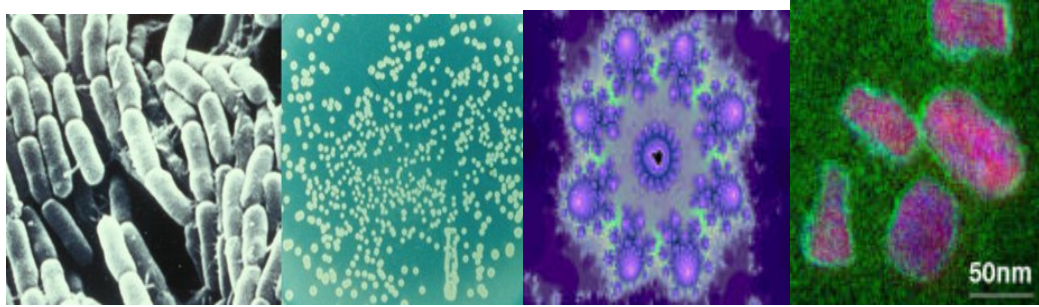


# Bacteria



Bacteria live almost everywhere, even where other forms of life can't. The only places where they can't survive is in sanitized places. Some bacteria need oxygen to survive, and others don't need any. Also some can survive with both, but some can't survive with oxygen. They protect themselves by forming a thick cell membrane inside the old one. Bacteria get food by feeding off of other tiny organisms and by making food. They make their food by using the sunlight, water, and carbon dioxide. They move by attachments off their body, which is mainly, called flagellas. They're like a tails or antennas. Bacteria reproduces when one of them become to large. It then divides into two. Bacteria can also harm humans, plants, and animals. They harm are bodies by coming through a opening in are body and then finding a cell. When they take over a cell they reproduce and kill it. Without a cell to take over they would die. Some diseases that bacteria make are cholera, gonorrhea, leprosy, pneumonia, syphilis, tuberculosis, typhoid fever, and whooping cough.

As hard as it is to believe, bacteria (also known to scientists as *Bacillus thuringiensis*) are everywhere; on your hands, on door handles, there's even thousands bacteria on the period at the end of this sentence (That's how small they are). Bacteria have been around for about 3.5 billion years. They were the first life forms on earth and more numerous then any other species we know of. Yet, while they are extremely common, they are also very small. Bacteria can only be seen with microscopes and are usually less then one micron (0.00002 inches) in length. Before I can explain how bacteria affect our world, you need to know more about them.

Basically, bacteria are numerous, unicellular organisms that don't contain a nucleus and consist of a capsule and a cell membrane made of peptidoglycan (that's a protein-sugar molecule). Like all cells, bacteria contain DNA, but the DNA in bacteria is different then other organisms, see it's arranged in a single circular chromosome while most cells have several rod shaped chromosomes. Some bacteria also have flagella. This assists the bacteria in moving by beating in a propeller-like motion. Bacteria can be classified in many different ways. Because of their simple cells structure they fit into the Moneran kingdom. Within that everything is a prokaryote (single celled organism that does not contain a nucleus) so the Moneran kingdom is sometimes called the Prokaryotae kingdom. (Confusing system right?)

Bacteria are also sometimes classified as gram negative or gram positive depending on the composition of their cell walls. There are also bacteria that need oxygen called aerobic bacteria and bacteria that don't need oxygen called anaerobic bacteria.

Since there are so many different types of bacteria it's hard to figure out how exactly how to group them and which characteristics are most important when putting them into categories. Of course different bacteria contain different components. While some contain endospores (thick protective structures which enable the bacteria to survive harsh conditions for decades) or pili (Hair-like outgrowths assist the bacteria in attaching to surfaces.) others may contain starch granules or ribosomes and enzymes. Bacteria come in three basic shapes, rod shaped bacteria, which are called bacilli, round shaped bacteria, which are called cocci, and spiral shaped bacteria called spirochetes. Also some bacteria look like half-spirals and tiny commas, although these are really just tiny spirochetes, they are sometimes called vibrios. The shape of a cell does not tell very much, not all cocci are harmful and not all spirochetes are helpful, even though we wish it could be that simple, it just doesn't work that way. Of course within each of these three groups there are many variations. Some bacilli may be thin, some may be thick, some may have pointed ends, others flat ends. The possibilities are endless, as are the different types of bacteria. Scientists have identified about 30,000 species of bacteria but obviously there must be so many more. Of course there's so much more to bacteria other than how they look or what they consist of, bacteria is what holds our world together. While many people believe that bacteria are harmful and dangerous threats to health it is the exact opposite in some cases. When something dies (plant or animal it doesn't matter) bacteria is what decomposes (breaks it down into simpler material) it. What we consider rotting is just bacteria releasing carbon and other important nutrients out of the dead organism and into the air and soil. Aside from breaking down dead organisms they also decompose compost and sewage which helps create methane (a natural gas used as fuel). If bacteria didn't exist the waste would just keep accumulating at record speed and interfere with the existence of everything living on earth. Plus decomposition returns carbon dioxide to the air which enables plants (and the rest of the world) to survive. This natural recycling process returns minerals to the earth and makes it fit for plants and animals. Not only this but bacteria can actually fight the diseases they cause.

