokaryotic flagella uses a rotary motor,and the eukaryotic flagella uses a complex sliding filament system. Eukaryotic flagella is ATP driven, while prokaryotes are proton driven.

**Protozoa**

Protozoa is a subkingdom of unicellular, mostly aerobic, eukaryotic organisms. Sometimes they are also called protists. They are neither plants nor animals. They make up the largest group of organisms in the world in terms of numbers and biomass. Some protozoans, like Euglena, have chloroplasts like plants and make their own food, which makes them autotrophs. Others, like amoeba, are heterotrophs. Protozoans can be free-living or parasitic, unicellular or colonial. Some parasitic protozoans can cause diseases in humans. Protozoans move around using their flagella or pseudopodia - cytoplasmic temporary 'feet'.

Because heterotrophic protozans consume bacteria, they play a very important role in controlling biomass. Biomass is the total weight of living organimsms in a given area.

**Ameba :**

The ameba is one of the simplest of the protozoa. It can be found in ponds and rivers and on the surface of the leaves of water plants. It looks like a grayish blob under a microscope. Its shape is constantly changing as it moves along. One characteristic of the ameba is its false feet, that scientists call pseudopodia. The false feet extend out and then the rest of the body follows the false feet along. The ameba eats little animals and plants. It sends out its false feet to surround the plant or animal and then pops it right into the cell! The ameba has tiny sacs in its body called vacuoles. Some of the vacuoles have food in them. Others collect water and squeeze the extra water out. Oxygen enters the ameba through its thin covering called a cell membrane. The carbon dioxide leaves the ameba through the cell membrane as well. The ameba avoids light but swims faster in warmer temperatures. The ameba reproduces by splitting in half. This is called fission. The ameba's nucleus or center splits in half and goes to opposite ends of.

**Euglena :**

Euglena is a genus of unicellular protists, of the class Euglenoidea of the phylum Euglenozoa  (also known as Euglenophyta). They are single-celled organisms. Currently, over 1,000 species of Euglena have been described. There are many to be discovered . Some Euglena are considered to have both plant and animal features. Due to these dual characteristics, much debate has arisen to how they have evolved, and into which clade they should be placed.

**Parasitic :**

Parasitism is a type of symbiotic  relationship between organisms of different species where one organism, the parasite, benefits at the expense of the host. In general, parasites are much smaller than their host, show a high degree of specialization for their mode of life, and reproduce more quickly and in greater numbers than their hosts. Classic examples of parasitism include interactions between vertebrate hosts and diverse animals such as tapeworms, flukes, the Plasmodium species, and fleas. Parasitism is differentiated from parasitoidism, a relationship in which the host is always killed by the parasite such as moths, butterflies, ants, flies, elietes and humans and also others. The harm and benefit in parasitic interactions concern the biological fitness of the organisms involved. Parasites reduce host fitness in many ways, ranging from general or specialized pathology (such as castration), impairment of secondary sex characteristics, to the modification of host behaviour.

**Plasmodium :**

Plasmodium is a genus of parasitic protists. Infection by these organisms is known as malaria. Currently over 200 species of this genus are recognized and new species continue to be described. Of the over 200 known species of Plasmodium, at least 10 species infect humans. Other species infect animals, including monkeys, rodents, birds, and reptiles. The parasite always has two hosts in its life cycle: a mosquito vector and a vertebrate host.

**Protista :**

Protista: Some members of Kingdom Protista are unicellular, others are colonial, and yet others are multicellular. Note that in the colonial forms, all the cells are similar with similar, generalized functions, whereas in the truly multicellular species, the body of the organism consists of a variety of types of cells, each type with its own specialized function. These organisms are all eukaryotes (they have a true nucleus). They all need some kind of a water-based environment-which can be fresh or marine water, snow, damp soil, polar bear hairs-in which to live. All are aerobic and have mitochondria to do cellular respiration, and some have chloroplasts and can do photosynthesis. Most of them reproduce or grow by mitosis, and some reproduce by meiosis and fertilization. Many can form cysts in adverse conditions. Protists are a major component of plankton. Protists are grouped into three major, unofficial categories based on means by which they obtain nutrition. These are the Protozoa, the Algae, and the Fungus-like Protists.

