Biological Safety

PRINCIPLES AND PRACTICES

EDITED BY

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Foreword

On October 29, 1997, a non-human primate research worker was transferring macaques from a transport cage to a squeeze cage preceding a routine annual physical. One of the macaques became agitated, and as he jumped, his tail flicked material from the bottom of the cage into the face and eye of the researcher. On December 10, 1997, that vivacious and talented 22-year-old worker, Elizabeth “Beth” Griffin, died as a result of that innocuous event.

Beth’s death was initiated by an ocular exposure to the Herpes simian B virus (Macacine herpesvirus 1). Her case was the first known exposure to be the result of something other than a bite or a scratch. An Agnes Scott College graduate, Beth—a dancer—died from an encephalitic disease that first paralyzed her from the neck down before finally causing her death.

Beth’s death gained national attention in the U.S. media. It was a featured story on a network newsmagazine. The incident gained international attention in the world of research. The world—especially the research world—wanted to know how such a thing could ever happen and what could be done to ensure it never happened again.

A number of things could have been done that would have meant this story would never be read. There were systematic failures in the occupational health response to her exposure. There were failures in the health care system. There were things Beth could have done, such as wear goggles while handling the monkeys or use the nearby eyewash stations within 5 minutes of her exposure. An emergency response measure could have provided a simple postexposure prophylactic prescription taken shortly after her incident. These actions and others as elements of an institutional culture of safety—Prevention, Detection, and Response—could have changed everything.

Two years after her death, Beth’s family established a nonprofit foundation to increase safety and occupational health awareness for people who worked with non-human primates. With the collaborative assistance of organizations such as the Association of Primate Veterinarians (APV), the American Association for Laboratory Animal Science (AALAS), and the American College of Laboratory Animal Medicine (ACLAM), many changes were made in processes and responses to exposures. Many people working in non-human primate research environments began carrying cards, quickly tagged as “Beth Cards,” that informed medical personnel to take specific measures to rule out B virus exposure first—not last—if the person was exhibiting certain viral symptoms.

In 2003, the world became gripped in an outbreak of a disease called SARS (severe acute respiratory syndrome). The outbreak began in China, but because of mobility the disease soon began popping up elsewhere. As Beth’s death had been a tipping point for safety awareness in working with non-human primates, the SARS outbreak and the global response of expanding laboratory capacity...
to detect and identify emerging infectious diseases became a massive springboard for biosafety.

The “Amerithrax” incident of 2001 had already sparked international attention to practices used in working with certain biological agents. The concepts of biosafety and biosecurity preceded all of these incidents by decades, but never had there been such total community attention to the potential risks of biological exposures.

At the encouragement of those groups with whom we had already collaborated, the Elizabeth Griffin Research Foundation reached out with our “no more Beth Griffin tragedies” message to the American Biological Safety Association to assist in highlighting awareness of and response to the exposure risks that those who work with biological agents face on a rather routine basis. With their assistance—and that of a growing number of similar professional organizations around the world—biosafety is a front-burner issue in conducting safe and responsible science. Much has been done to increase the awareness, research, and application of sound protocols that both reduce the risk of exposure and improve the quality of response to an exposure should one occur. The very truth that you are reading this book on biosafety and biosecurity is proof enough of how far this has come.

Good science is safe science. If the science isn’t safe, it isn’t good. Nothing can be more damaging to the reputation of a research institution or to the public view of the value of science than a bungled exposure issue or the appearance of cutting corners on safety in order to accomplish something. Biological risks are very different from many others in that they are most often not immediately evident, due to incubation periods. There are no immediate detection capabilities as with chemical or radiation risks, since biological manifestation may easily be delayed and often misdiagnosed. Compound those issues with the fact that many biological agents have highly contagious, often lethal capabilities, and we quickly see it’s not just the laboratory worker at risk.

Watchfulness, attention, caution, and prudence are all required whenever someone does anything that places individuals beyond themselves at risk. To engage in biological research requires that you exercise caution and follow protocols, not only for your safety but also for the safety of the community and world that surrounds you. It is not an option or a luxury. It is a necessity. Every risk, no matter how small it may seem, must be considered, assessed, and properly mitigated. The techniques of safety and security are every bit as important as the techniques used in your research.

Before getting into the technical nuts and bolts of biosafety and biosecurity, please keep these basics in mind.

