One Health
People, Animals, and the Environment
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ASM PRESS
Washington, DC
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One Health, the emerging discipline that brings together human, animal, and environmental health, is critical for the future control of infectious diseases. Over the past 30 years, new infectious diseases have been arising at an unprecedented frequency. Many diseases such as *Escherichia coli* O157:H7 infection, Lyme disease, hantavirus pulmonary syndrome, Nipah virus disease, and severe acute respiratory syndrome (SARS) were unknown before 1982. Other diseases that seemed to be dying out are now reemerging, including rabies and food-borne diseases. Some diseases like West Nile fever have leaped across oceans and spread across continents. Antibiotic resistance is increasing at an alarming rate. Where are the new diseases coming from? Why is the incidence of these diseases increasing? What can we do to respond to these health threats that seemingly arise suddenly? The answers to these questions lie in the One Health approach for achieving harmonized strategies for disease detection and prevention.

The vast majority of emerging infectious diseases in humans are zoonoses. The factors responsible for many of these diseases in humans often share common themes: environmental disruption by humans, exposure of microbes to a different niche that selects for new virulence traits and facilitates transmission to animals, and genetic changes that permit subsequent transmission to humans. In retrospect, this sequence is not surprising. Microbial evolution occurs rapidly. The increase in the human population has prompted the encroachment of humans into new environments, disrupting the ecology of these habitats and bringing humans and domestic animals into contact with wildlife. Exposure to wildlife facilitates the transmission of new diseases that were previously contained within localized niches.

This process is not unidirectional. Devastating infectious diseases in animals often result from human disruption of habitat. Examples include toxoplasmosis in marine mammals, leptospirosis in river otters, white-nose bat syndrome, and many other diseases that impact threatened species and reduce biodiversity.

Furthermore, as clearly demonstrated by the international spread of SARS and influenza and the impact of chytridiomycosis on amphibian populations worldwide, the emergence and re-emergence of infectious diseases are global problems. Extensive international travel and trade networks make it possible for pathogens to move from anywhere in the world to dense population centers within days.

This interdependence between human health, animal health, and environmental health underpins the concept of “One Health.” Solutions to the growing problems with infectious disease demand collaboration between experts in many disciplines, including human medicine, animal medicine, and environmental sciences. However, there remain many barriers to implementation of an interdisciplinary One Health approach. Education of physicians, veterinarians, and environmental scientists is typically done as a focused discipline with little emphasis on the other domains. Most funding sources are directed specifically at
human medicine, animal medicine, or environmental science, rather than the interfaces among these domains. Further, there is often ineffective communication between governmental agencies responsible for each of these domains within and between countries. Now, however, driven by the tremendous health and economic impact of infectious disease, the barriers are beginning to break down.

One Health is a paradigm shift in how we respond to the threat of emerging infectious diseases. The traditional approach has been to identify a sick person or animal, identify the pathogen, and apply a therapy to reduce the symptoms of disease. In contrast, the One Health approach focuses on surveillance of the environment, animals, and humans to predict an outbreak of disease before it happens, then to bring together environmental scientists, animal experts, and human physicians to develop upstream interventions that prevent the transmission of disease. This approach was not feasible before the development of computational approaches to analyze the large, complex data sets required to compile information from around the globe, evaluate the data, and pinpoint potential problems. In addition to reports from physicians and veterinarians, the data-gathering required for effective surveillance also includes social networking tools and new rapid laboratory approaches for DNA sequence analysis. Thus, although the close relationship between the environment, animals, and humans has been recognized for ages, the One Health initiative provides practical solutions that have broad implications. Interestingly, the greatest acceptance of One Health is seen in the developing world, where it is having significant impacts on control of infectious diseases.

This book presents core concepts, compelling evidence, successful applications, and the remaining challenges of One Health approaches to thwarting the threat of emerging infectious disease. The scientific insights described are timeless, and the potential solutions are timely. The One Health approach is simply too important to ignore.

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November 2013
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