

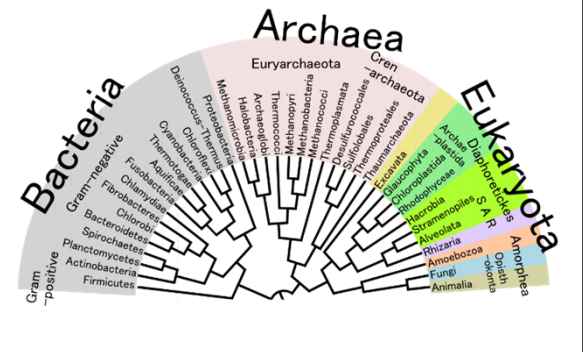
Prokaryotes





The prokaryotes are a group of organisms whose cells lack a membrane around their nucleus.

The current model of the evolution is that **the first organisms on Earth were some sort of prokaryotes**, which evolved out of protocells. The more structurally complex cells of the eukaryotes are thought to have evolved later. Some scientists have argued that the three domains of life arose simultaneously, from a set of cells that formed a single gene pool.



Most prokaryotes are unicellular organisms

a few, like cyanobacteria, can create large colonies.



Cyanobacteria 40 μm

Cyanobacteria are aquatic and photosynthetic. They have the distinction of being some of the oldest known fossils, more than 3.5 billion years old and are one of the most important groups of bacteria on earth.

Cyanobacteria are responsible for the oxygen atmosphere that we depend on today as it was generated by numerous cyanobacteria during the Archaean and Proterozoic Eras.

Prokaryotes do not have:

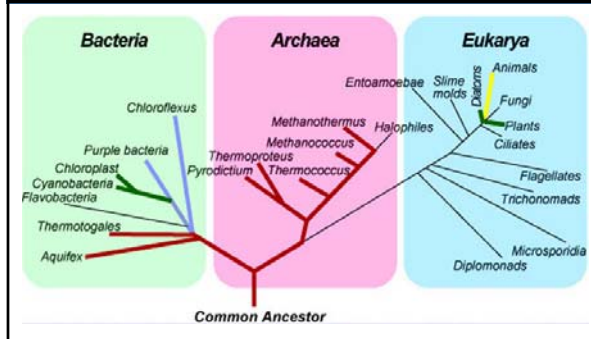
a membrane around their nucleus

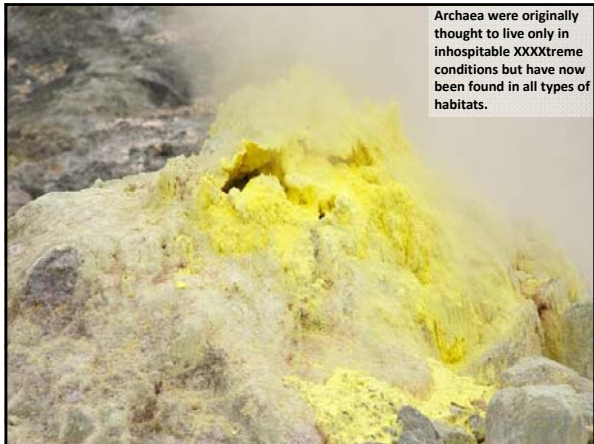
mitochondria

membrane-bound organelles

Prokaryotes make up two of the three domains of life:

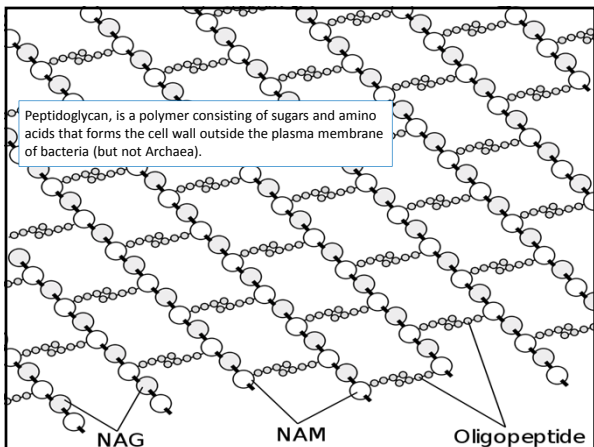
- the Bacteria
- the Archaea.