1. Everyone who works with biological agents in any capacity should discuss their work with their personal physician. You are quite possibly the zebra among a stable of horses.

2. Remember that most people drown in shallow water. While much attention is required to higher-risk agents, most laboratory-acquired infections (LAIs) occur when working with what are thought to be lower-risk agents. Most LAI deaths are attributed to Level 2 agents, not Level 3 or 4.

3. Learn from near-misses. Encourage nonpunitive conversations about things that “almost happened.” The “almost happened” events are likely to recur, so learn from them.

4. Compliance is a by-product of safe research. It is not the purpose of safe research.

5. Be a role model of biosafety and biosecurity. Create atmospheres where being safe appears the most natural thing to do.

6. Link up with the biosafety personnel at your institution. Learn from them.

7. If you think there’s a safer way, don’t just think it. Prove it by research, demonstrate it, and share what you learned with the biosafety community.

8. Commit to never letting a Beth Griffin tragedy happen wherever you may be.

We adhere to the words spoken by Thomas Huxley at the opening of The Johns Hopkins University in Baltimore, Maryland. In his remarks, Huxley noted that “the end of life is not knowledge, but action.” On behalf of the Elizabeth R. Griffin Research Foundation and our collaborative partners worldwide, we encourage that you not just learn the material in this book but act upon, promote, and add to this body of knowledge throughout your scientific career.

Caryl P. Griffin, MDiv, President and Founder
James Welch, Executive Director
Elizabeth R. Griffin Foundation
www.ergriffinresearch.org
Preface

It is with a great sense of honor and reverence that we take over the reins of editing this book from our esteemed colleagues, Diane O. Fleming and Debra L. Hunt. It is our hope that this 5th edition of Biological Safety: Principles and Practices remains the main text in the field of biosafety. We are indebted to the many authors who have contributed to this edition. This book serves as a valuable resource not only for biosafety professionals, but also for students, staff, faculty, and clinicians who are working with or around potentially biohazardous materials in research laboratories, medical settings, and industrial environments. Those who supervise biosafety or laboratory staff members will also benefit from this book.

We decided to keep the overall structure similar to the previous edition, with five major sections. Eight new chapters were added on the following topics: molecular agents, arthropod vector biocontainment, aerobiology, training programs, veterinary and greenhouse biosafety, field studies, and clinical laboratories. Biosafety Practices is not a separate chapter in this edition; the concepts have been incorporated into relevant chapters. Similarly, the information on prions was incorporated into the new chapter on molecular agents. The title of the last section was changed from “Special Considerations” to “Special Environments” and some chapters were moved out of this section to keep the focus on unique settings encountered in biosafety practice. Since regulatory guidelines are always changing, we have directed our readers to online sources for the most up-to-date information. Chapters have been made to be more fluid and stand-alone by minimizing references to other chapters. We are fortunate to have color in this new edition.

Both of this edition’s editors are Certified Biosafety Professionals, but we came to the field of biosafety through different avenues, giving us complementary perspectives on the topic. Dawn Wooley became intensely interested in biosafety during her graduate days at Harvard while researching the newly discovered AIDS viruses. These were the days before there were important administrative controls such as the Bloodborne Pathogen Standard. In trying to protect herself and others around her from these newly emerging pathogens, Dawn developed a love for the field of biosafety that has persisted until today. Karen Byers developed a keen interest in biosafety while working with measles in Harvard research laboratories. An appointment to the Institutional Biosafety Committee inspired her to become a biosafety professional. She is very grateful for Lynn Harding’s mentorship and the opportunities for professional development and leadership provided by colleagues in the American Biological Safety International (ABSA).

Professional organizations such as ABSA, the American Society of Microbiology (ASM), the American Public Health Association (APHL), the Clinical and Laboratory
Standards Institute (CLSI), and the American Association for Laboratory Animal Science (AALAS) have played a key role in fostering the development and implementation of evidence-based biosafety practice. The Foreword to this edition reminds us of the importance of this endeavor.

Gregory W. Payne, Senior Editor, ASM Press, was instrumental in pushing for the update of this book, and he provided much-needed guidance and inspiration. We thank Ellie Tupper and Lauren Luethy for their expert assistance with the production of this book.

We hope that our readers enjoy the book as much as we have appreciated the opportunity to work on it for you and the rest of the biosafety community. Be safe!

Dawn P. Wooley
Karen B. Byers