

PREFACE

Pathogenic microbes and their toxins have always posed a significant threat to the health of humans, animals and plants that become exposed and infected in the great scheme of Life. But now there is a new threat—the deliberate use of pathogens and toxins as weapons in acts of bioterrorism or the commission of biocrimes. Countering these weapons demands new tools and a new scientific discipline, microbial forensics. We define microbial forensics as a scientific discipline dedicated to analyzing evidence from a bioterrorism act, biocrime, or inadvertent microorganism/toxin release for attribution purposes.

Epidemiologists, particularly those in public health fields, have used forensic practices for decades to identify causative agents and the etiology of disease. Some essential elements of this new discipline aimed at attribution have long been growing in several government agencies. But microbial forensics could not evolve into its own discipline because it was not considered a potential deterrent and it seemed limited in its ability to attribute the source or to identify the perpetrator. However, over the last decade, and particularly after the 2001 anthrax letter attacks, microbial forensics has crystallized and become more formalized. This has brought renewed interest, an influx of resources and people, and new rules of engagement.

Scientists entering the field of microbial forensics and people who may make political, administrative, or legal decisions or just would like to be better informed have no single source to consult. This book was written to provide such a resource, to introduce the discipline, and to describe some of the challenges and opportunities ahead. Not all possible topics are described. Instead, representative examples are provided to initiate and educate the reader. We hope that the book will serve as a foundation text to stimulate new generations of scientists and legal experts who will bring additional expertise to the field. The book has this Preface and 18 other chapters that address: 1)

definition of the discipline, select history of past bioterrorism and biocrime events, challenges and direction; 2) synopses of the basic biology of viruses, bacteria, fungi, and toxins; 3) epidemiology; 4) laboratory and technology considerations; 5) host-pathogen interactions; 6) bioinformatics and population genetics; 7) quality assurance; and 8) legal aspects. An appendix lists quality assurance guidelines for microbial forensic laboratories that carry out analytical assays.

Over the past century, science has played an increasingly greater role in criminal investigation. Microbial forensic science will continue this tradition and assist in solving crimes by characterizing physical evidence found at a crime scene for attribution purposes. A combination of diverse disciplines is exploited to analyze evidence, including biology, microbiology, medicine, chemistry, physics, statistics, population genetics, and computer science. New techniques must be employed to get the most evidence from biological materials used in terrorist and criminal events, especially when more traditional forms of evidence are either not available or very limited in content. These concepts are explained in this book. Yet scientific analysis alone is not enough. Forensic science should be integrated with other information. In practice, rigorous attention must be paid to steps that will assure admissibility of results in a court of law. Admissibility rules, and legal expectations and consequences, are described by citing past cases. We also stress quality control and quality assurance as the means to ensure reliability. Practices such as adherence to chain of custody procedures, documentation of activities, using tested reagents, calibrated equipment, negative and known positive control samples, validated procedures, standard operating procedures, and so on, are the essence of reliability and confidence. These in turn ensure admissibility.

The foundations described here should be strengthened, built upon, and when appropriate remodeled. The driving force for the maturation of microbial forensics will be our present and future colleagues. We look forward to their input, interaction, and insight.

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