Microbiomes

Topic Overview

As we all know, most microbes are little bacterial organisms that cause disease and infection if they enter into the innate immune system. However, did you know that there are clusters of microbes that can be found in many ecosystems around the world? These are called microbes. To put it simply, they are all the microorganisms that live in this or that particular region. There are microbial communities in the soil of plant life, the bodies of water that form rivers, lakes, ponds, and even in your own intestinal gut! Microbiomes are very distinct in having physio-chemical properties depending on their surrounding environment. They have also been a great study for human health and scientists believe they can become more beneficial in the future.

In this chapter, we will discuss what exactly are microbial communities, where certain microbes of a community reside, their extremophile properties, and how they are relevant to medical research.

1.1 What is a Microbiome?

Microbiomes (or microbial communities) are the certain types of microbes that live in a certain type of environment. For example, there are more microbes prospering microbes in tropical climates. Why? Because warmer temperatures can breed more plant and animal life; therefore, more bacteria is able to be reproduced as well as archaea though archaea is not pathogenic.

1.2: Human Microbiome/Properties

One of the most common bacterias practiced for micro lab is Escherichia coli. It has a thin layer of peptidoglycan classifying it as a gram positive bacteria. It is rod shaped with spindles sticking out of the body and it can range from 2.0 micrometers to 6.0 micrometers in length and about 1.3 micrometers in width (see figure 1). However, can you guess where they grow and replicate? They grow inside intestinal tracts of not only animals but also humans. No need to fear, most Escherichia coli are harmless and are essential to the human gut. Not only does E.coli live in your intestinal tract, an archaea called methanobrevibacter smithii also resides in your intestines (see figure 2). This archaea is known for helping to produce methane in the intestines. It is coccobacillus and also meets the requirement for bacterial fermentation. This is a prime example of how a microbiome can exist even inside a human intestinal tract. There are more microbes to discuss but we will discuss that in another chapter.

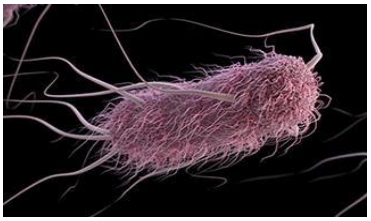

Figure 1

First discovered in 1885 by Theodore Escherich.

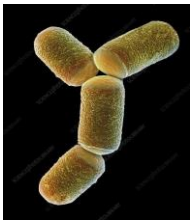

Figure 2

Found in human intestines

1.3: Microbiome Plasticity

The human gut microbiota is plastic. By that, we do not mean plastic by a cart of milk or a bag to put bread in. By plastic, this means that the microbiota inside the human can be easily shaped or molded. This can be backed by fecal transplants using stool. Individuals that lack healthy microbes in their gut can have a transplant of healthy bacteria inserted into their stomach from a stool of feces. “Fecal Flora Reconstitution is an effective, viable, and simple method of treatment for the difficult to treat patients with RCDI who fail standard therapy” (Rohlke). These therapies are to help people provide their own gut to liberate nutrients into their natural host without any pathogenic uptake.

1.4: Microbiome in Human Milk

As discussed, there are now known microbiomes in the human gut. There also lies communities of microbes in human milk produced in the breasts of women. What is very special about this is that these molecules of carbohydrates have the potential to shape microbial communities in prebiotics such as HMO milk. “Once ingested, HMOs resist the low pH in the infant's stomach as well as digestion by pancreatic and brush border enzymes. HMOs are not degraded by the infant and thus reach the distal small intestine and colon in an intact form, where they are available to help shape microbial communities and host-microbe interactions” (Milani et al). Humans themselves can create antibiotics from just their body alone!

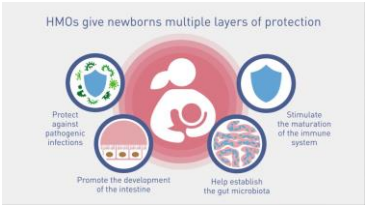

Figure 3

Conclusion

Microbiomes shape our community, environment, and our human way of life. Microbes can be found anywhere in the world and are not limited to just a certain area. Microbial communities are in clusters everywhere you go, even the very many you carry yourself without even knowing. To top that, microbiomes also have potential in creating biotics for human health. Eventually in the future as humans evolve, microbiomes could also evolve as well.

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