

Biological warfare: New concepts in bioterrorism and bioweapons

ESSAY

Submitted for fulfillment of the requirements of the
Master Degree in Forensic Medicine & Clinical Toxicology

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2008

Abstract

A bioterrorism attack is the deliberate release of viruses, bacteria, or other germs (agents) used to cause illness or death in people, animals, or plants. These agents are typically found in nature, but it is possible that they could be changed to increase their ability to cause disease, make them resistant to current medicines, or to increase their ability to be spread into the environment. Biological agents can be spread through the air, through water, or in food. Biological weapons (BW's) are the terrorist's perfect weapon; they are relatively easy to make, difficult to detect, and a significant threat of morbidity and mortality. The aim of this review is to clarify the different pathogens and toxins that can be converted to bioweapons and can be used to commit bioterrorism and biocrime in addition to focus light on the new subfield of forensics-microbial forensics. and the role of ethics as a Weapon to Counter Bioterrorism.

(Key words: bioterrorism, biowarfare, biological weapons, biocrime)

ACKNOWLEDGMENT

First and foremost thanks are due to Allah for allowing me to begin, to go through and to complete this work.

I am deeply indebted to Prof. Dr. **Ali Gamal Eldin**, Professor of Forensic medicine and Clinical Toxicology, faculty of Medicine, Cairo University, whose outstanding support, stimulating suggestions, and encouragement helped me all the time.

My deepest gratitude is to Prof. Dr. **Manal Mohy**, Professor of Forensic medicine and Clinical Toxicology, Cairo University, for her continuous support, meticulous supervision, valuable criticism, complete guidance, and encouragement throughout this work.

My deep appreciation and thanks to **my professors and colleagues** in the Forensic medicine and Clinical Toxicology department, faculty of medicine, Cairo University for their extended support and encouragement.

My heartfelt thanks to all **my family members**, my husband, my parents, my sisters and my lovely son **Anas** my brother for their assistance, encouragement, patience and support throughout my work.

Azza Mohammad Abdel Wahhab.

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List of abbreviation

ARS	Agricultural Research Service
ASM	American Society for Microbiology
APHIS	Animal and Plant Health Inspection Service
AD	Anno Domine
BC	Before Christ
BCG	Bacille Calmette-Guérin
BFAC	Bioforensics Analysis Center
BTWC	Biological and Toxin Weapons Convention
BW	Biological weapon
BWC	Biological Weapons Convention
BSE	Bovine spongiform encephalopathy
CDC	Centers for Diseases Control and prevention
CS	2-chlorobenzalmalononitrile
CNS	central nervous system
CWAs	chemical weapon agents
CWC	Chemical Weapons Convention
CT	Computerised tomography
DHHS	Department of Health and Human Services
DHS	Department of Homeland Security
DFA	direct fluorescent assays
DNA	Deoxyribonucleic acid
EF	edema factor
ED	Emergency department
ELISA	Enzyme-linked immunosorbent assay
FBI	Federal Bureau of Investigation

FDA	Food and Drug Administration
HAZMAT	hazardous materials
HFV	Hemorrhagic fever virus
H&E	hematoxylin and eosin
HEPA	high-efficiency particulate air
IHC	immunohistochemical
IND	Investigative New Drug
LF	lethal factor
LVS	live vaccine strain
ME/Cs	Medical examiners and coroners
NBACC	National Biodefense Analysis and Countermeasures Center
OPCW	Organisation for the Prohibition of Chemical Weapons
PPE	Personal protective equipment
PAPR	Powered Air Purifying Respirator
PA	protective antigen
PCR	polymerase chain reaction
QA	Quality assurance
Qc	Quality control
PAPRs	powered air-purifying respirators
RNA	Ribonucleic acid
RODS	Real-Time Outbreak Disease Surveillance
SWGMPF	Scientific Working Group on Microbial Genetics and Forensics
SARS	Severe acute respiratory syndrome
USSR	Union of Soviet Socialist Republics

UN	United nations
USAMRIID	United States Army Medical Research Institute for infectious diseases
VIG	Vaccinia immune globulin
WHO	World Health Organization
WW I	World war I

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Introduction

Introduction

A bioterrorism attack is the deliberate release of viruses, bacteria, or other germs (agents) used to cause illness or death in people, animals, or plants. These agents are typically found in nature, but it is possible that they could be changed to increase their ability to cause disease, make them resistant to current medicines, or to increase their ability to be spread into the environment. Biological agents can be spread through the air, through water, or in food. Terrorists may use biological agents because they can be extremely difficult to detect and do not cause illness for several hours to several days. Some bioterrorism agents, like the smallpox virus, can be spread from person to person and some, like anthrax, can not (**Paquette, 2007**).