Doctors are now able to take a small, weakened dose of a disease caused by bacteria and turn it into a vaccine which is given to people to prevent them from ever catching the illness. By giving your system a tiny dose of the disease it learns how to fight it and becomes immune to it. Along with vaccinations bacteria can also create antibiotics that kill the disease after it enters your body. Antibiotics trigger the reproduction of bacteria inside of you; it cuts off the supplies needed so it stops spreading. Unfortunately antibiotics don't always work now in days, as the bacteria get used to them they become immune and fight back. Antibiotics that used to work may become ineffective due to their overuse. For the time being though, we still have plenty of useful antibiotics because of bacteria. Like buttermilk? Yogurt? Sour cream? If yes, you can again thank bacteria. These are just a few foods in which go through fermentation with the help of bacteria. Bacteria usually help in the making of dairy products and things with high fructose corn syrup. When these foods go through fermentation the bacteria the bacteria change mild sugar into acid. Other products are also formed through fermentation such as solvent butyl alcohol, acetone and dextrane. Even some enzymes extracted from bacteria are used in meat tenderizers, laundry starches, household detergents and spot removers.

Without bacteria nothing could survive, the fate of the world rests on their shoulders. Who knew that such small creatures could have such great power. Bacteria reproduce by the means of binary fission. In this process the single chromosome is doubled, the bacteria divides into two cells and each cell receives one chromosome. You end up with two new, identical bacteria cells. Yet, this form of reproduction does not create any type of genetic diversity (difference in genes) so to shuffle DNA bacteria perform several processes such as conjugation, transformation and transduction. In conjugation one bacteria attaches to another, generates a tube called a pilus, and transfers fragments of plasmid DNA. In transformation, bacteria take up fragments of DNA released into the soil or water from decomposing bacteria. Transduction involves the transfer of DNA between bacteria cells by a bacteriophage (a virus that infects bacteria.) By mixing genes in bacteria it allows them to develop new characteristics and stronger abilities to undergo harsh conditions. It would be a lie to say that all bacteria are helpful, some are extremely dangerous and cause deadly diseases.

Out of the 30,000 bacteria species discovered, only a few hundred cause diseases yet hundreds of millions have died from bacteria related sickness. The plague was caused by a pathogens (bacteria that cause diseases) and did in fact kill millions. Other diseases caused by bacteria include tuberculosis, tetanus, cholera and Lyme disease. We haven't always known about bacteria, no one actually studied bacteria until the 1600's when Antoni van Leeuwenhoek started to.

Leeuwenhoek discovered many types of bacteria and worked hours to make fine glass for his simple microscopes. He was considered the founder of microbiology and set the path for other scientists like Louis Pasteur. Mr. Pasteur proved that microbes (or any living things) did not arise from non-living matter as scientists used to believe. Later, a German scientist named Robert Koch showed the world that bacteria actually did cause disease. We've come far in our knowledge of bacteria from the time, which we didn't even know it existed. Many scientists devote their lives to finding out more about bacteria because no matter how much you know; there's always more to learn. Bacteria also take part in symbiotic relationships in which they live as "partners" with other organisms. Some bacteria form a symbiotic relationship with animals, especially humans. While many people are unaware of it, there are bacteria throughout your body helping you to survive. Bacteria aid in digestion in humans and other animals. They produce nutrients and while assisting the body they get some food for themselves. Since both benefit from this symbiosis it can also be known as a mutualism. That's just the basics on bacteria. It's amazing something seemingly simple can actually be very complex. Remember, don't shun bacteria in this world, because without them, we wouldn't have a world.

( Nabi Raza Khan)