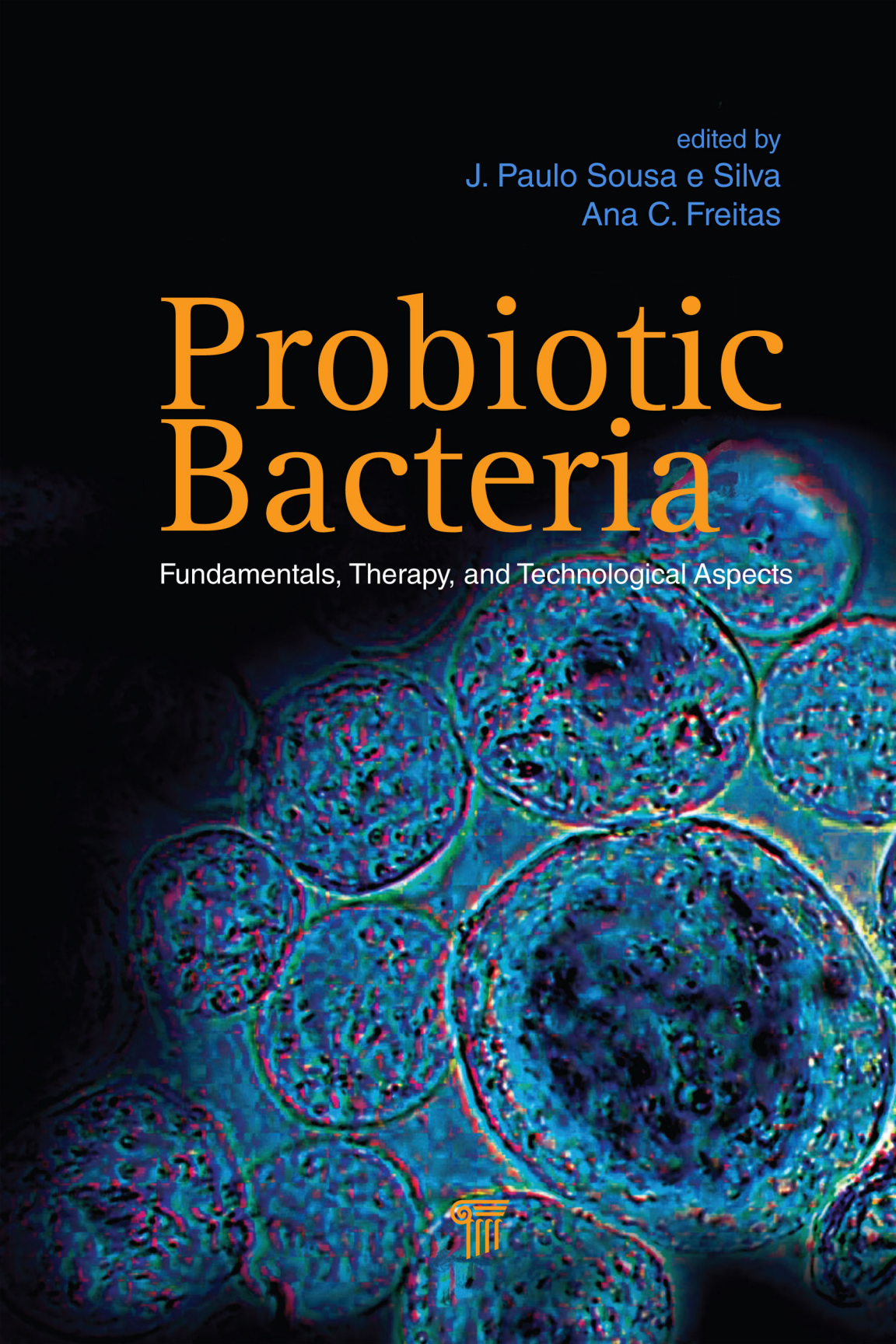
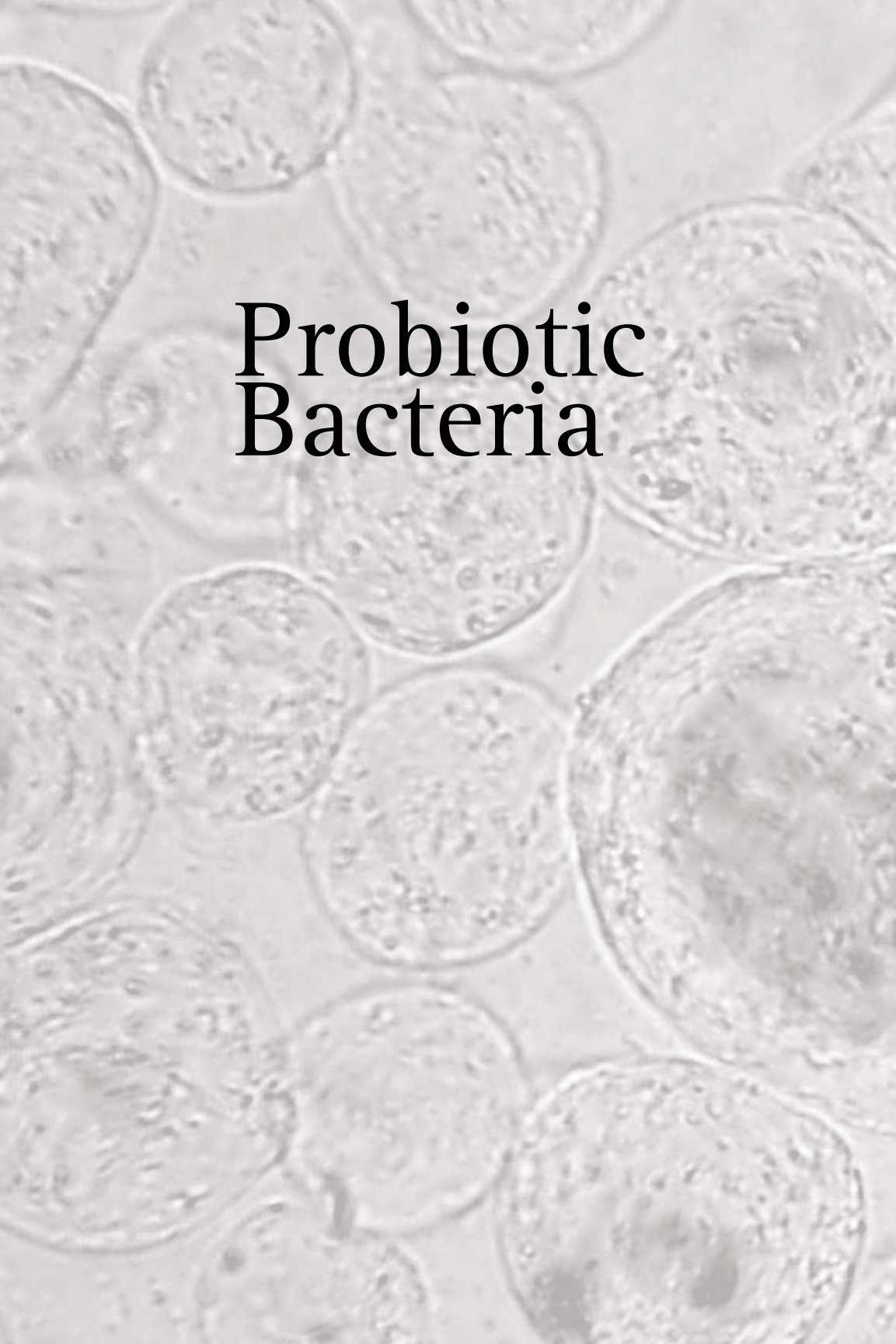
edited by
J. Paulo Sousa e Silva
Ana C. Freitas

