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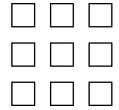
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Biosecurity and Bioterrorism

Containing and Preventing Biological Threats

Jeffrey R. Ryan *and* Jan F. Glarum



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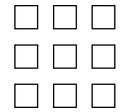


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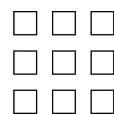
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Foreword

The future ain't what it used to be.

Twenty-five years ago, when Yogi Berra uttered his famous oxymoron, few of us could have realized how very prescient those words were. At the time, our major concerns for security were nuclear, and our biggest fears stemmed from state-sponsored full-scale nuclear warfare. Governments as well as private citizens scrambled to create security through construction of fallout shelters, nuclear drills, stockpiling of food, and wholesale investment in the Cold War. Infectious agents were not even on the radar screen, and terrorism was something that happened only in other countries.

Today, our approach to hazards protection is quite different, and we recognize a broad spectrum of threats, not only nuclear, but also chemical, explosive, radiologic, and biologic. We need comprehensive and flexible packages to cover all. This book is designed to address the significant and wide-ranging threats posed by the biological agents—understanding the diverse nature of the biological threats that exist and promoting effective responses appropriate to each incursion.

Regarding biological security, we are faced with twin threats: a devastating event due to biological terrorism and the development of a pandemic due to Mother Nature. Biosecurity and biodefense are critical in preparing us for protection for either an intentional or an incidental event.

Terrorism is a form of “asymmetric warfare,” designed to undermine economic, social, environmental, or political values. Targets and delivery mechanisms are highly variable, so preventive measures as well as control plans need to be flexible and comprehensive. In the case of biologic terrorism, targets are living organisms: humans, animals, or plants. Bioterror is aimed at humans and, as such, is capable of causing, if not mass morbidity or mortality, then mass hysteria, thereby undermining the whole fabric of society. This could be through dissemination of a disease agent that passes from person to person, or it could be through contamination of the food supply, causing illness through consumption of tainted food. But asymmetric threats may also be directed at agricultural animals or plants, with the purpose being to create economic devastation of the animal or crop industries that would initiate a cascade of negative events through multiple sectors of the economy.

In addition, the steady parade of emerging diseases, such as SARS or bird flu, has shown undeniably that destabilization and economic havoc can be wreaked by an emerging disease as well. These emerging diseases are spawned by globalization and

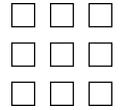
the ever-expanding human population, allowing for possibilities for agents to move from comfortable domains into new unexplored niches. There have been tremendous increases in international trade and trafficking of people, animals, and animal products, all with potential for bringing animal, human, or plant diseases to new locations. The increasingly complex international transportation network can neither be predicted nor paused, creating well-founded concerns about emergence and incursion of diseases and subsequent public health or economic consequences. As articulated in several recent publications, we are creating the microbial equivalent of “a perfect storm.” A human pandemic that emerges would be rapidly spread all over the globe. An agricultural epidemic could also have very severe consequences: production of sufficient food to feed the growing human population makes it imperative that we protect agriculture from emerging threats.

The key rule in limiting the damage caused by a biological event—whether it is bioterror, agroterror, or an emerging disease—is this: The amount of economic damage or human illness depends directly on how quickly the disease or contaminated food is detected and contained. If the first instance is recognized and adequate control measures implemented immediately, we will likely circumvent severe economic consequences and human illness. However, if the problem is not initially recognized and is allowed to spread to any extent, we will face dire consequences in our public or agricultural health. Our best defense against this serious damage is to increase awareness to a point where such an emergence or incursion is detected as early as possible and that effective local, state, and federal response capabilities are developed so that deleterious spread can be efficiently intercepted through rapid and appropriate actions.

In summary, these twin forces of terrorism and emerging diseases have made the possibilities of adverse biological events not just possibilities but probabilities. The threats are multifaceted and so preparedness and response plans must be also. There is not a “one size fits all” for biosecurity and biodefense. Generalized knowledge of biosecurity and biodefense are essential, and for each vulnerability that we recognize, there is an additional customized solution that can be applied. The same is true for emergency response plans. There is a general strategy, then for each potential scenario there are advanced solutions to optimal reaction.

This book is very timely and applicable, addressing the range and variety of threats and scenarios. The truth is that we do not know exactly what the future will bring in terms of threats, so we need the comprehensive and flexible understanding that is presented within these pages. In the words of Yogi Berra, once again, “You’ve got to be careful if you don’t know where you’re going because you might not get there.” This book takes us as close as we can get, in an efficient and straightforward manner, preparing us for the panoply of possibilities.

