

Preface

Antimicrobial peptides have been the subject of intense research in the past decades and are now considered as an essential part of the defense system in bacteria, plants, animals, and humans. Whereas lysozyme was identified in the 1920s, research on the smaller antimicrobial peptides started later. Pioneering work in, e.g., insects provided evidence for the central role that these so-called endogenous antibiotics play in host defense against infection. This is further supported by the observation that these peptides have been conserved throughout evolution and that they are present in vertebrates and invertebrates, plants, and microorganisms. Studies on antimicrobial peptides in cystic fibrosis that were performed in the 1990s prompted a range of research efforts that were aimed to define their role in disease development and progression. This increase in research on antimicrobial peptides also led to the conclusion that they contribute to host defense against infection not only through a direct and broad-spectrum antimicrobial activity but also through a variety of other mechanisms. This explains why the name host defense peptides is an appropriate alternative that is widely used. The aim of this book is to provide an update on these effector molecules of the innate immune system both for researchers that are already actively involved in the area and for those with a general interest in the topic.

The first three chapters of this volume provide an overview of the evolution of cysteine-containing antimicrobial peptides (including defensins) and the role of these peptides in host defense in plants and microorganisms. The realization that antimicrobial peptides also display functions distinct from their direct antimicrobial action is the focus of the next five chapters and puts these peptides center stage in immunity and wound repair. The remarkable increase in structure–function studies has provided new insights into how the peptides fulfill their various activities. The next block of chapters discusses the role of antimicrobial peptides in disease, by providing an overview of mechanisms in bacterial resistance to antimicrobial peptides and a discussion of their role in inflammatory bowel disease, cystic fibrosis lung disease, and chronic obstructive pulmonary disease. Although bacteria do not develop resistance against antimicrobial peptides as easily as they do to conventional antibiotics, bacteria do use resistance mechanisms to defend themselves

against antimicrobial peptide attacks by the host. Studies on these interactions provide insight into the host–microbe interaction during infection. Our insight in the role of antimicrobial peptides in disease has also improved considerably in recent years through studies that focus on, e.g., genetic and epigenetic regulation and studies that explore the activity of these peptides in complex environments that are changing as a result of the underlying disease. The final two chapters describe how knowledge of the function of antimicrobial peptides and their regulation can be used to design new therapies for inflammatory and infectious disorders. This is a very important area of research, in particular because of the increase in resistance of microorganisms to conventional antibiotics. Therefore, the use of synthetic or recombinant peptides, or agents that stimulate the endogenous production of antimicrobial peptides, provides an attractive alternative for conventional antibiotics.

Each chapter in this book was written by experts in the field of antimicrobial/host defense peptide research and provides a state-of-the-art summary of their area of research. The time and expertise of these experts were essential, and we would like to thank them for their excellent contributions.