

Preface

The positive impact of antibiotics in human health has been challenged in the past decade by the emergence and prevalence of antibiotic resistant pathogens either in the hospitals or in the community, requiring renovated efforts to identify and develop therapeutic alternatives. The current medical need to identify antibiotics with novel structures and unexploited mode of action is triggering the development of new strategies for the discovery of natural and synthetic molecules, providing new options in the never-ending battle against ever-evolving resistant bacteria.

The objective of this book is to present an updated review of the status of all major classes of antibiotics, especially focusing on most recent advances in already known chemical classes, including new analogs and semi-synthetic derivatives, as well as the recent new classes that have reached the clinic in the past years or are in clinical and preclinical development phases. This work is divided into two major sections covering both the clinical impact of bacterial pathogens and the current trends in antibiotic discovery and development.

The first section opens with a review by Davies ([Chap. 1](#)) on the origin and evolution of antibiotics emphasizing the need to understand their role in the environment and their chemical and biological evolution to successfully exploit their pharmaceutical potential. Rossolini et al. ([Chap. 2](#)) review the evolution of the clinical impact of Gram-positive pathogens, and especially the multiresistant ones, in health care-associated and community-acquired bacterial infections, whereas Paitan and Ron ([Chap. 3](#)) analyze the rising prevalence of resistant Gram-negative pathogens, including their various resistance mechanisms, prevalence, risk factors, as one of the major clinical problem given the lack of treatment options.

The second section contains a series of 13 chapters covering the status of different classes of antibiotics, including both novel candidates in development as well as mature compounds. The emergence of pan-resistant pathogens challenging the development of new β -lactams and the most recent advances in the understanding of the action of this family of antibiotics are accurately reviewed by Leemans et al. ([Chap. 4](#)). The chemical diversity of peptide antibiotics has been classified into five different classes of compounds. Glycopeptides are extensively described by Marcone and Marinelli ([Chap. 5](#)), whereas Baltz ([Chap. 6](#)) presents the specific characteristics of daptomycin and other related lipopeptides. Lantibiotics is another emerging family of peptides with no evident cross-resistance

with any of the major classes of antibiotics (Cortes, [Chap. 7](#)). Vaara reviews the status of old and new analogs of polymyxin against Gram-negative pathogens ([Chap. 8](#)), whereas Carter and McDonalds present the recent developments in the biosynthesis and medicinal chemistry of uridyl peptide antibiotics ([Chap. 9](#)). The recent development of new aminoglycosides within the review of traditional aminoglycosides by Kirst and Marinelli provides an extensive coverage of the evolution of this old class ([Chap. 10](#)). Similarly, the chapters on traditional macrolides (Kirst, [Chap. 11](#)) and tetracyclines (Genilloud and Vicente, [Chap. 12](#)) include recent progress in the development of semi-synthetic and synthetic analogs. The last four chapters include reviews on the class of oxazolidinones (Zappia et al., [Chap. 13](#)) with description of the antibacterial activity and chemistry of this synthetic new antibiotics, the development of actinonin and its analogs as peptide deformylase inhibitor (East, [Chap. 15](#)), the status of other smaller classes of protein synthesis inhibitors (Kirst, [Chap. 14](#)), and novel bacterial topoisomerase inhibitors (Pucci and Willes, [Chap. 16](#)).

The book concludes with an extended review by Genilloud and Vicente of recent strategies developed in the pharma and academic sectors to respond to emerging medical needs ([Chap. 17](#)), ranging from the use of selected old and new targets to novel screening approaches involving the implementation of alternative technologies and mode of action studies.

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