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Popular Article

Role of Microfold Cell in Intestine

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Introduction

The organs of body are covered and lined by various epithelial cells which play a vital role in tissue functions. The epithelial cells of respiratory, gastrointestinal and urogenital tracts are continuously exposed to huge variety of harmful pathogens and their products which invade the body through mucosal layers and cause infection to the host (Nakamura *et al.*, 2018). The mucosal immune system plays an essential role against such pathogens. The mucosal immune system regularly monitors exogenous antigens on the mucosal surface.

The characteristic features of the mucosal immune system are inherent lymphoid tissue called mucosa-associated lymphoid tissue (MALT). Although there are many differences between the MALTs in various organs, they all contain the same basic compartments like follicles, inter-follicular regions, sub-epithelial dome regions and follicle-associated epithelium (FAE). The FAE transports antigenic material from the mucosal surface into the underlying lymphoid tissues. The FAE overlies the PP and forms the interface between the intestinal lymphoid system and the intestinal luminal environment. The FAE is characterized by the presence of single layer of enterocytes and specialized epithelial cells called microfold or membranous epithelial cells, termed M cells.

Morphology

M- Cell or Microfold cell is a unique intestinal epithelial cell. It was first identified by Transmission electron microscopy from rabbit appendix. These cells lack a typical brush border unlike surrounding enterocytes. The usual thick glycocalyx associated with enterocytes is absent

in M-cells and is replaced by a thin glycocalyx, that provides better accessibility to large particulate antigens in the gut lumen (Corr *et al.*, 2008). M-cell villi have unique adhesion molecules which grab and sample luminal macromolecules. It has fewer lysosomes than other enterocytes. The basal membrane is deeply invaginated to form a large sac-like structure called 'M-cell pocket', where the Dendritic cells and lymphocytes can move in and take up residence, resulting a 'membranous' M cell cytoplasm.

Function

M-Cell lacks enzymatic activity thus it is not involved in absorption and digestion. The main function of M cells is the selective endocytosis of antigens and transporting them to intraepithelial macrophages and lymphocytes, which then migrate to lymph nodes where an immune response can be initiated (Figure 1). There are no afferent lymphatics through which antigen and antigen-presenting cells travel to reach the lymphoid follicles. Instead, M cells act as major pathways for direct sampling of antigen in the intestinal lumen. It allows the rapid transport of antigenic material to dendritic cells which is associated with M cells in the sub-epithelial dome (SED). Antigens are processed and presented to T cells that support the B-cell activation and maturation, which generates IgA-producing cells. The IgA-producing plasma cells repopulate into the lamina propria of intestine (through systemic circulation) and produce dimeric IgA.

Epithelial cells over the lamina propria express polymeric immunoglobulin receptor (pIgR), which captures and internalizes dimeric IgA into epithelial cells by endocytosis. This dimeric IgA-pIgR complex is transcytosed from the basolateral surface to apical plasma membrane, during which the extracellular domain of pIgR (the fragment is called "secretory component [SC]") is cleaved. The dimeric IgA-SC complex, designated as secretory IgA (SIgA) is secreted into the lumen called as secretory IgA (SIgA). Thus, M-cell-mediated antigen transcytosis is important to initiate the secretory IgA response in the intestine. S-IgA is not only suppressing the pathogenic infection but also maintain the gut microbial community.

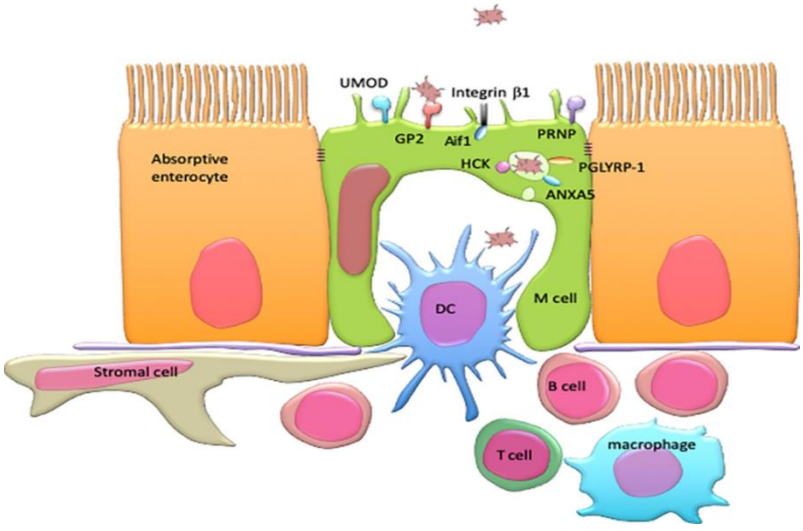

Figure 1: M cell morphology (Kanaya *et al.*, 2020)

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