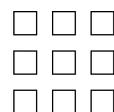
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About the Authors

Dr. Jeff Ryan is a retired Army Lieutenant Colonel with an extensive background in preventive medicine, epidemiology, clinical trials, and diagnostics development. Dr. Ryan also served in the private sector, working for a biotech company, Cepheid, where he was a senior business developer and manager for its biothreat government business program. Dr. Ryan wrote more than 40 scientific, peer-reviewed journal articles and is the lead instructor and codeveloper of the Pandemic Influenza Planning and Preparedness course, taught at the Center for Domestic Preparedness (Department of Homeland Security) in Anniston, Alabama. Currently, Dr. Ryan serves as an Assistant Professor at the Institute for Emergency Preparedness, Jacksonville State University. His specialty areas include biosecurity, biodefense, medical aspects of emergency management, homeland security planning and preparedness, and terrorism studies.

Jan Glarum retired after 27 years in the emergency response field. He has an extensive background in emergency medical services, fire, and police special weapons and tactics operations. He served as the Medical Preparedness Officer for the state of Oregon Health Division and Executive Director of Development for the Portland Metropolitan Medical Response System. Mr. Glarum wrote the *Homeland Security Field Guide* and is codeveloper of the Pandemic Influenza Planning and Preparedness course, taught at the Center for Domestic Preparedness (Department of Homeland Security) in Anniston, Alabama. Currently, he works as a consultant for the Department of Homeland Security and the Department of Defense, both domestically and internationally.



Preface

This book is the result of much research, writing and thoughtful discussion with students, first responders, scholars, and thought leaders in the fields of biosecurity and biodefense. It comes at a time when emergency managers, public health professionals, clinicians, animal health professionals, and government officials are preparing themselves for acts of terrorism and the potential that weapons of mass destruction may be used against our citizens.

At the dawning of the 21st century, we moved very quickly from the Information Age to the Age of Terrorism. Certainly, historians will recall how the dark specter of terrorism raised its ugly head in the fall of 2001 as we witnessed the fall of the Twin Towers at the World Trade Center in New York and a direct attack on the Pentagon in Washington, D.C. Less than a month later, citizens of the United States were faced with the threat of a deadly and rare disease, anthrax, which was spread by a few letters introduced into the U.S. Postal System. Now, looking back, this period seems almost surreal to us. Even though these human-made disasters affected all of us in different ways, many Americans have already forgotten their personal feelings at the time. The global war on terrorism has been raging for several years now. Some would argue that taking the battle to the enemy on another front in a distant land has given us some modicum of protection. That may be true, but to this day we still do not know who perpetrated the anthrax attacks that killed five people and shocked a nation. Nonetheless, we are as vulnerable to the biological threat today as we were seven years ago.

In the wake of the terrorist attacks and anthrax assaults of fall 2001, U.S. policymakers developed the nucleus of a new regulatory framework to address the suddenly evident threat of bioterrorism (Dr. Julie E. Fischer, February 2006).

Accordingly, *Biosecurity and Bioterrorism: Containing and Preventing Biological Threats* introduces readers to global concerns for biosecurity including the history of biological warfare, bioterrorism, concerns for agroterrorism, and current initiatives in biodefense. Included is a thorough review of specific agents, the diseases they cause, detection methods, and consequence management considerations. Readers are introduced to international initiatives and federal legislation that address biosecurity and biodefense.

A comprehensive treatment of the subject is needed to promote understanding of the problem and the complex network of federal, state, and local assets for dealing with the threat. The book is intended to be used as a textbook or reference for security managers in the food industry, public health professionals, and emergency managers.

The primary goal of *Biosecurity and Bioterrorism: Containing and Preventing Biological Threats* is to give readers an understanding of the threat that biological agents pose to society. Accordingly, the book details the myriad threats posed to society by the

Department of Health and Human Services (HHS) Category A, B, and C agents. Readers are presented with a number of case studies that illustrate the impact of certain biological agents on society. Readers will be able to discuss federal programs and initiatives that encompass the government's vision of *Biodefense for the 21st Century*.

Terminal Learning Objectives

At the end of the course, students should be able to

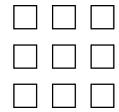
- Discuss the history of bioweapons development and how those programs relate to the current threat of bioterrorism.
- Discuss what biological agents are and how they can cause illness and death.
- Understand that the scale of bioterrorist and natural events makes a tremendous difference in our ability to respond to them.
- Understand what criteria are important in placing the most serious pathogens and toxins into HHS Categories A, B, and C.
- Know the different biological agents in HHS Categories A, B, and C, what diseases they cause, and signs and symptoms of the associated disease. In addition, students will understand the natural history of each of these agents, their use in warfare and bioterrorism, and public health issues.
- Discuss specific case studies that examine bioterrorism and natural disease outbreaks.
- Demonstrate familiarity with sampling and detection methods.
- List the laws and presidential directives that apply to biodefense and biosecurity.
- Discuss many federal initiatives and programs designed to enhance biodefense and biosecurity in the United States.
- Understand the difference between quarantine and isolation and the challenges both present.
- Understand programs that are implemented by public health agencies to enhance preparedness for acts of bioterrorism and where this fits into emergency preparedness programs.

