OPEN ACCESS Freely available online
Immunome Research
ISSN: 1745-7580
Opinion Article

Microbiome-Mediated Immunoregulation at Barrier Surfaces

Guangbing Zheng*

Department of Immunology, Zunyi Medical University, Zunyi, China

ABOUT THE STUDY

The human body is home to trillions of microorganisms collectively known as the microbiome. These microorganisms colonize various barrier surfaces, such as the skin, gastrointestinal tract, and respiratory tract. Recent research has highlighted the essential role of the microbiome in regulating immune responses at these barrier sites. The interaction between the microbiome and the immune system is crucial for maintaining homeostasis, preventing microbial invasion, and shaping appropriate immune responses.

Microbiome and barrier surfaces

The human microbiome consists of diverse microbial communities, including bacteria, viruses, fungi, and archaea. Barrier surfaces, such as the skin, gastrointestinal tract, and respiratory tract, provide habitats for these microorganisms. The composition and diversity of the microbiome vary across different barrier sites, reflecting their unique physiological characteristics and environmental exposures.

Skin microbiome: The skin serves as a physical barrier protecting against pathogens and environmental insults. The skin microbiome plays a crucial role in maintaining the skin barrier function and immune homeostasis. Commensal microorganisms on the skin outcompete potential pathogens, produce antimicrobial peptides, and modulate local immune responses.

Gastrointestinal microbiome: The gastrointestinal tract harbors a complex microbial ecosystem that profoundly influences host physiology and immune function. The gut microbiome promotes immune development, maintains gut barrier integrity, and regulates immune responses in the intestine. Dysbiosis of the gut microbiome has been linked to various immune-mediated disorders.

Respiratory microbiome: The respiratory tract, once considered sterile, is now known to harbor diverse microbial communities. The respiratory microbiome interacts with immune cells, regulates mucosal defense mechanisms, and influences susceptibility to respiratory infections and inflammatory conditions.

Immunoregulatory mechanisms

The microbiome exerts its immunoregulatory effects through various mechanisms, including microbial-derived products, metabolites, and direct interactions with immune cells. These interactions can be categorized into three main pathways: antigenic stimulation, immune cell modulation, and barrier maintenance.

Antigenic stimulation: Microorganisms within the microbiome express a wide array of antigens that interact with immune cells, thereby shaping immune responses. These antigens include Pathogen-Associated Molecular Patterns (PAMPs) and Commensal-Associated Molecular Patterns (CAMPs). Recognition of these microbial antigens by Pattern Recognition Receptors (PRRs) on immune cells triggers immune activation or tolerance, depending on the context.

Immune cell modulation: The microbiome influences the development, maturation, and function of immune cells. Through direct cell-to-cell interactions or the release of soluble factors, microorganisms can regulate the phenotype and activity of immune cells. For example, specific gut bacteria promote the differentiation of regulatory T cells (Tregs), which play a crucial role in maintaining immune tolerance.

Barrier maintenance: The microbiome helps maintain the integrity of barrier surfaces, which is crucial for preventing microbial invasion and subsequent inflammation. Commensal microorganisms contribute to the production of antimicrobial peptides, strengthen epithelial tight junctions, and modulate the secretion of mucus. These mechanisms collectively enhance barrier function and limit the penetration of pathogens.

Clinical implications and future directions

Understanding the complex interplay between the microbiome and immunoregulation at barrier surfaces holds great potential for clinical applications. Emerging evidence suggests that dysbiosis of the microbiome can contribute to the development of various immune-related disorders, including autoimmune diseases, allergies, and inflammatory conditions. Harnessing the

Correspondence to: Guangbing Zheng, Department of Immunology, Zunyi Medical University, Zunyi, China, E-mail: Guangbing@im.ac.cn

Received: 12-May-2023, Manuscript No. IMR-23-24637; **Editor assigned:** 15-May-2023, PreQC No. IMR-23-24637 (PQ); **Reviewed:** 30-May-2023, QC No. IMR-23-24637; **Revised:** 06-Jun-2023, Manuscript No. IMR-23-24637 (R); **Published:** 13-Jun-2023, DOI: 10.35248/1745-7580.23.19.236

Citation: Zheng G (2023) Microbiome-Mediated Immunoregulation at Barrier Surfaces. Immunome Res. 19:236.

immunomodulatory properties of the microbiome may offer novel therapeutic strategies, such as fecal microbiota transplantation, probiotics, and prebiotics. However, numerous challenges need to be addressed before microbiome-based interventions can be widely implemented. These include standardizing microbiome profiling techniques, identifying key microbial signatures associated with health or disease, elucidating the mechanisms of specific microbial interactions, and conducting well-designed clinical trials.