

# Avian Virology

Current Research and Future Trends

<https://doi.org/10.21775/9781912530106>

Edited by

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Caister Academic Press  
Norfolk, UK

[www.caister.com](http://www.caister.com)

British Library Cataloguing-in-Publication Data  
A catalogue record for this book is available from the British Library

ISBN: 978-1-912530-10-6 (paperback)

ISBN: 978-1-912530-11-3 (ebook)

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The cover image is a collage of electron micrographs (not adjusted to scale) and features, from top left and clockwise, avian metapneumovirus, fowl adenovirus 9, fowlpox virus and avian paramyxovirus serotype 13. The virus electron microscopy images were adapted from Figures 4.1A, 10.1b, 13.3 and 13.1, respectively. Please refer to respective chapters for image sources and descriptions.

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# Preface

The poultry industry is crucial for global food security. Poultry meat is a universally accepted source of protein and is projected to become the world's most consumed meat in the very near future. In the last decade, there has been significant growth of poultry production in different parts of the world, particularly Asia, Africa and South America. One of the major constraints that affects poultry production is infection by viral pathogens. A large number of viruses, belonging to almost all families of viruses, have been identified to cause infections in poultry. Clinically, these infections result in a broad range of outcomes from inapparent to severe and economically devastating diseases. Some of these viruses have been historically associated with poultry, while many were recently discovered. Some of these viruses, such as the avian influenza virus, West Nile virus and Japanese encephalitis virus, are also zoonotic. A thorough understanding of the molecular biology, immunology, and pathogenesis of viruses that cause disease in poultry is necessary for rationale design of vaccines and diagnostics to control avian diseases.

Historically, avian viruses have been a part of several significant contributions to the field of virology and molecular biology. The three most important contributions are (1) In 1911, Peyton Rous isolated a 'filterable agent' from the sarcoma of a Plymouth Rock hen, which was later called the Rous sarcoma virus (RSV). This discovery led to the foundation of tumour virology; (2) the interferon response, which is one of the most important mechanisms of host innate immunity against virus infection was discovered in chickens in 1957 by Alick Isaacs and Jean Lindenmann; and (3) in 1970, Howard Temin and David Baltimore, working independently, reported the discovery of an enzyme in RSV that could synthesize DNA from RNA. This enzyme, commonly called reverse transcriptase, has revolutionized molecular biology and biotechnology.

In the past 20 years, our understanding of the genomics, molecular biology and pathogenesis of avian viruses has greatly increased due to explosion of molecular genetic techniques. It is now possible to sequence the genome of the largest viruses

in a relatively short amount of time and to produce infectious viruses belonging to all known families from cloned DNAs. These techniques have allowed us to explore the functions of specific viral genes, protein domains, and even individual amino acids, on viral replication, virulence and pathogenesis of the disease. These methods also provide a powerful approach to design rationale vaccines and to use recombinant viruses as vaccine vectors for avian pathogens. However, despite these advances in molecular biology knowledge of avian viruses, there still remain many challenges in developing effective vaccines against poultry diseases. For these reasons, it was important to compile our current knowledge of some of the more important avian viral pathogens.

The objective of this book is to present the most comprehensive and up-to-date information on viral agents that are more important to poultry health. The book ends with an updated chapter on avian immune responses to virus infection. This chapter was created because of the important role the host immune system plays in a viral infection. Hence, a greater understanding of the avian immune responses to virus infection will assist in designing novel vaccine strategies. Rather than focusing on disease itself, the chapter authors were invited to contribute for their expertise on the viral genetics, molecular biology, and host-pathogen interaction studies. The chapters in this book not only cover the molecular characteristics of the virus, but also viral pathogenesis, and control measures. This book is a valuable source of timely information for students, virologists, molecular biologists, immunologists, veterinarians, avian disease researchers, and scientists in related fields.

The broad coverage of viruses in this book would not have been possible without the contributions from many leading scientists around the world who have made fundamental and seminal contributions to their field of avian virology research. I express my most sincere gratitude to all the authors for having joined in this effort. I would especially like to thank Dr Anandan Paldurai, who provided excellent assistance in assembling this book.

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