JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

Bioterrorism & Biosecurity: A Review

Amit Rastogi
Research Scientist cum Research Assistant Professor cum CEO cum Director Executive
Amit Biosciences & Bio Nanotechnology
An Autonomous Non Employed Research & Development

Elena Baryshnikova
Co – Founder
Amit Biosciences & Bionanotechnology

Corresponding Author: Amit Rastogi

Abstract

The thread of biological weapons at global level is not a myth but harsh reality which is called bioterrorism. Bioterrorism is always planned and use to attack any nation, multination, small population of trees, animal and male & female population of any country. Bioterrorism exist on this planet since 600 BC to demolish population of plants, animals and Male and Female population of other countries, sometimes same country. Biodefence shows multi-dimensional nature such as biosecurity, if unlock same nation may be in deep trouble. Immunization is most effective prevention and control for infectious disease air borne and by bioterrorism microbial agents. Gene Editing Technology such as CRISPER/ Cas 9 are effective & efficient against genetically transforming species or newly emerging infectious pathogens. Biohacking is done by trained physician to improve the condition of Male & Female body and mind using technology usually Bio, Bio-Drugs, or others Male and Female body suitable Biochemical substances such as hormones or some time Biochip to improve their health and Physical stamina. Furthermore, Biohacking is also done by Terrorist to produce or to make terrorist or to perform by them terrorist activity. The purpose of biohacking by terrorist is to perform bioterrorism too. Medication and Therapeutics are necessary after confirmation of bioterrorist attack for the same Male & Female.

General Introduction

Biological attack is the intentional release of a pathogen (disease causing agent) or biotoxin (poisonous substance produced by a living organism) against humans, plants, or animals. These biological agents can be isolated from sources in nature acquired from laboratories, and Synthesized or genetically manipulated in a laboratory. The aim of a bio attack is to create suffering and disruption by introducing an epidemic of infectious disease such as Covid -19. The thread of biological weapons at global level is not a myth but harsh reality which is called bioterrorism. Bioterrorism which is also called bio-crime always planned and use to attack any

nation, multination, small population of trees, animal and male & female population of any country. The main purpose of biocrime or bioterrorism is to achieve political and social objectives. Recently, developed nation & some developing nations are using bioterrorism as a threat to demolish any nation in which they used pathogenic microbes altered by genetic modification to demolish any nation more threatfully. Bioterrorism is also the part of Indian defence battery from last many decades. Bioterrorism agents are of three types such as Category A, Category B Category C where as category A bioterrorism agents are of highly potential of risk to demolish Male and Female population, categories B bioterrorism agents are with moderate risk where category C are low toxic than Category A & B Agents. (Violet N. Pinto, 2013). Bioterrorism exist on this planet since 600 BC to demolish population of plants, animals and Male and Female population of other countries, sometimes same country (Stefan, 2004).

Bioterrorism Agents

Bioterrorism agents can be categorised as A, B, and C are described below.

Category A: Category A agents are high-priority agents include microorganisms having risk to same nation security, if leaked can cause serious disease to the same nation or internationally or worldwide which results in penic death or either social disruption, and require special action for handling in lab elsewhere are being developed. Such as anthrax (Bacillus anthracis) and botulism (Clostridium botulinum toxin) are called category A Bioterrorism & Biosafety agents.

Category B: Category B agents are moderate high-priority agents include microorganisms having risk to same nation security, if leaked can cause moderate serious disease to the same nation or internationally or worldwide which results in moderate penic death or either social disruption, and require special action for handling in lab elsewhere are being developed. Such as brucellosis (*Brucella* species), epsilon toxin of *Clostridium perfringens*, Q fever (*Coxiella burnetii*), typhus fever (Rickettsia prowazekii) category A Bioterrorism & Biosafety agents.

Category C: The third highest priority agents include emerging pathogen are genetically engineered degined and fabricated for mass dissemination in the future to cause mortality rates and major health impact and Penic Death. Such as **Covid- 19** which is Biosafety agent anyhow leaked or any other circumstances to out from lab and became bioterrorism agent.

Such Bioterrorism agent are designed, prepared and fabricated in developed nations, developing nations laboratory for Biosafety purpose either or to attack to others nations for any purpose are threat to same nation too. Moreover, bioterrorism agents can harm small animal farm in the same nation or in the other nation. Furthermore, bioterrorism agents can harm to small agriculture farm in the same nation or in the other nation. Additionally, animal and agricultural bioterrorism agents are not discussed in the review (Violet N. Pinto, 2013).

