

**Directions:** Read, highlight, and answer the questions!

## Archaeobacteria and Eubacteria

**Archaeobacteria** are the oldest organisms living on the Earth. They are unicellular prokaryotes and belong to the kingdom, Archaea. Remember that **prokaryotes** do not have a nucleus that surrounds their Chromosomes. All **Eukaryotes**, including animal and plants have their chromosomes contained within a nucleus.

They were first discovered in 1977 and classified as bacteria. Most archaeobacteria appear like bacteria, when observed under the microscope. However, they are quite different from bacteria and eukaryotic organisms.

Archaeobacteria are found in very harsh conditions such as in the volcanic vents or at the bottom of the sea. They are often called "**extremophiles**". They can easily survive in such extreme environment as sea vents releasing sulfide-rich gases, hot springs, or boiling mud around volcanoes. They are found in the depths of the ocean. They are found in these place also swamps, deep-sea waters, sewage treatment facilities, and even in the stomachs of cows. This type of bacteria is different from the common type of bacteria that we see every day called Eubacteria.

**Eubacteria** are microscopic single-celled organisms. They are sometimes referred to as the "true bacteria," differentiating them from Archaeobacteria. The vast majority of organisms we think of as "bacteria" are Eubacteria. Eubacteria are responsible for many human diseases, but also help maintain health and play an important role in keeping the planet healthy.

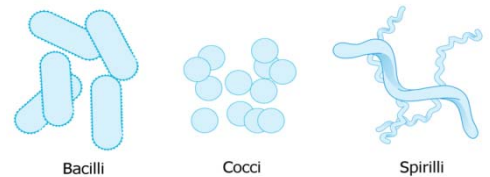
1. What makes prokaryotes different from Eukaryotes?

## Growth and Development



Most bacteria fall into 3 shape categories: spheres (Cocci), rods (Bacilli), and spirals (Spirilli). There are several others, but these 3 are the most common. The picture to the right

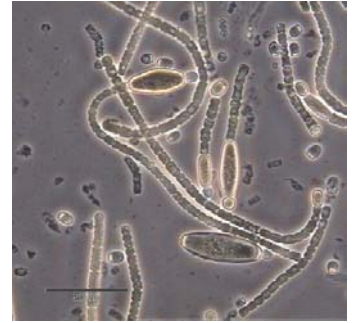
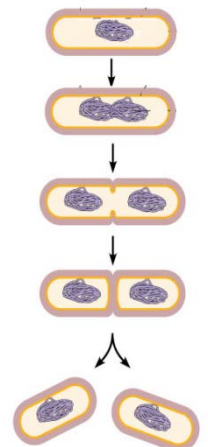
shows the different shapes. As for the growth part, bacteria do not grow like humans. There is no "baby" stage to "adult" stage. Bacteria are a one-size fits all kind of like you being born as a full grown adult (we probably wouldn't need car seats ☹️).



2. What are the 3 shapes of bacteria?

## Reproduction

Archeabacteria reproduces by a process called **binary fission**. This process is similar to mitosis in that one cell becomes two cells. This process does not happen in seconds it actually takes about 20 minutes for a bacteria cell to divide. This is much quicker than a human cell that can take up to or more than 24 hours to divide.



**Binary fission** is when an organism separates its body into two new bodies. In the process of binary fission, an organism copies its genetic material (chromosomes) and then divides into two parts ([cytokinesis](#)), with each new organism receiving one copy of the chromosome.

In **Binary fission** the chromosome is copied, then it gets moved to opposite ends of the cell, and finally two daughter cells are made. Wait that sounds a lot like Mitosis. When the chromosome copies is just like interphase. Chromosomes moving to opposite ends of the cell....hmmm....Anaphase. The phase where 2 daughter cells are made is called cytokinesis.

Binary fission and Mitosis are slightly different though. Because archeabacteria does not have a nucleus the stages of mitosis where the nucleus disappears (metaphase) or is made again (telophase) do not apply. The chromosome for bacteria just floats around inside the cytoplasm.