**Fungi**

Fungi are saprophytic (feed on decaying organic matter) and parasitic organisms. Fungi include moulds, rusts, mildews, smuts, mushrooms and yeast. By breaking down dead organic material, they continue the cycle of nutrients through ecosystems. Some plants have a symbiotic relationship with fungi. Symbiosis is a mutually beneficial co-existence of dissimilar organisms. For example, there are mushrooms that live near tree roots and supply them with essential nutrients.

All fungi are made of eukaryotic cells. Fungi can be single-celled or with cells arranged in filaments called hyphae. Yeasts are unicellular fungi. Masses of hyphae are called mycelia. Mycelia can be well structured, as in a mushroom, or tangled and unstructured, as in moulds. Some fungi can exist in the form of yeast and hyphae. These types of fungi are called dimorphic.

All fungi are heterotrophic, meaning that they obtain their energy and carbon compounds from organic nutrients. None of the fungi are photosynthetic. Some fungi are parasites and can cause diseases in humans, animals and plants. Some fungi are used in the food industry and pharmaceutics (antibiotic production).

**Algae**

The word *algae* represents a large group of different organisms from different phylogenetic groups, representing many taxonomic divisions. In general *algae* can be referred to as plant-like organisms that are usually photosynthetic and aguatic, but do not have true roots, stems, leaves, vascular tissue and have simple reproductive structures. They are distributed worldwide in the sea, in freshwater and in moist situations on land. Most are microscopic, but some are quite large, e.g. some marine seaweeds that can exceed 50 m in length.
The algae have chlorophyll and can manufacture their own food through the process of photosynthesis. Recently they are classified in the kingdom of protiste, which comprise a variety of unicellular and some simple multinuclear and multicellular eukaryotic organisms that have cells with a

membrane-boundnucleus.
Almost all the algae are eukaryotes and conduct photosynthesis within membrane bound structure called chloroplasts, which contain DNA. The exact nature of the chloroplasts is different among the different lines of algae.
[Cyanobacteria](http://www.lenntech.com/eutrophication-water-bodies/algae.htm#yanobacteria) are organisms traditionally included among the algae, but they have a prokaryotic cell structure typical of bacteria and conduct photosynthesis directly within the cytoplasm, rather than in specialized organelles.

 **Types of algae**

The main phylogenetic groups of algae are

* Diatoms
* Chlorophyta
* Euglenophyta
* Dinoflagellata
* Chrysophyta
* Phaeophyta
* Rhodophyta
* Cyanobacteria:

**Viruses**

Although viruses are not considered living organisms, they are sometimes classified as microorganisms. Viruses are much smaller than common microbes. They are made of a DNA molecule covered with a protein shell called a capsid. Retroviruses are made of an RNA molecule covered with a capsid. Capsids can take many shapes. Viruses cannot reproduce outside the host cell, but they cannot be called parasites either. Scientists still argue today about whether viruses are true living forms because they are not cells and they cannot metabolise on their own.

Viruses can infest prokaryotic and eukaryotic cells, often causing diseases in organisms. A virus that infects bacteria is known as a bacteriophage

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* **Prion:** A small proteinaceous infectious disease-causing agent that is believed to be the smallest infectious particle. A prion is neither bacterial nor fungal nor viral and contains no genetic material. Prions have been held responsible for a number of degenerative brain diseases, including [mad cow disease](http://www.medicinenet.com/mad_cow_disease/article.htm), [Creutzfeldt-Jakob disease](http://www.medicinenet.com/creutzfeldt-jakob_disease/article.htm), fatal familial [insomnia](http://www.medicinenet.com/insomnia/article.htm), kuru,
* **Viroids** are the smallest infectious pathogens known, consisting solely of short strands of circular, single-stranded [RNA](https://en.wikipedia.org/wiki/RNA) without [protein coats](https://en.wikipedia.org/wiki/Capsid). They are mostly plant pathogens, some of which are of economic importance. Viroid [genomes](https://en.wikipedia.org/wiki/Genome) are extremely small in size, ranging from 246 to 467 [nucleobases](https://en.wikipedia.org/wiki/Nucleobase%22%20%5Co%20%22Nucleobase).
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