Preface

The importance of insect-associated viruses is highlighted by their significant impacts on our environment, both positive and negative. On the positive side, insect viruses have proved to be useful tools for the suppression of damaging insect pest populations as well as for biotechnological applications, including protein expression, human gene therapy and vaccine production. Improvements in the baculovirus expression vector system have allowed for multiple applications. This strategy for efficient expression of a single or multiple proteins has utility for vaccine production, the production of virus-like particles for use in gene therapy and the surface display of proteins for use in diagnostic platforms.

In contrast to the positive impacts described above, insect viruses include those that harm beneficial insects, including butterflies, honey bees and other pollinators. Some insects serve as vectors for viruses that negatively impact crops and livestock, resulting in millions of dollars of damage annually. Insects also serve as vectors for viruses that affect humans (as in mosquito transmission of the dengue and Zika viruses), resulting in human morbidity and mortality. Research into the molecular mechanisms of virus–insect associations has been driven in large part by the need to reduce the costs associated with honey bee decline, crop losses, livestock illness and adverse effects on human health. Significant investment has been made into research on the underlying causes of honey bee declines and to understand mosquito transmission of human viruses in particular. Increased understanding of the molecular interactions between insects and associated viruses has led, in some cases, to transmission-blocking strategies to prevent or mitigate viral disease.

Each chapter of this book, written by experts in their respective areas, provides a rigorous review and outlines current trends and future needs, to expedite progress in the field. The book opens with a description of the insect virome, with details of the virus-derived sequences from *Drosophila* spp. and mosquitoes providing an indication of the sheer number of viruses associated with a given insect group. This review also addresses the challenges presented by insect viruses, including the potential impacts of viruses in cell lines commonly used for research. Subsequent chapters address endogenous viral elements (non-retrovirus-derived viral sequences) incorporated into the insect genome and their potential role in antiviral immunity, and mechanisms of insect antiviral defence, with particular emphasis on the role of RNA interference and small RNA in the modulation of virus infection. The use of 'omics to provide insight into molecular interactions between viruses and insects is described for insect vectors of plant viruses, along with strategies to block plant virus transmission. In addition, advances in tetravirus, polydnavirus and baculovirus molecular research are reviewed, followed by reviews on the diverse utility of baculoviruses, including for protein expression, protein display and gene therapy.

This volume on recent advances at the cutting edge of insect molecular virology was inspired in part by a symposium on *Virus–Insect Interactions* held at the International Congress of Entomology in Orlando, Florida, in 2016. I would like to thank the organizers and participants of that symposium, in addition to all others who have contributed to this book. The significant advances in insect

molecular virology seen in recent years, resulting in part from enhanced sequencing technologies that paved the way for the discovery of sequences derived from myriad new viruses, and the discovery of RNA interference as a primary mechanism of antiviral defence, are sure to continue.

Dedication

This book is dedicated to the Society for Invertebrate Pathology.