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Commensal bacteria (normal microflora), mucosal immunity and chronic inflammatory and autoimmune diseases.

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Abstract

Commensal microflora (normal microflora, indigenous microbiota) consists of those micro-organisms, which are present on body surfaces covered by epithelial cells and are exposed to the external environment (gastrointestinal and respiratory tract, vagina, skin, etc.). The number of bacteria colonising mucosal and skin surfaces exceeds the number of cells forming human body. Commensal bacteria co-evolved with their hosts, however, under specific conditions they are able to overcome protective host responses and exert pathologic effects. Resident bacteria form complex ecosystems, whose diversity is enormous. The most abundant microflora is present in the distal parts of the gut; the majority of the intestinal bacteria are Gram-negative anaerobes. More than 50% of intestinal bacteria cannot be cultured by conventional microbiological techniques. Molecular biological methods help in analysing the structural and functional complexity of the microflora and in identifying its components. Resident microflora contains a number of components able to activate innate and adaptive immunity. Unlimited immune activation in response to signals from commensal bacteria could pose the risk of inflammation; immune responses to mucosal microbiota therefore require a precise regulatory control. The mucosal immune system has developed specialised regulatory, anti-inflammatory mechanisms for eliminating or tolerating non-dangerous, food and airborne antigens and commensal micro-organisms (oral, mucosal tolerance). However, at the same time the mucosal immune system must provide local defense mechanisms against environmental threats (e.g. invading pathogens). This important requirement is fulfilled by several mechanisms of mucosal immunity: strongly developed innate defense mechanisms ensuring appropriate function of the mucosal barrier, existence of unique types of lymphocytes and their products, transport of polymeric immunoglobulins through epithelial cells into secretions (sIgA) and migration and homing of cells originating from the mucosal organised tissues in mucosae and exocrine glands. The important role of commensal bacteria in development of optimally functioning mucosal immune system was demonstrated in germ-free animals (using gnotobiological techniques). Involvement of commensal microflora and its components with strong immunoactivating properties (e.g. LPS, peptidoglycans, superantigens, bacterial DNA, Hsp) in etiopathogenetic mechanism of various

complex, multifactorial and multigenic diseases, including inflammatory bowel diseases, periodontal disease, rheumatoid arthritis, atherosclerosis, allergy, multiorgan failure, colon cancer has been recently suggested. Animal models of human diseases reared in defined gnotobiotic conditions are helping to elucidate the aetiology of these frequent disorders. An improved understanding of commensal bacteria-host interactions employing germ-free animal models with selective colonisation strategies combined with modern molecular techniques could bring new insights into the mechanisms of mucosal immunity and also into pathogenetic mechanisms of several infectious, inflammatory, autoimmune and neoplastic diseases. Regulation of microflora composition (e.g. by probiotics and prebiotics) offers the possibility to influence the development of mucosal and systemic immunity but it can play a role also in prevention and treatment of some diseases.

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