Probiotic Bacteria

Fundamentals, Therapy, and Technological Aspects

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Contents

Foreword

It gives me immense pleasure to write a few words about the upcoming book *Probiotic Bacteria: Fundamentals, Therapy, and Technological Aspects* edited by Drs. J. Paulo Sousa e Silva and Ana Cristina Freitas. Probiotic organisms have been a subject of keen research for more than a century. Studies on probiotic organisms have come a long way from the era of Metchnikoff in the early 1900s, and our knowledge is being enhanced with each passing decade. Traditionally, probiotic organisms have been incorporated in fermented products like yogurt, however, as of recent times there are numerous probiotic products in the global market of varied types. The literature on probiotic organisms is vast and diverse and there is enough clinical evidence to support the health-enhancing potential of probiotic organisms.

This book is a unique compilation of technological aspects related to probiotic products, their benefits, and their therapeutic and physiological implications. The information is conveniently grouped under seven chapters. Chapter 1 details the fundamentals of probiotic bacteria. Chapter 2 covers the gastrointestinal physiology and its relevance to probiotic products. Chapter 3 deals with the various therapeutic roles of probiotics beyond gut-health. Chapter 4 gives an overview on the advances in probiotic food, with judicious insights into the technological and functional aspects. Chapter 5 provides a detailed analysis of several materials and techniques for immobilization and microencapsulation of probiotic bacteria. Chapter 6 is devoted to the development of probiotic dosage forms, and Chapter 7 focuses on the guidelines and regulation pertaining to the use of probiotic organisms.

In general, an attempt has been made to provide a comprehensive review on the fundamentals of probiotic organisms, along with their therapeutic and industrial aspects. The book is unique in presenting a dedicated section on the development of several dosage forms containing probiotic bacteria. The book provides a contemporary update and a holistic review of the topic, and is designed to augment related books in the market. The editorial team comprises individuals

with noteworthy and remarkable experience in the field of probiotic organisms. It is anticipated that this book should be an indispensable resource for academicians, extension staff, and students working in the field of probiotic organisms and probiotic products. Also, the book should appeal to technologists and food scientists in the related industry.

