

The Influenza Viruses

THE VIRUSES

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Preface

Influenza virus is an important human pathogen, frequently causing widespread disease and a significant loss of life. Much has been learned about the structure of the virus, its genetic variation, its mode of gene expression and replication, and its interaction with the host immunologic system. This knowledge has the potential of leading to approaches for the control of influenza virus. In addition, research on influenza virus has led to important advances in eukaryotic molecular and cellular biology and in immunology.

A major focus of this book is the molecular biology of influenza virus. The first chapter, which serves as an introduction, describes the structure of each of the genomic RNA segments and their encoded proteins. The second chapter discusses the molecular mechanisms involved in the expression and replication of the viral genome. In addition to other subjects, this chapter deals with one of the most distinctive features of influenza virus, namely the unique mechanism whereby viral messenger RNA synthesis is initiated by primers cleaved from newly synthesized host-cell RNAs in the nucleus. Among the most significant accomplishments in influenza virus research has been the delineation of the three-dimensional structure of the two surface glycoproteins of the virus, the hemagglutinin and neuraminidase. This has provided a structural basis for mapping both the antigenic sites and the regions involved in the major biological functions of these two molecules. The current state of research on the hemagglutinin and neuraminidase is presented in the third and fourth chapters of this book. Chapter 5 describes the research on the biosynthesis, processing, and transport of these two viral glycoproteins. This research has been important not only for understanding the morphogenesis of influenza virus, but also for providing new information about the biosynthesis and transport of all cell-surface glycoproteins.

Defective-interfering virus particles were first discovered in influenza virus preparations, and the sixth chapter describes what is currently known about the generation and mechanism of action of influenza virus defective-interfering particles. The different evolutionary patterns of ge-

netic variation of influenza A, B, and C viruses in humans, and the roles of different influenza virus genes in pathogenicity, are dealt with in Chapter 7. Influenza virus induces thymus-derived lymphocytes (T lymphocytes), which play an important role in antiviral immunity in humans. As discussed in Chapter 8, studies using influenza A viruses have provided some of the most significant findings on the nature of the antigens recognized by T lymphocytes, on the specificity of T lymphocytes, and on the process by which antigens are presented on the cell surface for recognition by T lymphocytes.

This book was put together with two overlapping objectives in mind: providing a current review of the research on influenza virus for virologists, while highlighting for a wide audience of scientists the impact that influenza virus research has had on eukaryotic molecular and cellular biology and on immunology.

Robert M. Krug

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