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Microbiome and its Role in Immune System Development

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Description

The microbiome is a characteristic microbial community that occupies a reasonably well-defined habitat with different physicochemical properties. The microbiome is not only related to the microorganisms involved, but also includes their sphere of activity, which leads to the formation of specific ecological niches. The microbiome, which forms a dynamic and interactive micro ecosystem that is susceptible to changes over time and scale, is embedded in macro ecosystems, including eukaryotic hosts, and is critical to their function and health. The microbiome is essential for human development, immunity, and nutrition. The bacteria that live inside and outside of us are not invasive but useful colonizers. Autoimmune diseases such as diabetes, rheumatoid arthritis, muscular dystrophy, multiple sclerosis, and fibromyalgia are linked to a malfunction of the microbiome. They consist of bacteria, bacteriophages, fungi, protozoa, and viruses that live inside and outside the human body.

In humans, the composition of the gastrointestinal microbiome is determined during delivery. Birth by Cesarean or vaginal delivery also influences the microbial composition of the intestine. Babies born through the vaginal canal have a beneficial, non-pathogenic gut microbiota that is similar to their mother's. Overuse of antibiotics can cause an imbalance in the microbiome, which can lead to overgrowth of pathogenic bacteria and yeast. Babies who are not delivered vaginally or who are not breastfed may never develop a fully functional microbiome. Microbiome research has its origins in microbiology and began in the 17th century. The development of new techniques and devices has driven microbiological research and caused a paradigm shift in the understanding of health and disease. Since infectious diseases have affected the human population for most of history, medical microbiology was the primary focus of research and of public interest.

Microbiome in Immune System Development

The interaction between the commensal microbiota and the development and function of the mammalian immune system encompasses various interactions in homeostasis and disease. Colonization of the mucosal surfaces of the mammalian host at an early age plays a central role in the maturation of the host's immune system. The most critical events in the development of host immunity can occur in the first years of life, when the composition of the microbiota shows the greatest intra- and inter individual variability, before reaching a more stable adult-like configuration at 3 years of life. The microbiome plays a critical role in the formation and development of key components of the host's innate and adaptive immune systems, while the immune system organizes the maintenance of key characteristics of the host's microbial symbiosis.

In a genetically susceptible host, imbalances in the immunity interactions of the microbiota in defined environmental contexts are believed to contribute to the pathogenesis of a variety of immune-mediated diseases. The human body, including the intestines, skin, and other mucosal environments, is colonized by an enormous number of microorganisms, collectively known as the microbiome. The collective genomes of bacteria and other microorganisms in this ecosystem, including fungi, viruses, and parasites, have been increasingly studied over the past two decades, thanks to the rapid development of culture-independent genomic techniques. Recent advances in microbiome research have shown that the gut microbiome is not just a passive bystander, but actively affects multiple host functions, including circadian rhythms, nutritional responses, metabolism, and immunity.