Preface

There is a growing body of evidence to support the potential of probiotics in the prevention and treatment of various human and animal diseases. Numerous organisms meet the criteria established by the FAO/WHO to define a probiotic as: "a live organism, which confers a health benefit on the host when administered in adequate amounts". Various lactic acid bacteria (LAB) strains including several lactobacilli, a number of bifidobacteria, *Saccharomyces boulardii*, and the gram-negative *Escherichia coli* strain [Nissle 1917], are the primary microorganisms classified and studied as probiotics.

Probiotics may be classified as three types: (a) *Probiotics exert directly effecting other microorganisms*. In fact, the well-studied probiotic mechanism is their capacity to exclude or inhibit pathogens. This beneficial effect of probiotics is of great importance in the prevention and therapy of infections and restoration of the microbial equilibrium in the gut. (b) *Probiotics which enhance the function of the intestinal epithelial barrier*. Some probiotic strains have been shown to enhance tight junction integrity or improve mucus and defensins production by modulating various signaling pathways in the gut. (c) *Probiotics which regulate the immune system*. It has been extensively seen that some probiotics strains exert their probiotic abilities by influencing the host's immune system, thereby regulating immune responses. In fact, interest in probiotic-regulated immunity dominates contemporary literature. In 2003, Clancy published in her paper "Immunobiotics and the probiotic evolution" proposed the term *immunobiotics* to describe probiotic strains able to beneficially regulate the mucosal immune system.

Over the past decade it has become clear that probiotics can interact with epithelial cells lining the mucosa or mucosal immune cells to modulate certain specific functions of the mucosal immune system. Numerous probiotic studies such as different LAB strains have been performed in humans and marine models to investigate their immune-regulatory potential. It has been shown that some immunobiotics strains have significant and promising results in treating intestinal infections such as acute diarrhoea and in the prevention of antibiotic-associated diarrhoea. Moreover, some immunobiotics are able to beneficially regulate the immune

system not only in the gut, but also at the systemic level and in distant mucosal sites as well. In addition, the use of probiotics in the treatment and prevention of allergic diseases such as allergic rhinitis/asthma and atopic eczema or dermatitis has been also successful.

Overall there is encouraging evidence that specific immunobiotic strains are valuable in the prevention and treatment of different diseases and their successful application is related to the better understanding of the mechanisms of probiotic action. In this sense, a great progress in understanding immunobiotic cellular and molecular interactions with host cells has been achieved in the past years. The accumulated evidence demonstrates that immunobiotics communicate with the host by pattern recognition receptors, such as toll-like receptor family and nucleotide binding oligomerization domain-like receptor family, modulating key signaling pathways, such as nuclear factor-κB and mitogen-activated protein kinase, to enhance or suppress activation of immune cells and influence downstream pathways.

It has been also discovered that immunobiotics influence the immune system by products like metabolites, cell wall components and DNA/RNA and therefore, immune regulatory effects might be even achieved with dead probiotic bacteria or just probiotics-derived components like peptidoglycan fragments, secreted peptides or DNA/RNA. The identification and characterization of the immunobiotic molecules as ligands for specific host receptors was key to the understanding of probiotic function. The selection of these optimal immune regulatory probiotic effector molecules, termed as immunogenics, requires in-depth molecular studies dealing with both the cell surface and the secreted products of probiotic bacteria and the interacting host cells via their receptors. The detailed molecular comprehension should ultimately lead to a more focused and rational application of probiotics in functional food or as supporting therapy for specific disorders such as allergy, infections or inflammatory diseases.

In this comprehensive book, international experts review the most recent research advances in the use of immunoregulatory probiotics (immunobiotics) and their bioactive compounds (immunogenics) to prevent and improve different health disorders. Written by leading experts from the industry and academia in the field of Food and Feed Immunology, each chapter affords a critical insight to a particular topic, reviews current research, discusses future perspective and aims to stimulate discussion. Topics covered include the use of immunobiotics and immunogenics in the prevention and improvement of inflammatory, infectious and atopic diseases. In addition, novel applications of immunobiotics are discussed such as their use in respiratory infections, treatment of wounds and regulation of the interaction between inflammation and coagulation as well as their effect on hematopoiesis. As pointed out in the book, the potential

benefits of immunobiotics and immunogenics are enormous and should enable the development of novel clinical strategies to improve human and animal health through the appropriate manipulation of the host immune system.

This book has been an exciting project to work on. It would not have been possible without the valued inputs of several people. We would first like to acknowledge the role of our contributors who are internationally reputed leading scientists in their disciplines. We also acknowledge the continued patience and support of our families. This book is therefore dedicated to our esteemed colleagues, from whom we had the opportunity to learn a lot, and our loving family members.

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