EMERGING INFECTIONS

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ASM Press • Washington, D.C.
To our children:
Sarah Scheld,
Rebecca, Alison, Priscilla, and Bradford James Armstrong, and
Andrew and Mitchell Hughes
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FOREWORD

Infections have been emerging since the first microbe tried to climb the food chain ladder, preying on the protoalgae who were the primary producers of photosynthate. Some of them learned tit for tat, first learning the joys of putrefaction, then accelerating that process as they learned the comforts of in vivo parasitism. Perhaps this happened even closer to the dawn of life, depending on when the first viruses emerged to take their free lunch out of the hide of their microbial hosts.

Emergence is none other than the dark side of coevolution, a typical, inexorable biological phenomenon. But we came along with marvelous vaccines and antibiotics, with sanitary water and food; for a while, some of us practiced safer lifestyles, from handwashing to discreet sex. And perhaps we thought we had licked the bugs with our technology.

But they kept and do keep evolving, and besides having let down our guard, we have contrived a world that is safer for bugs than ever before, with instantaneous travel, mass production and transport of foodstuffs, and crowded and sharply stratified urban populations.

So, in the past decade, we have begun to rouse ourselves, and specialists in various diseases and etiological agents have learned that they have common cause with many others. And molecular and evolutionary biologists commune with heroic field workers and doctors and the public health system for a new convergence that is as intellectually challenging as it is humanly important.

This exchange of lessons is well typified in the current volume: it will have exciting news, and much to think about, after the headlines have faded. The microbial cosmos is one worldwide web of exchange of genetic information via transmittal of plasmids for virulence and antibiotic resistance. It is the least we can do to drop the parochialism that inscribed artificial boundaries between one infectious agent and another, and perhaps we can keep our place in this game without suffering the immense toll of the plagues of ancient and current history.

Joshua Lederberg
May 1997
PREFACE

As a result of improvements in sanitation and overall living conditions during the early 20th century and the subsequent introduction of many vaccines and antibiotics, tremendous progress has been made in the prevention and control of infectious diseases. Globally, smallpox has been eradicated and target dates have been established for the eradication of polio and dracunculiasis. In the United States, the annual incidence of several vaccine-preventable diseases is at an all-time low.

Despite these successes, infectious diseases remain the leading cause of death worldwide and the third leading cause of death in the United States. The World Health Organization (WHO) estimated that approximately 17 million (33%) of the 52 million deaths that occurred worldwide in 1995 were caused by microbial agents. Human immunodeficiency virus (HIV) infection is now the leading cause of death in the United States among persons between the ages of 25 and 44 years. AIDS, which was first recognized in 1981, is the most dramatic example of a new infectious disease that has rapidly emerged during the last 15 years. However, there are numerous other examples of emerging and reemerging infectious diseases of great current clinical and public health importance.

The Institute of Medicine (IOM) published a report entitled “Emerging Infections: Microbial Threats to Health in the United States” in the fall of 1992. This report, developed under the leadership of Joshua Lederberg and Robert Shope, identified the important factors that contribute to disease emergence and reemergence. These factors include changes in human demographics and behaviors, advances in technology and industry, economic development and changes in land use, increases in travel and commerce, microbial adaptation and change, and deterioration in the public health system at the local, state, national, and global levels. The IOM report defined new and emerging infectious diseases as those that have (i) newly appeared in humans, (ii) rapidly increased in incidence, (iii) expanded in geographic range, and/or (iv) developed increasing or novel mechanisms of antimicrobial resistance.