Ideal characteristics of biological weapons are high infectivity, high potency, availability of vaccines, and delivery as an aerosol. The biological agents used in biological weapons can often be manufactured quickly and easily. The primary difficulty is not the production of the biological agent but delivery in an infective form to a vulnerable target (**Woods, 2005**).

Detection of biological agents involves either finding the agent in the environment or medical diagnosis of the agent's effect on human or animal victims. Early detection of a biological agent in the environment allows for early specific treatment and time during which prophylaxis would be effective. Unfortunately, currently no reliable detection systems exist for BW agents. The US Department of Defense has placed a high priority on research and development of a detector system (**Dire, 2006**).

Biological weapons (BW) are the terrorist's perfect weapon; they are relatively easy to make, difficult to detect, and a significant threat of morbidity and mortality. Victims are contaminated via 3 potential routes: skin, gastrointestinal (GI), and pulmonary. Cutaneous exposure provides the least potential for significant morbidity and mortality, since intact skin provides an excellent barrier against most of these agents except mycotoxins. However, mucous membranes, abrasions, or other lesions may provide a portal of entry for bacteria, viruses, or toxins (**Jagminas, 2006**).

Because of the availability of pathogenic microorganisms and the relatively low cost of preparing and disseminating bioweapons, there is a continuing threat of biocrime and bioterrorism. Thus, enhanced capabilities are needed that enable the full and robust forensic exploitation and interpretation of microbial evidence from acts of bioterrorism or biocrimes. To respond to the need, greater resources and efforts are being applied to the burgeoning field of microbial forensics. Microbial forensics focuses on the characterization, analysis and interpretation of evidence for attributional purposes from a bioterrorism act, biocrime, hoax or inadvertent agent release (**Budowle et al., 2005**).

Microbial forensics is a relatively new scientific discipline dedicated to analyze microbiological evidence from a crime for attribution purposes. It builds on traditional microbiology and epidemiology but within a legal framework. Important motives for forensic investigations include interdiction of criminals, prosecution of justice, and ideally, deterrence of others from committing similar acts. Forensic capabilities in animal health should focus on building capacity for detection and reporting of increases in

infectious disease morbidity and mortality among animals that might reflect a covert release of a pathogen (McEwen et al., 2006).

Most people and nations agree that the use of biological or chemical weapons is unethical and morally wrong. So why are such weapons produced? One significant reason is that most biotechnology is dual-use, that is, it has both peaceful and harmful purposes. The same technology that gives us genetically engineered medicine can also give us military weapons (Reyes, 2003).

Aim of the work:

To clarify the different pathogens and toxins that can be converted to bioweapons and can be used to commit bioterrorism and biocrime in addition to focus light on the new subfield of forensics-microbial forensics—that has been created to focus on characterization of evidence from a bioterrorism act, biocrime, hoax and, an inadvertent release since combating bioterrorism is a challenge to all of us in addition to the role of ethics as a weapon to counter bioterrorism.

Chapter 1

HISTORICAL OVERVIEW

The use of pathogenic agents as weapons has been documented for more than two millennia (**Budowle et al ., 2005**).

Biological warfare has been practiced repeatedly throughout history. Before the 20th century, the use of biological agents took three major forms (**Woods, 2005**):

1. Deliberate poisoning of food and water with infectious material.
2. Use of microorganisms, toxins or animals, living or dead, in a weapon system .
3. Use of biologically inoculated fabrics.

Whether by driving infected livestock into an opponent's camp over 3000 years ago, catapulting plague-infested bodies over castle walls during the Middle Ages, or sending anthrax-filled envelopes in the mail during the twenty-first century, the intent of these efforts throughout time has been the same: to cause illness and death among one's enemies (**Dembek, 2006**).

The Ancient World

Attempts to use biological weapons(BW) date back to antiquity. Scythian archers infected their arrows by dipping them in decomposing bodies or in blood mixed with manure as far back as 400 BC. Persian, Greek, and Roman literature from 300 BC quote examples of the use of animal cadavers to contaminate wells and other sources of water. In 190 BC, at the Battle of Eurymedon, Hannibal won a naval victory over King