

Avian Influenza

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BOOK REVIEWS

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Avian Influenza. By David E. Swayne, Blackwell Publishing Ltd., Oxford, UK. 2008. 605 pp. ISBN-13 978-0-8138-2047-7/2008. US \$149.99 (hardback).

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Sabir Muzzafar, and
John Takekawa*

Wildlife diseases have become a more prominent feature of ecological studies relatively recently, particularly in the face of increased contact between humans, domestic animals, and wildlife (Daszak et al., 2000). Highly pathogenic avian influenza (HPAI) of the H5N1 subtype, in particular, has drawn much public interest in just the last several years, with the infections of 383 humans with 241 deaths as of May 2008. It has also attracted new wildlife scientists to the problem because of the increasing involvement of wild bird species. HPAI H5N1, however, remains primarily a disease of domestic poultry, and in fact has been present in Eurasia for over 11 yr. As outbreaks of H5N1 continue to occur in wild birds, poultry farms, and humans, significant scientific questions remain.

For scientists seeking to pursue these questions and for policymakers concerned with the ongoing zoonotic threat of a potential pandemic, David Swayne's book *Avian Influenza* is both timely and important. David Swayne assembles a remarkable ensemble of researchers, veterinarians, medical professionals, and government officials working in this field to provide a comprehensive review of the many dimensions of what we know about avian influenza and what we need to know and do. The issues are complex and technical, but the writing is accessible to the educated layman as well as the scientist seeking to work in a cross-disciplinary context. The book is ambitious in its scope, with chapters on the origin and evolution of fowl plague in the 1920s, the ecology of avian influenza in wild birds and man-made systems, the range of molecular complexity of viral subtypes, clinical signs and pathobiology of the disease, control measures at local to regional to global levels, and the future

proactive strategies needed to adapt to and minimize this problem in human and animal health.

Although there has been significant research in all aspects of avian influenza during the last several years, we continue to grapple with some basic aspects of the disease. We do not know what causes low-pathogenic avian influenza (LPAI) subtypes to mutate to HPAs, we are unclear about what role different kinds of poultry play in maintaining the disease, and we are unclear about the role of wild birds in spreading the virus. In the opening chapter David Suarez provides a very concise overview of what the book is about, touching on viral classification and systematics, influenza ecology in wild and domestic birds, genetic properties of the virus, and aspects of pathobiology. The pathogenicity of the virus—the characteristics that make it of such global significance—is dealt with in the second chapter (M. Perdue), as well as in Chapter 4 (Swayne), which highlights molecular determinants of pathogenicity. Examining pathogenicity helps us understand the bigger picture of adaptation, evolution, and spread of the virus in “novel” hosts, and the molecular changes that make LPAI viruses pathogenic (HPAI).

The greatest obstacle that any virus faces is that of the host barrier, a complex series of factors that prevent the virus from infiltrating into a novel system. The Asian lineage of HPAI H5N1 has managed to do this exceptionally well, as is illustrated in other chapters on the emergence and spread of HPAI H5N1 at regional and continental scales (Swayne, Chapters 4 and 6; Sims and Brown, Chapter 11), making it a particularly difficult problem in animal health. Wild birds seemingly have been partially spared from this problem for a number of reasons. First, the disease and its history indicate that it is primarily a disease in domestic poultry, having evolved from LPAI precursors from wild waterfowl. Conventionally HPAI outbreaks in poultry were considered a result of LPAI viruses spreading from wild-bird reservoirs to poultry. Alexander et al. (Chapter 9) point out, however, that recent outbreaks of H5N1 in Europe and Africa fail to conform to the dogma of LPAI spread from wild birds to poultry with subsequent mutation in domestic

birds to HPAI. Second, adaptation of HPAI to wild waterfowl has historically been rare. In most cases, sporadic wild bird infections have, in fact, been spillover events from outbreaks at nearby poultry operations. In spite of their rarity in the wild, HPAI viruses have managed to kill thousands of wild birds on some occasions (the South African outbreak in 1961 and the Qinghai Lake, China, outbreak in 2005 are two examples of large wild bird die-offs). Additionally, the South African outbreak and the Qinghai Lake outbreak occurred in the absence of nearby poultry operations, raising the significant question of whether HPAI viruses can evolve in wild birds and if so, how frequently they may do so.

