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Popular Article

# Microbial forensics: A potential tool for investigation of bioterrorism

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***Abstract***

The deliberate release of biowarfare agents into a community with the goal to inflict disease or death is known as bioterrorism. Investigating bioterror incidents requires the use of microbial forensics. This is a brand-new area of forensic science that is still developing and that has many theoretical and moral challenges to overcome. With contemporary biotechnological advancements, there is grave concern that bacteria and viruses could be genetically altered to serve as biological weapons. Bioterrorism has the potential to result in humanitarian catastrophes, just like other nuclear weapons. In addition to emphasizing the many stages of bioterror assaults through the investigative lens of microbial forensics, this study summarizes numerous bio-warfare agent detection techniques.

**Keywords:** Microbial forensics, Bioterrorism, Biological weapon convention

## Introduction

Many weapons of mass destruction, including nuclear bombs, chemical weapons, and biological agents, have been created in a number of nations. One of the riskiest ways to incite terrorism is the idea of utilizing an infection as a weapon (Britten, 2022). These weapons can be used by terrorists to wreak devastation. Numerous bio attacks have occurred throughout the 20th century, affecting a number of nations. The purposeful release of biological agents to contaminate or kill people, animals, or plants is referred to as bioterrorism. These bio-agents include bacteria, fungus, viruses, and poisonous substances. These substances can be found in nature, but they can also be deliberately altered to make them more lethal or contagious. Some agents, like the chicken pox, can travel from one person to another by the air, water, food, touch, etc., whereas others, like anthrax,

cannot. Additionally, a lot of these bioagents are dispersed throughout the population after being altered to make them more lethal by mixing them with other substances.

The most popular form of bioterrorism used by terrorists is because it is simple, cheap, and difficult to detect these agents. Due to the rapidly advancing technological capabilities and the accelerating development of molecular biological sciences and biotechnology, bioterrorism dangers are always evolving. Another significant issue that heightens the complexity of the situation is the transnational terrorist organizations' quick spread and their easy access to resources for finance, technology, and experience to create biological weapons. Several nations, particularly Germany and France, researched covert bioweapons during World War I, including contaminating cattle feed with *B. anthracis* and *B. mallei* to infect their adversaries. To lessen negative health impacts and prevent fatalities, a bioterrorism danger must be recognized and dealt with.

**Categories of bio-agents**

Based on ease of dispersion or transmission, death rate, social disruption, public health readiness, and public health planning requirements, the Centers for Disease Control and Prevention (CDC) divides potential biological weapons into three broad categories. The agents in "Category A" are those that are thought to be most vulnerable, and a lot of biodefense research has been focused on them. Such agents are very lethal, may spread quickly, and constitute a serious threat to both national security and public safety. There could be potentially serious effects on world health, raising public concerns or necessitating particular public health disaster response measures. Agents with a moderate potential for dissemination are included in "Category B." The CDC's diagnostic capacity needs to be significantly improved and developed because these agents produce low mortality and moderate rates of infection. 'Category C' includes pathogens that are thought to be dangers to newly emerging infectious illnesses and may be created for widespread transmission.

The CDC analyses the hazards to public health posed by different bio-agents by taking into account the severity of the illness outbreak, the mechanism of transmission, the effectiveness of immunization, disease prevention, diagnosis, and treatment.

**Examples and Perspective of Bio-agents use in bioterrorism**:



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| Category | Description | Agent | Disease |
|---|---|---|---|
| A | Most vulnerable agents<br>Transmit easily<br>Requires public health preparedness<br>Results in high mortality<br>Cause social disturbances and public panic | *Francisella tularensis.*<br>*B. anthracis.*<br>*Variola virus.*<br>*Clostridium botulinum.*<br>*Y. pestis*<br>*Ebola virus* | Tularemia<br>Anthrax<br>Smallpox<br>Botulism<br>Bubonic Plague<br>Hemorrhagic Fever |
| B | Moderately Vulnerable<br>Moderately disseminate<br>Results in low mortality<br>Results in moderate morbidity rate | *Brucella species*<br>*Burkholderia mallei*<br>*Coxiella burnetii*<br>*Abrus precatorius*<br>*Rickettsia prowazekii* | Brucellosis<br>Glanders<br>Glanders<br>Abrin<br>Typhus |
| C | Easily available<br>Engineered for high dissemination<br>High mortality and morbidity rate<br>Can cause major health Impacts | *Hantavirus*<br>*Nairovirus*<br>*Coronaviruses*<br>*Bunyaviruses*<br>*Nipah virus* | Hemorrhagic Fever<br>Severe Acute Respiratory Syndrome (SARS)<br>Hemorrhagic Fevers<br>Nipah Infection |

**Detection of biological warfare agents**

To find biowarfare agents, a variety of combined molecular and microbiological sensory approaches are applied. Currently, methods for identifying biological agents include antibody-based immunoassays, biochemical spectrometry, microbiological culture, and genomic analysis PCR (used in the USA Biowatch Programme). Some of these detection techniques have limitations and they need to use Random Amplification of Polymorphic DNA (RAPD) to examine DNA Profiles generated by various isolates. This technique can therefore be used to connect isolates used in biological attacks to one another and establish whether the bio-agents have a common ancestor. Recently, some commercial businesses have begun to offer PCR-based kits to detect biothreat chemicals. These kits eliminate the requirement for a thorough primer and probe design and allow for the quick identification and monitoring of biowarfare chemicals.

**Significance of microbial forensics in bioterrorism**

- Forensic evidence utilised to create, maintain, and convey the toxin or infection, as well as fingerprints, hair, fibre, and pollen, is covered by microbial forensics.



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- Microbial forensics include molecular sequencing, microbiological cultures, biochemistry, electron microscopy, crystallography, and mass spectrometry are employed in epidemiologic research and medical diagnosis.
- The early detection of microbiological dangers is also achievable because to the development of computer techniques and artificial intelligence.
- The full genome sequence of *B. anthracis*, which contains about five million bases, may now be determined by The Institute for Genome Research (TIGR), microbial forensic analysis, in order to differentiate polymorphisms that may constitute bioweapon indicators.
- According to Wani *et al*. (2022), the early detection of microbiological hazards is also now achievable because to the development of computational techniques and artificial intelligence.

**Conclusion**

Crime has a negative impact on important resources in our society, such as life loss. Especially with the employment of biowarfare chemicals in terrorist acts, the types and methods of crimes committed nowadays are growing more complex. Using biological weapons in terror strikes Bioterrorism, in contrast to other acts of terrorism, has the ability to wipe out humanity. The investigation of bioterror incidents involves microbial forensic specialists. The biological hazard posed by a crime can be categorized using morphological, genomic, and bioinformatic aspects. In collaboration with forensics experts, medical professionals, and law enforcement organizations, the investigation of biological attacks is thought to be essential. Bio-terror investigators will need to keep an eye on the crime scene, uphold the chain of custody, validate methods, and provide a defensible interpretation of the findings in order to ensure the results are admissible in court. It is advised to pursue further education, training, research, and development in this area to meet the problems posed by the forensic analysis of biowarfare attacks.

**References**

Britten, S. (2022). Terrorism and Biological Weapons. In: COVID-19 Pandemic: The Threat and Response, Routledge.

Wani A.K., Roy, P., Kumar, V. (2022). Metagenomics and artificial intelligence in the context of human health, Infect. Genet. Evol.: 105267.



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