Bio-defence Research Funding

In 2001, annual US biodefense research funding was estimated $700,000,000. Many others funding programs were launched in association with the US federal government. A $1,000,000,000 program was introduced in the US in 2002 for bioterrorism and Biodefence preparedness in form of grants with the Department of Health and Human Services. Total US biodefense funding suddenly increased in 2001 from ~$700,000,000 to ~$4,000,000,000 in 2002 which was at the peak of funding in 2005 was worth nearly $8,000,000,000 and continued with steady average spending around $5,000,000,000. In 2019, the global biodefense market was $12,200,000,000 and will be expected to rise at a compound annual growth rate of 5.8% from 2020–2027, resulting in a projected market value of $19,800,000,000 in 2027 (Long et al., 2021)

North Korea Biological Weapons Interests and Programme

North Korea build a biological weapons program under Kim II-Sung.1 During the Korean War (1950-1953), North Korea population experienced epidemic of cholera, typhus, typhoid, and smallpox, when United Nation attacks to North Korea This epidemic forced to North Korea to create their own Biological Weapon program. North Korea's chemical and biological weapons program started in the early 1960 whereas according to South Korean Defense White Paper, North Korea began weaponizing of biological agents in the 1980s. Accurately assessing North Korea's BW capability is challenging without access to classified intelligence. The ROK Ministry of National Defense has disclosed partial intelligence reports via White Papers, reports, and testimonies at the request of the South Korean legislature. These reports, in addition to several sources from the United States, South Korea, and the former Soviet Union, indicate that North Korea has the capability to cultivate pathogens for BW purposes and weaponize them. However, a reasonable assessment is that North Korea has the capability to cultivate and produce biological weapon. North Korea is assumed to have several pathogens in their ownership. In 2000 ROK Defense White Paper mentions anthrax and smallpox most frequently. Since 2012, the plague (Yersinia pestis) and others have been on the list as well. More information on North Korea's BW has been disclosed through other occasions, which maps out 13 agents: Bacillus anthracis (Anthrax), Clostridium botulinum (Botulism), Vibrio cholerae (Cholera), Bunyaviridae hantavirus (Korean Hemorrhagic Fever), Yersinia pestis (Plague), Variola (Smallpox), Salmonella typhi (Typhoid Fever), Coquillettidia fuscopennata (Yellow Fever), Shigella (Dysentery), Brucella (Brucellosis), Staphylococcus aureus (Staph), Rickettsia prowazekii (Typhus Fever), and T-2 mycotoxin (Alimentary Toxic Aleukia). Furthermore, to possessing these agents, the Ministry of National Defense assessed that North Korea may even have capabilities to weaponize them. The Joint United States Forces Korea portal and Integrated Threat Recognition (JUPITR) program supports new bio-surveillance equipment that increase the speed and ease of monitoring bio-threats (https://www.belfercenter.org/sites/default/files/2017-10/NK

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U.S. government funded programs for rapid detection and response to infectious pathogens

The U.S. Department of Defense, through the Defense Advanced Research Projects Agency (DARPA) supports both academic and industry research for fast detection and response to infectious disease pathogens. DARPA's Biological Technologies Office (BTO), with an annual budget of $296 million, has organized the "Outpacing Infectious Disease" program to easily identify pathogens via DNA and RNA sequencing. Pathogen sequences would be then used to make DNA/RNA vaccines within few days or weeks as compared to the months or years required for traditional vaccine pipelines. In particular, DARPA has funded Moderna Therapeutics, a biotech startup, to develop RNA vaccine platforms. (https://www.belfercenter.org/sites/default/files/2017-10/NK%20Bioweapons%20final.pdf)

Policies for Biological Weapons Use

Biosecurity involves bio-technologies, bio-procedures, and bio-protocols to secure the use of highly infectious pathogens and to control access to those pathogens within a defense, research, industrial, or storage facility.

Biosecurity for biological weapons use includes: licensing of facilities and facilitate to work with highly infectious pathogens, pre-transport approval for highly infectious pathogens and appropriate security during transport, appropriate security for information related to processes and techniques that could be useful in weaponization of the biological agent (https://carnegieendowment.org/files/BIO-survey-final-report.pdf)

Psychological implications of biological weapons on Human (Male & Female Health)

Psychological implications of biological weapons on Human **(Male & Female Health)** includes the following

Horror, anger, panic, fear of invisible agents, anger at terrorist, government or both, attribution of arousal symptoms to infection, paranoia, social isolation, demoralization, loss of faith (https://ris.org.in/sites/default/files/article3_v8n1.pdf)

WHO strategy for global health security in epidemic

The WHO strategy for Global Health Security in Epidemic for Alert and Response systematically addresses the threat of natural bio-agent and intentional epidemic to declare it such as Covid-19. In epidemic WHO activities include intelligence on epidemics and systematic event detection and verification, information management and dissemination including the Outbreak Verification List (OVL) and the Weekly Epidemiological Record (WER), real-time alert, coordinated rapid outbreak response (together with the Global Outbreak Alert and Response Network GOARN) and outbreak response logistics. (https://www.files.ethz.ch/isn/31146/Biodefense_HB.pdf).

