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***Wolbachia: A Bug's Life in another Bug***

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# Issues in Infectious Diseases

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# ***Wolbachia: A Bug's Life in another Bug***

Volume Editors

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*Ramakrishna U. Rao* St. Louis, Mo.

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## Issues in Infectious Diseases

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## Foreword

This comprehensive publication is intended for readers with teaching or research interests in microbiology, entomology, infectious diseases, genetics, tropical medicine, and clinical research.

Worldwide, approximately 120 million people are infected by filarial nematode parasites. Transmitted to humans through mosquitoes and black flies, the majority of the disease-causing nematodes are hosts to the *Wolbachia* bacteria. These nematodes cause the often devastating diseases elephantiasis and onchocerciasis, commonly referred to as filariasis. Moreover, heartworm disease, caused by another *Wolbachia*-containing nematode, is another mosquito-borne disease that has significant importance in the veterinary field.

This textbook in the infectious disease series intends to comprise a reference for researchers in the field of drug discovery, as antibiotics and antiwolbachia formulations will aid in eliminating disease transmission and pathogenesis. Entomologists may be interested in this work since *Wolbachia* infections in some arthropods have been known to the scientific community for several years, and the biological and biochemical relationships between *Wolbachia* and their insect hosts have been fascinating the insect research community. Much progress has been made studying insect *Wolbachia* genes in influencing insect populations and behavior. Successful manipulations with *Wolbachia* transgenes in mosquito vectors may eventually lead to control of the vector-borne diseases in humans and animals. In early 2007, more than 700 research papers indexed in PubMed were associated with *Wolbachia* and most of them were related to its role in arthropods. Since the identification of *Wolbachia* endobacteria in filarial nematodes, the number of research papers on this subject has steadily increased with some very

interesting findings and enhanced the vision of eliminating the dreadful disease ‘filariasis’ sometime in the near future. In 2005, three decades after the discovery of *Wolbachia* in filarial nematodes, the genome sequencing of nematode *Wolbachia* was completed. Detailed comparisons to insect *Wolbachia* genome were performed and made available to the public, leading to new insights in their relationships. This publication features a mixture of internationally recognized leaders in infectious disease research and insect biology. Their interesting perspectives on *Wolbachia*’s genome, evolution, symbiosis, biology, pathogenicity as well as its potential as a drug target are some of the highlights of this book.

Chapter 1, written by one of the pioneers in identifying the bacteria in filarial nematodes, addresses the historical perspectives and highlights what we have learned about *Wolbachia* then and now. Chapter 2 details the evolution and phylogeny of the filarial *Wolbachia* lineage in comparison with *Wolbachia* found in other organisms. Chapter 3 provides a review on *Wolbachia* as a target for chemotherapy and its current status in human clinical trials. Chapter 4 highlights and updates the current understanding of the *Wolbachia* genome and the mining of *Wolbachia* genes in the genome, which is useful to identify the bacterial relationships with their nematode hosts. Chapter 5 expands our understanding of the *Wolbachia* genome of filarial nematodes in comparison with insect *Wolbachia* genome including recent studies involving the lateral gene transfer between bacteria and their hosts and its significance. Chapters 4 and 5 provide new insights and exclusive features about the biological relationships of *Wolbachia* with their nematode host. Another fascinating field is *Wolbachia*’s role in insects; Chapters 6–7 describe *Wolbachia*’s biological significance in insects and insights through their genomic analysis. These two chapters bring additional knowledge, and lessons learned from arthropod *Wolbachia* may shed light on diverse symbiotic associations (parasitism or mutualism) observed in two different organisms. Chapter 8 describes the importance of *Wolbachia* in veterinary filariasis and defines the multiple roles of *Wolbachia* in the pathogenesis, diagnosis and treatment of animal filarial infections, which goes in parallel with studies of *Wolbachia* in human filariasis. Chapter 9 discusses the role of *Wolbachia* in the induction of filarial pathogenesis and critical role of the Toll-like receptor pathways in the host’s immune response to these endobacteria.

We hope that the users of this book will enjoy reading the chapters as much as we did!

Ramakrishna U. Rao, St. Louis

Achim Hoerauf, Bonn