Editorial

The human microbiome: an emerging paradigm for better health

Abstract

The human microbiome is rapidly emerging as an intriguing field of scientific research. Its role in human physiology and modulation of human diseases spanning genetic expression, immune system, and mental health to body weight is currently the focus of intense investigation. Dysbiosis, the alteration of the bacterial ecology, is being linked to increasing illnesses. Although still in its infancy, investigating the human microbiome is becoming an exciting field of scientific endeavor that addresses the symbiotic relationship between humans and their internal microbiome. This research is revealing a vast reservoir of knowledge that will ultimately have enormous implications for the treatment of diseases.

Volume 6 Issue 2 - 2018

Joseph F Murphy
Director of Immunology Applications, Caprion Biosciences Inc, Canada

Correspondence: Joseph F Murphy, Director of Immunology Applications, Caprion Biosciences Inc, 201 President Kennedy Avenue, Canada, Tel 781 664-4897, Email jmurphy@caprion.com, www.caprion.com

Received: April 09, 2018 | **Published:** April 19, 2018

Introduction

The past few years has witnessed a blossoming of research revolving around the human microbiome. Increased knowledge about this field has led to realizing its crucial role in modulating human health. The microbiome genome, compromised of bacteria, fungi, viruses, and protozoa is referred to as our second genome. It is estimated that there are 100 trillion microbes, comprised of over 1,000 species. The composition varies from person to person based on several factors, such as diet, health history, geographic location, and ancestry. They are intertwined with our immune system, interacting directly with our body's natural killer T-cells. Moreover, this complex ecosystem must be properly balanced and nurtured to remain healthy. Imbalances within our microbiome can lead to illness. Our microbiome also helps control gene expression, which ultimately affects several facets of our physiology.

Gut instinct

The human enteric nervous system (ENS), an off shoot of the autonomic nervous system, is embedded in the wall of our intestines, and works both independently and in alignment with the brain. Comprised of an estimated 500 million neurons, it is also the original nervous system, emerging in the first vertebrates and becoming more complex as vertebrates evolved. Our ENS is believed to be largely responsible for our "gut instinct," responding to environmental threats and sending information to our brain that ultimately affects our well-being. Like the brain, the ENS uses more than 30 neurotransmitters, with over 90% of the body's serotonin found in the gut. Since our microbiome is closely linked to our autonomic nervous system, it follows that microbe-based therapeutics can lead to long-lasting effects and can be readily modified for regulatory aspects. For example, if a pathogen crosses the gut lining, immune cells in the gut wall secrete inflammatory substances that are detected by neurons in the ENS. The importance of the microbiota in influencing mental health extends beyond mood swings, but also includes the development of serious conditions, such as autism, Alzheimer's disease, and schizophrenia.

Inflammation

Given that over 70% of the body's immune system is committed to maintaining homeostasis with the human microbiome, it stands to reason that the gut microbiota is an important regulator of immune responses. It has been established that the microbiome plays a protective role in acute local inflammatory responses to injury partly through toll-like receptor (TLR) activation promoting survival and tissue repair. Inability to regulate these responses contributes to the development of food allergies and various inflammatory bowel diseases, while immunity and inflammation within organs distal from the intestine are affected by microbial composition and density.[1] For a comprehensive analysis of the potential mechanisms underlying microbiota-based changes to systemic inflammatory disease, see review by Clemente et al.[2]

Cancer and immuno-oncology

It is well established that the clinical response to checkpoint inhibitors varies among patients. There is accumulating evidence that this variance may be mediated through the gut microbiome. Several studies have demonstrated that the response or inactivity of cancer patients to immunotherapy is dependent on the intestinal flora. Animal models have demonstrated that T-cell infiltration into the tumor microenvironment, which promotes tumor regression, can be modified by restoring a healthy intestinal microbiome. Moreover, the efficacy of checkpoint inhibitors is enhanced by the intestinal microbiome.[3] Cancer immunotherapy efficacy with immune checkpoint antibodies can be diminished by antibiotics, while better efficacy is observed with the presence of specific gut microbes. Future strategies of precision medicine will probably rely on therapeutic tools, in conjunction with companion diagnostics, to identify and correct defects in the microbiome that diminish therapeutic efficacy.[4]

Conclusion

As the field evolves, we are beginning to elucidate the mechanisms underpinning the symbiotic relationship between human physiology and the microbiome. An understanding of this complex relationship will allow us to prevent or intervene effectively in many diseases. One of the most important questions is to address the gaps to move beyond correlation to causation of human diseases. Pivotal to this quest will be deciding upon the technological tools required (*in vitro, ex vivo*, and *in vivo* models, in addition to computational or

"omic" tools) to gain a mechanistic understanding of precisely how the functional microbiome engages with the immune system. Can the microbiome be used to predict treatment response, or as a cancer biomarker? Using a metaproteomic approach, coupled with 16S rRNA sequencing analysis, Caprion is actively looking at these questions to help companies working in this field address them. Insight into the landscape of microbiome-based therapy will be instrumental in providing therapeutic strategies for several disease states, including cancer immunotherapy.

Acknowledgment

None.

Conflict of interest

None.

References

1. Buford TW. Trust your gut: the gut microbiome in age-related inflammation, health, and disease. *Microbiome*. 2017;5:80.
2. Clemente JC, Manasson J, Scher JU. The role of the gut microbiome in systemic inflammatory disease. *BMJ*. 2018;360: j5145.
3. The microbiome in cancer immunotherapy: Exploring the Role of the Microbiome in Cancer and Immune Response. *Immunotherapy progress and clinical treatment:* USA; 2017.
4. Zitvogel L, Ma Y, Raoult D, et al. The microbiome in cancer immunotherapy: Diagnostic tools and therapeutic strategies. *Science.* 2018;359(6382):1366–1370.