

# Structure and Function of Prokaryotes

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Prokaryotes are simple unicellular organisms in which the genetic material is not enclosed in a cell nucleus. They are considered to be the first forms of life on earth. The actual word comes from the Greek language, where pro = before and karyo = cell.

## General Structure of Prokaryocytes

- small cells (1-5  $\mu\text{m}$ );
- hereditary material (DNA) is not enclosed within nuclear membrane;
- no histones (specific basic proteins) bound to their DNA;
- no membrane bound organelles (eg mitochondria, chloroplasts);
- no distinct nucleus, no chromosomes, no centrioles, no microtubules;
- prokaryotes are divided into 2 domains: Bacteria and Archaea.

## Archaea

### Structure

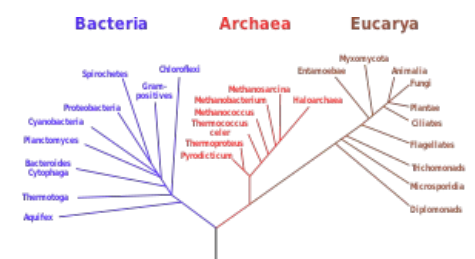
Archaea are very similar to bacteria (in size, shape, absence of membrane bound organelles). Until 1990, they were considered an unusual group of bacteria and named archaebacteria. They were given their own domain since they have gone through an independent evolution and have many differences in their biochemistry from other forms of life. Archaea reproduce asexually and divide by binary fission, fragmentation, or budding; in contrast to bacteria archaea do not form spores. Initially, archaea were seen as extremophiles that lived in harsh environments, such as hot springs and salt lakes, but they have since been isolated from various habitats including soils, oceans, and marshlands. One example are the methanogenic archaea that inhabit the gut of humans and ruminants, where they are present in vast numbers and aid in the digestion of food.

### Function

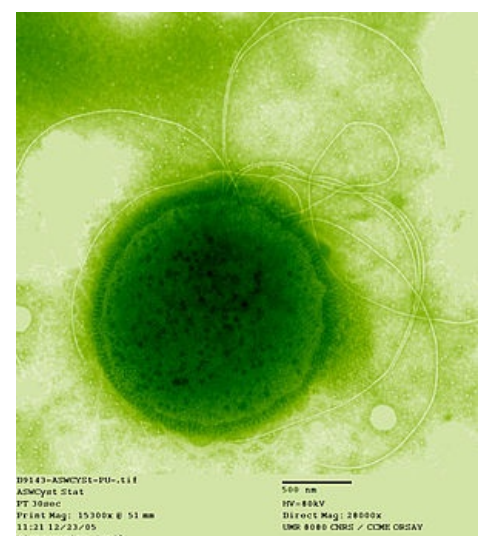
Archaea are important in technology; methanogens are used to produce biogas and as part of sewage treatment, and enzymes from extremophile archaea that can resist high temperatures and organic solvents are exploited in biotechnology.

### Genome

Archaea share certain features of their genome with both Eukaryotes and Prokaryotes. Firstly their DNA is double stranded and circular, which closely resembles that of Prokaryotes, however this DNA is associated with histones and organised into chromatin (a typical feature of Eukaryotic DNA). Archaea don't possess introns in their genes but the genes that are responsible for RNA, DNA and protein synthesis are all similar to those found in Eukaryotes. These diverse range of features show why archaea should be considered a separate domain of life from Eukaryotes or Prokaryotes.



The phylogenetic tree

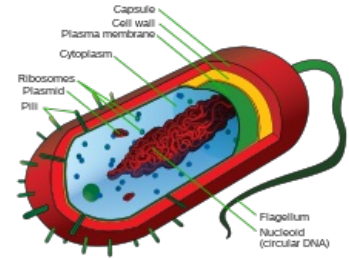


Archaea: *Thermococcus gammatolerans*

# Bacteria

## ■ Functions:

1. Bacteria are responsible for decaying and recycling organic material in the soil (producing fossil fuels) & sewage deposits.
2. Some bacteria are parasitic, causing disease to host. Bacterial diseases of man can spread in a variety of ways including direct contact, contamination of food & water, eg Tuberculosis (mycobacterium tuberculosis)
3. Some have symbiotic relationship with host eg helping digestion
4. Bacteria are also used by humans in several ways: food production eg cheese, alcohol, yogurt; detergents (especially preferred those which withstand high temperatures); use in research, especially in genetics; and in making antibiotics



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