Recognizing the intense interest in and scientific and public health importance of new and emerging infectious diseases, the program committee of the Interscience Conference on Antimicrobial Agents and Chemotherapy (ICAAC) and the officers of the Infectious Diseases Society of America (IDSA) scheduled joint sessions during ICAAC and the IDSA annual meetings beginning in 1995. These joint sessions on new and emerging pathogens were immensely popular, attracting audiences in excess of 4,000, and were planned carefully to span the gamut among new and emerging bacteria, viruses, fungi, and parasites with appropriate discussions on national and international strategies for control. The chapters in the present
volume are derived from presentations given at the joint sessions on new and emerging infections of ICAAC and the IDSA meeting in 1995 and 1996 and are updated and fully referenced for this volume, the first in a planned series. They focus on a variety of diseases that pose major challenges today; some have been recognized for a century or more, while others have been identified during the past 25 years. Some affect healthy persons, while others primarily affect immunosuppressed persons. Some are important problems in the United States, while others cause disease primarily in other parts of the world. Approximately half of these diseases are zoonotic or vector borne, reflecting the current importance of these modes of transmission. The epidemiology of each has been influenced by one or more of the factors identified in the IOM report. Because of the nature of the "global village" in which we live, we cannot afford to be ignorant or complacent about any of them.

Experiences with these diseases dramatically remind physicians, microbiologists, researchers, public health officials, policy makers, and the public of the critical importance of ensuring the availability of the capacity to detect, respond to, and control these infections. The ability to address these emerging and reemerging microbial threats requires adequate surveillance and response capacity, ongoing research and training programs, strengthened prevention and control programs, and repair of the public health system at the local, state, national, and international levels. Strategies to address these threats and the factors that underlie disease emergence are outlined in the last two chapters. The challenges that these diseases will continue to pose demand a multidisciplinary approach and a supply of trained clinicians, microbiologists, pathologists, biomedical researchers, rodent and vector biologists, ecologists, behavioral scientists, and public health officials. The challenges also require funds to support the people and facilities needed to meet them. This is true particularly, but not only, in the developing world. Poverty makes populations especially susceptible to emerging and reemerging infections.

Future challenges are difficult to predict but certainly include more problems with antimicrobial-resistant infections, the threat of another influenza pandemic, the increasingly complex challenges of food-borne disease resulting from the globalization of the food supply, and the likelihood of increasing problems with dengue hemorrhagic fever and the risk of the resurgence of urban yellow fever in the Western Hemisphere. The global HIV epidemic will put large numbers of people at risk for currently recognized and new opportunistic infections. The roles of hepatitis B virus in chronic liver disease and hepatocellular carcinoma, human papillomavirus in cervical cancer, and Helicobacter pylori infection in peptic ulcer disease and gastric cancer are now well established. Additional chronic diseases will certainly be found to have an infectious etiology, providing important new opportunities for disease prevention in the future.

On the basis of the continued importance of new and emerging infectious diseases as defined by the 1992 IOM report, symposia on these topics are planned for future ICAACs. We plan production of an annual volume on new and emerging infections based on the presentations at each year’s ICAAC. This volume is there-
fore the first of a planned series. It should serve as a valuable source of information for persons responsible for coping with infectious diseases in the new millennium.

W. Michael Scheld
Donald Armstrong
James M. Hughes
ACKNOWLEDGMENTS

We thank everyone who has helped us in the preparation of this volume. Most importantly, we thank all of the authors for their outstanding contributions. As editors, we are particularly grateful to those members of the Interscience Conference on Antimicrobial Agents and Chemotherapy (ICAAC) Program Committee and of the leadership of the Infectious Diseases Society of America (IDSA) who assisted us in coordinating topic and speaker selection for and moderating the joint symposia on emerging infections during the 1995 and 1996 ICAAC-IDSA meetings: Vincent Andriole, William Craig, and Jerome Klein. Numerous other colleagues provided helpful discussion, advice, and criticism. We are also grateful to our secretaries, Susan Shaker, Susan Waisner, Lynn Erickson, and Darlene Shannon. The editorial staff at ASM Press deserves our gratitude: Patrick Fitzgerald, Pamela Lacey, Eleanor Tupper, and Ken April. And, finally, we thank our families for their tolerance and support during this undertaking.
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