The Pedagogical Features of This Book

- **Objectives and Key Terms** at the beginning of all chapters guide the reader on chapter content and the topics to understand.
- **Scenarios** are placed at the beginning of some chapters to offer the reader a dose of reality and to increase interest in the chapter content.
- **Examples, illustrations, and figures** help explain concepts and relate theory to practice.
- **Boxed topics** are contained in each chapter to extend the depth of the information and to offer additional perspective on the issues.

- **Critical Thinking boxes** throughout the book help the reader to formulate alternative perspectives on issues and seek creative and improved solutions to problems.
- **Discussion Questions** at the end of each chapter reinforce content and provide an opportunity for the reader to review, synthesize, and debate major concepts and issues.
- **Web sites** at the end of each chapter provide direction for additional resources to enhance learning along topic lines and supplemental resources for student learning.
- An **interdisciplinary research base** was developed from books, journals, newsletters, magazines, associations, government, training programs, and other professional sources.

The book is organized into four thematic sections: Part I provides a conceptual understanding of biowarfare, bioterrorism, and the reasons why biosecurity and bio-defense are so important to modern day society. Part II investigates HHS Category A, B, and C agents; case studies; and recognition of the threat. Part III focuses on agricultural terrorism and food security. Finally, Part IV outlines and details federal and local initiatives for biodefense and biosecurity; included here are considerations for government officials, emergency management practitioners, public health professionals, and first responders. Each thematic section includes a short preface that draws together the key points and learning objectives of the chapters within them.



Preface to Section III

Agriculture can be defined in many ways. In very general terms it represents the body of knowledge, science, and practice of cultivating the soil and rearing animals. Agriculture is vitally important to the development and maintenance of human society. Agricultural systems enable modern day societies to safely and inexpensively feed their populace. Countries that have not developed a sophisticated agricultural system are neither able to sustain large cities, concentrate their people, nor advance their technologies.

The business of agriculture or “agribusiness” is vitally important to the economy of nations. Recent estimates from the United States Department of Agriculture indicate that agribusiness is responsible for more than 12% of the United State’s Gross Domestic Product, 17% of the Nation’s employment, and about 20% of her exports. Therefore, agricultural products are not only essential for the survival of its people; they are also paramount to a thriving economy.

Outbreaks of animal or plant diseases threaten the capacity to produce commodities essential to domestic sustenance and international trade. Outbreaks of disease have the potential for creating significant losses for the economy. Most often, we concern ourselves with foreign animal and plant diseases; however, highly contagious and serious pathogens are endemic to the United States and her allies. When it comes to food safety and agricultural security we must consider pathogens that are naturally spread and accidentally introduced. In addition, because we live in the Age of Terrorism and face the threat of asymmetric warfare, we have to be watchful for intentional acts of introducing disease agents into the agricultural sector. A directed, well-planned, intentional act could be devastating.

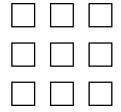
As we learned in Chapter 1, humans developed agriculture about 12,000 years ago. In his poignant book *Guns, Germs and Steel*, Dr. Jared Diamond discussed how agriculture enabled man to settle in one place, efficiently sustain larger tribes, develop new tools and gain advantage over nomadic groups and neighboring tribes. These advances, however, did not come without cost. Diamond also referred to domesticated animals as if they were “deadly gifts” because they introduced humans to new disease pathogens.

In an eloquently written article on avian influenza 1, Dr. Corrie Brown emphasizes that control of bird flu in the human sector will require control of the disease in the animal. To make her point she reminds us of what German physician Rudolf Virchow stated in 1855 when he defined the term zoonoses:

Highly pathogenic avian influenza has become the “zoonosis” of the decade and hopefully will not become the pandemic of the century. . . . On the subject of comparative medicine, Virchow stated, “Between animal and human

medicine, there is no dividing line—nor should there be.” Virchow is a name familiar to all pathologists because he is widely regarded as the father of modern pathology and is heralded for elucidating the cellular nature of disease, which drastically changed the course of medicine. However, it may be his emphasis on considering diseases across species lines that will be his most lasting legacy.

Regardless of how introduced, the biological threat to agriculture has the potential to rob us of our ability to feed ourselves, shake our confidence in Government, undermine an economy and pose a threat to human health. For these reasons, an entire Section in this book is dedicated to the threat of biological agents to agriculture. Chapter 8 covers the threat to domesticated animals and crops and outlines the response actions and control measures used in disease containment. Chapter 9 briefly describes four case studies where foreign animal diseases have caused great harm to agribusiness.



Acknowledgments

We both thank our families for taking the time to listen to our ideas and for pardoning us for our extended absences, idiosyncrasies, and preoccupation as we worked on researching and writing this book. We also give special thanks to Dr. Pam Ryan for critically reviewing each chapter, while balancing the rigors of a busy companion animal practice and a precocious three-year-old daughter. Finally, we thank the men and women in uniform, both military and civilian. They are the guardians standing on the front lines everywhere, protecting each other's families. Our hope is that they will find this compilation useful as they face the threat of asymmetric warfare.

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