**Bacteria in Our Bodies:**

**Introduction:**

While it is hard to imagine, there are more bacterial cells present in, and on, our bodies than there are human cells (Slashinski et. al 2013). Oftentimes when we think of bacteria, we automatically think of them as being completely negative. This assumption is not often true. Bacteria helps keep the body working efficiently in many different ways. Bacteria live on our bodies almost everywhere. They are in our skin, our mouths, our digestive system, and many other areas (Simon and Gorbach 1986). The entire collection of microorganisms in, and on, our bodies are referred to as the *microflora*. There are bacteria all around us, in the food we eat, water we drink, air we breathe, and in the soil (Moe and Rheingans 2006). The sheer amount of bacteria surrounding us emphasizes the importance for us to understand as much as we can about how bacteria function. Although many types are harmless, or even beneficial, there are certain kinds of bacteria that can cause problems and diseases. Understanding how bacteria function in different areas of our bodies can help us maximize the benefits they give us, and minimize the chances of disease or infection.

**How do we Acquire Bacteria?**

If we have so many bacterial cells in, and on, our bodies, the next logical question would be identifying how the bacteria ended up within our bodies. When babies are in the womb, they are *sterile*, meaning they have no microbes on them. The mother does not pass her own bacterial residents to the fetus while she is pregnant (Lin et al. 2013). Birth is the first time the baby will encounter bacteria. The baby will be exposed to different types of bacteria depending on the method of birth. It is suspected that the bacteria given to the baby during vaginal birth is more beneficial than the bacteria the baby would acquire during a C-section (Azad 2015). For the first two years of life, the microflora of a baby is changing rapidly. As they are exposed to more and more, their bacterial population will become more stable. By the time that a child reaches age two, their microflora will look very similar to that of an adult (Lin et al. 2013). However, the microflora can change throughout an individual’s life span as the result of a variety of environmental factors. These factors could be taking antibiotics, or other medications, getting sick, changes in diet, level of personal hygiene, along with a number of other factors. Bacteria can be spread through food, sexual contact, drinking contaminated water, breathing contaminated air, or human contact (Takahashi and Nyvas 2010). Bacteria can be ingested in numerous many ways without individuals noticing when it is happening. This is why it is important to maintain healthy practices to minimize the risk of exposure to harmful species of bacteria. These healthy practices include good hygiene, maintaining clean cooking surfaces, and washing your hands frequently.

**Benefits of Microflora:**

A symbiotic relationship has evolved between humans and many species of bacteria (Mazmanian et al. 2008). For instance, the bacteria in a human gut break down components in our food that human metabolism cannot process. Firmicutes, Bacteroidetes, Actinobacteria, and Proteobacteria are the most prevalent phyla of bacteria in the gut. These bacteria in turn, benefit from the protection, nutrients, and moisture the human host provides (Mazmanian et al. 2008). Bacteria can also synthesize vitamins or other materials that the body needs to function, but is unable to synthesize itself.

There is an intricate balance between the species of bacteria that co-exist in specific areas of the body. The bacteria must be adapted to survive in the specific pH of whatever part of the body they are in, the moisture level, nutrients available, as well as be tolerant of byproducts made by the human host or other bacterial populations who reside in the same area (Nau et al. 2002). For instance, bacteria in the stomach must be able to withstand the acidity of the stomach acid and bile, while bacteria in the vaginal region must be able to withstand the lower pH environment. Along with this, bacteria present on the skin must also be able to handle a dry environment in order to survive (Nau et al. 2002). The range of species of bacteria on the body corresponds to the different physical conditions they live in.

Microflora and Defense against Pathogens:

Another benefit bacteria provides to humans is to deter the success of virulent bacteria that have infiltrated the body. *Virulence* refers to the ability of a pathogen to cause disease. Through competition, it is difficult for virulent bacteria to compete with the native bacteria, which lowers the likelihood of infection (Jandhyala et al. 2015). Non-virulent bacteria also secrete metabolic products and chemicals to discourage the growth of other bacteria (Jandhyala et al. 2015).

Antibiotics effect on Microflora:

If you have ever gone to the doctor and discovered you had a bacterial infection, you were likely prescribed antibiotics. Antibiotics are commonly used to treat bacterial infections. They are often effective, and necessary. However, they can sometimes have unintended negative effects. Antibiotics do not have complete specificity to the type of bacteria they are targeted to kill (Plotkin 2003). As a result, antibiotics kill some of the commensal bacteria present in our bodies along with the targeted pathogen (Nau et al. 2002). This can leave the body more vulnerable to attacks by other pathogens, since there is no competition to deter their growth. This can be especially problematic for those who are immune compromised and it can even become life threatening (Plotkin 2003). Those who are immune compromised have issues with their immune system that causes it to not work at full efficiency.

**Pathogenic Microorganisms:**

There are many different types of bacteria that can cause disease. They can differ significantly in their mode of infection, severity of infection, and *incubation times. Incubation time* refers to the length of time that it takes a bacterium that has been ingested to cause disease. Incubation times can vary from less than a day to several weeks (Plotkin 2003). Furthermore, there is substantial diversity in the method by which the bacterium actually causes the disease. Often, the disease is targeted at specific cells in the body (Plotkin 2003).

**Protection against Disease**

There are numerous species of bacteria that can cause very serious diseases. It is important to take steps to lessen the chances of becoming ill. Personal hygiene helps to limit exposure to pathogens (Moe and Rheingans 2006). Washing your hands frequently and brushing your teeth regularly rids the skin and teeth of many types of bacteria that could be potentially harmful. Avoiding touching your nose, eyes, and mouth with your hands also limits the possibility of infection. You likely have bacteria on your hands, and transferring it to a mucosal surface could give the bacteria an environment where they are able to cause disease (Nau et al. 2002). Buying food from reliable sources and storing it properly along with keeping cooking areas and bathrooms clean will also lower the chances of disease (Moe and Rheingans 2006).

Vaccines:

Vaccines are the most significant advancement in preventing disease. Some vaccines work by taking a small part of the infectious organism, deactivating it with chemicals or heat to take away its virulence,and injecting it in the body (Plotkin 2003). As a reminder, virulence is the ability of an organism to cause disease. The immune system will then make antibodies for the vaccine, and produce memory cells. If the body is exposed to the pathogen again, the memory cells will recognize the component from the vaccine and have the corresponding antibodies to fight it (Plotkin 2003). Taking away a pathogen’s ability to cause disease, and injecting it, allows the body to prepare a defense against the real pathogen without simultaneously dealing with the effects of the infection. The immune system only needs a small part of the bacteria in order to make antibodies. Proteins work the best, but carbohydrates, and nucleic acids can also be effective (Plotkin 2003). When making vaccines, a specific protein, or other component of the bacteria, will be identified that is unique to the infectious pathogen. So when the actual pathogen comes into contact with the body, it will be recognized by the immune system from the specific protein that was in the vaccine. This allows the body to be able to eradicate the pathogen before it has the opportunity to cause harm to the body.

**Summary:**

Bacteria have a large influence on human life. They are present in astronomical numbers in our bodies, and in our environment. Many types of bacteria benefit our bodies by helping break down materials, synthesizing compounds humans are unable to, and deterring pathogenic infection through competition. Other types of bacteria are *pathogenic*, meaning they can cause disease. By utilizing sanitary habits, the risk of exposure and infection become greatly lowered. Vaccines have been used against diseases that were very deadly in the past. Mass use of vaccines lead to the eradication of these devastating diseases from some societies. Progress is constantly being made towards discovering more about bacteria in regards to how they function and their effects on the world. However, there is still much to learn about this numerous, diverse group of organisms.

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