Recognition of bioterrorism agents & prevention and control

Several features of a disease eruption or epidemic suggest bioterrorism is the caused. An epidemic's outcomes are suffering, death, lost livelihood, and commerce are troubling which is predetermined.Exotic diseases such as

pneumonic plague, smallpox, pulmonary anthrax, typhoidal tularaemia, haemorrhagic fever, typhus, etc. suggest the possibility of deliberate infection. The diagnosis of these diseases depends on an astute clinician considering them when faced with an undiagnosed unusual case such as twenty century epidemic Covid-19. Infectious disease physicians need to be aware of biological agents attack of that was used as bioterrorist weapons and must physician have diagnostic kit, biosensor kit to identify bioterrorism agent and available medicine to cure it. The European Centre for Disease Prevention and Control compared five methods to categorized the infectious disease risks with use of bibliometric index, Delphi panels, multi-criteria decision analysis, qualitative algorithms, and questionnaires (Bellamy et al., 2001).

NIH strategy for Covid-19

The National Institutes of Health (NIH) layout existing infrastructure to establish a public-private framework with the goal and objective to accelerate the research and development of therapeutic interventions, vaccines, and diagnostics for Covid – 19 through prominent strategies (Cook et al, 2021):

S. No.	NIH Strategy for Covid-19
1.	Invest in NIH and NIH-funded researchers to increase fundamental and foundational knowledge towards COVID-19.
2.	To enhance speed innovation in COVID-19 testing technologies
3.	To participate in public-private partnerships, such as NIH's accelerating COVID-19 Therapeutic Interventions and Vaccines (ACTIV) partnership, and federal partnerships to manufacture therapeutics and vaccines
4.	Strategy for treatment as well as behavioral and community prevention practices to enhance
5.	To Ensure diagnosis, treatment, and prevention options to be accessible and available for underserved and vulnerable populations

Table 1: NIH Strategy for Covid-19

CDC strategic plan for epidemic

CDCs strategic plan is based on the following five focus areas including preparedness and prevention, detection and surveillance, diagnosis and characterization of biological and chemical agents, response, and communication. (https://www.cdc.gov › about › strategic-plan)

Epidemic intelligence service

The Epidemic Intelligence Service (EIS) was created in 1951, in response to concerns about bio-logical warfare during the Cold War. The EIS has been called upon toinvestigate the first cases of hauntavirus, Legionnaire's Disease, WestNile virus outbreak, and Ebola outbreaks in Uganda and Zaire. According to one report, the CIA asked the CDC to investigate the out-break of West Nile Fever in New York City, as early as 1999, in reac-tion

to information from an Iraqi defector which raised concerns that Saddam Hussein may have developed a West Nile-like encephalitisand launched a bioterrorism attack (Kaledin, 1999).

Ethical & unethical biohacking

Near Since 1990-2000 a new phenomenon came in existence called bio-hacking was reported in scientific literature where a typical bio-hacker works outside & established research units or companies as DIY (DIYBIO) researcher and tries as a kind of ethical hacking to modify genes to invent something useful for them usually a terrorist not a researcher or works for terrorist agencies in the same country or internationally or for worldwide agencies of terrorist making gene manipulation in the same male and female to capture their mind or body to modify them in terror to perform terrorist activity or to take unethical work from them as they are doing. Moreover, due to biosecurity reasons the biohacking is closely observed by government authorities (Bernauer, 2008 and Berndt, 2003).

Biohacking is a do-it-yourself citi-zen science merging body modifi-cation with technology (Bio). In the firld of Red Biotechnology which is called physiology and medicine Biohacking is done by trained physician to improve the condition of Male & Female body and mind using technology usually Bio, Bio-Drugs, or others Male and Female body suitable Biochemical substances such as hormones or some time Biochip to improve their health and Physical stamina Biohacking hence if not dne to be wrong use is is a useful biotechnology to improve lifestyle style and maintain the health quality in same nation of their Population (Male & Female) which is called ethical practice of Biohacking (Rafiq, 2023)

Medicinal treatment for Covid – 19 as per guidelines of World Health Organisation

(https://www.cdc.gov/coronavirus/2019-ncov/your-health/treatments-for-severe-illness.html)

The National Institutes of Health (NIH) provides COVID-19 Treatment Guidelines to maintain health of peoples worldwide. Medicinal Treatment includes:

Nirmatrelvir with ritonavir (Paxlovid) antiviral

Dose according to infectious disease physician to adults and children age 12 years and older, start as soon as possible; must begin within 5 days of when symptoms start, taken at home by mouth (orally)

Remdesivir (Veklury) antiviral

Dose according to infectious disease physician to adults and children, start as soon as possible; must begin within 7 days of when symptoms start, intravenous (IV) infusions at a healthcare facility for 3 consecutive days.