Although the cell may look like its growing, it's actually not. The size of a bacteria cell pretty much remains the same throughout its life. The lifespan of bacteria varies depending on the type, but the environment the bacteria are in must be perfect for it to stay alive. (Which is why adults tell you to wash your hands with soap and water, because it changes the environment for the bacteria and helps to kill it off).

3. What is binary fission? \_\_\_\_\_  
\_\_\_\_\_
4. How is binary fission like mitosis? \_\_\_\_\_  
\_\_\_\_\_
5. How is binary fission unlike mitosis? \_\_\_\_\_  
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## Obtain and Use energy

Depending on the bacteria type, they obtain energy in 3 different ways.

**Autotrophs**- make their own food.

**Heterotrophs** – These are like scavengers obtaining energy from eating other sources. Humans fall in this category. Bacteria on your teeth (plaque) are heterotrophs scavenging your tooth enamel causing decay and cavities.

**Photoautotrophs** – These make their own food obtaining energy from sunlight. They are very similar to plants.

**Chemoautotrophs** – These share their environment with another organism and obtain energy from a chemical reaction usually after another organism does something to it. The bacteria in your stomach are eating what you just ate in your last meal. Thankfully, they help us digest our food.

6. Why humans are consider to be heterotrophs and not photoautotrophs?  
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## Adaptations

In order to survive, bacteria must be able to adapt. This is both good and bad for humans. When bacteria **adapt**, we say their chromosomes have mutated or changed. Bacteria's ability to adapt or mutate keeps us alive. In a world without bacteria, humans couldn't survive since we depend on them to help us digest our food and even help return all of the atoms we use (nitrogen, oxygen, and carbon) back to the environment. They are kind of like

nature's little recyclers. Because they are constantly hit with different chemicals that humans create, they have to change and change quickly to stay alive.

Mutations don't just happen to the good bacteria though. They also happen to the dangerous bacteria. If you've ever had strep throat, you are thankful that we have medicine that kills off harmful forms of bacteria. The problem is bacteria adapts to the medicine making the medicine less effective. Unfortunately, because of all of the anti-bacterial stuff we use in our everyday lives such as soap and medicine, some bacteria are becoming resistant to these medicines and able to live even if we take medicine.

7. Are all bacteria adaptations bad? Why or why not?

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Most bacteria are harmless and offer beneficial functions to living things and humanity. Some bacteria, such as *E. coli*, live in the intestines of animals and people, helping them digest food as well as producing vitamins.



Other animals (including cows, goats, deer, and giraffes) depend even more than humans on bacteria to digest their food. Plants also depend on bacteria to help them absorb nutrients into their roots. Bacteria are used all the time in the food industry. Yogurt wouldn't be tangy without the help of a bacterium called *Lactobacillus acidophilus*.



So what is bad about bacteria? The bad news is that sometimes bacteria cause diseases in plants and animals that sicken or even kill them. Disease-causing bacteria can infect organisms in two different ways. Most attack the body's cells directly. Others produce chemicals called **TOXINS** (poisons). Either way, the bacteria destroy or damage cells within the plant or animal.



Humans also have to deal with bacterial disease on a daily basis. Around the world, hundreds of thousands of people die every year from bacterial infections, which can invade the body in several ways. Some bacteria enter the body through the intestines. This occurs by eating or drinking contaminated food or liquids. Cholera, for example, is a disease caused by bacteria in unsanitary drinking water. Food poisoning is brought on by eating food contaminated with bacteria such as salmonella and *E. coli*.

Even though bacteria does some really great things for humans, plants, and Earth the only bacteria we hear about are the bad kind. Think about the huge amount of antibacterial hand soap and sanitizers that have become popular over the years.

8. Should humans be afraid of bacteria? Why or Why not? \_\_\_\_\_

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