What are bacteria, and what do they mean to you?

 It's happened to almost everyone. You wake up bleary eyed, stomach churning. You're too hot, and then too cold. Nausea sends you running to the bathroom. You're sick. So you drag yourself to the doctor, suffer through the exam, and learn you have an infection. A bacterial infection, to be specific. The doctor writes you a prescription for an antibiotic, and in a few days you're good as new. Most people think this is the only interaction they ever have with bacteria, but boy, would they be wrong! Bacteria are an important part of our world, and even a vital part of our own bodies!

By the end of this chapter, you should be able to:

* **Explain what bacteria are**
* **List a few ways we encounter bacteria in our everyday lives**
* **Explain what role bacteria play in our health**
* **Understand why we have to be cautious using antibacterial products**

**What are bacteria?**

 Bacteria are a type of organism that are far too small to see with the naked eye, often as small as 2 micrometers long. This means you need a microscope to see them individually. Bacteria are single celled organisms. They are exposed to the environment around them, and just like you, they need a protective outer layer. For humans that layer is skin. For bacteria, that layer is called a bacterial envelope, and it's made of a cell wall, and an inner plasma membrane. Inside that envelope is something called cytoplasm. This cytoplasm contains the cell's DNA, as well as some small molecules that produce proteins, energy, and enzymes the cell needs. There's not a lot of structure inside of bacteria, especially when compared with organelle-laden eukaryotes. Structures are randomly distributed throughout the cytoplasm, and are supported by a series of filaments known as a cytoskeleton.

**Bacteria every day**

 Bacteria are everywhere. They're in the ground, in our food, and even inside our bodies. Bacteria play a huge role in our everyday lives, to the point we literally could not live without them. Bacteria decompose dead animals and plants, which returns nutrients to the soil. Bacteria are also crucial in taking nitrogen from the air and converting it into a form that plants can use, a process call nitrogen fixation. Without fixation, plants wouldn't get the nitrogen they need to grow!

 But bacteria are even more useful to us. Without bacteria we wouldn't have cheese, yogurt, sour cream, or many other types of food. The bacteria break down lactose, a type of milk sugar, making the cheese inhospitable to many organisms that would spoil the cheese. They can also add to the flavor. Think about that next time you eat a grilled cheese sandwich!

 Bacteria is even useful in cleaning up the environment. Often, bacteria can convert harmful chemicals into neutral ones. This is known as bioremediation, and can be used to clean up oil spills and hazardous waste. Bacteria can make our environment safer for us.

 These are just a few ways bacteria help us in everyday life. Bacteria can also be used to make antibiotics. That's right, some bacteria produce natural antibiotics that kill other types of bacteria. Bacteria are also key in making insulin for diabetics who cannot produce their own. Who knew the tiniest living organisms could have such a big impact on the world around us?

**Bacteria inside us**

 Right now, your body has more bacterial cells than human ones. That's impossible, you might think. There's no way there can be more bacteria in me than cells that are, well, me. But bacteria are so small that they simply don't take up much space. Don't worry, though. That's a good thing! Bacteria in our guts can actually help us digest food more efficiently and extract more nutrients.

 Bacteria help our immune systems, too. Studies have shown that use of probiotics, or supplements that contain good bacteria, can help improve immunity. Bacteria also seem to play a role in developing tissues that focus on immune function. They can also make a big difference just by being there so bad bacteria have less space and resources to use to reproduce.

 There are a lot of advantages to having bacteria inside of us, but there are some disadvantages, too. Just like the example in the introduction, sometimes bacteria can make us sick. Sometimes the illness is easily taken care of with an antibiotic and some rest. Other times it's more serious and takes a long time to recover from, or even a trip to the hospital. This often happens with bacteria that don't normally live in the body. These organisms can be introduced through a cut in the skin, or in food that's been infected. Once they get inside, they can multiply quickly, due to their small size and simple structure. Before we know it, we have an infection.

**Antibiotics and You**

 No one likes to be sick. Whether it's a serious illness or a case of the sniffles, we want to feel better as quickly as possible. When we combine that with a misunderstanding of what's making us sick, it can cause big problems. Lots of things can make us sick. It could be bacteria infecting us, or a virus, or any one of a hundred other things causing our symptoms. Often people think an antibiotic will cure their cold, and insist on being given one every time. What's the harm? they think. It's just a little pill.

 The problem is that antibiotics kill bad bacteria and good bacteria. This is the reason they can cause upset stomach and diarrhea. They kill the good bacteria in your stomach, upsetting the natural balance. It can take a while for the bacteria in your stomach to recover, and you can have stomach problems until they do.

 Another big problem is antibiotic resistance. This is when a type of bacteria evolves so certain antibiotics, usually the ones most commonly used, won't work on it anymore. When you take antibiotics, you kill the susceptible bacteria. That means there's more room and resources for the antibiotic resistant bacteria to grow and multiply. The same goes for the good bacteria as well. If you take antibiotics and kill off the susceptible good bacteria in your stomach, you leave the resistant bacteria. Since different types of bacteria can share genes, you may be making a little pool of antibiotic resistant bacteria just waiting to share that resistance with any visiting bacteria.

 That goes for antibacterial soap, too. Bacteria don't know if they're inside your body or outside of it. You can create antibiotic resistant bacteria just as easily on your hands by using antibacterial soap.

 Does that scare you? Don't worry. It's not as bad as it sounds. Scientists are working hard to create new antibiotics bacteria haven't seen before, and doctors are being more careful to prescribe less antibiotics. Just trust the doctor when she tells you to rest for a few days and come back if your cold doesn't go away, and buy normal soap.

**Conclusion**

 Now that we know what bacteria are, we know they play multiple roles in our lives, both good and bad. They are all around us, and are important not only in the environment, but inside of us as well. Without them, plants wouldn’t grow, we wouldn’t have some of our most delicious foods, and our immune systems would be far weaker than they are. Bacteria can also cause problems, like spoiling food and causing illness. We’ve also learned why it is important to respect the bacteria in our lives, and not expose them to antibiotics unnecessarily. You should now be able to:

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