Molnupiravir (Lagevrio) antiviral

Dose according to infectious disease physician to adults, start as soon as possible; must begin within 5 days of when symptoms start, taken at home by mouth (orally).

Therapeutics' for Covid-19

COVID-19, an infectious disease caused of death worldwide in last few years to which nCoV, the novel SARS coronavirus that causes COVID-19, selected by scientists for possible therapeutic and preventive measures to cure Covid- 19. The new drugs development to manage COVID-19 effectively is a challenging and time-consuming process. Several medications, including remdesivir, hydroxychloroquine, chloroquine, lopinavir, favipiravir, ribavirin, ritonavir, interferons, azithromycin, capivasertib and bevacizumab, are currently under clinical trials for COVID-19. Four types of vaccines, namely, whole virus, viral vector, protein subunit, and nucleic acid (RNA/DNA), which can confer protection against COVID-19 in different ways, were already in a clinical trial (Rahman et al., 2021).

Strategy and Laws on Biodefense to Curbed & Prevent

To strengthen the area of biodefense and maintain the security against bioterrorism, the US senate passed the "Bioterrorism Act in 2002." This law works on the safety of drugs, food, and water from biological agents and toxins which are called bioterrorism agents. However, in India there is no law on bioterrorism. Recently, there is a gap in international legislations and treaties to prevent biological weapons' attacks. First, Interpol Global Conference on Preventing Bioterrorism" at its headquarters on 1-2 March 2005 was held with discussion on to "examine the risk of bioterrorism attacks, case studies, prevention of attacks, preparation and training of law enforcement personnel, and the related legal and political framework was main discussion strategy. (Violet N. Pinto, 2013).

Bioterrorism & Bio-security Strategy of Former Soviet Union (FSU) Millatery and United Nation

The Former Soviet Union (FSU) biopreparat programme developed massive quantities of bio agents to use against male & female, plants and animals. The fate regarding to trained or genetically modified pathogen from the FSU bio-weapons programme is o particular concern. The nature and scale of parallel R & D activities undertaken in regards to FSU Millatery laboratories is still unknown publically as well as to scientific communities. Many FSU scientists are working in Iraq, Iran & North Korea (George Poste, 2002).

Biodefence shows multidimentional nature such as biosecurity, if unlock same nation may be in deep trouble. In relation to biosecurity in novenber 1969 President Nixon issued National security memorandum 35 which is clearly related to mankind of male & female in United Nation. In 1972 Nixon with the support of United Nation established norms for spreading of bioagents & also made strict action against violators of misuser of bio-weapons. Biosecurity may be defined as defence against bioterrorism (George Poste , 2002).

Biosafety technology for preventions and control

Immunization is most effective prevention and control for infectious disease air borne and by bioterrorism microbial agents. Gene Editing Technology such as CRISPER/ Cas 9 are effective & efficient against genetically transforming species or newly emerging infectious pathogens. Such technologies are having great potential in development of new vaccines and new drugs. (Dongsheng Zhou et al., 2019).

Biosafety Level Laboratory (https://www.phe.gov)

Biosafety level laboratory are of four types:

Biosafety level laboratory 1

These laboratories follow basic safety procedures which are called standard microbiological practices.

Biosafety level laboratory 2

These laboratories are used to study moderate risk infectious agents. These laboratories have equipment to decontaminate laboratory waste. These laboratories also have hand washing sinks, eye washing stations and doors close automatically and lock.

Biosafety level laboratory 3

These laboratories are used to study infectious agents with transmission through air to cause lethal infection.

Biosafety level laboratory 4

These laboratories are used to study infectious agents having high risk of aerosol- transmitted infections with life threatening disease with no vaccines therapy at all. These are of two types cabinet and suit laboratory.

Concluding Remark

As we fight against bioterrorism, there is great need of to do excess research to overcome bioterrorism & bioterrorism agents. As bioterrorism is a great threat to same nation and to the global boundary may sometime be overcome by excessing the temperature of environment of the same country or at global level to inhibit the growth of same bioterrorism agent or may be spreading of bio-nanoparticles in the environment of silver, gold and platinum origin either to wear mask with same nanoparticles layer 1-2 mm near at nasal area on the mask to be biosecuritise to inhibit and not to enter the same bioterrorism agent via nasal chamber. Therapeutic treatment is also necessary for infectious disease management such as Covid – 19 which is actually a Biosafety or bio defence agent and becoming bioterror agent of the twenty centaury.

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