



A short note on microbial immune system

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DESCRIPTION

The microbiota performs an essential role in the induction, training, and function of the host immune system. In return, the immune system has largely developed as a means to maintain the symbiotic relationship of the host with those relatively various and evolving microbes. When operating optimally this immune system–microbiota alliance permits the induction of protective responses to pathogens and the maintenance of regulatory pathways involved in the maintenance of tolerance to innocuous antigens. However, in high-income nations overuse of antibiotics, changes in diet, and elimination of constitutive partners including nematodes have selected a microbiota that lacks the resilience and diversity required to establish balanced immune responses. This phenomenon is proposed to account for some of the dramatic rises in autoimmune and inflammatory problems in components of the world in which our symbiotic relationship with the microbiota has been the most affected.

Multicellular organisms exist as meta-organisms comprised of both the macroscopic host and its symbiotic commensal microbiota. These complex groups of microbes that consist of bacteria, fungi, viruses, and different microbial and eukaryotic species, provide notable enzymatic capability and play an essential role in controlling most aspects of host physiology. Over the past few years, the field of immunology has been revolutionized by the developing knowledge of the essential role of the microbiota in the induction, education, and function of the mammalian immune system.

The immune system is composed of a complex network of innate and adaptive components endowed with an exceptional capability to adapt and respond to

relatively diverse challenges. Pathologies that increasingly have an effect on humans such as allergies, autoimmune and inflammatory issues all arise from a failure to control misdirected immune responses against self, microbiota-derived or environmental antigens. Further, alteration of the composition and function of the microbiota as a result of antibiotic use, diet evolution, and the recent elimination of constitutive partners such as helminth worms has converted our microbial allies into potential liabilities. Although members of the microbiota are often known as commensals the symbiosis-persistent interaction among the microbiota and its mammalian host encompasses various forms of relationship including mutualistic, parasitic, or commensal.

Over the past decade, exploration of the optimal and dysregulated partnerships between the microbiota and its mammalian host has taken a center stage in the field of immunology and led to the there-discovery of a more holistic view of host physiology. Recent sequencing efforts of the human meta-genome have changed our knowledge of the microbiome and how variations in those populations can make contributions to disease states.

A vital factor to consider when exploring the role of the microbiota on the immune system is that pathogenicity is, in most cases, a contextual state. Indeed, the capacity of a given microbe, including those composing the microbiota, to trigger or promote disease is highly dependent on the state of activation of the host, the host's genetic predisposition, and the localization of the specific microbe. As such, the mechanisms used by the immune system to hold its relationship with the microbiota are highly analogous to the ones which might be used to constrain organisms with pathogenic potential.

A huge fraction of the immune system's constitutive function is aimed at controlling our relationship with the microbiota. As such the highest number of immune cells in the body are resident at sites colonized by commensals including the skin or the GI tract. A crucial method used by the host to maintain its homeostatic relationship with the microbiota is to minimize contact between microorganisms and the epithelial cell surface thereby limiting tissue inflammation and microbial translocation.

Autoimmune and inflammatory diseases, all associated with dysregulated immune responses have been rising dramatically over the last few decades. In recent years, immunological research has evolved from a lymphoid tissue-centric view of the immune system to the understanding of tissue microenvironments as an essential determinant of immune responses. This

area of research has led to the integration of the microbiota as an intrinsic regulator of all immune responses. There is an explosion of discoveries related to the developing knowledge of the role of communities of microbes, keystone bacterial species, commensal derived products or metabolites, and more specifically of the link between some of these components and disease states in human beings. This provides scientists and clinicians with a unique opportunity to develop an integrated exploration of human health that consists of ecologists, nutritionists, geneticists, microbiologists, biochemists, and immunologists. In this multidisciplinary area of research lies the key to fundamental discoveries aimed at manipulating or restoring defined aspects of the immune system-microbiota dialogue in order to promote or restore the health of the human meta-organism.