The Gut Microbiome: An Overview

In this chapter, we will take a look inside of the stomach. Section 1 will discuss what is found inside of the gut microbiome and how it affects us directly and indirectly. Section 2 will be an overview on the relationship between the gut microbiome and the immune system. Section 3 will cover the role it plays when it comes to sickness and diseases, especially cancer.

Around the world, humans get infected with viruses, diseases and other illnesses without knowing that the microbiota within the gut microbiome can affect a person’s immunity towards the illnesses. These tiny microbes inside of the stomach are constantly trying to keep our bodies rid of foreign cells or bugs that lead to viruses and other danger. The gut is more important to our health than many people realize. The microbiota within the gut are involved in numerous aspects of human physiology dealing with nutrition, stress and even behavioral responses (Sekirov et al., 2010). They can weigh up to 2 kilograms in total. Two kilograms is about the weight of two one-liter bottles of soda. One-third of our gut microbiota is common among most people while the other two-thirds is specific to each individual (ESNM et al., 2018). The balance in the composition of the microbial community is extremely important in maintaining homeostasis inside of the intestines and other parts of the human body. **Homeostasis** is the ability to maintain internal stability even during environmental changes. For humans, homeostasis within the body would be keeping a stable temperature of 98.6 degrees Fahrenheit.

The composition and balance of gut microbiota evolves throughout our entire lives. Prebiotics and probiotics are beneficial by serving as “food” for the bacteria inside of the stomach. Prebiotics strengthen and improve the function of microbiota and also allow the growth of good bacteria. They can be found in certain fermented foods like yogurt. Probiotics aid in keeping the microbiota balanced and diverse (ESNM et al., 2018). This is important because it ensures that everything will digest properly into the stomach.

Although there is a wide variety of microbes and bacteria in the stomach which contribute to protection against many illnesses, there are also some that are not beneficial in helping stop attacks on the body and can determine our resistance to certain drugs.

The Impact of The Gut Microbiome

The gut microbiome, formerly called the gut flora, is composed of the many microbes (microorganisms), fungi and bacteria that are found within one’s stomach. The human stomach contains trillions of microorganisms with at least 1000 known bacteria and more than three million genes. This specific microbiome plays a huge part in our health, especially with the immune system, digestion system and diseases. The microbes within the stomach can protect the body against **pathogens**, a microorganism that can cause disease.

The majority of the gut microbiota is composed of **strict anaerobes**, organism that can live only in environments lacking oxygen (Sekirov et al., 2010). The intestines harbor the gut microbiota. The microbes also contribute to metabolic functions, and while aiding the immune system, the microbes directly/indirectly affect most of a person’s physiologic functions. Gut microbiota can accumulate nutrients from substrates that are indigestible by its host, helping with nutrition and digestion (Shreiner et al., 2015). The microbes also extricate short chain fatty acids from the indigestible fibers. The fatty acid chains are an important source of energy from intestinal mucosa and help modulate **tumorigenesis**, the formation of tumors, and immune responses inside of the gut microbiome.

Microbes Aid the Immune System

It is very important to have a healthy gut, which influence and affect other organ systems in the body. The Immune System is a host defense protecting the body from foreign cells, tissues, substances and other invaders. The mucosal immune system has two conflicting functions to handle: it needs to be tolerant of microbiota in order to prevent the induction of detrimental systemic immune responses while also being able to control the gut microbiota. This control will stop the microbiotas’ translocation and overgrowth to systemic sites (Sekirov et al., 2010). **Translocation** is the transport of soluble food from one plant to another via phloem or xylem. Gut bacteria are an essential factor in having a healthy immune system. The bacteria play a role in:

* Teaching our immune system how to behave
* Keeping the immune system balanced

Although the microbiota can act as barriers, having a diverse gut microbiome with many different bacteria, microorganisms and fungi, teaches the immune system that not everything it comes in contact with is bad. This balance influences the immune system to stay regulated; if not, it could cause inflammatory responses to certain foreign bacteria. This result could lead to problems with other bodily organs, increasing the risk of obesity, diabetes and depression. At first, we are born with a naive system that is originally protected by our mother’s antibodies. As we grow, our immune cells have to be taught how to further protect us once these antibodies are gone. The gut microbiota helps with this (Science, 2018).

Gut Microbes & Disease

Specific gut microbes can affect our immunity to certain diseases. They also can determine the way we will respond to different immunotherapy drugs. A lot of gut bacteria are beneficial, yet some can have negative effects on our health by either aiding foreign invaders in attack or not being able to protect normal cells from them. Sometimes good bacteria can be taken out of the body by certain prescription medications or diets and pathogens are quick to come in and try to fill that gap. When this happens, the body is not strong enough to fight off the foreign invaders which could lead to more serious problems, like disease.

One common disease directly related to the gut is inflammatory bowel disease. IBD is characterized by the chronic inflammation of the gastrointestinal tract, which is the stems from a defective immune system. The immune system is supposed to attack foreign bacteria, but when the system is defective, it incorrectly responds to environmental triggers, causing the gastrointestinal tract to become inflamed (CDC, 2018).

Overall, the many bacteria within the stomach are vital to our health. It can affect other major organs in the body, especially our immune system. Keeping our immune system strong and having a diverse gut helps us continue to fight off viruses, diseases and more.

References

“CDC -What Is Inflammatory Bowel Disease (IBD)? - Inflammatory Bowel Disease - Division of Population Health.” *Centers for Disease Control and Prevention*, Centers for Disease Control and Prevention, 2018, [www.cdc.gov/ibd/what-is-IBD.htm](http://www.cdc.gov/ibd/what-is-IBD.htm).

ESNM. “Gut Microbiota Info.” *Gut Microbiota for Health*, 2018, [www.gutmicrobiotaforhealth.com/en/about-gut-microbiota-info/](http://www.gutmicrobiotaforhealth.com/en/about-gut-microbiota-info/).

Sekirov, Inna, et al. “Gut Microbiota in Health and Disease.” *Physiological Reviews*, vol. 90, no. 3, 1 July 2010, pp. 859–904., doi:10.1152/physrev.00045.2009.

Shreiner, Andrew B et al. “The gut microbiome in health and in disease”*Current opinion in gastroenterology* vol. 31,1 (2015): 69-75.

staff, Science X. “Why Gut Bacteria Are Essential for a Healthy Immune System.” *Medical Xpress - Medical Research Advances and Health News*, Medical Xpress, 29 Mar. 2018, medicalxpress.com/news/2018-03-gut-bacteria-essential-healthy-immune.html.