Prokaryotic and Eukaryotic Microorganisms

All cells share four common characteristics:

First, all cells are enclosed within a plasma membrane, an outer layer that separates the cell's interior from its surrounding environment.
Second, all cells contain cytoplasm, a jelly-like region within the cell where proteins and cell structures are found.
Third, all cells have genetic material, such as DNA, which provides information necessary for the cell to remain alive.
Finally, all cells have ribosomes, a non-membrane bound organelle, used to synthesize proteins.

All cells also display the properties of life: order, response to stimuli, reproduction, evolution, growth and development, homeostasis, and energy processing.

Biologists classify living things as belonging to one of three domains:

Bacteria, Archea, Eukarya

Cells fall into one of two broad categories: prokaryotic cells or eukaryotic cells. Organisms in the domains Bacteria and Archaea are classified as prokaryotes (pro- = "before"; -kary- = "nucleus") whereas cells of animals, plants, fungi, and protists are all eukaryotes (eu- = "true"). Although all prokaryotic and eukaryotic cells share the similarities discussed above, they also differ in several ways.

Archaebacteria: Prokaryotes, unicellular, that lack a peptidoglycan cell wall, autotrophic or heterotrophic, including the methanogens and extreme halophiles and thermophiles.

Eubacteria: Prokaryotic organisms with a peptidoglycan cell wall, autotrophic or heterotrophic, including cyanobacteria, soil bacteria, nitrogenfixing bacteria, and pathogenic bacteria.

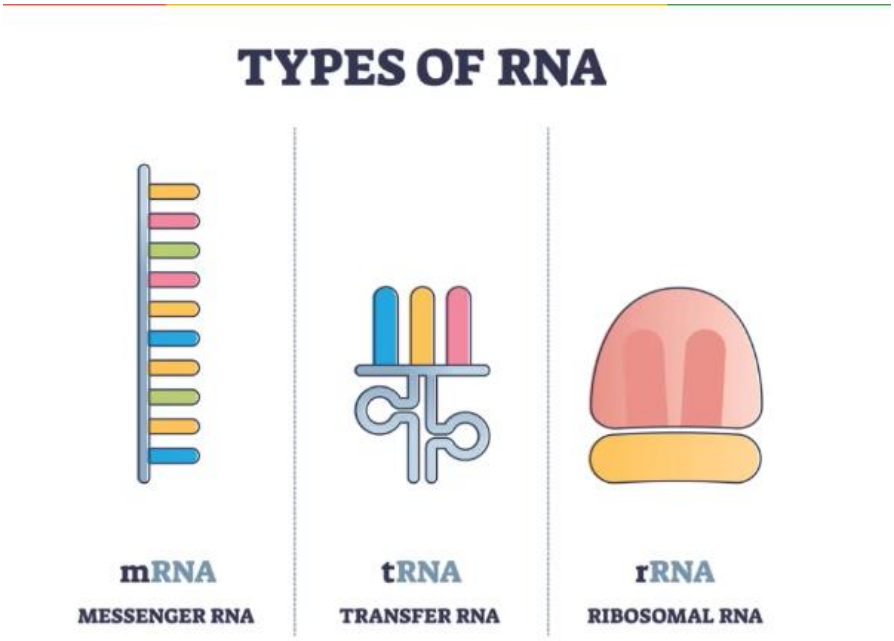
Protista: Eukaryotic, primarily unicellular and less are multicellular, autotrophic (photosynthetic) or heterotrophic organisms, such as amoebas ,algae and paramecium.

Fungi: Eukaryotic, mostly multicellular , heterotrophic, usually non-motile organisms, with cell walls of chitin, such as yeast, molds and mushrooms.

Eukaryotic cell:

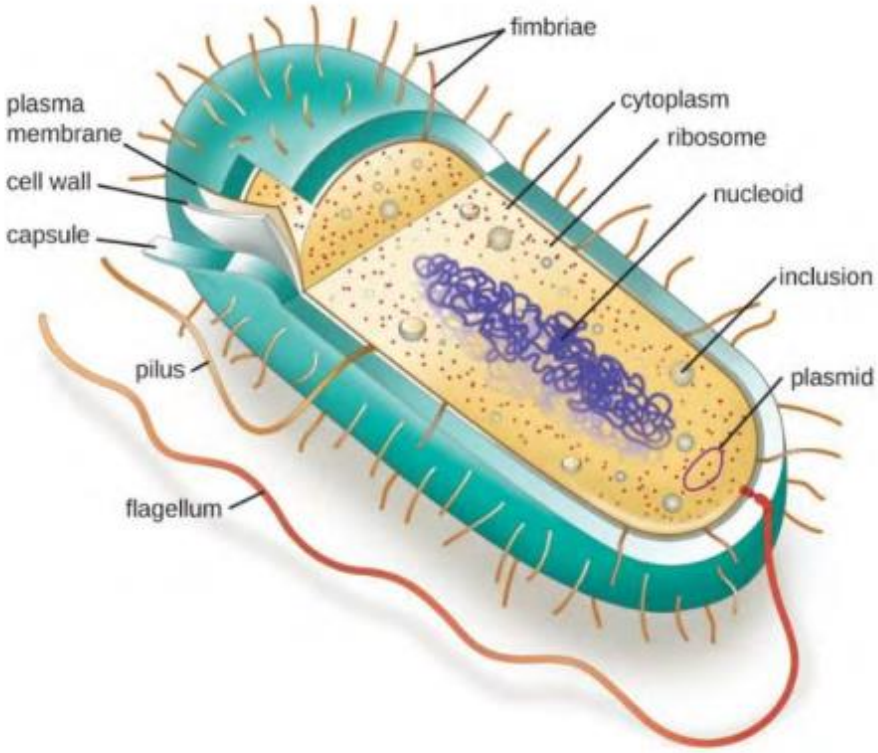
Eukaryotic cells possess a nucleus. The nucleus is a membrane-bound organelle that houses the DNA. The nucleus, because it contains the DNA, ultimately controls all activities of the cell and also serves an essential role in reproduction and heredity. Eukaryotic cells typically have their DNA organized into multiple linear chromosomes. The DNA within the nucleus is highly organized and condensed to fit inside the nucleus. At 0.1–5.0 µm in diameter, prokaryotic cells are significantly smaller than eukaryotic cells, which have diameters ranging from 10–100 µm. The table below explain the main differences between prokaryotic and eukaryotic cells.

DNA	RNA
DNA is Deoxyribonucleic Acid	**RNA** is ribonucleic acid
It is made up of Adenine, guanine, cytosine, and thymine	It is made up of Adenine, guanine, cytosine, and uracil
Very stable structure	Comparatively less stable structure
Less prone to mutations	More easily prone to mutations
Present in Nucleus and mitochondria.	Present in the Cytoplasm, ribosomes, and nucleus
It is Self-replicating.	Most of the RNA is dependent on DNA for its synthesis.
It is the **genetic material** of most organisms and helps in the transfer of information from one generation to another.	It is most essential component during **protein synthesis.**
3 forms of DNA are B-DNA, A-DNA and Z-DNA.	3 types of RNA are found: m-RNA, r-RNA and t-RNA.
Contains a Deoxyribose sugar	Contains a ribose sugar



Components of Prokaryotic Cells:

- Prokaryotes are predominantly single-celled (unicellular) organisms.
- Classified in the domains Bacteria and Archaea.
- All prokaryotes have plasma membranes, cytoplasm, ribosomes, a cell wall, genetic material (lacks a nucleus) , and lack membrane-bound organelles.
- Prokaryotic chromosomes are typically circular and unpaired. Prokaryotic DNA is found in the central part of the cell: a darkened region called the nucleoid.
- Prokaryotic cells range in diameter from 0.1-5.0 µm.



The domains of Bacteria and Archaea are both classified as prokaryotic cells.

There are significant differences between them:

- Unlike Archaea, bacteria have a cell wall made of peptidoglycan, and many have a polysaccharide capsule. The cell wall acts as an extra layer of protection, helps the cell maintain its shape, and prevents dehydration.
- The capsule enables the cell to attach to surfaces in its environment.
- Some prokaryotes have flagella or pili. Flagella are used for locomotion, while most pili are used to exchange genetic material during a process called conjugation.
- Unlike most bacteria, archaeal cell walls do not contain peptidoglycan, but their cell walls are often composed of a similar substance called pseudopeptidoglycan .
- Like bacteria, archaea are found in nearly every habitat on earth, even extreme environments that are very cold, very hot, very basic, or very acidic. - Some archaea live in the human body, but none have been shown to be human pathogens.

Viruses

A virus (non-cellular infectious particle) consists of nucleic acid (either DNA or RNA) ,a protein coat or sheath or capsid (one or more types of protein subunits organized in to a rod like or many side shape) and sometimes an outer envelope (mostly of membrane remnants from a previously infected cell). Virus cannot reproduce itself . it can be reproduce only after its genetic material and few enzymes enter a host cell and subvert the cells biosynthetic machinery.

The size of virus is usually less than 0.3 μm . however ,some viruses form large particle which can be seen under high power light microscope . Viruses cause many diseases in all living organisms .such as: Smallpox, Chicken pox, Measles, German measles (Rubella), Viral encephalitis, Mumps, influenza, infectious Hepatitis, Yellow fever, Rabies and AIDS. in addition viruses have been implicated in some cancers and leukemia. Nearly all viral multiplication cycles include five steps: attachment to suitable host cell, penetration of it , DNA or RNA replication and protein synthesis , assembly of new viral particles and release .

Bacteriophages are a group of viruses that infect bacterial cells .some bacteriophages consists only of DNA and a protein coat.