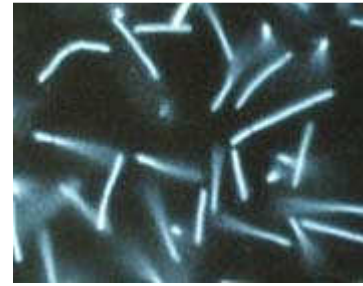


Archaea

The archaea very much resemble bacteria, so much so that they were once thought to be a weird group of bacteria. However, by studying archaeal cells on a molecular level, scientists have now come to think that these "weird bacteria" actually are a separate category of life altogether. In fact, in some ways, archaea are more like you than they are like bacteria!



Methanopyrus
Courtesy Karl Stetter

Classification

Archaeans are single-celled creatures that join bacteria to make up a category of life called the Prokaryotes (*pro-carry-oats*). Prokaryotes' genetic material, or DNA, is not enclosed in a central cellular compartment called the nucleus. Bacteria and archaea are the only prokaryotes. All other life forms are Eukaryotes (*you-carry-oats*), creatures whose cells have nuclei. (Note: viruses are not considered true cells, so they don't fit into either of these categories.)

However, while archaeans resemble bacteria and have some genes that are similar to bacterial genes, they also contain other genes that are more like what you'd find in eukaryotes. Furthermore, they have some genes that aren't like any found in anything else.



Methanothermus
Courtesy Karl Stetter

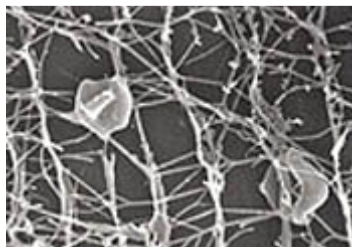
For more details about the differences between bacteria and archaea, see [this website](#). (Note: this site contains some pretty technical information and language.)

Early Origins

Archaeans are among the earliest forms of life that appeared on Earth billions of years ago. It's now generally believed that the archaea and bacteria developed separately from a common ancestor nearly 4 billion years ago. Millions of years later, the ancestors of today's eukaryotes split off from the archaea. So historically, archaeans are more closely related to us than they are to bacteria.

Life at the Extreme

Many archaeans thrive in conditions that would kill other creatures: boiling water, super-salty pools, sulfur-spewing volcanic vents, acidic water and deep in Antarctic ice. These types of archaea are often labeled "extremophiles," meaning creatures that love extreme conditions.



Heat-loving Pyrodicticum
Courtesy Karl Stetter

Archaeans have been found that can live in temperatures above 212°F (100°C). In contrast, no known eukaryotes can survive over 140°F (60°C). Other archaeans have been found in an Antarctic lake with a surface that is permanently frozen.

How do these extremophiles do it? They make a variety of protective molecules and enzymes (*en-zymes*). For example, some archaeans live in highly acidic environments. If the acid got into the archaeal cells, it would destroy their DNA, so they have to keep it out. But the defensive molecules on their cellular surfaces do come into contact with the acid and are uniquely designed not to break apart in it. Archaeans that live in very

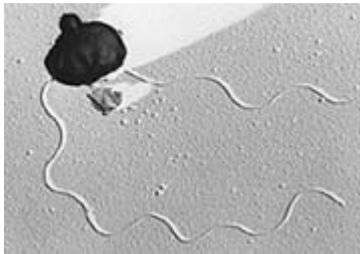
salty water are able to keep all the fluid from dissolving out of their cells by producing or pulling in from the outside solutes such as potassium chloride that balance the inside of the cells with the salty water outside. Other enzymes allow other archaeans to tolerate extreme hot or cold.

Not all the archaea are extremophiles. Many live in more ordinary temperatures and conditions. For example, scientists can find archaeans alongside bacteria and algae floating about in the open ocean. Some archaeans even live in your guts.

What They Eat

Archaeans dine on a variety of substances for energy, including hydrogen gas, carbon dioxide and sulfur. One type of salt-loving archaean uses sunlight to make energy, but not the way plants do it. This archaean has a light-harvesting pigment in the membrane surrounding its cell. This pigment, called bacteriorhodopsin (*back-tear-ee-oh-row-dop-sin*), reacts with light and enables the cell to make ATP, an energy molecule.

Types of Archaea



Archaeoglobus
Courtesy Karl Stetter

There are three main types of archaea: the crenarchaeota (*kren-are-key-oh-ta*), which are characterized by their ability to tolerate extremes in temperature and acidity (see [this site](#) for more details); the euryarchaeota (*you-ree-are-key-oh-ta*), which include methane-producers and salt-lovers; and the korarchaeota (*core-are-key-oh-ta*), a catch-all group for archaeans about which very little is known. Among these three main types of archaea are some subtypes, which include:

Methanogens (*meth-an-oh-jins*) — archaeans that produce methane gas as a waste product of their "digestion," or process of making energy.

Halophiles (*hal-oh-files*) — those archaeans that live in salty environments.

Thermophiles (*ther-mo-files*) — the archaeans that live at extremely hot temperatures.

Psychrophiles (*sigh-crow-files*) — those that live at unusually cold temperatures.

You'll find more information about the archaea at [MicrobeWorld](#). You can see more images of archaea at the [website of Karl Stetter](#), a German scientist who has found and identified many archaeans (click on the word "Bilder" in lefthand column).

Make 10 questions about the previous article. They can be true/false, multiple choice, or matching. MAKE SURE THAT YOUR QUESTIONS HAVE ANSWERS (make a key!).