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Preface

Probiotic organisms, according to the Food and Agriculture Organization (FAO) of the United Nations and the World Health Organization (WHO), are live microorganisms that when administered in adequate amounts could confer a health benefit on the host. Probiotics can play a major role in human health if they can be incorporated in food products or used as dosage forms. For this, a detailed knowledge of the microorganisms is required, which forms the basis of the selection and use of probiotics.

Probiotics may be useful in several functions, namely protection against pathogenic bacteria directly via displacement of these bacteria by competitive binding or growth inhibition, by antimicrobial compounds or pH reduction, or indirectly by neutralization or elimination of toxins from the intestine, improving gut barrier integrity by ameliorating epithelial and tissue integrity through low-dose NO synthesis, simulation of mucus production, or/and enhancing gut epithelial cell proliferation. In addition, probiotics have also been shown to have immunomodulation capacity, to inhibit endogenous carcinogen production, and to provide nutrients for enterocytes by short-chain fatty acid production. Such activities by a specific strain (or group) allow them to promote several health benefits, which enables assuring of different therapeutic applications, including alleviation of lactose intolerance, inhibition of *Helicobacter pylori* or other enteric pathogenic bacteria and enteric virus (particularly *Rotavirus*) with reduction of associated diarrhoea symptoms, prevention of inflammatory bowel disease, reduction of cholesterol level, treatment and prevention of allergy, reduction of the risk associated with mutagenicity and carcinogenicity, reduction and control of urogenital infections, improvement in liver and pancreas dysfunctions, promotion of oral health.

This book, organized in seven chapters, will help to understand what a probiotic is, how to isolate and assess the efficiency and safety of each strain, and to elucidate about health benefits and main mechanisms of action presenting the major current in *in vitro*, animal, and human studies supporting these properties.

Chapter 1 introduces the theme and summarizes the steps of launching probiotic products in the market. Chapter 2 presents an updated overview of the human intestinal microbial ecosystem from both endogenous and exogenous perspectives. At an endogenous level, the chapter covers the available knowledge on the dominant microbiota composition and stability, discusses the functional roles bacteria play in human health and well-being, and analyzes the consequences of homeostasis rupture among microbial balance as far as intestinal disorders are concerned. At the exogenous level, the chapter illustrates that target organisms are capable of modulating gut microbiota and of promoting different physiological roles. The chapter also gives perspectives on the use of probiotics in dietary management and disease risk reduction.

The main goal of Chapter 3 is to describe the relevant health potential of probiotics and current advances. The beneficial properties assigned to probiotics and the corresponding specific mechanisms of action that will support each of the subsequent therapeutic applications will be explored in this chapter.

Chapter 4 aims to provide a comprehensive overview on the advances in probiotic food, covering the technological issues, functionality aspects, and limitations of some foods as carriers of probiotics. This chapter is divided in two parts: the first part covers dairy products, fermented milks, and cheeses that constitute the major group of products that can carry and deliver probiotic bacteria; the second part covers non-dairy products where alternative functional foods with probiotics such as juices and other food carriers are presented and discussed.

To confer health benefits to the human host, probiotics must be kept alive until they reach their site of action. In Chapter 5 different approaches including immobilization and/or encapsulation of probiotics inside a protective material in order to increase the resistance of these sensitive microorganisms against adverse conditions have been revisited.

The probiotic strains intended to benefit health or treat illness may be incorporated into suitable dosage forms in which they can maintain their effectiveness. Therefore, Chapter 6 is concerned with dosage forms, such as oral powders, capsules, oral and vaginal tablets, vaginal suppositories, chewing gums, gels, eye drops, and pellets, that are used to administer probiotics. The definition of

these dosage forms, their respective processes of manufacturing, and characterization tests are also addressed in this chapter.

In Chapter 7, which is the last chapter of the book, the global legal framework for probiotics is addressed. Generically, probiotics may be considered as a food, including food additives and dietary supplements, or as a drug. The chapter underlines the safety considerations and presents a comprehensive report on all necessary requirements related to them.

In summary, the book intends to provide a comprehensive overview of the fundamental concepts, mechanisms, therapeutic actions, technological aspects, and ongoing research related with probiotic bacteria. The book will be helpful for students and scientists from the food science and technology, pharmacy, and nutrition sciences fields; scientists working in the field of gastrointestinal disorders and other chronic diseases; companies who are designing and marketing new functional foods or nutraceuticals; as well as other public health professionals and clinicians. Furthermore, it provides important information for all readers interested in the relationship between food and health.

This scientific work was a team effort written by a group of scientists from the food and pharmaceutical research fields directly involved in the development of project PROBIOCAPS (PTDC/AGR-ALI/71051/2006; FCOMP-01-0124-FEDER-008792): Ana Gomes, Dina Rodrigues, Helena Amaral, Manuela Pintado, Paulo Costa, Sérgio Sousa, Teresa Rocha-Santos, and the editors of this book, and through individual research grants (SFRH/BD/77647/2011; SFRH/BPD/73781/2010; SFRH/BPD/65410/2009) by FCT. We would like to thank all these scientists for their contribution, and all others who, in different areas and skills, helped this project become a real success. We would also like to thank the reviewers for their professional advice and reviewing the chapters of this book.

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