

How eukaryotes are different from prokaryotes

Around two billion years ago, when all cells still lived in the ocean, a few of the earliest cells, or prokaryotes, evolved into more complicated cells called eukaryotes. They seem to have done this by enclosing several different kinds of prokaryotes inside another prokaryote. At first, this happened by chance, probably because one cell was trying to eat another cell. But it turned out that this whole group of prokaryotes could then all work together, cooperating to increase everyone's chance of survival and reproduction. The cells that are part of your body, and that are part of trees and other plants and animals, all still work this way.

One kind of prokaryote that evolved to live inside another cell was a chloroplast. A chloroplast is basically a prokaryote that can photosynthesize and instead of just producing energy for itself, it produces energy for a larger cell, and in exchange the bigger cell keeps the smaller one safe inside it. All plant cells have lots of chloroplasts inside them. Chloroplasts still have their own DNA molecule separate from the cell they live in.

Another kind of prokaryote that evolved to live inside another cell was a mitochondrion. Mitochondria use oxygen to break down the

sugars that the cell eats in order to make energy for the cell. Mitochondria could not evolve until about two billion years ago because that was the first time that there was enough oxygen in the atmosphere for them to use.

Most eukaryote cells also have other specialized pieces inside them that help them. These other pieces seem to have evolved gradually inside the cells. Some of these pieces are the nucleus, vacuoles, the endoplasmic reticulum, Golgi bodies and lysosomes. Eukaryote cells are about ten times as big as prokaryote cells, so they can hold all these pieces.

Most eukaryote cells still live independently as one-celled creatures like yeast. But starting about 600 billion years ago, a few eukaryotes evolved into multi-celled creatures, beginning with small simple animals and ending up with complicated creatures like people. Other eukaryotes live on or in animals. Some of these are helpful – you need bacteria in your intestines to help you digest your food. Others are harmful. Usually the harmful bacteria are just newcomers, and they gradually evolve into a more helpful role.

1 Choose the correct statement.

- a.** Prokaryotes appeared on the Earth around two billion years ago. **b.** Prokaryotes appeared on the Earth earlier than two billion years ago. **c.** Prokaryotes appeared on the Earth later than billion years ago.
- a.** Eukaryotes are less ancient and less complicated cells than prokaryotes. **b.** Eukaryotes are more ancient and more complicated cells than prokaryotes. **c.** Eukaryotes are more complicated cells than prokaryotes but prokaryotes are more ancient.
- a.** Prokaryotes cooperated to reproduce more easily and to survive longer. **b.** Prokaryotes cooperated to reduce their chance of survival and reproduction. **c.** Prokaryotes did not work together to reproduce more easily and to survive longer.
- a.** Chloroplasts are prokaryotes able to photosynthesize. **b.** Chloroplast evolved to live inside other cells. **c.** Both a. and b. are true.
- a.** Mitochondria started evolving about two billion years ago. **b.** Mitochondria need oxygen to live. **c.** Both a. and b. are true.
- a.** Eukaryotes are a bit larger than prokaryotes. **b.** Eukaryotes are much larger than prokaryotes. **c.** Eukaryotes are much smaller than prokaryotes.
- a.** Most eukaryotes are single-celled. **b.** Most eukaryotes are multi-cellular. **c.** All eukaryotes are helpful.