Molecular Biology of Picornaviruses
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The Editors would like to dedicate this book to the memory of our colleague, Donald F. Summers, a true pioneer in the study of picornavirus molecular biology and one of our real-life heroes in science.
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Preface

Animal virology began with foot-and-mouth-disease virus (FMDV). This infectious entity was discovered by Friedrich Loeffler and Paul Frosch in 1898 as a "filterable agent" causing foot-and-mouth disease, an enduring curse in agriculture even today. Because of its highly contagious nature, Loeffler began to conduct all research with FMDV in northern Germany on the small island of Riems in 1908, thereby establishing the first animal virus research institute ("Forschungsanstalt für Tierseuchen") in the world.

In 1909, Karl Landsteiner and Edwin Popper succeeded in infecting two Old World monkeys with a filtrate of spinal cord material from a polio victim who had died of the terrible human disease called poliomyelitis. The monkeys developed a disease syndrome resembling that of the human disease. Landsteiner and Popper thus not only identified a virus as the cause of poliomyelitis, but also established an animal model for the study of this agent.

FMDV and poliovirus, of course, are picornaviruses. Immediately after their discovery, they were intensely studied because of the dreaded diseases they cause. In the succeeding decades, a large number of viruses have been discovered with physical properties similar to those of FMDV and poliovirus. Collectively, these viruses are classified as members of the family Picornaviridae.

Research on picornaviruses has yielded numerous landmark discoveries, often with an impact on virology and even biology in general. Such discoveries include the growth of these viruses in cultured human cells, development of inactivated and attenuated vaccines to prevent paralytic poliomyelitis, the demonstration that genomic RNA is infectious, the discovery of receptor-mediated determinants of susceptibility to picornavirus infection, demonstration of the first RNA-dependent RNA polymerase activity of an animal virus, the discovery of polyproteins as precursors to viral polypeptides, the discovery of virally encoded proteinases mediating polyprotein processing, the first chemical structure of the genome of an autonomously replicating RNA virus [including a 5'-linked protein and 3'-terminal poly(A)], the demonstration that a cDNA copy of a picornavirus genome could produce infectious virus, the first resolution of the three-dimensional structures of animal viruses at the atomic level, the discovery of internal ribosome entry to initiate translation on uncapped picornavirus RNAs, and the production of infectious virus in cell-free extracts programmed only with purified viral RNA.

These and numerous other remarkable studies have placed picornavirus research at the forefront of discovery in molecular virology. However, the precise details of molecular events of picornavirus replication, such as virion uncoating, translation initiation, viral RNA replication, virus assembly, and the many layers of virus-host interactions (including mechanisms of pathogenesis) remain to be elucidated. This is well documented in many chapters of this volume. It is our hope that the contributions to this volume will provide not only a summary of the many significant accomplishments in picornavirus research but also a road map of the path to future exciting discoveries for this amazing group of simple but elegant animal viruses.

In the not-too-distant future, a major payoff of picornavirus research may include the worldwide eradication of poliovirus as an agent of human disease. Such a remarkable event will mark the sunset to decades of research on wild-type polioviruses as infectious agents and will signal a new era in picornavirus research, with a challenge to develop novel models of picornavirus pathogenesis while continuing to provide experimental systems and analytical tools to address the many unsolved mechanistic questions of the picornavirus infectious cycle. Considering that human picornaviruses alone cause an estimated 6 billion infections per year in humans, inflicting misery, debilitation, and even death, these viruses will remain a challenge to humankind.

We would like to thank all authors for their excellent contributions (and their patience!) and the editorial staff at ASM Press, particularly Eleanor S. Tupper and Jeff Holtmeier, for their help in bringing this book to fruition.

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