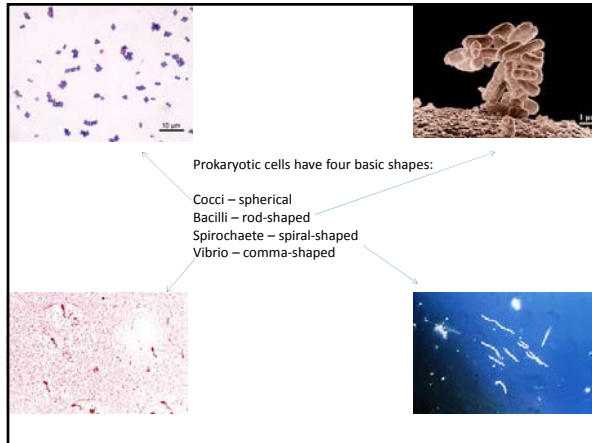
Most prokaryotes do have:

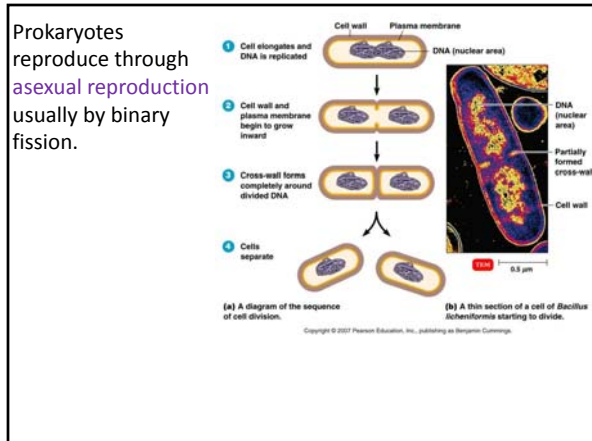
- A cell wall
- ribosomes
- A single circular chromosome



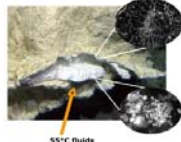
Comparing the Three Domains

Comparing the 3 Domains: Archaea with Bacteria and Eukaryotes			
Feature	Bacteria	Archaea	Eukaryotes
Type of Cell	Prokaryotic	Prokaryotic	Eukaryotic
Cell wall contains peptidoglycan?	Yes	No	No
Ribosomes	Yes	Yes	Yes
Reproduce via binary fission	Yes	Yes	No
Initial amino acid in translation	fMet	Met	Met

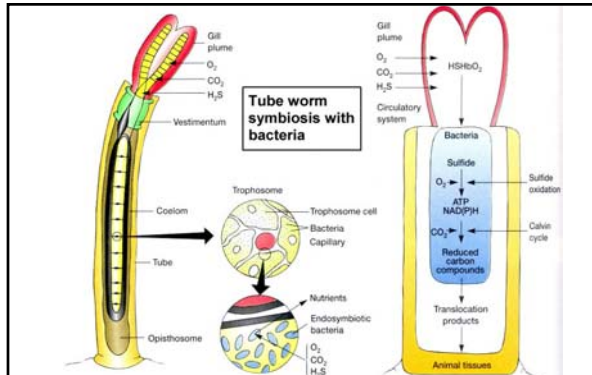




Hyperthermophilic Archaea
 (“extremely heat-loving”)

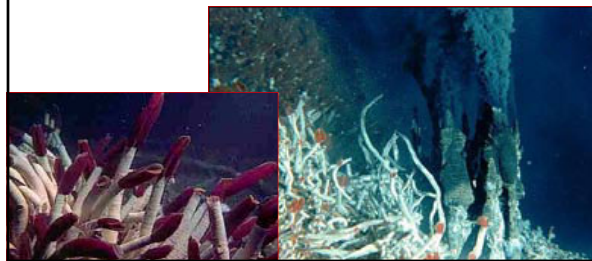


- Found typically in and around hot springs or volcanic flows, where temperatures can exceed 100°C and there are high concentrations of sulfuric acid.
- Pyrodicticum- Live in undersea volcanic vents that emit water (not steam) at temperatures over 100°C.
- Cells of Pyrodicticum grow best at 105°C, and are attached to a mass of filaments composed of protein subunits, that anchor the bacteria to the substrate.



Tube worms carry bacteria in their blood which use O_2 to oxidize H_2S from the thermal vent. The oxidation of H_2S releases energy, which is used to fix CO_2 into body parts of the animal.

Hydrothermal vent communities exist because of Archaea (sometimes called Archaeobacteria) converting chemical energy into organic energy



Archae don't just live in extreme environments.

Some Archae are useful to humans

For example, methanogenic archaea live in anoxic sediments in marshes and are used in sewage treatment facilities.



Another archaean, Methanobrevibacter smithii, lives and generates methane in the human colon. (This allows the guys on the show Jackass to light their farts on fire)

Domain Bacteria

Bacteria are **unicellular** microorganisms. They are typically a few micrometers long and have **many shapes including spheres, rods, and spirals**. Bacteria are found in every habitat on Earth, growing in soil, hot springs, radioactive waste, seawater, and deep in the earth's crust.



Some bacteria can even survive in the extreme cold and vacuum of outer space. There are typically 40 million bacterial cells in a gram of soil

