Introduction

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Actinobacteria, as one of the largest bacterial phyla, is a dominant group of microorganisms being widely distributed in various terrestrial and aquatic ecosystems. These Gram-positive, high G+C content bacteria have received much attention in terms of studying its biology, majorly as they have been found to be tremendously potent in producing medically and industrially relevant secondary metabolites. This extensive secondary metabolism has led to the discovery of more than 120 antibiotics, different enzymes, enzyme inhibitors, and many other useful products from actinobacterial sources, discussion on which is one of the main focuses of the current book.

Apart from being designated as a controversial kind of microorganism when first discovered, namely, prokaryotic equivalent of fungi, the primary motivator for increasing the interest for biological basic studies on actinobacteria was the discovery and observation of their vast biotechnologically related potentials. That is to say, although being popularly accepted as a basic science, microbiology generally implements a bottom-up approach in studying microorganisms (including actinobacteria), and this seems to be an inherent property of the field. This is while other well-developed basic sciences such as *botany* or *zoology* have been basically formed on the basis of a top-down approach in which the objects being studied are considered, regardless to their importance in terms of application and consequently their potentials will be revealed after gaining an evenly developed knowledge.

The mentioned approach of microbiology consequently has resulted in an unbalanced and uneven development of basic biological knowledge for microorganisms,

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having more basic information on those showing more application potencies. This pattern is also true in case of actinobacteria.

Accordingly, the understanding of the actinobacterial biology has been based on merely a few model organisms which are either medically important pathogens such as *Mycobacteria* or biotechnologically relevant producers including mainly *Streptomyces*. This is while there are many other actinobacterial groups with insignificant basic biological knowledge of which *Coriobacteriaceae*, *Catenulisporales*, the class *Thermoleophilia*, as well as many other taxa within this group can be named. However, it is also important to note that the yet-existing limitations in turning uncultured actinobacteria to cultivable ones are another shortcoming in understanding these bacteria which must be take into account. Yet the first steps to better and fully understand these bacteria to uncover their further potentials owe to addressing the problem of unevenly distributed basic biology of actinobacterial members.

Even though the taxonomic characterization has a very long tradition starting with its morphological features, today there are many open questions which also cannot be easily solved by sequence analysis of the organisms. Currently, many groups have their focus on the molecular characterization and the expressed features are often neglected. As the taxonomic description of novel actinobacteria can only be done by the use of a polyphasic approach, one aim of the book is to give an overview on the methods which can be used in the laboratory, even the more classic ones.

The search for novel antibiotics came into focus again in the last years because of the resistance development of many bacteria especially the nosocomial ones and the upcoming role of the so-called neglected diseases. The role of actinobacteria in this search for the future is still open, but the editors think that this class of bacteria is still one of the most promising groups even in the future. Therefore, we need more understanding of the biological role, the environment, and the bacterial communities for the isolation and identification of potential metabolite producers in the nature. Also the presentation of a straightforward identification procedure of interesting isolates is very important.

In this regard, the chapters of the present book are intended to provide a comprehensive view on the currently available issues relating to the biology and biotechnology of actinobacteria to hopefully depict and introduce the correct path for the development of a significant balanced understanding of the biology of this bacterial group.

Topics reviewed include all aspects of actinobacteria biology from their cellular properties, physiology, taxonomy, and genetics to their ecology and symbiosis. Despite these, their most important biotechnological traits are reviewed in the closing chapters to better elucidate the targeted trajectory which must be acquired to comprehensively cover the knowledge on actinobacteria as one of the most important bacterial phyla in medicine, industry, environment, and energy disciplines. As the final chapter of this book, the role of rapidly progressing omics data analysis and computational tools in the study of actinobacteria is also reviewed at a glance to not only stay synchronized with the novel paradigms of the post-genomic era of biology

but also to introduce these tools as efficient implementations to address the mentioned problem of unbalanced knowledge of actinobacteria in a time- and cost-effective manner.

Hopefully, the book will be of particular value to basic microbiologists and biotechnologists to unravel the great world of actinobacteria as well as bioinformaticians and molecular biologist who are trying to exploit biological data to find and address the existing biological problems with the aid of, namely, post-genomics approaches.