Swayne's book has several chapters that provide a historical perspective on the disease that gives insight to these questions. Kaleta et al. (Chapter 7), Alexander et al. (Chapter 9), and Sims and Brown (Chapter 11) draw on the vast body of historical literature to provide a very thorough review of outbreaks and synopses for each case, synthesizing the information to help the reader draw his or her own conclusions on the history of avian influenza epidemiology in relation to man-made and wild systems. Evidently, LPAI viruses mutated to HPAI in poultry across the world, and although LPAI viruses are all of waterbird origin, their maintenance and enhancement in poultry operations has resulted in HPAI outbreaks. Experimental studies have alluded to the relative abilities of some wild birds to remain asymptomatic (Sturm-Ramirez et al., 2004; Brown et al. 2006), but as yet, no wild reservoirs of HPAI have been found. It can be argued that some wild birds may have survived in the wild after infection with HPAI H5N1 (Chen et al., 2006). Whether this resulted in adaptation in the virus to cause prolonged persistence in waterbirds—as suggested by some (Liu et al., 2005)—is not known, and this remains an important question in HPAI H5N1 ecology.

The latter half of the book (Chapters 12–25) considers control methods, biosecurity measures, vaccination strategies, and policy aspects necessary in HPAI H5N1 management. Multiple chapters demonstrate that mass depopulation of poultry has been the most effective tool in controlling and containing HPAI viruses since the earliest epidemics. Multiple authors conclude from various perspectives that control strategies should be part of a comprehensive package including high biosecurity measures, diagnostics and surveillance, and education, in addition to controlled depopulation when faced with an epidemic. The context in Asia is very complex, however, because poultry operations have minimal to

low biosecurity, and live bird (and other animal) markets provide ample mutation opportunities for avian influenza strains as wild and domestic animals are in frequent close contact. Under these circumstances, alternative methods, such as gradual shifts toward more biosecure farming practices, are proposed, although the duration of time necessary to achieve some of these options is likely very long. The economics of instituting such changes and dealing with outbreaks as they occur is also expected to be costly, as highlighted by McLeod (Chapter 24). Swayne and Kapczynski (Chapter 19) aptly warn about the futility of using vaccination as a strategy when biosecurity and other measures are not in place. Lubroth et al., in the last chapter, advocate comprehensive, structural, and proactive approaches for an effective global strategy to address the multiple threats of avian influenza. The problems of poultry-rearing practices in Asia are likely to remain for years to come, as “backyard” poultry operations are an important means of meeting protein and basic economic demands of the rural poor. Adaptive strategies to minimize losses and create incentives to help governments in the region cope with and improve on existing systems are currently the best options, but a solution to globally eliminate HPAI from poultry is not immediately forthcoming.

Wildlife disease ecology has been studied from different perspectives. The emerging need for understanding transboundary zoonotics, as this book demonstrates, is for a science that achieves an interdisciplinary approach in wildlife ecology. The book provides a clear example of how a disease of significance to wildlife can be studied from different perspectives to produce a unifying picture of disease ecology and wildlife and human health. It is also an exceptionally informative reference for wildlife researchers, veterinarians, and policymakers. Each chapter, however, stands on its own, and as a result readers can quickly focus on the information they need in the specific chapters. The book will stimulate readers to consider how to enhance our understanding of diseases of wildlife significance in changing, human-influenced ecosystems. We still need to know if wild ducks, geese, swans, and other waterbirds, that are central to LPAI epidemiology in the wild, are capable of maintaining HPAI H5N1 in endemic cycles. Suarez (Chapter 1), Stallknecht and Brown (Chapter 3), Swayne (Chapter 4), and several others mention the importance of learning more about migratory bird movements in conjunction with virological studies to help piece together the HPAI H5N1 puzzle.

Examining these areas is central not only to the ecology of HPAI in Asia, but also to the very discipline of wildlife disease epidemiology in the modern world. Ultimately this book demonstrates that as wild bird scientists we need to expand our understanding of diseases in relation to wildlife population dynamics and migration as well as virology, genetics, and human system interactions, not only just for the health of wild birds and the conservation of wild bird populations, but also for our own well being.

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